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ABSTRACT

A study examined the general content and characteristics of elementary science textbooks and compared selected text segments from several content domains across publishers. The Merrill and Silver-Burdette science programs for grades 1-5 and one level of both the Holt and McGraw-Hill programs were evaluated. Results indicated substantial differences between the programs in lecture/discussion and classroom activities included in teachers' editions, in pedagogical questions presented, and in the number of content domains. Programs with the greatest amount of text (the highest number of content domains, propositions, and vocabulary) were also found to have (1) the most hands-on activities; (2) fewer problems with illogical structures and sequences or problematic connectives and referents; and (3) far more teacher-directed activities and, consequently, fewer activities that appeared only in student materials. Silver-Burdette was found to have both more pictures and a more substantial text-based program with longer text and a higher percentage of activities related to topic than Merrill. Findings also showed that Holt had far more chapters, activities, propositions, and questions on the content domains than any other program, particularly McGraw-Hill. Overall, the four programs were most alike on the percentage of activities related to the topics covered. (Four pages of references and 10 tables are provided.) (JD)

CENTER FOR THE STUDY OF READING

Technical Report No. 386

ELEMENTARY SCIENCE TEXTBOOKS: THEIR CONTENTS, TEXT CHARACTERISTICS, AND COMPREHENSIBILITY

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Abstract

The purpose of this paper is to present findings from a systematic analysis of elementary school science textbooks. Comparisons of content domains and vocabulary are presented for the Merrill (1982) and Silver-Burdette (1985) science programs, grades 1-5 as well as the fourth grade Holt (1980) and fifth grade McGraw-Hill (1974) texts. Analyses of how each publisher presents information, types of questions, and various text characteristics reveal striking differences between programs. Systematic comparisons of content domains between programs also reveal few instances of "inconsiderate" texts. The textbooks analyzed were selected because they are used in the three school districts participating in our longitudinal study. Results are discussed in light of the differences found between programs regarding textbook content and opportunity to learn, the greater amounts of text and activities within each program, the teachers' probable uses of textbooks, the long-term results of students' exposure to various textbooks, and the need for careful examination of materials in order to determine their quality.

Previous Research on Elementary Science

In a direct attempt to increase and improve science instruction in the United States, the National Science Foundation (NSF) supported the development of three major and different kinds of science programs: the Science and Curriculum Improvement Study (SCIS), the Elementary Science Study (ESS), and Science--a Process Approach (SAPA). Bredderman's (1983) recent meta-analysis of the results of 57 studies comparing achievement and affective outcomes of children in these activity-based science programs with that of children in traditional, usually textbook-based, programs shows greater gains for the former. Shymansky, Kyle, and Alport (1982) reached similar conclusions.

Mechling and Oliver (1983), however, assert that despite the superiority of activity-based methodology, "what was intended to be a joyful discovery for students too often turned out to be a lost sojourn into the abstract and difficult" (p. 43) and teachers returned to textbooks. Therefore, textbook programs continue to be the primary vehicle for science instruction in elementary grade classrooms (Gega, 1980; Manning, Esler, & Baird, 1982). Given the dominance of textbooks for instruction, it seems important to know about their contents and characteristics, yet a recent review of the literature yielded no such research. Instead, papers on science textbooks fell generally into two categories; studies of text properties, and assertions about textbook properties believed to ... fferences in student performance.

Research on Science Text Properties

Research on science texts properti has focused on these areas; readability, textbook helps, sexism, and vocabulary vs. concept prevalence. In their recent Summary of Research in Science Education, Olstad and Haury (1 84) devoted only two of their report's 352 pages to what is known about science textbooks. Their review of research on instructional media and learning outcomes focused on two properties of textbooks, textbook helps, and textbook readability. Olstad and Haury report that readability studies, primarily in the upper elementary and middle grades, revealed greater differences in readability across content domains than between either grade levels or publishers. Field (1982) demonstrated students' science achievement to be adversely affected by texts written above their reading ability. Research on textbook processing aids such as headings (Dansereau, 1982a; 1982b; 1982c; 1982d), and the results of training studies in which students were taught to use headings, increased the students comprehension and recall. Dansereau also completed research (1982c) with college students that demonstrates students benefitted from developing their own headings for texts.

The New Zealand Department of Education conducted research (1982) in a very different area. These researchers analyzed the prevalence of sexism in science textbooks. This work revealed some bias toward males, though the books were judged to be fairly balanced to represent females and males.

The fourth and final area of studies on science textbooks focuses on vocabulary and concepts. Daugs (1984) and Cho and Kahle (1984) recently examined vocabulary in high school science textbooks. Daugs found as many non-science words in the "hard" vocabulary as science words. Furthermore, Cho and Kahle report a direct linear relationship between achievement level and concept emphasis (instead of vocabulary emphasis) in biology textbooks. These studies support the general notion of "content covered," which is closely linked to Carroll's (1963) concept of opportunity to learn.

