INFORMATION TO USERS

Concept mapping: An information processing strategy for reading fifth grade social studies text

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CONCEPT MAPPING: AN INFORMATION PROCESSING STRATEGY

FOR READING FIFTH GRADE SOCIAL STUDIES TEXT

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ABSTRACT

A class of 26 fifth graders were taught by their classroom teacher how to organize prior knowledge and process social studies text using Novak and Gowin's (1984) model of concept mapping. They were observed for 45 sessions over 14 weeks. The teacher combined direct instruction with collaborative learning.

Student progress was measured by two individual mapping tasks, one just after eleven sessions of instruction (Day 12) and the other on Day 44 near the end of the study. Components and subcomponents of concept maps were identified and a set of criteria developed for evaluating them. There was a significant difference between Map_1 and Map_2 scores ($p < .01$) with the largest mean gain score in the low reading achievement group. Map_1 scores correlated positively to SAT reading comprehension raw scores. Differences in gain scores between boys and girls and between the low and high achievement groups were not significant.

Map subcomponent scores revealed some minimal gender and achievement group differences. For example, the boys were less likely to copy text verbatim. Students were able to select important concepts and arrange them in levels from general to specific. They were less successful at selecting appropriate linking words and integrating concept segments.

Two summary writing tasks were completed by students on Day 13 and Day 45. Despite no instruction in summary writing, a significant positive correlation ($p < .05$) was found between scores on the second map and the second summary indicating some similarity between the measures.

Learning Log Entries revealed that the number of students who liked social studies at the beginning of the study doubled by the end (from 10 to 20 students). Of the 26 students, 24 liked concept mapping and 19 recognized benefits for studying.

Conclusions from the study suggest that concept mapping is an important text-processing strategy which can be evaluated according to certain criteria. Concept mapping should be investigated further as an alternative measure of comprehension and as potential preparation for summary writing instruction.

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CHAPTER 1
INTRODUCTION

Background

There is concern among educators that American schools are not producing adults who have a "sufficient grasp of concepts, principles, or skills" (Gardner, 1991, p. 18) that can be used for problem solving and dealing with new situations. Nor are they producing responsible citizens who can make informed decisions from what they read and hear (Resnick, 1987a). Educational goals for the information age of the 1990's should be geared toward empowering students with expertise in skills and strategies to assist the integration of new information with their existing knowledge and the construction of greater meaning (Jones & Idol, 1990; Marzano, Brandt, Hughes, Jones, Presseisen, Rankin, & Suhor, 1988; Wood, 1988). The ability to organize new information and meanings would then facilitate students' acquisition and retention of information and lead to independence in learning (Barron, 1979).

Theoretical support for an emphasis on organizing information comes from the field of cognitive psychology and the theory of information processing. According to this theory, success in receiving, storing, and remembering information depends heavily on the processes of organization and elaboration. Organizing the information

received into meaningful units and interrelationships helps to overcome the limitations of short term memory. Empirical studies by Dansereau, Collins, McDonald, Holley, Garland, Diekhoff, and Evans (1979) support this theory. These researchers taught college students to organize information from unfamiliar texts into networks or visual cognitive maps on which they specified the relationships that linked different nodes of information. These students were better able to retain new information than students who did not organize information in this way.

Elaboration of text by constructing mental or visual images to represent ideas and by making deductions or inferences facilitates the integration of new information with that already existing in one's long term memory (Derry, 1990; Ormrod; 1990). Existing or prior knowledge is theorized to be organized in semantic networks called schemata (Rumelhart, 1980, 1985) or in "a vast network of interconnected elements" (Bereiter, 1991, p. 11); both facilitate understanding and remembering. The covert nature of mental processes precludes empirical proof of schemata; however, Jones and Idol (1990) conclude from reviewing numerous studies that "successful learners organize what they know in terms of fundamental principles, concepts, and patterns that are both meaningful and accessible" (p. 519). This conclusion supports the

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schema theory and implies that the process of elaboration
is required to achieve meaning and accessibility.

Studies of the elaboration process also imply that
learning to relate new information to "already established
content and/or procedural knowledge" is crucial to
successful "new learning and subsequent performance"
(Weinstein & Mayer, 1986, pp. 320, 321). Empirical evi-
dence for the important role played by prior knowledge in
improving retrieval or recall is found in the research of
Bransford and Johnson (1972) where adult readers who were
provided with a context or schema before reading an unfam-
iliar passage were able to recall more than readers who
were not. Studies by Pichert and Anderson (1977) indicate
that readers who were instructed to take a particular
perspective when they read a passage recalled ideas from
the passage that were important to that perspective both
immediately after reading and after a one-week delay.
Ausubel (1960) helped undergraduate students prepare for
unfamiliar textual material with "advance organizers"
(p. 271) or generalized previews of the content to be
learned. These students were able to retain unfamiliar
information more effectively than those who did not
receive this treatment. Barron (1979) provided students
with a structured overview, a "visual/verbal presentation
of key vocabulary in a new learning task in relation to

broader, more inclusive terms presumably understood by students" (p. 172).

The studies cited above acknowledge the importance of linking prior knowledge with new information yet none of them are based directly on the students' prior knowledge. Instead, they depend on what the teacher or researcher presumes that knowledge to be. Anderson and Armbruster (1984) cite studies in which children who were able to integrate their prior knowledge about sandstorms with new information about camels were able to recall more about the camels. Further justification for activating the students' own prior knowledge comes from Resnick (1989) and Roth (1990) who warn that prior knowledge can interfere with learning when it is inconsistent with new information and when connections are not made explicit. Some students, for example, may have assumptions about scientific phenomena that contradict the scientific facts being taught. Without making explicit links between their assumptions and the new information they may be unable to expand their understanding of the phenomena.

It is clear that in addition to organizing new information a conscious effort should be made to activate prior knowledge as a prereading activity (Anderson, Reynolds, Schallert, & Goetz, 1977; Pichert & Anderson, 1977). Elementary school teachers can do this by having students brainstorm what they already know about a topic

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before beginning to read the text. This information could be organized in preparation for reading but often the teacher merely guides an oral discussion related to the students' responses. Sometimes the information is written on a chart or chalkboard in an unorganized manner or in a linear form as it is received (Vacca & Vacca, 1989). Organizing information by concepts and their connections is usually not done until *after* reading when students write the key points of the selection in outlines, networks, or maps. The students' prior knowledge is activated but no explicit connections are made between prior knowledge and new content.

Rationale

The concepts of: 1) prior knowledge activation and its possible interference, 2) prereading or advanced organization of prior knowledge, and 3) postreading organization of information can be combined in an effective strategy for upper elementary school students who would provide their own advanced organizer by mapping on paper what they already know about a topic *before* encountering new information. Maps could be revised and augmented by students during and/or after reading. These explicit links between prior knowledge and new content would enable students to construct new meanings and expand on those they already have.

Students who use this strategy to make unfamiliar
text more familiar and meaningful could improve their
comprehension and retention at a crucial time of increased
content area reading. A valuable bonus for students who
anticipate examinations on the information would be con-
cise yet comprehensive study notes in the form of maps. A
bonus for the teacher would be the concrete evidence of
student prior knowledge or gaps in prior knowledge that
the prereading maps would provide.

Purpose

Various forms of conceptual mapping have been recom-
mended as effective tools for studying informational text
(Dansereau, Collins, McDonald, Holley, Garland, Diekhoff,
& Evans, 1979; Novak & Gowin, 1984), and for vocabulary
development (Heimlich & Pittelman, 1986). Novak (1990)
recommends one form of conceptual mapping called concept
mapping for students of all ages and for various content
areas. Mapping has been included in recent reading meth-
odology textbooks (e.g., Harris & Sipay, 1990; Lapp &
Flood, 1989; Leu & Kinzer, 1987; Mason & Au, 1990; Vacca &
Vacca, 1989) as a study skill for upper elementary
students in content area classes. However, the meager
research that exists is focused on achievement changes of
students from junior high school and higher, particularly
in science classes.

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The purpose of this study is not to measure achievement but to examine the process of fifth grade students learning to map concepts in text. It will document the experience of one fifth grade teacher and her class as they proceed through a 14-week program of concept mapping in social studies. The focus will be on the students' attitudes toward the process and on the characteristics of the concept maps they produce. Information gleaned from this study could assist educators in developing appropriate instructional programs in concept mapping for teachers and students as well as criteria for evaluating their mapping efforts. It could also provide insight into fifth graders' prior knowledge and understanding of the social studies topics covered.

Research Questions

The question of whether fifth grade students *can* be taught a concept mapping strategy was answered positively by Novak (1990) and by an eight-month pilot study conducted by this researcher in 1991-1992. The present study will describe the process of fifth graders learning to map concepts from their prior knowledge and from their social studies textbooks. While the description will include more general aspects of the social studies classes such as the teacher's instructional procedures and student responses, the primary focus will be on the concept maps and the

journal entries produced by the students over a 14-week period. This analysis will address the following questions:

1. What are the components of concept mapping and are there identifiable phases of development over time?

2. Are there identifiable differences in maps produced by students at different reading comprehension achievement levels; by boys and girls; and by students with positive or negative attitudes toward social studies?

3. Can information about developmental phases of mapping skills and/or student differences be used to establish criteria for fifth grade concept map evaluation?

Definition of Terms

For the purpose of this study the terms below are defined as follows:

1. <u>content area</u>: an area of learning that depends on expository or informational text which is "written for the purpose of conveying factual information, explaining ideas, or presenting an argument" (Mason & Au, 1990, p. 125). Examples at the elementary school level include social studies and science.

2. <u>strategies</u>: "behaviors and thoughts that a learner
   engages in during learning and that are intended
   to influence the learner's encoding process"
   (Weinstein & Mayer, 1986, p. 315). Examples
   include summarizing, notetaking, mental imaging,
   positive self-talk, visual representation, time
   management, and others.

3. <u>mapping</u>: the condensation of verbal and written
   information in a graphic representation. The terms
   mapping and concept mapping will refer to the
   model of Novak and Gowin (1984) unless otherwise
   specified (see <u>Related Literature</u>).

CHAPTER 2
RELATED LITERATURE

Planning of an instructional program should include consideration of the following aspects of learning: the materials to be used, the learning activities, the criterial task or anticipated outcomes, the character- istics of the learners, the interpersonal context or the type of learning interactions in the classroom, and the socio-cultural context of the class (Bail, 1989; Brown, Bransford, Ferrara, & Campione, 1983). This review of literature will investigate the first five of these areas as they relate to the study. The socio-cultural context of the class will be addressed in the description of the particular class participating in the study.

Materials

Classroom materials vary from teacher to teacher, but textbooks remain the prevalent information resource in elementary school social studies classes (Dishner & Olsen, 1989; Elliott, Nagel, & Woodward, 1985) despite recommen- dations such as that made by Elliott and others "to encourage curriculum specialists and teachers to develop their own curriculum and materials locally" (p. 24) or to at least rely more on other textual resources and media. School systems that are committed to textbook use are unlikely to change quickly since to do so would require

radical changes in both philosophy and policy from the elementary school level up through the levels of state and national government. The greatest hindrance to such change has been the accountability factor of standardized assessment (Eisner, 1990).

There has been some movement away from standardized assessment as goals for education are being reevaluated in teacher education institutions and among groups like the National Commission on Testing and Public Policy (Evangelauf, 1990). However, extensive national reports (e.g., A Nation at Risk, Becoming a Nation of Readers, What Works, and America 2000) continue to support the traditional tests. Teachers, administrators, and parents will be reluctant to give up the textbooks they perceive as the essential sources of information needed by students to pass the standardized tests (Edelsky & Harman, 1988).

The move to find alternatives to such testing is a positive step toward developing curriculum and materials locally, but such change will occur slowly (Eisner, 1990). In the meantime teachers will continue to use the textbooks their administrators supply. They may rely upon textbooks to varying degrees (Vacca & Vacca, 1989) but their reasons for using them are the same: accountability; the parents' expectation that their children bring home a recognizable text to study; a lack of easily obtainable alternative resources and/or the time to locate them; and

the needs of teachers, who are often disinterested and uninformed in social studies themselves, for preplanned lessons and guidelines (personal communication with three upper elementary school teachers, 1992).

An inclination toward more integrated educational programs lead many of us away from textbook use and toward a variety of information sources. This bias is fueled by doubts concerning the validity of standardized assessment as a measure of learning and the belief that learning takes place in the socio-cultural context of the classroom and not as the one-way transmission of information from the teacher and/or text (Vygotsky, 1978). However, the reality of textbook prevalence and the assumption that an organizing strategy such as mapping would be useful in processing *any* informational material justify the use of a textbook in this study.

Skills

Ten currently and widely used elementary school social studies textbook series were analyzed and found to be "a facile and shallow treatment of numerous topics" (Elliott, Nagel, & Woodward, 1985, p. 23). Of particular interest is the finding that the emphasis on skills teaching was confined mainly to map and globe reading skills and did not extend to the "higher-order thinking skills" (p. 24) as claimed by the publishers. The analysts

attribute this emphasis to the fact that map and globe
reading skills are easily measured. Unfortunately, these
skills represent only a very small part of effective use
of informational text. According to Resnick (1987b) "an
ability to read complex material and the ability to build
and evaluate arguments" (p. 7) are both crucial to future
employment opportunities for today's students. Strategies
that help improve comprehension and organize information
are more important to developing these abilities than map
and globe reading competence.