Textbook Selection

The previous research on science textbook properties yields a smattering of information. No systematic descriptive studies of science textbooks were found in the literature. Nonetheless, suggestions for what to look at in science materials abound in a few articles. These suggestions often appear as guidelines for textbook adoption. It is possible that these efforts may have contributed to the substantial change in the last few years in the popularity of science textbooks. For, if one compares the thirteen most frequently used science textbooks in 1979 (Fitch & Fisher, 1979) with those preferred very recently (Reichel, 1984), not one of the best sellers in 1984 was even in the top thirteen reported in 1979.

McLeod (1979), Finley (1979) and Anderson and Armbruster (1984) are among those who offer guidelines to aid in the selection of science textbooks. McLeod's suggestions focus on one major question, can the text stand alone, or is it experiment-dependent? He believes that experiments are essential for science instruction if students are to learn science as a process. McLeod places particular importance on analyses of experiments. He suggests that textbook reviewers ask these questions. "Are students required to make careful observations? Are students encouraged to make inferences? Is classification a skill used in the experiments?" (p. 14) "How often are students asked to make a prediction based on observation or data? How often are students encouraged to display data in a systematic way that will enhance their ability to communicate?" (p. 15) These activities amount to instruction in the scientific method. Therefore, McLeod's questions have a great deal of intuitive appeal because they direct reviewers' attention to those aspects of science textbooks that have the greatest potential for delivering sound activity-based experiences from a textbook.

Finley's (1979) suggestions for selecting a new science program focus on administrators' and teachers' roles, as well as the actual selection process. Finley asserts that while administrators are in the strongest positions to assess a program's budgetary impact, teachers are in the best position to assess a program's content and instructional approach. Finley offers an evaluation checklist for science programs that has reviewers examining content, learning difficulty, presentation, and teachability. This checklist results in giving each program an overall rating for several dimensions on a five point scale between "strongly disagree," and "strongly agree."

Anderson and Armbruster's (1984) criteria for determining the "considerateness" of content area texts build on Grice's (1975) "cooperative principle" of conversation. This principle focuses on the quantity, quality, relation, and manner of communication during conversation. Anderson and Armbruster developed maxims for judging a text's considerateness for Grice's principles. These maxims relate to the structure, coherence, unity, and audience appropriateness of content area texts. They report that the use of these maxims reveals numerous examples of inconsiderate text in both science and social studies. They have also formulated a textbook evaluation checklist that includes 8 steps for sampling texts. These steps range from surveying the selection for headings to determining whether or not the passage has unity.

Other steps in the Anderson and Armbruster evaluation plan include studying samples of text structure, determining the coherence level of the passages, and how appropriate the text is for its intended audience. Like Finley, Anderson and Armbruster expand their evaluation scheme to a Textbook Evaluation Response Form with a 5 point rating scale to measure samples of text for structure and coherence.

Our review of the literature on the properties of content area textbooks and procedures for textbook selection reveals that guidelines for textbook selection and recommendations for improving science textbooks proliferate despite the dearth of descriptive research on the content and characteristics of these materials. Assertions have been made about, and changes have been proposed for, science textbooks before completing careful analyses of several widely used programs to determine what they contain and how they vary. These methods do not provide reviewers the opportunity to assess either the considerateness or the content/presentation of science textbooks. Both types of analysis are important if one is to have accurate knowledge of textbooks.

Method

As part of a longitudinal study of science concept acquisition in progress (Meyer & Linn, 1985), we have conducted an indepth analysis of the Merrill (Sund, Adams, & Hackett, 1982) and Silver-Burdette (Mallinson, Mallinson, Smallwood, & Valentino, 1985) science programs, grades 1-5 as well as one level of the Holt (Abruscato, Fossaceca, Hassard, & Peck, 1980) and McGraw-Hill (Holmes, Leake, & Shaw, 1974) programs. These textbooks were selected because they are used in the three school districts participating in this longitudinal study. The analyses proceeded in several steps. Each successive step grew, in part, from the findings from the previous steps. These analyses had two goals: to determin· the content and general properties of these science materials, and to compare selected text segments from several content domains across publishers. For each analysis we coded every page from each textbook appropriate for content domain.

Content Domain

Chapter or unit titles often, but not always, determined a content domain. In the case of the McGraw-Hill program (Holmes, Leake, & Shaw, 1974), it was usually necessary to read each chapter or unit through in order to title the content domain. The vocabulary counted was those words clearly specified for students to learn. These words were typically listed at the ends of chapters. They were also usually highlighted and defined within the text.

Pedagogy

To determine how the programs presented similar content domains, we selected all chapters on the same topics within grade levels and across publishers. We chose this procedure because we believed only a comparison of "like-content" might yield defensible differences between programs. We then identified the major ways content was presented and tallied them.

Considerateness

Structure. Each category for assessing a text's considerateness came from the Anderson and Armbruster (1984) guidelines. In this stage of the analysis, we were actually searching for examples of "inconsiderate text," or more specifically, illogical structure. Inconsiderate text has confusing or incorrect headings. It lacks cohesiveness because logical connectives are missing, or it includes referents so far from their antecedents that students might have difficulty following the meaning. Illogical sequences, explanations, or procedures are either out of order or judged to lack important information.

Content. An irrelevant idea was a phrase or statement inserted into the text that was unrelated to the main idea. Incomplete background knowledge included references to activities, procedures, or vocabulary probably beyond the common experiences of children at the intended grade level. Problematical technical terms were counted if it appeared that the text contained a word or phrase that was unnecessarily difficult. Extraneous figurative language involved similes or metaphors more complicated than the information conveyed. False information is an incorrect statement of fact.

Pictures and diagrams. Pictures and/or diagrams that were unnecessary to the text as well as those that were hard to see or unlabeled were counted as inconsiderate.

Results

The analyses proceeded to address three questions. What is the content of the four programs? How is common content presented across grade levels in the programs? And, how well is the content presented? This section of the paper presents those findings.

What is the Content?

1. How does the content of these programs differ? Table 1 shows a listing of each content domain and the number of vocabulary words each program presents at each grade level. There is obvious variance between programs on the number of content domains presented as well as the concentration of vocabulary presented within each content domain. Consistently, Silver Burdette has the largest number of vocabulary words. It averages anywhere from two to five times the number of vocabulary words per content domain as the Merrill program. Holt presents close to the same number of words as Silver Burdette in fourth grade, whereas in fifth grade McGraw-Hill is closer to Merrill. Table 2 summarizes the findings across four programs at five grade levels.

Insert Tables 1 and 2 about here.

<u>How is the Content Presented?</u>

2. A second question addresses one aspect of how the programs' content are presented. How is the information in the Teacher Presentation Book and Student Materials delivered? Table 3 presents our summary. Again, there are substantial differences between programs for the number of lecture/discussion and hands-on activities in the teachers' editions. Through third grade, Merrill averages three to five items the amount of teacher-directed lecture/discussion activities as the Silver Burdette program, and the ratios reverse for hands on activities in the teacher presentation book. The patterns are less distinct for fourth and fifth grade although Merrill continues to have far more lecture/discussion activities and far fewer teacher-directed hands-on activities than Silver Burdette or McGraw Hill.

There are large differences as well in the number of both optional activities and hands-on activities in the student materials. Merrill has consistently more optional activities as a whole, and more hands-on activities in particular.

Insert Table 3 about here.

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3. How does the text prescribe that the teacher interact with students to deliver content? In addition to the activities, questions and directive statements suggest how teachers are to interact with students. Table 4 presents a count of four kinds

of questions from the texts. We used the Pearson and Johnson (1978) taxonomy to classify questions. Students answer background knowledge questions from personal experience. Text explicit questions are answered "right there" in the text, whereas students must search to find answers to text implicit questions. Although this taxonomy is designated primarily for use with basal readers, it is very similar to the system Leonard and Lowery (1984) used with biology texts.

In addition to the three Pearson and Johnson categories, we also counted review questions to measure categories in the programs' spiral curricula. Table 4 shows substantial differences in the number of various question types between programs, particularly for grades 1, 2, and 3.

Silver Burdette has far more questions of each type than Merrill. The differences between the two programs are particularly great for text explicit and text implicit questions in grades 1-3. Silver Burdette features text explicit questions whereas Merrill has far more text implicit questions. In addition, Silver Burdette regularly provides more review questions.

Just as the number of teacher-directed and student materials activities shifted for these two programs between grades 3 and 4, a similar shift occurs with the programs' background knowledge questions at the same grade level. For fourth and fifth grade, Merrill has more background questions than Silver Burdette, but

Silver Burdette continues to be very text-based as evidenced with its high incidence of text-explicit questions.

Insert Table 4 about here.

All of the data presented in Tables 1-4 come from across-program comparisons. Beginning with Table 5, several analyses follow that compare content domains from common grade levels. These analyses were completed in order to look at comparable text segments between programs. Questions on the common content domains focus on general text characteristics, the number and type of activities, and the programs' inconsiderateness.

4. How different are the general text characteristics between programs when analyses focus on common content domains? Table 5 presents these results. Animals and plants are the only two common content domains for Merrill and Silver-Burdette in the lowest elementary grades. Therefore, analyses for first through third grade are limited to those areas. Chapters on electricity and magnetism, the human body, the solar system, and weather are common to three programs for grades 4 and 5.

Table 5 shows the number of chapters each publisher used to present the content domains, the number of pictures, propositions (i.e., thought units), irrelevant propositions, questions, and answers to questions that appear either in pictures or text. The final two columns show the number of direct question, i.e., questions answered in the text, and indirect question, i.e., questions not answered in the text, for each content domain.