Text Difficulty

Content area texts are traditionally more difficult
to read than texts in reading classes for the same grade
(Leu & Kinzer, 1987). One reason for this difficulty is
that the expository nature of the texts requires a great
deal of subject-specific vocabulary. Another reason is
that there is one text per grade level despite the fact
that, unless they are tracked homogeneously, upper
elementary classes include students with a wide range of
reading abilities. A conservative estimate of fifth grade
reading grade-equivalent scores from standardized results
"can range from 2.3 (third month of grade 2) to 12.5
(fifth month of grade 12)" (Harris & Sipay, 1985, p. 104).
Teachers who use graded or basal reading texts divide
their classes into homogeneous groups and provide texts

that are of appropriate difficulty for each group. This adjustment is possible when the emphasis is more on developing reading competence than on acquiring information. Content area texts are based on the assumptions that the information is important and that for all of the students of a particular grade level the information should be the same.

Altering the difficulty of text by manipulating the vocabulary and sentence length is not a good solution. By simplifying vocabulary, precision of meaning is lost and by shortening sentences, important causal connections that are necessary for comprehension may be eliminated (Armbruster, Osborn, & Davison, 1985; Schallert & Roser, 1989). Besides, an attempt to match the difficulty level of a content area text (as determined by readability formulas) to a student's reading grade-equivalent score does not guarantee that the student will comprehend the text easily (Klare, 1976, 1989). A readability level represents only an average of various parts of the text rather than a consistent or gradually increasing level throughout (Armbruster et al., 1985). Depending on which formula has been used the level of various parts can vary considerably. Furthermore, too many factors other than those considered by most formulas (e.g., word difficulty, sentence length, and number of syllables) are at work. These include conceptual difficulty, text organization,

style, and physical layout (Armbruster, et al., 1985).
There are also the six broader characteristics of any
learning situation to be considered as noted at the
beginning of the literature review.

Instead of trying to reduce the mismatch between text
difficulty and student reading achievement levels by
rewriting materials, teachers could prepare students for
difficult text by teaching them a strategy to make
connections between their prior knowledge and the new
information. It may be that given a more meaningful
context as a starting point (e.g., prior knowledge maps)
students may be able to process text at higher levels of
difficulty than their achievement scores would indicate.

Text Structure

Sensitivity to text structure or the way in which
text is organized has been shown to affect one's ability
to recall ideas from written prose, especially for mature
and skilled readers (Taylor, 1980). Related studies
conducted with younger students in grades 2 through 6
demonstrate their sensitivity to text structure (Danner,
1976; Meyer, 1977; Waters, 1978) in listening to rather
than reading text. In an effort to demonstrate sensitivity
to text structure of younger *readers* Taylor (1980) studied
immediate and two-day delayed recall of 51 fourth and
sixth graders who had read textbook-type passages.

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Although the results were inconclusive, Taylor suggests that "children's memory for expository material is enhanced if they follow the top-level structures of the text to organize their recalls" (p. 409).

Meyer, Brandt, and Bluth (1980) support Taylor's views with a study of 102 ninth grade students having good, average, and poor SAT comprehension scores. Finding a positive correlation between use of the author's text structure and the number of ideas recalled by the students they conclude that "the ability to utilize the text's top-level structure appears to be an important organization strategy for remembering information in text" (p. 97).

The implications are that if textbooks are used they should be well organized and that students should be instructed in the use of this organization to improve their recall of information. Unfortunately, social studies texts have been found lacking in this area (Osborn, Jones, & Stein, 1985). When textbook authors do not use the standard top-level structures a student's reliance on his/her own organizational patterns of prior knowledge may be more useful than text structure patterns.

Learning Activities for Information Processing
Some Alternatives

Teachers of heterogeneous classes who are expected to use the same content area text for everyone are faced with

the dilemma of either adjusting the text to the students'
abilities or teaching the students "ways of processing
information that will enable them to read and learn from
(that) particular textbook" (Singer & Donlan, 1980, p.
50). In an age of increasing information the latter
solution better fulfills students' needs to learn how to
process not only a particular textbook but any informa-
tional text they encounter (e.g., reference books,
newspapers, journals, computer text).

Strategies for processing information that improve
comprehension and/or retention of information abound. That
teachers must be knowledgeable in a variety of strategies
and the conditions for their use, as well as cognizant of
other learning factors, makes strategy selection and use
enormously complex. A starting point would be to examine
carefully some of the better known strategies to identify
those which are based on prior knowledge activation and
organization of information.

One possibility is the Directed Reading Activity
(DRA) from formal reading programs (Herber, 1970, 1978;
Burmeister, 1974), and its variations -- the Directed
Reading Lesson (Vacca, Vacca, & Rycik, 1989) and the
Directed Reading-Thinking Activity (Harris & Sipay, 1990;
Leu & Kinzer, 1987; Mason & Au, 1990; Stauffer, 1969;
Vacca & Vacca, 1989). The steps in the original DRA are as
follows:

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1. Determining background by eliciting the prior
   knowledge/experience of the class,

2. Building background by preteaching difficult
   vocabulary from the passage/chapter,

3. Prequestioning such as "What would you like
   to know about the topic?" followed by reading
   to answer the questions posed,

4. Postreading review by recalling information and
   reviewing the prereading questions and subsequent
   answers, and

5. Extending the chapter with related projects or
   further reading on the topic (Singer & Donlan,
   1980).

Although the teacher activates student prior knowledge in the first step, heavier emphasis is placed on the prereading and postreading questioning as the key to remembering specific information. Research into the effects of both prereading (Rothkopf, 1966) and postreading questions (Frase, 1967; Rothkopf, 1966; Watts & Anderson, 1971) shows both types to be effective in aiding recall of information. It is not clear whether the questioning strategies aid the comprehension of students who find the text especially difficult to read since measures of information recall take priority over comprehending that information in the research cited above. The key to both improved recall and comprehension

of difficult text may be the attention paid to making explicit connections between student prior knowledge and text rather than to questioning strategies.

Additional strategies are described in recent elementary reading methodology textbooks (Lapp, Flood, & Farnan, 1989; Leu & Kinzer, 1987). Eight of these were reviewed by this researcher to determine if any of them met the following conditions: 1) the collective prior knowledge of the students is used directly rather than presumed by the teacher; 2) this prior knowledge is organized before reading new text; 3) explicit links are made between prior knowledge and text; and 4) prior knowledge that conflicts with the new information is explored during and/or after reading. While each of the eight strategies reviewed meets some of the conditions, none of them meet all four (see Appendix A).

Summary Writing

Another strategy described as useful for study, especially in the content areas (Vacca & Vacca, 1989), is summary writing. Summarizing involves deeper levels of information processing and organization by analyzing and restating the main ideas of text. It "promotes (students') involvement with both the structure and content of expository text" (Mason & Au, 1990, p. 153). While instruction in summary writing is advocated for students

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from elementary school age up to college levels, warnings are given that summarization is a complex process requiring an ability to use a set of specific steps and rules, some of which cause difficulty even for college students (Mason & Au, 1990).

From extensive analysis of how effective learners write summaries, Kintsch and van Dijk (1978) developed a set of basic rules including the processes of deleting propositions that are either unessential or can be inferred from other propositions, using general terms to substitute for lists of related items, and constructing new propositions that capture the meaning and make it possible to infer what was deleted (Sherrard, 1989). Brown, Campione, and Day (1981) expanded these to six rules based on the same three processes. Using rules 1 and 2 students delete information which is either trivial and unnecessary or is important but redundant. With rules 3 and 4 they substitute superordinate terms for lists of related items or for a sequence of related events or actions. Rule 5 requires the selection of a topic sentence if there is one. If there is not, rule 6 provides for inventing one.

While students at various ages were able to use rules 1 and 2 effectively, Brown and Day (1983) found that students at the 5th and 7th grade levels and younger had difficulty with rules 3, 4, and 5. Rule 6 caused problems

for students up to junior college level. It is this developmental sequence that prompts reading methodology textbook authors to warn of the complexities of summary writing for even mature students and to include suggestions that "systematic instruction should probably occur in the fourth through sixth grades..." but that "...teachers should not expect elementary students to master this writing technique (summarization)" (Mason & Au, 1990, p.153).

Various strategies for teaching summary skills are suggested (Hare & Borchardt, 1984; Taylor, 1984; Vacca & Vacca, 1989), but all of those cited include: 1) direct instruction in the use of specific steps and/or rules; 2) practice summary writing of text making first and second drafts; and 3) confirmation of each draft with the original text before writing the final version. Teacher modeling of when and how to use the rules as well as comparisons made between samples of good and poor summaries is also suggested (Winograd & Hare, 1988). Linking one's prior knowledge to new information is not included as part of the process but this step could be easily added.

Specific instruction in summary writing rules and procedures has been shown to improve community college students' summary writing skills (i.e. identifying main ideas and deleting unessential information), but the

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benefits for students having writing difficulties prior to
instruction were fewer than for the more accomplished
writers (Brown, Campione, & Day, 1981). Younger students
have also benefited from specific instruction in summary
writing and learning to use summarization rules has been
shown to have a positive effect on their reading compre-
hension. A small sample of fifth graders (N=8) who had
been taught to use summarization rules wrote better
summaries than did fifth graders who wrote summaries
without specific rule instruction or who comprised the
control group with neither instruction nor summarization
practice (McNeil & Donant, 1982). They also achieved
higher scores on passage comprehension questions requiring
recognition of main ideas, cause and effect, and making
conclusions. Taylor (1982) sought to improve 5th and 6th
graders' comprehension of content area text with hierarch-
ical summaries by teaching them to examine the text
structure and relate superordinate to subordinate
propositions.

Teaching students to write summaries of informational
text has great potential as a study strategy. However,
without a component that involves students' prior know-
ledge as in advanced organizers and prior knowledge
mapping, an important opportunity to enhance further
learning is lost. A strategy that combines active
processing of prior knowledge with the processes of

reorganization and condensation of text as in summary writing and can be mastered by students when they begin encountering informational text in the upper elementary grades is worth considering.

Mapping

A strategy that has students mapping their collective prior knowledge and revising these maps in collaborative groups as they read or after reading is based on a combination of the four conditions found lacking in other strategies. Initially, under the teacher's guidance, the students make up an "interpretive community" (Fish, 1980) in which they pool their prior knowledge (Condition 1). They organize this prior knowledge onto a map (Condition 2), creating a framework with which to compare the new textual information (Condition 3). When conflicts arise between prior knowledge and text, the students work collaboratively to resolve the conflict (Condition 4). Information is not taken at face value and memorized but is processed actively by the students. As their skills in processing increase students work through the four steps in smaller groups with assistance from the teacher as needed (see Instructional Procedures below).

Mapping, or conceptual mapping, is an information processing strategy in which the learner organizes existing and/or new concepts graphically by connecting

them according to how they are semantically related (Heimlich & Pittelman, 1986). There are four major types of conceptual mapping: 1) networking, 2) mind mapping, 3) semantic webbing, and 4) concept mapping. All are based on schema theory and while there are similarities, each has its own characteristics.

Networking was developed by Dansereau and his colleagues and was described earlier (see Background above). It is the most limited of the four types of conceptual mapping having been developed specifically for college students as a postreading strategy for the analysis of lengthy expository passages (Holley, Dansereau, McDonald, Garland, & Collins, 1979). The specificity of the links between nodes distinguish networking from the other types. These links were specified by the researchers to represent three types of relationships: hierarchical structures describing particular types or parts of a concept node; chain structures in which one node leads to or causes another; or cluster structures in which one or more nodes describe characteristics of, evidence of, or analogies to the concept node (Holley, et al., 1979). Empirical evidence of the effectiveness of networking exists but is not extensive and was obtained mostly in laboratory settings.

Mind mapping is a more general form of conceptual mapping. Based on the assumptions of Buzan (1983) that

using both sides of the brain increases thinking ability, mind mapping combines words, pictures, symbols, and colors to represent complex thought (Margulies, 1991). Mind maps are non-hierarchical and links are not labeled. Mind mapping has been promoted for the general public of all ages (beginning at age 5) to use for a variety of purposes. Margulies' emphasis is more on the organization of one's own knowledge in a creative manner than on mapping as a comprehension or study aid. No empirical evidence is cited to support mind mapping.

Semantic webbing was designed as a vocabulary development strategy by Johnson and Pearson (1984) and has since become a general strategy for reading (Heimlich & Pittelman, 1986). It is based on schema theory and the assumption that how words fit into a learner's semantic repertoire is more important than learning them in the context of specific sentences (Pearson, 1985). Webbing also can be used to assess prior knowledge, organize details for study, integrate content areas for thematic instruction, and as a prewriting organizer. Semantic webs are usually, although not necessarily, hierarchical with a central main-idea node, link lines radiating out to secondary categories, and further lines drawn to supporting details (Stice & Alvarez, 1987). These links are not labeled. Colors are recommended to differentiate stages of information (prior knowledge versus postreading), or

sources of information (teacher, students, or text)
(Heimlich & Pittelman, 1986). Semantic webbing is
considered appropriate for all subject areas and for all
ages. The empirical evidence cited by Heimlich and
Pittelman support webbing as an effective vocabulary
development strategy.