Silver Burdette comes across as a more substantial text-based program, although it also has more pictures than the Merrill program. Silver Burdette also has far fewer irrelevant propositions than Merrill. Silver Burdette provides substantially more answers to questions in the text than Merrill, and it has double the number of direct questions as well as more indirect questions.

Insert Table 5 about here.

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5. How many activities are there in these science texts, what are their salient characteristics, how related are the activities to the topics presented in the content domain, and to what extent are these activities logically sequenced? Table 6 provides these data. The programs differ most in the number of activities, propositions, and questions. The programs are most alike on the percentage of activities related to the topics. Activities in all four programs are, with few exceptions, logically sequenced.

Silver Burdette has more activities with longer text (i.e., higher numbers of propositions), and a higher percentage of activities related to the topic than Merrill. Merrill has larger numbers of questions, a higher percentage of activities related to the text, and more activities that follow logical sequences than the Silver Burdette program.

At the fourth and fifth grade levels, Holt and McGraw Hill present striking contrasts to each other. Holt has far more chapters, activities, propositions, and questions on the common fourth grade content domains than any of the other programs. The McGraw Hill program, however, averages far fewer of these characteristics than any of the other materials. Holt and McGraw Hill both have 100% of their activities related to text and topic, and they are all logically sequenced.

Insert Table 6 about here.

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6. How "inconsiderate" are these four science programs when one compares the structure and content of common grade levels and content domains? Table 7 addresses this question. Examples of illogical structure, lack of connectives, unclear referents, or any of the other problematical categories for either structure or content defined by Anderson and Armbruster were counted as examples of inconsiderate text. There are very few instances of inconsiderateness, except for incomplete background knowledge and problematic pictures and diagrams. In fact, there are so few examples of illogical structures, problematical connectives and referents or illogical sequences, that these categories are

uncharacteristic of those texts. There are few content problems as well.

Insert Table 7 about here.

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7. How do the four science programs compare overall to each other? Tables 8, 9, and 10 present these findings. The mean for a publisher within a column category, across grade levels and content domains and the standard deviations appear for each category.

Insert Tables 8, 9, and 10 about here.

Discussion and Future Research

Systematic research comparing national assessment results in science for 1982 and 1977 show that the youngest students in the sample (9 year olds-third graders) have declined in performance (Rakow, Welch, & Hueftle, 1984). What factors may contribute to this problem? Is it the content of textbooks, the way textbooks are constructed, the way teachers do or do not use them, or are these results related to students' problems developing background knowledge about science outside of school?

The results of these analyses raise a number of issues. First, there are clearly substantial differences between programs. They vary a great deal in areas that have not received much attention previously--content and pedagogy. It was surprising to find that the programs that had the greatest amount of text (i.e., the highest number of content domains, propositions, and vocabulary) also have the most hands-on activities and have fewer problems with "considerateness." Therefore, all science instruction should not be dichotomized as either textbook-based or hands-on, because there is simply too much variance between these programs to justify this. Teachers and administrators clearly have a choice between programs, and future research should acknowledge these programmatic differences.

Second, the programs with the greatest amount of content also had far more teacher-directed activities, and subsequently fewer activities that appeared only in student materials. Classroom observations and informed opinion suggest that activities that appear in a teacher presentation book are far more likely to get done than those that appear only in student materials. Therefore, while some may argue that teacher direction limits children's spontaneous exploration, a legitimate counter argument is that a certain amount of teacher direction may guide students, and thereby positively affect their hands-on experience.

Third, a number of studies have concluded that elementary school teachers often feel uncomfortable teaching science, and subsequently spend little time on it. Given these tendencies, might the type of textbook presentation make a difference to teachers? Or, is the prevalence of science instruction determined by issues beyond teachers' comfort or discomfort with pedagogy? Careful descriptive research that takes the textbook and other aspects of science instruction into consideration is needed to answer this question. One can only speculate that some teachers might be more comfortable with a traditional textbook format that closely resembles reading and math textbooks in its amount of teacher-direction, while other teachers might favor less teacher direction and more student-initiated exploration.

Fourth, does instruction from a particular science text result in differences in student performance in science, or in students' desires to learn more science? These questions are well beyond the scope of this paper. They must be addressed by longitudinal research that looks carefully at textbook characteristics, classroom and out of school processes, and student assessment.

Research in basic skills that identifies content coverage and subsequent opportunities to learn suggests that students will learn more in an instructional setting that provides a rich environment of concepts and processes. Similar findings may result from longitudinal research on science concept acquisition.

Fifth, these systematic analyses of science textbooks reveal large differences between program considerateness. Some materials lack a number of the inconsiderate characteristics suggested to prevail in content area textbooks. This came as a pleasant surprise, and suggests the importance of examining ample portions of entire series systematically in order to describe the program accurately.