The fourth type of conceptual mapping, called concept
mapping, was developed by Novak and Gowin, (1984). Concept
maps are similar to webs except that the more inclusive
concepts are usually placed at the top with specific
details underneath. Another difference is that the links
between nodes are labeled to describe relationships
between them. Unlike Dansereau's networks these labels are
generated by the mapmaker. Concept mapping is based on
schema theory and Ausubel's (1960) theory of assimilation
which stresses the importance of what students already
know (Novak, 1990). Concept mapping was developed to
"represent students' knowledge structures before and after
instruction" (p. 32) which gives it potential as an
evaluation tool. Novak's emphasis on explicit revision of
"before" or prior knowledge maps as students learn by
reading helps prevent prior knowledge interference (Ault,
1985). Concept mapping also has been suggested as a useful
tool for teachers in planning lessons and courses, in
presenting these plans to students, and for sharing infor-
mation with parents. Concept mapping also has potential

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for educational researchers as interview guides and as a
direct source of concepts held by students of various ages
in all areas of learning. Such data could inform teacher
training and curriculum development programs (Novak &
Gowin, 1984).

Versatility and its compliance with the four condi-
tions stated earlier make concept mapping a more valuable
choice than other forms of conceptual mapping for the
purpose of this study. Numerous classroom studies, albeit
from junior high school to college levels, support this
choice. Among others, Novak (1990) cites Moreira's 1977
studies of college physics students and Lehman, Carter,
and Kahle's 1985 studies of inner city Black students.
Both studies corroborate Novak's own findings that junior
high school students who used concept mapping improved
their mapping skills with practice and performed better
than control groups on tasks requiring meaningful reor-
ganization of text (Novak, Gowin, & Johansen, 1983). In
the three sets of studies there was little correlation
between concept mapping skill and standardized achievement
scores. Two important inferences can be made from these
findings. First, the development of concept mapping skills
requires time and practice. Second, concept mapping skill
has little effect on measures requiring rote memorization
of information. There is also preliminary qualitative data
indicating that low achieving inner city elementary

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students improved their organization skills, chapter test results, class participation, and attitudes toward learning from text by mapping reading passages (Stice & Alvarez, 1987).

Novak, Gowin, and Johansen (1983) found that it is difficult to change older students' rote memorization strategies to strategies that promote meaningful learning. This finding is supported by Okebukola and Jegede (1988) who studied the relationship between the cognitive preference of Nigerian college students and the benefits of mapping skill. Students who favored learning about principles and application of knowledge used concept mapping more effectively on meaningful learning tasks than students who favored rote memorization. The researchers concluded that meaningful learning occurs when "a person consciously and explicitly ties new knowledge to relevant concepts or propositions they already possess" (p. 489). This process is promoted by concept mapping.

Further justification for focusing on concept mapping includes its information processing similarities to summary writing combined with its accessibility to younger students. Both mapping and summary writing have been shown to be useful study strategies and helpful in improving and demonstrating comprehension of text. Yet they are presented in methodology textbooks (Harris & Sipay, 1990; Leu & Kinzer, 1987; Mason & Au, 1990; Vacca & Vacca, 1989) and

research reports (Anderson & Armbruster, 1984; Tierney &
Cunningham, 1984) as two separate entities. There are some
differences between them but the similarities that can be
found are numerous. Listed below are points made about
(a.) summary writing and (b.) concept mapping.

1. a. Summarizing text is a "sophisticated method
of testing one's level of comprehension."
Students must "delete, select, or manipulate
sentences already provided" and "add infor-
mation in his or her own words" (Baker &
Brown, 1984, p. 373).

   b. Concept mapping "requires students to perform
on all six levels (of comprehension)" including
"analysis, synthesis, and evaluation" (Novak &
Gowin, 1984, p. 23).

2. a. Summarization is "an important study skill
involving both comprehension of, and attention
to, importance at the expense of trivia" (Brown
& Day, 1983, p.1).

   b. "Concept maps are useful for separating
significant from trivial information" and
they "work to make clear to both students
and teachers the small number of key ideas
they must focus on for any specific learning
task" (Novak & Gowin, 1984, pp. 23 and 15).

3. a. An inadequate summary can be used "as an
      indication that "comprehension (is) not
      proceeding as it should and remedial action
      such as rereading or clarifying (is) needed"
      (Baker & Brown, 1984, p. 384).

   b. "Misconceptions are usually signalled either
      by a linkage between two concepts that leads
      to a clearly false proposition or by a linkage
      that misses the key idea relating two or more
      concepts" (Novak & Gowin, 1984, p. 20).

4. a. Summarization becomes "an effective study
      strategy when students receive instruction on
      how to produce summaries" (Harris & Sipay,
      1984, p. 520).

   b. "The primary benefit of concept maps accrues to
      the person who constructs the maps." "It will
      be unfortunate if students are not instructed
      in preparation of concept maps and required to
      prepare some of their own maps" (Novak & Gowin,
      1984, p. 37).

The terms summarization and concept mapping are
nearly interchangeable in these four points. Both require
levels of comprehension deeper than the literal level;
both emphasize the importance of main ideas over trivia;
both can signal a student's need for clarification of
meaning; and students who are taught how to produce

summaries and/or maps of their own benefit more than students who merely use those produced by others. The production of first and at least second drafts is also common to summarization (Vacca & Vacca, 1989) and concept mapping (Novak & Gowin, 1984) and in both, the subsequent drafts can result from the negotiation of meaning among students. While the products differ in form (i.e., maps are visually schematic as opposed to the connected text of summaries), students are left with the gist of the text to be studied.

There are fewer differences than similarities between summary writing and mapping. While trivial and redundant information is lost in both mapping and summary writing, mapping allows for the inclusion of more details (i.e., examples) and more specific propositions that require less inference and invention than do summaries. Maps are more visual than summaries with greater focus on the "human capacity for recognizing patterns in images to facilitate learning and recall" (Novak & Gowin, 1984, p. 28). In mapping, students are expected to use words and/or phrases that are organized mostly in hierarchical relationships. Good summary writing requires logical and fluent but concise prose. To illustrate their differences a map and a summary were written by two adults after reading the following passage:

> A Mexican father loves his children, but he was taught that the mother is the one to teach young

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children. He helps her only when she cannot handle a problem alone. As soon as his sons are old enough he teaches them the jobs they must do in the man's role.

In Mexico the men and the boys work on the land. A man greatly values his land. It provides almost everything his family needs. It grows vegetables that feed his family and animals. It provides clay for dishes, jars, bricks, and tiles for building his home.

A young boy is happy to begin working with his father. By the time he is five or six he will begin caring for chickens or pigs. As soon as he is tall enough he will want to harness the burro. Besides plowing, planting, hoeing, and harvesting, a growing boy learns other skills. (adapted from The United States, 1980, pp. 42-43)

Concept Map
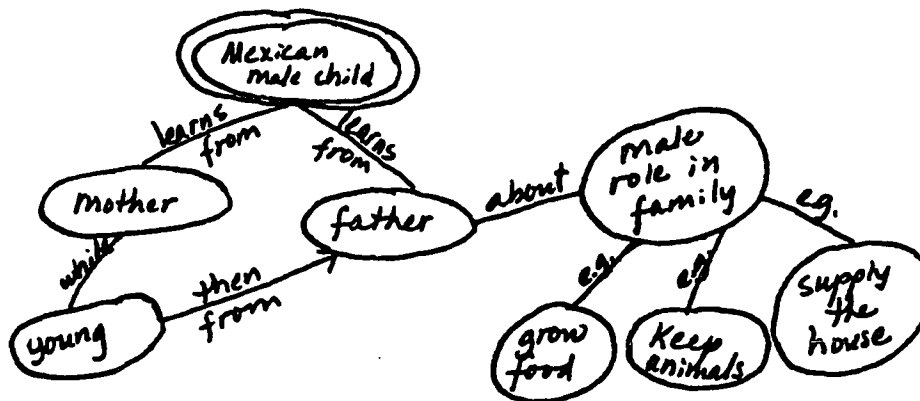
Summary

Figure 1
Concept Map and Summary of the Same Text

These differences, when added to the findings that less mature students have difficulty with the invention rule of summary writing (Brown & Day, 1983), suggest that concept mapping might be useful as preparation for summary writing. Mapping could be an intermediate step in which students learn how to delete, substitute, select, and invent in the context of concrete visual relationships of mapped propositions before dealing with the less concrete summary format. Once these processes are mastered they could be presented to students as guidelines for summary writing. Research in this area is needed.

Criterial Task

Mapping Skill and Processing of Content

When teaching a comprehension and recall strategy such as mapping, the teacher must decide whether to teach it as a skill separate from subject matter or to use the subject matter as a vehicle for the strategy. Herber (1979) supports the latter choice as does Resnick (1987b), stating that "the evidence shows clearly that thinking is driven by and supported by knowledge in the form of both specific facts and organizing principles" (p. 45).

Grounding strategy instruction in the context of specific subject matter is supported also by Glaser (1984) and by Alexander and Judy (1988) who view knowledge about strategies as contributing in turn to further "utilization

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and acquisition of domain-specific knowledge" (p. 388).
Learning a strategy while actually reading or studying
helps contextualize the learning thus making it more
meaningful to the student (Brown & Campione, 1984;
Collins, Brown, & Newman, 1989).

Social studies and science are the main content areas
in the fifth grade and both require students to read
informational text. Both areas introduce subject-specific
vocabulary which contributes to increased reading diffi-
culty. Either area would provide appropriate content for
concept mapping instruction. Social studies was chosen for
this study for a number of reasons. The topic for Grade 5
is the development of early America, a topic that is
somewhat difficult to contextualize, particularly for
students living in tropical Hawai'i who have just studied
Hawaiian history in Grade 4. Also, the social studies
textbook provides more text mapping opportunities since it
has a higher proportion of text (fewer illustrations and
experiment-type procedures) than the science text. The
choice was guided by these considerations, plus the
teacher's perception that her social studies instruction
needed improvement to increase her own and the students'
motivation.

The Requirements
Considerable thought and planning is required to

implement concept mapping instruction successfully. Mapping requires commitment from the students (Anderson & Armbruster, 1984) and students who are used to rote memorization without much thinking may perceive mapping as not worth the time and effort. To be successful with these students, teachers must themselves be comfortable with their own mapping skill and must appreciate its benefits. Teachers must also be familiar with other strategies so that those appropriate to different learning tasks can be selected as needed and no one strategy is overused (Resnick, 1987b).

Direct instruction has been found to be an important initial step in strategy learning and use (Roehler & Duffy, 1984). In order to maintain the use of a strategy and prevent it from becoming inert knowledge, Brown, Bransford, Ferrara, and Campione (1983) have suggested a process of informed instruction in which students are taught when, how, and why the strategy might be useful. Bransford, Sherwood, Vye, and Reiser (1986) suggest further that students must be "explicitly prompted to use (the strategy)" (p. 1081). They suggest also that the strategy should be put into the students' social context by asking students to think of ways in which they could use the strategy in other classes as well as in their personal lives. Preparing to write papers, studying for examinations, reading in other content areas, preparing

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for class presentations, personal problem solving, and decision-making could be considered.

Some of the considerations for ensuring acquisition and maintenance of a strategy also apply to the transfer of learning to novel situations. Haywood (1988) suggests bridging activities in which students are asked to devise instances in school, home, and peer relationship situations to which they could apply learned principles and strategies to everyday life.

The effectiveness of stressing the utility of a strategy in a wide range of situations is supported by a number of studies. Ghatala, Levin, Pressley, and Lodico (1985) document the nine-week maintenance of a strategy used by second graders who had been taught explicitly about the effectiveness of that strategy. Brown and Campione (1978) observe that young children who were told how a strategy was helping them were more likely to continue using that strategy.

The importance of making the utility of a strategy explicit is considered an essential part of informed instruction by Pressley, Snyder, and Cariglia-Bull (1987) who add that to maintain use learners must be able to attribute success and improved performance to the use of the strategy. Positive changes from pre-instruction work (e.g., concept maps or summaries) to post-instruction work could provide evidence to students of the strategy's

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utility (Meyer, Brandt, & Bluth, 1980. If positive changes are not evident for students who are already achieving high performance in summary writing and/or recall of ideas it could mean that these students are already using an effective strategy that should not be replaced. Likewise, if low performance in these tasks continues after strategy instruction it could indicate either that mastery of the strategy has not been accomplished or the value of the strategy is not recognized by the students.

Referring to his own research, Pintrich (1987) concludes that transfer depends in part on the student's motivation to use a strategy in various domains as well as an expectation of success. He adds that students who were more interested in mastering the information than in their grades were more likely to use the strategy.