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Table 1

Analysis of Science Materials:

Content Domains and Vocabulary Frequencies in the Silver-Burdette, Merrill. Holt, and McGraw-Hill Science Programs

Level 1 (First Grade)

Silver-Burdette

Content Domains (8)	Number of Vocabulary
Plants	241
Animals	
Colors, Shapes, Sizes	
Living/Non-Living	
Our Earth	
The Sky	
Weather	
Self-Care	

Merrill

Content Domains (4)	Number of Vocabulary
Plants	56
Animals	
Water & Air	
Living/Non-Living	

Level 2 (Second Grade)

Silver-Burdette

Content Domains (10)	Number of Vocabulary
Prehistoric Animals	277
How Plants Grow	
Where Plants & Animals Live	
Observation & Forms of Matter	
Magnets	
Heat & Light	
Earth, Air, & Water	
The Sun	
Weather	
Safety	

Merrill

Content Domains (9)	Number of Vocabulary
How Animals Grow	44
Magnets	
Sound	
Measurement & Comparison	
Heat & Temperature	
Light & Shadows	
Air & Weather	
Plants & Seasons	

Table 1 (Continued)

Level 3 (Third Grade)

Silver-Burdette Content Domains (15)	Number of Vocabulary	Merrill Content Domains (20)	Number of Vocabulary
Animals	243	Living Things Need Homes	96
Animals Are Important		Food	
Seed Plants		Adaptations	
Plants Are Important		Matter	
Observing Matter & Energy		Forms of Matter	
All About Matter		Changing the Form of Matter	
Force: Work & Energy		Water Around Us	
Machines		Water in Air	
Sound		Rain	
Earth's Changes		Water Cycle	
Earth's Resources		Machines & Work	
Weather		Simple Machines	
Sun, Moon, & Planets		Complex Machines	
Health		Rocks	
Nutrition		How Rocks are Formed	
		How Nature Changes Rocks	
		Seeds & Plants	
		The Moon	
		Earth's Satellite	
		Moon's Changing Face	

Level 4 (Fourth Grade)

Silver-Burdette Content Domains (15)	Number of Vocabulary	Merrill Content Domains (25)	Number of Vocabulary	Holt Content Domains (19)	Number of Vocabulary
Animals that Live Together	288	Plants	137	Ocean	224
Plants		Use of Plants		Ocean Movements	
Food Chains & Food Webs		Nature of Light		Ocean Exploration	
Adaptation		Light & Color		Sound	
Matter		The Eye		How Sounds Differ	
Energy & Machines		The Sun		Sounds Around Us	
Heat Energy		Solar System		The Body	
Electricity & Magnetism		Other Space Objects		Senses	
Rocks & Minerals		Minerals		Bones, Muscles, & Health	
The Ocean		Rocks		Food & Health	
Weather		Fossils		Digestion & Circulation	

Table 1 (Continued)

Solar Systems	Adaptation	Respiration & Excretion
Human Body	Animal Behavior	Taking Care of Yourself
Body Systems	Sound	Solar Systems
The Sense Organs	Hearing	Stars
	Different Sounds	Universe
	Using Sound	Electricity
	The Ocean	Magnetism
	Ocean Bottom	Using Electricity
	How People Use the Ocean	
	Magnets and Electricity	
	Human Body	
	Cells to Systems	
	Health	
	Nutrition	

Level 5 (Fifth Grade)

Silver-Burdette		Merrill		McGraw-Hill	
Content Domains (15)	Number of Vocabulary	Content Domains (25)	Number of Vocabulary	Content Domains (24)	Number of Vocabulary
Green Plants	466	Vertebrates	210	Collecting, Counting, Sorting	211
Invertebrates		Invertebrates		Leaves and Trees	
Vertebrates		Classifying Matter		Water Inhabitants	
Living Communities		Observing Matter		Fish	
Forms of Matter		Three Forms of Matter		Mollusks	
Changing Forms of Matter		Changing Forms of Matter		Prairie Dogs	
Electricity		Air & Weather		Electricity	
Sources of Energy		Weather & Climate		Generators	
The Changing Earth		Human Body		Forms of Matter	
Cleaning Up the Earth		Muscles		Pike's Peak	
Weather		Skin & Inner Systems		Lightning & Thunder	
Beyond the Solar System		Nerves		Distance & Time	
Human Body		Motion, Force, Work		Eye	
Muscles		Friction		Terrain	
Body Systems		Working with Forces		Earth	
		Observing the Sky		Earthqaukes & Volcanoes	
		Constellations		Oil	
		Types of Energy		Archeology	
		Chains of Energy		Carbon	
		Energy & the Future		Steel & Rust	
		The Earth's Layers		Fibers	
		Earth's Changing Surface		Estimating	
		Features of Landscapes		Communication	
		Patterns in Plants		People Everywhere	
		Plants Grow & Change			

Table 2

Number of Content Domains and Vocabulary Presented in the Silver-Burdette, Merrill, Holt, and McGraw-Hill Science Programs

Science Program	Grade	Number of: Content Domains	Number of: Vocabulary	Number of: Content Domains Common for Grade
Silver Burdette	1	8	241	
Merrill	1	4	56	3
Silver Burdette	2	10	277	
Merrill	2	9	44	3
Silver Burdette	3	15	243	
Merrill	3	16	96	1
Silver Burdette	4	15	288	
Merrill	4	25	137	
Holt	4	19	224	4
Silver Burdette	5	15	466	
Merrill	5	25	210	
McGraw-Hill	5	24	211	4

Table 3

How Information is Presented from the Teacher Presentation Book and Student Materials in the Silver-Burdette, Merrill, Holt, and McGraw-Hill Science Programs

Program	Grade	Number of Various Activities in			
		Teachers' Editions		Student Materials	
		Lecture/ Discussion	Hands-On Activities	Optional Activities	Hands-On Activities
Silver Burdette	1	56	40	23	0
Merrill	1	207	7	143	22
Silver Burdette	2	50	41	32	9
Merrill	2	276	3	191	18
Silver Burdette	3	58	36	26	11
Merrill	3	188	18	112	65
Silver Burdette	4	72	16	91	47
Merrill	4	82	2	223	3
Holt	4	127	27	174	68
Silver Burdette	5	124	53	73	20
Merrill	5	293	9	285	121
McGraw-Hill	5	57	22	109	30

Table 4

Types of Questions in the Silver-Burdette

Merrill, Holt, and McGraw-Hill Science Programs

Grades 1-5

Publisher	Background	Text Explicit	Text Implicit	Review
		Level 1 (First Grade)		
Silver Burdette	315	141	183	205
Merrill	127	91	157	22
		Level 2 (Second Grade)		
Silver Burdette	253	308	263	164
Merrill	46	70	354	81
		Level 3 (Third Grade)		
Silver-Burdette	127	552	183	321
Merrill	97	50	493	96
		Level 4 (Fourth Grade)		
Silver-Burdette	313	611	187	337
Merrill	368	303	238	219
Holt	335	363	355	178
		Level 5 (Fifth Grade)		
Silver Burdette	208	712	232	368
Merrill	234	179	296	253
McGraw-Hill	618	482	139	247

TABLE 5

GENERAL TEXT CHARACTERISTICS OF COMMON CONTENT DOMAINS AND

GRADE LEVELS FOR THE HOLT, MCGRAW-HILL, MERRILL, AND SIVLER BURDETTE SCIENCE PROGRAMS

Grade Level	Content Domain	Publisher	No. of Chapters	No. of Pictures	No. of Propositions	No. of Irrelevant Propositions	No of Questions in Text	Answers in Text	Answers in Pictures	T. ED. Questions Direct	T. ED. Questions Indirect
1	ANIMALS	Merrill	2	41	26	1	6	0	3	16	42
1		Silver Burdette	1	62	34	0	14	0	9	16	36
2		Merrill	1	30	71	10	15	1	3	2	7
2		Silver Burdette	2	40	79	0	15	0	3	27	45
4		Merrill	2	73	228	3	57	9	3	5	17
4	ELECTRICITY & MAGNETISM	Holt	3	56	485	13	45	14	13	6	6
4		Merrill	3	21	95	0	21	2	0	0	19
4		Silver Burdette	1	30	171	4	12	5	1	4	3
4	HUMAN BODY	Merrill	4	42	196	3	42	10	2	0	9
4		Silver Burdette	2	74	367	11	44	17	2	10	6
4		Holt	6	90	1004	28	263	171	26	41	17
5		McGraw-Hill	1	13	185	0	11	5	0	3	13
5		Merrill	4	48	394	23	33	12	3	20	13
5		Silver Burdette	2	100	534	17	37	13	6	31	0

Table 5 (Cont'd)

Grade Level	Content Domain	Publisher	No. of Chapters	No. of Pictures	No. of Propositions	No. of Irrelevant Propositions	No of Questions in Text	Answers in Text	Answers in Pictures	T. ED. Questions Direct	T. ED. Questions Indirect
1	PLANTS	Merrill	2	32	26	5	6	0	2	3	17
1		Silver Burdette	1	35	29	2	16	0	4	7	36
2		Merrill	1	34	94	6	18	0	2	3	17
2		Silver Burdette	2	82	225	15	45	2	4	14	77
3		Merrill	2	73	146	6	41	0	1	3	37
3		Silver Burdette	2	90	233	2	34	5	4	12	14
4		Merrill	2	57	280	13	33	10	5	1	15
4	SOLAR SYSTEM	Holt	4	62	642	11	151	105	16	6	4
4		Merrill	3	36	185	42	11	7	0	26	8
4		Silver Burdette	1	36	195	2	17	10	5	12	6
5	WEATHER	McGraw-Hill	1	12	136	8	13	3	1	5	8
5		Merrill	2	43	256	5	37	7	8	1	16
5		Silver Burdette	1	45	270	3	23	10	2	21	1