Prawat (1989) and others (Brown & Campione, 1978, 1984; Salomon & Perkins, 1989) add a further condition for the facilitation of learning. This condition involves self-awareness, self-questioning (*What do I already know that will help me understand? What can I do to make this information more meaningful?*), and self-regulation of one's thinking processes and strategy use. Salomon and Perkins refer to six studies (Belmont, Butterfield, & Ferretti, 1982) in which students were taught not only a learning strategy but also the importance of "mindful attention to and management of one's own (thought)

processes" (p. 127). These students were able to use the strategy effectively at a later time in novel recall tasks.

The implications are two-fold. First, it appears that simply teaching a strategy is not enough to ensure its becoming part of the student's learning repertoire. Information about the strategy's utility for improved performance, encouragement for the student to use it in other areas of learning and personal life, and student self-awareness of strategy use are all necessary to prevent strategy skills from being forgotten immediately after instruction.

Second, if all of these conditions are met it seems that the particular strategy is less crucial as long as students are involved in their own learning. Anderson and Armbruster (1984) refute the latter implication in their review of research on studying techniques. They conclude that "some techniques have more potential than others for promoting the deeper processing suited to criterion tasks requiring greater comprehension and/or recall. These techniques include outlining, networking, mapping, and schematizing, which all force students to identify or impose relationships that convey the meaning of text" (p. 674). They add that while these strategies are the most successful they also require students to invest more

time and effort than in other less successful strategies, making time and effort the most important variables.

Learner Characteristics

In a heterogeneous class of 25 or more fifth graders a teacher can expect a variety of differences. The reading achievement comprehension scores can range from mid-second to mid-twelfth grade levels (see Materials: Text Difficulty above). There will be differences in the students' prior knowledge that can widen or narrow gaps in understanding. Student motivation may range from high to low and attitudes may vary from positive to negative as influenced by past experience. There may be gender differences that interact with the nature of the content, the strategy to be taught, or other factors. All of these differences should be examined.

Reading Achievement

Despite their limits as a "rough approximation of some characteristic at a special point in time under special conditions" (Patton, 1986, p. 228), standardized reading achievement scores are frequently used to categorize students as poor, average, or good readers. Experienced teachers can validate the standardized results with their own observations of how the students handle actual reading tasks in the classroom (Leu & Kinzer,

1987). It is important for a teacher to be aware of student achievement differences in order to make instructional decisions about text presentation and grouping arrangements.

Prior Knowledge

The crucial process of linking one's prior knowledge to new information to improve recall and understanding has been described previously (see Background above). The interaction between this process and reading achievement also should be considered. The Bransford studies (Bransford, Stein, Shelton, & Owings, 1980) determined that less successful fifth graders who had not been explicitly taught to do so made little effort to make the connections Similar results were found with high school students (Sullivan, 1978). This finding justifies teaching a strategy which will promote the process for those students who are unaware of it and which will provide the teacher with information as to what prior knowledge the students have about the topic to be studied.

Motivation and Attitude

Differences in motivation and attitude are important to note because they can affect the energy and enthusiasm with which students approach a task (Haggard, 1989). In a research summary of specific study strategies such as

outlining, notetaking, summarizing, and mapping, Anderson
and Armbruster (1984) conclude that any of the strategies
that require deeper processing of information would be
effective depending on the amount of time and energy
students are willing to invest.

Motivation and attitude interact closely with
students' self-perceptions of their reading ability,
perceptions that are based largely on their prior
successes or failures with reading (Vacca & Vacca, 1989).
This factor makes it important for teachers to plan
instruction so that students who are used to failure can
experience success.

Gender Differences

Teachers should be sensitive to individual differ-
ences among students as well as differences between boys
and girls. Cultural and sex-role expectations at home and
at school can be powerful influences on both motivation
and achievement (Harris & Sipay, 1985). Girls are more
likely to score higher on reading comprehension tests
(Threadgill-Sowder, Sowder, Moyer, & Moyer, 1985) and also
to conform to academic tasks for whatever, as yet undeter-
mined, reason (Harris & Sipay, 1990).

That student preference or ability for concept
mapping can be attributed to gender differences in
spatial-visual ability is not supported by meta-analysis

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of related research from the 1974 Maccaby and Jacklin studies up to studies in 1982 (Linn & Petersen, 1985). However, the issue has resurfaced in a review of research on toy preferences of boys and girls and the possible influence on the development of spatial abilities (Tracy, 1985). Data relating to children from 8 to 13 years old and to the promotion of spatial development by specific toys is lacking but Tracy suggests a possible link. The inference is based on girls' preference for domestic toys such as dollhouse furniture which is limited to manipulation for producing different arrangements. In contrast, boys choose toys like building blocks and vehicles that require specific steps in manipulation, construction, and/or movement in space in order to make them "work."

More relevant to concept mapping is a study of boys and girls between 8 and 11 years old which compares their production of a geographic map after walking in an area unfamiliar to them (Matthews, 1987). The same environmental features were pointed out to all the students (no sample size was stated). The results showed there was no difference in the number of details recorded but that girls were "unable to arrange these elements in a spatially coherent manner" (p. 86) and boys and girls emphasized different features. Boys tended to recall more roads and girls noted more landmarks. Girls also tended to

"distort maps in a stylized manner" (p. 86). These find-
ings imply that there may be gender differences in the
ability to translate information into the visual format of
concept maps.

Interpersonal Context

The teacher must decide whether class interaction
patterns should be teacher-directed or student-directed
and whether students should work individually or in
collaboration. Okebukola and Jegede (1988) determined that
greater gains were made by adult students who mapped
collaboratively. Bayer (1990) and Brown and Palincsar
(1989) recognize the benefits of a collaborative pool of
knowledge. However, developing strategies for independent
learning is still an important educational goal.

Teaching a strategy by using a combination of
interaction patterns as in a guided, cooperative learning
model is advocated by Brown and Palincsar (1989) and
Collins, Brown, and Newman (1989). This model includes
three key elements: 1) direct instruction with teacher
modeling, concrete examples, and practice of the strategy;
2) coaching of the students as the teacher observes their
progress, provides clues, and leads them toward more
difficult tasks with scaffolding support as necessary; and
3) fading of the coaching support as the students become
more able to carry out the tasks themselves (Collins, et

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al., 1989). Once the teacher has modeled the processes
involved in strategy use and guided the students
in their initial practice, heterogeneous groups can
practice using the strategy collaboratively.

The advantages of such collaboration are three-fold:
1) the collective prior knowledge of a heterogeneous group
or class is more extensive than that of individuals and
provides a broader base from which to approach new infor-
mation (Bayer, 1990; Brown & Palincsar, 1989); 2) the
social studies texts used in most classrooms are written
for a national audience so the interpretation of meanings
must be put into a local context and a consensus reached
by the particular students involved (Fish, 1980); and
3) students of varying abilities can work within their
zones of proximal development (Vygotsky, 1978) or learning
zones which represent gradual progress from what students
can do in collaboration with others to what they will be
able to do independently. By recognizing the importance of
collaboration, group interpretation, and the social con-
text of the learning environment, we also recognize the
shift away from learning as rote memorization of facts.
Further benefits of collaboration include opportunities
for students to assume different roles of group member-
ship, confront conflicting perceptions, and develop skills
needed for collaborative work (Brown, Collins, & Duguid,
1989).

CHAPTER 3
THE STUDY

Socio-Cultural Context

The School

The students participating in this study attend an
elementary school in Honolulu, Hawai'i. It is located in
an elevated valley between steep mountains with cool
breezes, frequent showers, and lush tropical vegetation.
The school is at the end of a quiet cul-de-sac in the
middle of a residential neighborhood, a setting which
strikes the visitor as an idyllic place for teaching and
learning. The campus includes: separate one-story
buildings with two classrooms for each grade level, an
administrative block with teachers' lounge and nurse's
office, an air-conditioned library, a well-equipped
computer room, a large playing field, a covered yet open-
sided gymnasium, and a large multipurpose cafeteria.

The 375 students attend classes from kindergarten to
Grade 6. Classes in the upper elementary grades average
about 26 students and there are two classes at each grade
level. About 50% of the students live in the neighborhood
and the rest live elsewhere but have obtained district
exemptions to attend. The reasons vary. Students may have
relatives who live in the neighborhood with whom they can
stay before and/or after school while parents are working.
Children from broken homes may live with one parent in the

district part of the time and with the other parent in another district at other times. They may live elsewhere but are dropped off by a parent who works in the district. According to the school administration, many parents seek these exemptions "because of (the school's) reputation to provide high quality instruction and to offer an excellent before and after school care program" (Informational Brochure, 1992). They support this claim with 1992 Stanford Achievement Total Reading Test scores for Grade 6 that place students at 37% above average, 55% average, and 8% below average. The brochure also lists various local and national awards for excellence received by the school since 1983 as further support for its high standards and expectations.

The socioeconomic background of the students is predominantly average and above. Less than 5% receive public assistance such as free or fee-reduced meals.

The school's ethnicity profile includes about 85% Asian (Japanese, Chinese, and Indo-Chinese) and Pacific Islanders (Part-Hawaiian and Filipino); 10% Caucasian; and 5% from other groups. Of the 14 full-time classroom teachers, 13 are Asian and Pacific Islanders and 1 is Mexican. Only 1% of the students were born outside the United States and participate in the Students of Limited English Program. The rest were born in the U.S. and are native English speakers.

School events and fund-raising projects are organized
and supported by active community groups such as the local
Senior Citizens; a Cub Scout Pack; a Parent Community
Networking Group; a School Community Council made up of
parents, teachers, community members, and the principal;
and Friends of (the school).

The Teacher

The participating teacher, Mrs. M., is a 32 year-old
Japanese-American who has been teaching elementary school
for eight years, five at the fifth grade level. She has a
B.Ed. and is currently working toward an M.Ed. at the
University of Hawai'i. She has created a classroom
environment that organizes spaces and routines, encourages
both independence and collaboration, and highlights
student self-esteem in various ways. One esteem builder is
called the "Star of the Week." Each week a different
student puts his/her photograph on a colored-paper star,
writes favorite things and hobbies on precut computer-
generated forms, adds photographs of family members,
trips, and other personal events and puts them all on the
Star of the Week bulletin board. At the end of the week
the star photo is moved to the chalkboard border at the
front of the room and another student becomes the Star of
the Week. Student work is displayed prominently around the

room and each student has both a storage cube and a pigeon hole for messages from the teacher and each other.

Mrs. M. is firm, yet warm and supportive. She provides guidance but encourages students to work out minor disputes with each other. She obviously enjoys the fifth graders and she has an easy, friendly way of talking and joking with them. Visitors are made welcome but nothing special is done to impress them.

Until participating in a pilot study (1991-1992) with the researcher, Mrs. M. had not done any concept mapping herself. She developed her mapping skills during that year and came to appreciate both its benefits and difficulties. She agreed to collaborate with the researcher in developing instructional procedures for the current study.

The Class

The Grade 5 class of 26 students has 15 girls and 11 boys. In September 1992 they were between the ages of nine years, nine months and ten years, ten months. All of the students are of Asian or Pacific Island ethnicity. All of the students were born in the U.S. and are native English speakers. Only one student has a parent who has difficulty with English. Over half (54%) of the class attends the school with exemptions from other districts.

At the end of Grade 4, the Stanford Achievement Total Grade-Equivalent scores ranged between grades 3.0 and 11.5

in reading and grades 4.3 and post-high school in math.
The grade-equivalent scores for just the SAT reading
comprehension test were 2.9 to PHS (post-high school).
According to the relevant SAT reading stanine scores, 6
students (23%) are considered above average in reading
comprehension achievement, 16 (62%) are average, and 4
students (15%) are below average. Of the 6 students in the
above-average group, 3 attend Enrichment Class during the
language arts period.

This class was selected for the study because the
students meet the following criteria:

1. They form an ethnically and academically
   heterogeneous group as shown by the ethnic
   profile and the SAT reading scores listed
   above.

2. There are relatively equal numbers of boys
   and girls from mostly average socio-economic
   backgrounds.

3. They have not received prior instruction in
   the use of concept mapping.

4. Their primary learning material for social
   studies is a fifth grade social studies text.

5. Their school principal gave her permission
   and support to the study.

6. Their parents gave the researcher permission
   to use their children's test scores and

classwork for analysis under the condition
of confidentiality.

Instructional Procedures

The social studies class was scheduled to meet for 30
minutes three times a week. Adjustments were made for
holidays and the 3 days of Fifth Grade Camp to provide a
total of 45 sessions for the study in the first semester.

Mrs. M. agreed to use a guided, cooperative learning
model (see Interpersonal Context), beginning with direct
instruction and modeling of the mapping process for the
whole class. Key components are the use of concrete exam-
ples generated by both teacher and students and provision
for ample practice opportunities. As students develop
mapping skills the teacher divides them into groups and
coaches them with clues and other assistance as needed.
Gradually she withdraws her assistance to promote student
independence.

Before school convened in September Mrs. M. had
familiarized herself with activities suggested by Novak
and Gowin (1984) for introducing concept mapping to stu-
dents. The researcher had selected their model of concept
mapping for this study because it complies with the four
important conditions for learning stated earlier: 1) di-
rect use of student prior knowledge, 2) organization of
prior knowledge, 3) explicit connections between prior

knowledge and text, and 4) negotiation of conflicts between prior knowledge and new information (see Learning Activities for Information Processing). Another reason for its selection was the fact that Novak and Gowin have been able to teach this form of concept mapping to upper elementary grade students in various content areas (Novak, 1990).

On the opening day of school Mrs. M. told her students that the next day they would begin learning a study skill called concept mapping in their social studies classes. In preparation she showed them how to construct concept mapping booklets using two sheets of 12" by 18" manila paper for the covers and newsprint sheets for the pages. Two holes were punched at the left edge for binding with paper fasteners. Each student also made a learning log folder using a 9" by 12" manila folder for the cover and pages of 8.5" by 11" lined paper attached with a two-pronged metal fastener. During free time the students decorated their booklets and folders with drawings.

The first five sessions were planned for introducing the class to concept mapping and its specific vocabulary (*mapping, concepts, nonconcepts, nodes* or *bubbles,* and *links*) using pre-mapping activities suggested by Novak and Gowin (1984, pp. 29-30). Procedures and ground-rules were also established. The number of class sessions varied from week to week so they are described as separate days.

References appearing in quotes and/or dialogues are taken directly from the audio tape transcriptions of class sessions. Pseudonyms are used to maintain confidentiality. They reflect gender but not ethnic background.

Day 1: Mrs. M. introduced the researcher and the students introduced themselves in turn. Students were told that the researcher would be coming for all social studies classes through December (although concept mapping would continue until June). She would take notes and use a tape recorder to observe how fifth graders develop concept mapping skill. After the introductions the students were asked to make their first learning log entry, a process familiar to them from other classes. They were to respond to the question, *Do you like social studies? Why or why not?* They were told that only the researcher, not their teacher, would be reading and responding to them so that they could be completely honest.

The teacher began pre-mapping activities by comparing what the students already knew about other kinds of maps to concept mapping. It was established that in concept mapping they would learn how to "make a picture or a map of how information ties together." Then she presented the term *concept words* as represented by object words (e.g., boat, monkey, table, lemon) and event words (e.g., running, fixing, earthquake, baseball game). She had

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students visualize these concepts and share what they saw. To contrast concept words with nonconcept words the teacher asked what they could visualize with words like *the*, *is*, *has*. Students decided they could only see the words themselves without any meaning so these words must be nonconcept words. Also during this first session ground rules for participation were established (e.g., one person speaking at a time, raising hands to speak), partly to facilitate tape recording.

Day 2: After a brief review Mrs. M. had students identify in class the concept words in four sentences and a short paragraph. Each concept word was discussed and agreed upon by the class. The paragraph was the beginning of the first of three passages of text to be used for mapping practice. These passages of about 250 words each were adapted from a magazine for upper elementary students, the National Geographic World (permission granted by the National Geographic Society). An unusual dog, earthquakes, and hurricanes were the three topics chosen for their general interest (see Appendix B).

Mrs. M. modeled the mapping process using the paragraph about an unusual dog named Mutley. Using student input the teacher demonstrated how to decide what the title or main heading should be; select the most important information to write in bubbles; reword the text to make

more general headings linked to more specific subheadings;
link the information together with lines, words, and
arrows when appropriate to show relational direction; and
make revisions to clarify and improve the presentation.
Making sense out of the information was an important part
of the discussion, for example:

Mrs. M.: What else do we know about Mutley?

Paul : Mutley's a dog.

Mrs. M.: Does it say she's a dog?

Paul : No but it says she's part terrier, part
cocker spaniel.

Mrs. M.: OK. What else?

Hannah : Never signs autographs

Mrs. M.: OK. Do you think we can put that coming out
of something (that is already on the map)?

Alex : TV star...

Mrs. M.: Why TV star and not athlete?

Alex : Um, TV stars write more autographs than
athletes. I think they do.

Paul : If you're popular, a TV star or uh whatever,
if you're popular you give out autographs.

Mrs. M.: You know what I'm gonna do then - maybe
I won't put it out of TV star because you're
right she isn't ...

Alex : Why don't you make a double arrow?

Mrs. M.: Good, Alex, that's right.

Day 3: A new girl, Rebecca, had joined the class so the
students reviewed concepts, nonconcepts, maps, and the
concept words identified in the sentences from the

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previous day. Mrs. M. told the class that they would also be doing some mapping in their science class with the other 5th grade teacher. She explained to Rebecca how the class had made the map together and she introduced the idea of prior knowledge using the example of Paul knowing that Mutley was a dog from prior knowledge about cocker spaniels and terriers.

She passed out the complete passage about Mutley and told the students they could underline the concept words as she read the passage to them. She quickly realized that their concentration on underlining was interfering with their listening so she had them just listen first, then go back and underline all the important concept words.

As students told her what they thought was important she listed the items on a chart. As students made suggestions Mrs. M. asked them to reword and shorten them and she praised those students who spontaneously did so, for example:

Mrs. M.: What else is important?

Tom   : She was a stray dog.

Mrs. M.: Right!!! Stray dog. You know what I like
         about what Tom said. . . it says here that
         she wasn't always such a lucky dog. As a
         puppy she was chained at the pound. Instead
         of telling me all that he just put all that
         information in two words. That was a good
         job.

Choosing only important information over unimportant details was stressed. When all the important ideas were

listed the students attempted to rank order the 11 items
they had decided were the most important. The discussion
got bogged down in lengthy arguments about minor points
and in voting on what concepts were most important.

Day 4: Mrs. M. and the researcher agreed to abandon the
rank ordering of items. Instead the items were discussed
and transferred directly to the map that had been done for
the first paragraph about Mutley. The teacher reviewed the
list and differentiated between concept words and concepts
pointing out that concept words alone may not give as
complete a picture as concepts. She had students recall
all the lines they had on their paper for concept words
and led them to suggest that it would be easier and would
make more sense to put them together. She called on stu-
dents to read concepts from the map (e.g., Mutley is a TV
star) to show them how the map provides a short form of
the ideas from the text which can be reconstructed into
sentences. She demonstrated how they could group the
concepts that were related by marking them with the same
colored pen. Unlike the rank-ordering fiasco the students
were able to indicate quickly which items went together.
Zachary suggested a group of items and went on to say they
could come under "Mutley is talented," anticipating the
teacher's next step of developing subheadings. Searching
for meaning, the use of nonconcept linking words, and the

deletion of unnecessary repetition and unimportant details
were all stressed in this session.

Day 5: Mrs. M. began with praise for the class effort at
mapping so far. She introduced highlighting of the title
and the main heading bubbles with a colored marker to
differentiate them from the subheadings and miniheadings.
Alex had suggested the term miniheadings which the class
agreed was preferable to Zachary's suggestion of baby
subheadings. Mrs. M. gave a direct indication of the
benefits of mapping as a study tool and students agreed
that it would be easier to study a map than to reread the
passage over and over, a study technique many of them
use. When Anna complained about all the writing involved
Zachary insisted, "It'll pay off when you study because
it's gonna be a lot easier for some people. It's gonna be
worth writing it." Mrs. M. pointed out the needless
repetition in the list of items about Mutley and that
although on the map the word Mutley was written only once
you could reproduce numerous sentences about Mutley by
reading the linking bubbles.

To conclude the instruction phase of the program Mrs.
M. had the students tell her the steps they went through
in concept mapping and she wrote the list on a chart.
These included reading the passage, listing important
concepts, choosing or making up a short main idea or title

bubble, grouping the concepts, finding words to describe the grouped concepts to make heading and/or subheading bubbles, writing related concepts under the headings/sub-headings and writing connecting words on the lines, and discussing in order to revise and rewrite the map. Tony was concerned about how much paper had been used and Alex noted that it had taken five days to make this map. Mrs. M. pointed out that it was their first and that with practice, mapmaking would become easier and faster.

Days 6-7: Before practicing the mapping process using a new passage about earthquakes, the teacher introduced the prereading step of listing and organizing prior knowledge of a topic to prepare for the text. This step was added to the process chart done on Day 5.

After their prior knowledge about earthquakes was listed the teacher had the students tell her how to go about putting the information onto a map following the steps on the process chart. Concepts were grouped and the teacher wrote them up on the prior knowledge map as directed by the students, not without considerable negotiation. To explain "tsunami" without making a separate bubble Alex suggested using "those c things" (parentheses) around "underwater earthquake" and putting it in the same bubble as tsunami.

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Students were pleased to see how little time it took to make their second concept map in comparison to their first and that when they read the passage there was very little new information to add. The few items that were added were written in a different color to differentiate prior knowledge from new information. As part of the revision process better linking words were found and new headings were invented such as "theories" (Alex) to describe different ways earthquakes start. At the end of the session the process chart was discussed, revised, and displayed in a prominent place for reference.

Days 8-15: For the third class mapping effort the topic hurricanes was introduced. This topic had been selected before the program began and it seemed particularly appropriate since a few days before Hurricane Iniki had narrowly missed the island but had devastated the neighboring island of Kauai. However, what at first had seemed serendipitous turned into an information overload. The students had so much prior knowledge that Mrs. M. had to limit them to 50 items in order to move on to mapping. Then, because it was so recent and meaningful to them (many had relatives living on Kauai), all of the information seemed important enough to map. The process chart was followed as the teacher listed items, grouped

them according to student input and developed the class prior knowledge map.

To begin independent practice Mrs. M. divided the students into five heterogeneous groups of five or six students each. While groups this size are considered large for effective collaboration, Mrs. M. felt that in the early stages providing attention to seven or eight smaller groups would be too demanding. Students were assigned group jobs such as reader, recorder, reporter, encourager, and timekeeper and their tasks were defined by the teacher. Roles would alternate with the exception of the reader. Readers were chosen for their ability to sight read without difficulty, a necessary step because the class social studies text, The United States (Center for the Study of Instruction, 1980), was written at a level of difficulty higher than many fifth grade students would be expected to handle easily.

The approximate difficulty level of the text was determined by a readability study using the Harris-Jacobson Wide Range Readability Formula (Harris & Sipay, 1985), pp. 656-673). This formula was chosen for three reasons. First, the formula measures both sentence complexity and word difficulty rather than measuring only one factor such as the number of syllables. Second, it is more current than the other formulas since its word list is derived from various basal reading series published in

the 1980's. Third, the formula is calculated on samples of 200 words and provides broader representation of the text than the 100-word passages used in the Fry Readability Scale and the Spache Readability Formula (Leu & Kinzer, 1987). Keeping in mind the warnings about relying too heavily on readability formulas (see Materials: Text Difficulty), the readability levels for the first eleven chapters in the fifth grade text range from 4.7 to 8.1 (i.e., high fourth grade to low eighth grade) with an average level of 6.4 for a fifth grade class.

A further difficulty factor is evident in the author's use of words (in italics below) that appear on the readability formula's easy word list yet have meanings unfamiliar to some of the students (e.g., *bases* of the mesas, *mouth* of the canyon, hunted small *game*, and crossed the *land bridge*). These decoding and conceptual difficulties can be alleviated somewhat by having the teacher or students known to be at the higher achievement levels in reading read the text as the other students follow along in their books.

Students were shown how to write the class map information on index cards to be temporarily stuck on a large sheet of paper using a sticky but removable adhesive called 'hold-it'. As they read the passage they could manipulate the cards into different patterns before coming up with the final map. This technique was suggested by

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Novak and Gowin (1984) and seemed to alleviate the need
for too many time-consuming map drafts.

The class was told that when the maps were finished
two or three groups would present their maps. It was hoped
that knowing they might be chosen to present their maps to
others would motivate each group to complete their maps.
Also, group maps could be revised further as a result of
these presentations. Seven sessions later, four more than
had been anticipated, the hurricane mapping cycle was
completed.

On Day 11, students wrote their second log entry in
response to the questions, "Do you like reading stories?
Do you like reading in social studies textbooks? Why/why
not?"

Days 16-17: Students completed independent mapping and
summary worksheets consisting of fifth grade social
studies text that they would not be studying as part of
the regular sessions (see Data Collection).

Day 18:   The first topic in the social studies textbooks
is explorers. Unfortunately, the complexity and density of
information on the first three pages make them not
conducive to beginning mappers so the teacher kept the
students as a class instead of working in their groups.
She asked them what they already knew about explorers,

writing their responses on the board. Then she introduced new vocabulary they might find difficult to understand. Accessing prior knowledge and introducing new vocabulary are prereading steps from a Directed Reading Approach (Vacca & Vacca, 1989)(see Learning Activities for Information Processing).

Then Mrs. M. read the three pages of text in sections as the students followed along in their textbooks. She constructed a map as she read each section. Ideally students should construct all of their own maps but in this case the teacher distributed copies of her map which could be put into their mapping booklets. Her reasons were that the text was too difficult for them at this stage and that the information was not something she felt they needed to spend a great deal of time processing.

Days 19-24: The students went back to their groups for the next section of text after the teacher introduced the new vocabulary. Groups made prior knowledge lists, constructed a map using index cards, read the two pages of text about three different Native American groups, confirmed points, added new information to their prior knowledge maps, made revisions, and constructed a final map. Mrs. M. circulated from group to group encouraging total participation, clarifying processes and items in the text, and helping to settle arguments.