TABLE 6

CHARACTERISTICS OF ACTIVITIES WITHIN CHAPTERS OF COMMON CONTENT DOMAINS AND GRADE LEVELS FOR THE HOLT, MCGRAW-HILL, MERRILL, AND SILVER BURDETTE SCIENCE PROGRAMS

Grade Level	Content Domain	Publisher	No. of Chapters	No. of Activities in Text	No. of Propositions	No. of Questions	Percent Related to Text	Percent Related To Topic	Percent Logical Sequence
1	ANIMALS	Merrill	2	2	5	1	50	100	100
1		Silver Burdette	1	3	4	1	50	100	0
2		Merrill	1	1	8	5	100	100	100
2		Silver Burdette	2	2	9	6	100	100	100
4		Merrill	2	2	19	10	100	100	100
4	ELECTRICITY & MAGNETISM	Holt	3	8	43	12	100	100	71
4		Merrill	3	6	38	44	100	100	66
4		Silver Burdette	1	3	28	13	100	100	100
4	HUMAN BODY	Merrill	4	4	27	15	50	75	75
4		Silver Burdette	2	5	44	37	66	83	100
4		Holt	6	12	82	33	100	100	100
5		McGraw Hill	1	3	22	5	100	100	100
5		Merrill	4	3	22	26	66	66	100
5		Silver Burdette	2	6	86	40	66	100	83

Table 6 (Cont'd)

1	PLANTS	Merrill	2	3	7	5	66	66	66
1		Silver Burdette	1	2	8	2	100	100	50
2		Merrill	1	3	25	9	66	66	66
2		Silver Burdette	2	5	25	16	80	100	100
3		Merrill	2	5	71	37	100	100	100
3		Silver Burdette	2	3	35	15	33	66	100
4		Merrill	2	4	36	12	100	100	100
4	SOLAR SYSTEM	Holt	4	5	48	10	100	100	100
4		Merrill	3	1	15	13	100	100	100
4		Silver Burdette	1	3	30	12	100	100	66
5	WEATHER	McGraw-Hill	1	1	13	5	100	100	100
5		Merrill	2	4	25	41	75	100	75
5		Silver Burdette	1	4	40	12	75	100	100

TABLE 7

INCONSIDERATE STRUCTURAL, CONTENT, AND PICTORAL CHARACTERISTICS OF COMMON CONTENT DOMAINS AND GRADE LEVELS FOR THE HOLT, MCGRAW-HILL, MERRILL, AND SILVER BURDETTE SCIENCE PROGRAMS

			Number of									
			Structure			Content					Pictures & Diagrams	
Grade Level	Content Domains	Publisher	Illogical Structure	Lack of Connectives or Unclear Referents	Illogical Sequences, Explanations, or Procedures	Irrelevant Ideas	Incomplete Background Knowledge	Problematic Technical Terms	Unnecessary Figurative Language	False Information	Unnecessary	Hard to See or Unclear
1	ANIMALS	MERRILL	0	1	0	0	2	0	0	0	0	29
1		SILVER-BURDETTE	5	0	0	0	5	0	0	0	0	54
2		MERRILL	2	0	0	1	9	0	0	1	0	27
2		SILVER-BURDETTE	0	0	0	1	14	2	0	0	0	12
4		MERRILL	0	6	0	3	28	5	1	0	8	73
4	ELECTRICITY & MAGNETISM	HOLT	0	5	0	10	23	1	0	2	5	35
4		MERRILL	1	2	0	0	14	0	0	0	0	0
4		SILVER-BURDETTE	0	6	0	3	12	2	0	0	5	11

Grade Level	Content Domains	Publisher	Number of: Structure: Illogical Structure	Lack of Connectives or Unclear Referents	Illogical Sequences, Explanations, or Procedures	Content: Irrelevant Ideas	Incomplete Background Knowledge	Problematic Technical Terms	Unnecessary Figurative Language	False Information	Pictures & Diagrams: Unnecessary	Hard to See or Unclear
4	HUMAN BODY	MERRILL	1	6	1	2	14	1	2	1	8	30
4		SILVER-BURDETTE	2	0	0	1	1	0	0	0	4	1
4		HOLT	0	0	0	2	3	1	0	1	10	4
5		MCGRAW-HILL	3	3	0	0	5	0	0	0	4	2
5		MERRILL	0	0	0	4	8	5	0	0	9	3
5		SILVER-BURDETTE	0	1	0	2	5	0	0	1	5	4
1	PLANTS	MERRILL	5	8	0	6	6	0	0	1	2	6
1		SILVER-BURDETTE	0	0	0	1	8	0	0	0	0	7
2		MERRILL	0	11	0	0	11	0	0	0	5	8
2		SILVER-BURDETTE	0	6	0	6	22	0	0	0	0	11
3		MERRILL	4	9	0	6	15	0	0	0	9	10
3		SILVER-BURDETTE	0	1	1	1	10	0	0	0	0	0
4		MERRILL	1	6	0	13	18	0	0	0	10	56
4	SOLAR SYSTEM	HOLT	0	1	0	1	7	4	1	0	0	8
4		MERRILL	0	0	0	0	2	2	0	0	1	25
4		SILVER-BURDETTE	0	4	0	2	12	2	0	0	1	9
5	WEATHER	MCGRAW-HILL	3	10	0	8	10	0	1	0	4	8
5		MERRILL	1	3	0	6	20	2	1	1	0	1
5		SILVER-BURDETTE	0	11	0	3	4	0	0	0	6	12