<u>Days 25-26</u>: Three group reporters presented their maps and led discussions with the help of other members of their groups. Students wrote their third learning log entry of how they felt about concept mapping so far and some made suggestions for improvement (e.g., not using the index cards because they were too confusing and troublesome).

<u>Day 27</u>: As a class the students discussed the qualities of good maps they had noticed in the presentations such as highlighting or using capital letters for headings, rewording the text to make bubble entries as short as possible, using appropriate linking words, leaving out unnecessary information, and writing neatly.

All groups revised their own maps based on the presentations adding any information they had missed which they felt was important. Then students copied their final group map into their concept mapping booklets for study reference.

<u>Days 28-30</u>: After Mrs. M. introduced the new vocabulary from the next two pages of text the groups repeated the entire mapping process but with two modifications. The first was the abandonment of the index cards which had caused more problems than solutions. Students had com-plained about them in log entries and numerous arguments over the 'hold-it' had flared. The second change was made

because the lengthy group presentations involved only one or two students at a time talking to the largely passive remainder of the class. Mrs. M. and the researcher collaborated on an alternative to be tried in the subsequent session.

Day 31: Instead of group presentations, group maps were spread out on tables and the groups moved from map to map comparing, discussing, and deciding if they should add to their own maps (in a different color) any information they had missed. In this way each group actively participated and five maps were discussed in the time it had taken three groups to make presentations. At the end of class the students copied their final group maps into their individual concept mapping booklets.

Day 32: Mrs M. administered her own test on Chapter 1 for her own grading purposes.

Day 33: Mrs. M. introduced the new vocabulary from the first section of Chapter 2. Groups listed their prior knowledge about early colonists and the group readers read the relevant page of text. Students were asked to do an individual map of the page before doing their group maps. These maps provided students with an opportunity to try

individual mapping followed by group discussion and revision.

Day 34: Each group discussed and revised their individual maps.

Day 35: Tests on Chapter 1 were returned and discussed. Students were asked to make their fourth log entry as to how long they had studied for the test. Then they were asked if they had used their maps to study and if so did it help. If they had not used their maps they were asked how they had studied.

Days 36-38: As students became more confident in the mapping process, arguments and difficulties within the larger groups increased considerably. Mrs. M. felt that, since less assistance was needed from her for concept mapping, the time she was spending in mediation might be decreased if groups were smaller. She assigned new groups of two to three students each. These groups followed the mapping procedures with two more pages of text.

While the maps were still in the draft stage the researcher and Mrs. M. noticed that for the most part the entries were not becoming less verbatim but had regressed in quality. Also, numerous misinterpretations of the text were evident.

Day 39: Mrs. M. demonstrated to the whole class how
information can be reworded and rearranged with emphasis
on cutting out repetition and unimportant detail. Unfor-
tunately, this session had little impact since the
students were in a state of great anticipation about
departing for their Fifth Grade Camp Week which began the
following day.

Days 40-43: Again as a class activity, the two pages of
text were reread and considerable time was spent
confirming points and/or negotiating meaning. Certain
points about the Africans in particular needed to be
clarified such as the false impression created by the
statement, "In 1619, Black Africans came to Virginia to
work on the plantations" (The United States, pp. 76-77).
This led to student perception that the Africans came to
America willingly and merely had to work off their travel
debts like the indentured servants from England. After the
discussion, group maps were revised and copied into
mapping booklets.

Days 44-45: Students were asked to complete individual
mapping and summary passages as a follow-up to those done
in sessions 16 and 17. They also made a fifth log entry as
to whether or not they liked social studies at this stage
and why or why not.

These sessions occurred just before the Christmas vacation and marked the end of the planned 45 sessions in the study. Mrs. M. resumed group mapping of Chapter 2 in January 1993. The researcher returned twice in January 1993. In the first session the teacher returned the first (September) and second (December) individual maps to the students. They were asked to examine them on their own and write a log entry to say which one they thought was better and why. In the second session the researcher discussed the entry with each student to clarify their responses.

Data Collection

Data for analysis came from numerous sources during the course of the study. They are as follows:

1. SAT Reading Comprehension Stanine Scores: The Spring 1992 SAT reading comprehension stanine scores were confirmed by the 1991-1992 fourth grade teachers' perceptions of reading abilities and were used to assign students to low, middle, or high reading achievement groups. This group assignment was used solely for data analysis to determine if mapping skills developed differently for students with different reading comprehension scores. Group assignment for classroom activities was heterogeneous.

2. Audio-tape Transcriptions: All whole-class social studies sessions and some of the group sessions were

audiotaped. The group taping was not particularly successful because the proximity of the groups made voices overlap. Selected tapes were transcribed to document the instructional procedures and the students' responses. The transcriptions were discussed with the teacher to support modifications in instructional procedures during the study.

3. <u>Student Learning Logs</u>: Students made six learning log entries during the study. They were told they would be asked to respond to certain questions and that they also could include any questions, comments, and suggestions that they wanted to share with the researcher. The researcher would respond in writing and since Mrs. M. would not read the entries they were encouraged to be completely honest. The following questions were asked:

9/02 Do you like social studies? Why or why not?

9/24 Do you like reading stories? Do you like reading in your social studies textbook? Why or why not?

10/29 What do you think of concept mapping so far? What do you like or not like about it? What suggestions do you have for making the concept mapping sessions better?

11/19 How long did you study for your chapter test? Did you study your concept maps? If so, did they help? If not, how did you study?

12/16 Do you like social studies now? Why or why not?

What do you need to remember when making a concept map? (This question was aimed at determining awareness of qualities of a good map but the teacher suggested they think about the concept mapping process chart. Many of the responses were in list form and few mentioned specific qualities so an additional entry was scheduled for January.)

1/11 Which of your maps is better, the one you did in September or the one you did in December? Why? What could you do to improve your better map even more?

4. <u>Teacher's Journal</u>: Mrs. M. and the researcher maintained a dialogue through journal entries during both the pilot study (1991-1992) and the current study.

5. <u>Student Concept Maps</u>: Concept maps produced by the students either singly or by groups are the main focus of analysis. Group maps completed just prior to their being copied into the individual concept mapping booklets were examined.

Two individual map samples were collected. Both were produced under test-like conditions and were scored by three independent raters. These maps were administered first on Day 12 just after students had completed their first group mapping cycle on hurricanes and again on Day 44 at the end of the study.

The passages used for these two mapping tasks (see Appendix C) were chosen on the basis of: 1) content, text not covered in class but taken from the social studies textbook and text that was not sequentially context dependent, (i.e., types of housing and crop culture of the Hopi tribe rather than events leading up to a war); 2) length equivalence (three passages each totaling between 150-160 words); and 3) readability (adaptability to a 5.0 grade-equivalent readability, keeping in mind the problems surrounding readability). To even out differing prior knowledge of the topics and passage content differences, half the class read about Hopi shelter and half read about Hopi crop culture for the first task and for the follow-up in December each read the alternative Hopi passages.

In the first task students were told that their maps would not be compared with other students for grades but that they would be able to compare their own map with a later one. In both mapping tasks there was no discussion of vocabulary and no listing or organization of prior knowledge as a group (as in the regular group activities). To prevent interference from differences in decoding ability the passages were read to the students as they followed along on their papers. Then they made their own map on the worksheet. There was no time limit but all finished within the class period of 30 minutes.

6. <u>Student Summaries</u>: Summary writing was not a main focus of this study. However, in view of the strong similarities of text-processing involved, the possibility of transferred learning from mapping to summary writing was examined. On Day 13 and Day 45, students were asked to write summaries on passages similar to those they had mapped but about Eskimo shelter and current Eskimo culture (see Appendix D).

As in the mapping task, the students alternated the passages and there were no vocabulary or prior knowledge activities. Because students had received no instruction in summary writing criterion task awareness was lacking. To compensate for this Mrs. M. gave them a sample sheet of a passage followed by two sample summaries and the statement "A summary is a short statement that gives the main ideas of an article. It has only a few sentences in it."

Evaluation Instruments
Map Components and Guidelines for Scoring

Novak and Gowin's (1984) model of concept mapping was developed to represent students' "knowledge structures" (Novak, 1990, p.32) or what they know both before and after instruction in any form (e.g., reading, lecture, film, demonstration, or field trip). Mapping is also suggested as a useful "shorthand for taking notes on

papers and articles in newspapers, magazines, and technical journals" (p.49), or text processing, the purpose for which it has been adapted in this study. In their evaluation of concept maps Novak and Gowin (1984) describe three characteristics to be considered. These are based on Ausubel's theory of cognitive learning in which "Cognitive structure is hierarchically organized..., concepts in cognitive structure undergo progressive differentiation ..., and integrative reconciliation occurs when two or more concepts are recognized as relatable ..., and/or when conflicting meanings of concepts are resolved" (Novak and Gowin, 1984, p. 97).

According to Novak and Gowin (1984), for a concept map to demonstrate a student's cognitive structure it must have valid propositions. A proposition is defined as two or more concepts that are connected by a line and linking word(s) to represent a valid relationship between/among them. Second, there must be valid levels of hierarchy from general concepts to more specific ones. Third, there must be valid cross links between two concepts that were developed separately but which share meaning. While the need to revise, clarify, and make maps easy to read is mentioned as important by Novak and Gowin (1984), this aspect does not appear in their evaluation scheme.

Analysis and comparison of fifth graders' individual maps of content area text provide a more detailed

description of the components, subcomponents, and processes involved. Two major components of mapping emerge. These are content organization and presentation.

Content organization was analyzed by the researcher and three colleagues. One is a college graduate in English. One has an ESL Master's Degree and teaching experience. One has an EdD in Curriculum and Instruction and is currently teaching college English. None of these colleagues had previous experience with concept mapping but all were familiar with the principles of text processing such as summary writing, outlining, and notetaking. They agreed to rate the student maps independently.

This task involved 3 four-hour group sessions plus independent rating time. In the first group session, raters received information about the current study and concept mapping. They read the two passages that students had mapped in September and December and agreed which important concepts should appear in an "ideal" map.

The raters were taught how to interpret transcriptions of student maps by comparing actual maps to their transcribed forms. The transcriptions were done by the researcher to prevent the raters from being influenced by a student's spelling, handwriting, or other aspects of presentation. Transcriptions also prevent raters from

possible bias should they identify a student's first and second maps.

The following conventions were used in the transcriptions (see Figure 2): an outline point system represents segments and levels within segments; parentheses ( ) contain words written on linking lines; a hyphen in parentheses (-) represents lines with no linking words; unmarked text represents the entries within the concept bubbles; and an asterisk indicates that the entry appears only once but is connected to different general concepts. Points 1, 2, and 3 do not reflect any particular order because it is impossible to tell in which order entries were written. Instead they represent superordinate concepts linked directly to the key concept, in this case a group of Native Americans called the Hopi. Points 1.1, 1.1.1, 1.1.1.1 indicate levels descending linearly from one bubble while 1.1, 1.2, 1.3 indicate three subordinate points coming from the same bubble.
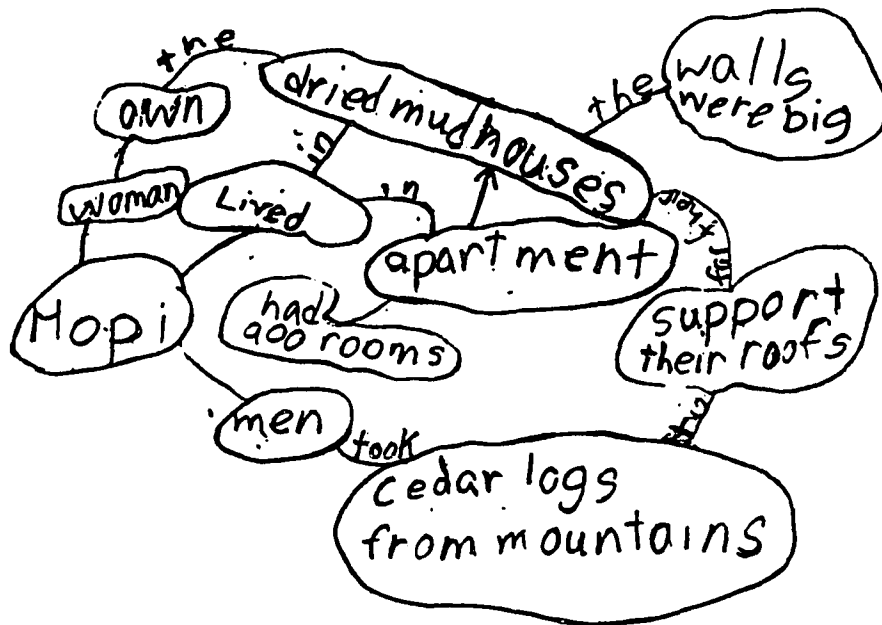
HOPI
```
1 (-) woman
  1.1 (-) own
      1.1.1 (the) dried mud houses*
2 (-) lived
  2.1 (in) dried mud houses*
      2.1.1 (the) walls were big
  2.2 (in) apartment {arrow to dried mud houses}
      2.2.1 (-) had 900 rooms
3 (-) men
  3.1 (took) cedar logs from mountains
      3.1.1 (to) support their roofs
              3.1.1.1 (for their) dried mud
                      houses*
```

Figure 2
A Concept Map and Its Transcription

In the second session actual student maps were used for discussion. Novak and Gowin's (1984) scoring model was reviewed. The researcher pointed out shortcomings of this model. First, the process of awarding points varies from 1 point for each valid proposition to 5 points for each valid level of hierarchy and 10 points for each valid cross link making scoring both arbitrary and unwieldy.

Second, the skill of choosing appropriate linking words is subsumed in the score for valid propositions and is not recognized separately. It is possible for a student who has not yet mastered the use of linking words to develop a map that shows an understanding of valid relationships (e.g., the map in Figure 2). Using Novak and Gowin's model this student would have scored poorly on propositions when four of the nine agreed important concepts are present and there is evidence of understanding in the cross linkages to "dried mud houses."

Third, the Novak and Gowin model was not developed to evaluate the ability to process text. The ability or inability to select important concepts from text and to reword them concisely in map entries is not considered. These are skills that are essential and should be acknowledged if concept mapping is to be used as a study tool.

Novak and Gowin's scoring of map levels from general to specific was adapted for use. Points are awarded for the largest number of levels developed by the student in

any one segment of the map. This measure allows for variations in text since not all concepts presented can be developed to the same number of levels.

One of the raters suggested that an "ideal map" be constructed and numerous acceptable ways to map the same information were proposed. The group agreed that it would be simpler, more flexible, and more informative to teachers if scores reflect the specific subcomponents of maps and evaluate both understanding of meaningful relationships in the text as well as overall skill in mapping.

The group decided that student maps revealed five distinct subcomponents of content organization that should be evaluated. Each reflects a different process: 1) the selection of *concepts* is represented by the percentage present of those concepts judged by rater consensus to be important (e.g., a student who includes half of the prejudged concepts scores 2 points while a student who includes all of them scores 4 points); 2) the ability to paraphrase text concisely is demonstrated by the predominant *type* of map entries, either verbatim, reduced verbatim, reworded, or reworded and reduced (e.g., an entry like "women construct houses and maintain them when they need repair" is verbatim and earns 1 point. "Women construct and maintain houses" is reduced verbatim for 2 points. "Women build and fix houses when they need it" is

reworded for 3 points and "women build and fix houses" is reworded and reduced for 4 points); 3) the understanding of meaning can be determined by the proportion of *links* or linking words used to connect concepts appropriately (e.g., in "Hopis <u>adapt to</u> land," <u>adapt to</u> is an appropriate link. In "Hopi <u>plants</u> small," <u>plants</u> refers to corn plants and should be in a concept bubble rather than on the linking line); 4) the differentiation of general and specific aspects of a concept is represented in the number of valid *levels* to which a concept is developed (e.g., in Figure 2 the student received points for 4 levels: Hopi to men, men to cedar logs, logs to roof support, and roof to dried mud houses); and 5) the recognition of the interrelationship of meaning across concepts is evident in appropriate cross links or *integration* (e.g., in Figure 2 the student demonstrates integration by connecting the three concepts of woman, apartment, and roofs to the bubble containing "dried mud houses").

A tentative scoring model based on these five subcomponents was developed for trial. The September and December maps had been transcribed, coded, and then mixed together and were randomly distributed for scoring before the next meeting.

The third session was spent discussing difficulties the raters experienced and making revisions in the scoring guidelines. Decisions were influenced by the desire to

develop a system which could be used by teachers and could be generalized from one passage to another (see Appendix E for Concept Map Scoring Guidelines). An interrater reliability of .79 was established by scoring the subcomponents of six sample maps using the revised guidelines. Student maps were then rescored.

Presentation, the other main component of mapping, was discussed. Three subcomponents were identified and added to the scoring scheme. These represent the visual aspects of mapping which may be included in either a draft or a revised map: *1) heading differentiation* by using color, all capital letters, size, and/or shape to separate general concepts from the more specific concepts; 2) separating concept segments by *space* to prevent confusion and increase legibility; and 3) the appropriate use of *arrows* to indicate a deviation from the normal direction of a relationship. Scoring for presentation was done on the actual maps after the transcriptions were scored for content organization.

The researcher discussed with the teacher the appropriateness of the map scoring guidelines for teacher use. For further validation, Mrs. M. scored three maps which had also been scored by one of the independent raters. Interrater reliability was established at .96.

Summary Components and Guidelines for Scoring

The summaries completed by the students on Day 13 and
Day 45 were typed with correct spelling and punctuation
and coded so as not to influence the raters. The raters
who scored the maps discussed various ways to evaluate
summaries with the researcher including criteria based on
research studies of text summarization. Garner (1985)
reports that the number of ideas present which were judged
to be important by rater consensus and the total number of
words in the summary appear in numerous studies. The score
for the number of words is based on the maximum number of
words used by "expert" summary writers for the particular
passage to be summarized. Garner includes also the reduc-
tion of text or integration as a measure of efficient
summarization, a point made earlier by Brown and Day
(1983). Integration is scored by the number of important
ideas combined in one sentence.

Since the scoring procedures above were used with
ninth-grade students and older, the raters analyzed some
fifth-grade sample summaries for suitability of the
scoring system. They agreed that the first two measures
were appropriate but that the integration aspect needed to
be revised. Garner's (1985) integration scoring awards 1
point for ideas that are presented in separate sentences
up to 4 points for "all important ideas combined in a
single sentence" (p. 553). This level of integration is

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not common with college students let alone fifth-graders (Brown & Day, 1983). Furthermore, having had no previous instruction in summary writing, the fifth-graders in this study had been given two sample summaries of text for criteria awareness of the task. Each sample contained three sentences. The raters developed a simpler, more appropriate system of scoring 1 point if ideas are in separate sentences and 2 points if two or more ideas are logically combined in any one sentence.

By consensus, an additional measure called processing level was added. This measure indicates whether the student has copied text verbatim (1 point) or paraphrased the text (2 points). The total possible score is 8 points (see Appendix F for Summary Scoring Guidelines).

Interrater reliability of .83 was established on four sample summaries. Summaries were randomly distributed for scoring.

Limitations of the Study

1. Since this is an exploratory, in-depth study of students in a single classroom, the sample size is small and non-randomly selected.

2. Changes observed in participation, attitudes toward social studies, and concept mapping performance may not be due to mapping instruc-

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tion alone, but to other factors as well such as teacher expectations, researcher involvement, and increased time-on-task.

3. Observational data is limited by the ability of one researcher-participant to record events occurring in the classroom. This is especially true for the group activities.

CHAPTER 4
RESULTS

Individual Concept Maps

There are 26 students in the class but only 24 pairs
of maps were scored because two students were absent for
Map2 (see Appendix G). A significant difference was found
between scores on Map1 (M = 10.42) and Map2 (M = 12.71),
$t(23)$ = 5.73, p < .01. There is a positive correlation
between the Map1 scores and the reading comprehension raw
scores of the Stanford Achievement Test (SAT), $r(22)$ =
.65, p < .01 (see Appendix H). The positive correlation
between SAT raw scores and Map2 scores is not significant,
$r(20)$ = .29. The SAT's were administered by the school at
the end of Grade 4 (April, 1992).

For further statistical analysis of gain score dif-
ferences the class was divided into gender groups (10 boys
and 14 girls) and two reading achievement groups, A1
(below average, stanines 1-4, n = 7) and A2 (above
average, stanines 6-9, n = 10), excluding 7 students at
stanine 5 (see Table 1). Dividing the class into three
groups of 3 stanines each would have produced numbers too
small for comparison. There is no significant difference
between mean gain scores of boys (M = 2.50) and girls
(M = 2.14), $t(22)$ = .48, p, n.s. The difference between
gain scores of students in the lower stanines (M = 3.14)
and those in the upper stanines (M = 1.40) is greater and

it approaches statistical significance, $t(15) = 1.72$.

With a possible total of 20 points the overall average gain from Map₁ to Map₂ is 2.3 points. Only two students, both in A₂, did not make gains. Zachary remained the same at 13 points and Belinda scored 2 points less (from 14 on Map₁ to 12 on Map₂).

The small sample of students makes further inferential statistical analysis inappropriate. Instead, the scores for the separate subcomponents were used to describe qualitatively the differences in results of students by gender and achievement levels. To include the students at Stanine 5, the class was reassigned to three reading achievement groups. There are 3 low (L, stanines 1-3), 15 middle (M, stanines 4-6), and 6 high (H, stanines 7-9) students in these groups.

Table 1

Gain Scores for Map1 and Map2
by Gender and Achievement Groups
(N = 24)
(M = mean gain score)

Note: Code letters represent the first
letters of pseudonyms except for
O (Tom), X (Alex), and Y (Tony).

	A1 Below Average (Stanines 1-4) (M = 3.1) (n = 7)			Average (Stanine 5) (M = 2.7) (n = 7)			A2 Above Average (Stanines 6-9) (M = 1.4) (n = 10)		
	(n = 2)			(n = 3)			(n = 5)		
	Code	M1,M2	Gain	Code	M1,M2	Gain	Code	M1,M2	Gain
Boys (M=2.5) (n=10)	S	7,10	+3	P	10,14	+4	O	11,16	+5
	T	11,15	+4	W	10,12	+2	Q	12,13	+1
				Y	10,13	+3	R	9,10	+1
							X	16,18	+2
							Z	13,13	0
	(n = 5)			(n = 4)			(n = 5)		
	Code	M1,M2	Gain	Code	M1,M2	Gain	Code	M1,M2	Gain
Girls (M=2.1) (n=14)	A	10,11	+1	D	11,13	+2	B	14,12	-2
	C	10,11	+1	E	10,12	+2	F	8,11	+3
	H	9,14	+5	K	10,15	+5	G	12,13	+1
	L	9,10	+1	M	8,9	+1	I	11,13	+2
	N	5,12	+7				J	14,15	+1

Subcomponent scores by gender

The scores related directly to the subcomponents are more relevant to the questions of group differences in mapping (see Appendix G for Raw Data). Because of the small numbers in each group these scores are reported in numbers of students rather than percentages.

The first subcomponent (a possible 4 points) is the selection of important *concepts*. The boys' scores varied little from Map$_1$ to Map$_2$ with 6 of the 10 boys scoring 3 or 4 points on Map$_2$, indicating that they included most or all of the concepts judged important by the raters. Of particular interest is Wayne who scored 4 points on Map$_1$ and dropped to 1 point on Map$_2$. On Map$_2$, all but one of the girls scored 3 or 4 points, two more than did so on Map$_1$.

On *type* (of entry), scores of 1 or 2 points indicate verbatim or reduced verbatim map entries. A score of 3 points indicates that students reworded the text but were not concise. Four points are awarded for both rewording and reduction. On Map$_2$, none of the boys continued to write unreduced verbatim entries while 6 of the 14 girls did so. Eight of the 10 boys scored 3 or 4 points but only half of the girls scored 3 and none scored 4. Again, Wayne's score stands out. In contrast to his concepts score he increased his *type* score from 1 point to 4.

Links (possible 4 points) posed problems for both boys and girls. In the component of content organization, *links* and integration are the only subcomponents that produced scores of 0 points on Map_1. On Map_2, only two boys and none of the girls had all appropriate links for a score of 4 points. However, progress was made since only Elizabeth from the M group scored 1 point and no one scored 0 on Map_2.

On the subcomponent of *levels* (possible 4 points) scores ranged from 1 to 4 points on both Map_1 and Map_2. However, everyone except Steve from the L group and Robert from the M group developed their second maps to more than one level.

Scores for *integration* are 0 or 1 point representing either absence or presence of links between concept segments. On Map_1 all of the boys and all girls except Belinda scored 0. On Map_2, 6 of the boys and 11 of the girls, including Belinda, still scored 0.

On the presentation component 1 point is awarded for each of three subcomponents: differentiation of *headings,* use of *space* which includes legibility, and the use of *arrows* to denote unexpected directions in concept relationships. Proportionately more boys than girls scored 0 on Map_1 but this difference nearly evened out on Map_2. Still, a few boys and girls scored 0 on Map_2 and only two boys and one girl scored all 3 points.

Subcomponent scores by achievement level

As in their mean gain score, variation in the
subcomponent scores of the 15 M group students is minimal
and most of the comparisons involve just the L and H
groups. On *concepts* all three of the L students scored 2
points on Map1. On Map2, Troy scored 2 points, Steve
scored 3, and Nora scored 4. The change among the H
students was in the opposite direction with four of them
scoring 4 points on Map1 and only Zachary retaining that
score on Map2.

The scores for *type* do not show as much variation by
achievement group as they do by gender. Both boys in the L
group reworded their entries (3 or 4 points) on Map2 while
Nora's entries remained verbatim (1 point). Likewise, all
of the boys in the H group scored 3 or 4 points while
Faye, one of the two girls, scored 1 point on both maps
(as did three of the M group girls). Wayne's score was the
only one to increase from 1 to 4 points.