TABLE 8

CROSS PUBLISHER COMPARISONS OF GENERAL TEXT CHARACTERISTICS IN COMMON DOMAINS BY GRADE LEVEL

Grade Level	Content Domains	Chapters	No. of Pictures	No. of Propositions	No. of Irrelevant Propositions	No of Questions in Text	Answers in Text	Answers in Pictures	T. ED. Questions Direct	T. ED. Questions Indirect
MERRILL, 1980										
1	PLANTS; ANIMALS	4	73	52	6	12	0	5	19	59
2	PLANTS; ANIMALS	2	64	165	16	33	1	5	5	24
3	PLANTS	2	73	146	6	41	0	1	3	37
4	ELECTRICITY & MAGNETISM; HUMAN BODY; SOLAR SYSTEM	7	99	476	45	74	19	2	26	36
5	HUMAN BODY; WEATHER	6	91	650	28	70	19	11	21	29
		4.2(2.2)	80(14.46)	297.8(253.42)	20.2(16.56)	46(26.03)	7.8(10.23)	4.8(3.90)	14.8(10.21)	37(13.40)
SILVER BURDETTE, 1984										
1	PLANTS; ANIMALS	2	97	63	2	30	0	13	23	72
2	PLANTS; ANIMALS	4	122	304	15	60	2	7	41	122
3	PLANTS	2	90	233	2	34	5	4	12	14
4	ELECTRICITY & MAGNETISM; HUMAN BODY; SOLAR SYSTEM	4	140	733	17	73	32	8	26	15
5	HUMAN BODY; WEATHER	3	145	804	20	60	23	8	52	1
		3(1.0)	118.8(24.75)	427.4(324.4)	11.1(8.58)	51.4(18.54)	12.4(14.26)	8(3.24)	30.8(15.74)	44.8(51.12)
HOLT, 1980										
4	ELECTRICITY & MAGNETISM; HUMAN BODY; SOLAR SYSTEM	13	208	2131	52	459	290	55	53	27
MCGRAW-HILL, 1974										
5	HUMAN BODY; WEATHER	2	25	321	8	24	8	1	8	21

TABLE 9

CROSS PUBLISHER COMPARISONS OF ACTIVITIES IN COMMON DOMAINS BY GRADE LEVEL

Grade Level	Content Domains	Chapters	No. of Activities	No. of Propositions	No. of Questions	Percent Activities Related to Text	Percent Activities Related to Topic	Percent Activities Following Logical Sequence
MERRILL, 1980								
1	PLANTS; ANIMALS	4	5	12	6	58	83	83
2	PLANTS; ANIMALS	2	4	33	14	83	83	83
3	PLANTS	2	5	71	37	100	100	100
4	ELECTRICITY &	7	11	8	100	100	100	
4	ELECTRICITY & MAGNETISM; HUMAN BODY; SOLAR SYSTEM	7	11	80	72	83	92	80
5	HUMAN BODY; WEATHER	6	7	47	67	70	83	88
		4.2(2.3)	6.4(2.8)	48.6(27.7)	39.2(30.0)	78.8(15.8)	88.2(7.7)	86.8(7.9)
SILVER BURDETTE, 1984								
1	PLANTS; ANIMALS	4	5	12	3	75	100	25
2	PLANTS; ANIMALS	2	7	34	22	90	100	100
3	PLANTS	2	3	35	15	33	66	100
4	ELECTRICITY & MAGNETISM; HUMAN BODY; SOLAR SYSTEM	7	11	92	62	89	94	89
5	HUMAN BODY; WEATHER	6	10	126	52	71	100	92
		4.2(2.3)	7.2(3.3)	59.8(47.4)	30.8(25.1)	71.6(23.1)	92(14.8)	81.2(31.8)
HOLT, 1980								
4	ELECTRICITY & MAGNETISM; HUMAN BODY; SOLAR SYSTEM	13	25	173	55	100	100	100
MCGRAW-HILL, 1974								
5	HUMAN BODY; WEATHER	2	4	35	10	100	100	100