The score variation for *links* in the M group occurred
mostly between 2 and 3 points with only Robert scoring 4
points on Map2. The L and H groups showed more variation
with Nora and Steve in the L group going from 0 to 2 and 0
to 3 points respectively, and Faye and Alex in the H group
jumping 0 to 3 and 2 to 4 points respectively. None of the
L students and only one H student had all links correct (4
points).

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The variation in *levels* scores in all three groups is small with 19 of the 24 students remaining the same or changing by plus or minus 1 point. It is the only subcomponent in which nearly a third (29%) of all the students actually lost points.

The *integration* subcomponent reveals scores on Map2 of 0 points for half of the H group, 80% of the M group, and two of the three L group students. Conversely, at least some of the students from each group scored 1 point.

The presentation component score also shows little progress in any of the achievement groups. On Map2, ten M students and five H students still had scores of 0 or 1 point out of a possible 3 points. The low group fared somewhat better with Nora and Troy both scoring 2 points.

Discussion

The overall correlation between the SAT reading comprehension scores and Map1 scores suggests that both measures are tapping similar skills. The significant difference between Map1 and Map2 scores is consistent with direct instruction and practice in the use of a learning strategy which helps students make connections between their prior knowledge and new information, increases student participation through collaborative learning, and increases student interaction with text. The similarity of mean gain scores between boys and girls shows benefits to

both. The somewhat higher mean gain score of the low
reading comprehension achievement group than both middle
and high groups could reflect regression toward the mean
but it implies that the strategy is most beneficial to the
low group students. This finding is supported by research
where the reading performance of less skilled or disabled
readers was improved by instruction in learning strategies
(Bransford, Stein, Shelton, & Owings, 1981; Brown,
Campione, Bray, & Wilcox, 1973). The assumption is that
more skilled readers already have their own strategies and
the new one is no better or in some cases it causes
confusion. The latter effect was reported by Zachary who
has the highest SAT grade-equivalent reading score in the
class (12.+).

An analysis of the map subcomponent scores by gender
and achievement groups revealed some interesting, though
not startling, results. Two important reading comprehen-
sion tasks are selecting the main topics and processing
this information in some way. Copying text verbatim
indicates inefficient processing which does not neces-
sarily indicate comprehension. An ability to paraphrase
"... in one's own language clearly and unambiguously is a
crucial test of whether the thoughts (or text) were
understood" (Harris & Sipay, 1990, p. 537). From the third
day of instruction Mrs. M. stressed both tasks and encour-
aged students who did either. While most of the students

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showed improvement in selecting the main concepts in text, there was less improvement in text processing, especially for the girls. The fact that nearly half of the girls (low, middle, and high groups) continued to copy text verbatim while most of the boys (low, middle, and high groups) reworded the text indicates gender rather than achievement level difference. This is consistent with gender research that shows girls to be more conforming to academic tasks (Harris & Sipay, 1990) and suggests they may need more direct instruction in paraphrasing in order to change their strategy.

A possible subcomponent interaction is suggested by the complete reversal of Wayne's *concepts* and *type* scores. It could be that by improving his entries from unreduced verbatim to reduced paraphrasing Wayne reduced too much and omitted important concepts. On the other hand, Debbie regressed from reworded entries to verbatim entries while increasing her *concepts* score by 2 points. Nora retained her verbatim entries and increased her *concepts* score from 2 to 4 points. Perhaps students who take information from the text verbatim are less likely to omit important concepts from their maps. Whatever the cause, teachers should be aware of possible interaction between concept selection and the type of entries written so that a balance can be achieved.

Despite a general improvement in scores from Map1 to Map2 for the appropriate use of linking words, *links* still caused difficulty for all groups. In some cases linking words were omitted and in others concept words that should have been in the bubbles were written on the lines. Some students who were able to identify concepts were unable to form, on paper at least, valid propositions or "units of psychological meaning" (Novak, 1990, p. 29) that are demonstrated by appropriate links. If students who wrote verbatim entries scored generally higher on *links* than those who reworded their entries it could be concluded that the difficulty is one of production rather than selection. When copying directly from the text the links are already there for selection and do not need to be invented as they do in the more difficult rewording process. In meager support of this hypothesis are two girls and one boy who wrote verbatim entries and had most or all appropriate links. One other girl reworded her entries and had only one appropriate link.

It should be noted that the scoring of *links* is somewhat deceptive because points are awarded for the proportion of appropriate links to the total number of links generated by the student. It is possible for a student to develop a map to only one level using 4 links. If those links are all appropriate, 4 points are given. For a student who develops a concept to four or five

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levels with 20 links, all 20 would have to be appropriate
to score 4 points. This situation illustrates the need for
further review of the scoring criteria. It would be
difficult to set a number criteria for links and the
separate scores for *concepts*, *type*, and *levels* may
compensate somewhat for the link-score problems.

The numbers of boys and girls from all three
achievement groups who developed their maps to 3, 4 or
more levels are high enough on Map2 to indicate under-
standing of map hierarchy and differentiation between
general and specific concepts. The two boys, Steve (L
group) and Robert (M group), who did not progress from
one-level maps are both experiencing personal and academic
difficulties (a minimum of effort being one) in most of
their classes. They both had total Map2 scores of 10
points, slightly below the mean score for Map1 and 2.7
points below the mean for Map2 .

From the *integration* scores it is evident that the
process of making connections between or among different
segments of a map is difficult for all students, regard-
less of gender or achievement group. This finding is not
surprising for two reasons. First, integration requires "a
conscious awareness of new (meaning) relationships" (Novak
and Gowin, 1984, p. 105), the highest level of comprehen-
sion of all the subcomponents in content organization.
Second, integration was not taught as explicitly as the

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other components and was discussed only as it occurred naturally when a student or Mrs. M. pointed out a connection between two map segments.

The presentation component appeared to be difficult for many of the students despite repeated emphasis on the subcomponents, especially in the group presentations. Few students from any group scored all 3 points on Map2 despite the seemingly easy task of spacing and highlighting headings and the slightly more difficult use of arrows to denote directional relationships. One explanation for this is that presentation is a revision process and students were neither instructed to revise Map1 or Map2 nor were they given appropriate time to do so.

Summaries

Summary1 and Summary2 were completed by 23 students (see Appendix I). The difference between scores on Summary1 (M = 4.83) and Summary2 (M = 5.09), $t(22)$ = 1.27, is not significant. Of the 23 pairs of summaries, 10 showed 0 gain scores, 8 had gains of only 1 or 2 points, and 5 lost 1 point. There is a negative correlation between map gain scores and summary gain scores, $r(20)$ = -.26, p, n.s. There is a positive correlation between the Summary1 and SAT raw scores, $r(19)$ = .40, which approaches statistical significance (the smaller N is a result of not having SAT scores available for some students or summary

samples from others). The correlation between Map_1 and $Summary_1$ scores is positive but not significant, $r(21) = .20$. However, Map_2 and $Summary_2$ results are more highly correlated, $r(20) = .51$, $p < .05$.

Discussion

The lack of significant gains in summary writing is not surprising for three reasons: students did not receive instruction in writing summaries, summary writing is known to be difficult for fifth-grade students without instruction, and the scoring system of 8 points does not allow for discrimination among students. A fourth reason involves the relatively short time span between $Summary_1$ and $Summary_2$. If transfer of mapping skills to summary writing (without instruction in the latter) were to occur one would expect a longer period of time to be required.

The significant correlation between Map_2 and $Summary_2$ scores is an important finding. It warrants further research over a longer time-span.

Group Maps

The group maps provide qualitative evidence of collaborative mapping progress, particularly in the subcomponents that produced low scores for individuals. Groups produced their second maps of social studies text between Days 28 and 31. The three previous sessions had

included group presentations that culminated in student generated tips for good mapping. Presentation qualities such as ways to highlight headings and organize space provided the main focus, but reducing text was also discussed.

Unlike the individual maps, which had low scores for presentation, all five groups highlighted their headings using larger bubbles and/or colors. One group used two colors, one for the main topic and another for the main headings (see Figure 3). Space was used appropriately and one group used arrows effectively. This evidence supports the conclusion that the apparent difficulty with presentation is more a result of the instructions given for the individual map tasks. When given time and instructions to revise, the groups worked on presentation.

Selection of important concepts and developing them from general to specific levels posed no problems for the groups. The maps were developed from three to five levels.
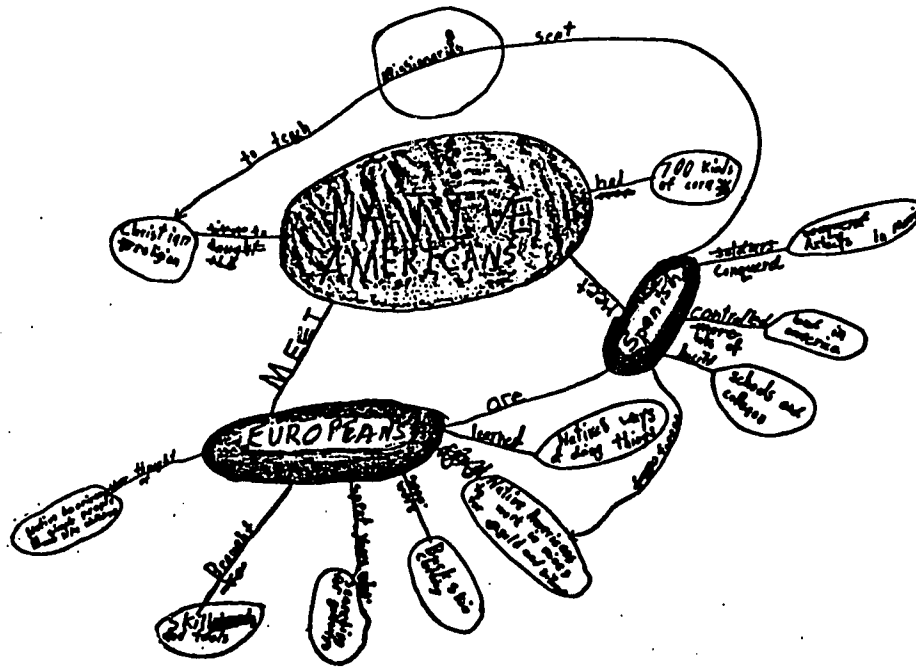
Figure 3
Group Map with Two-color Highlighting

The type of entries varied from verbatim to reworded and reduced. The group that was most strongly verbatim (see Figure 4) was led by Faye (H group) who still made verbatim entries on her own second map. The group led by Alex (who reworded and reduced his own entries on both maps) reworded and reduced their entries by substituting general terms such as supplies (see Figure 5).

The groups had much more success with linking words than did individuals. Two groups had about 75% appropriate links and the other three had about 95%. Also encouraging is evidence of integration, a subcomponent that proved difficult on Map$_2$.

The group maps clearly represent Vygotsky's zone of proximal development, a stage of collaborative learning that is more advanced than many of the individuals. Given more time and practice as groups, greater individual gains can be expected.
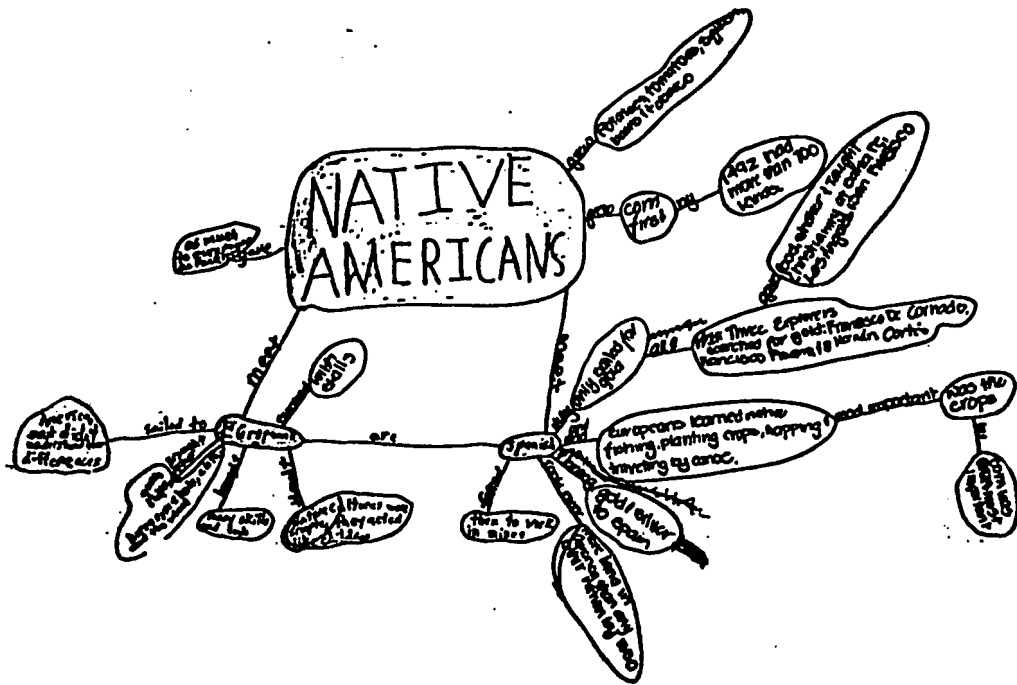
Figure 4
Group Map with Verbatim Entries
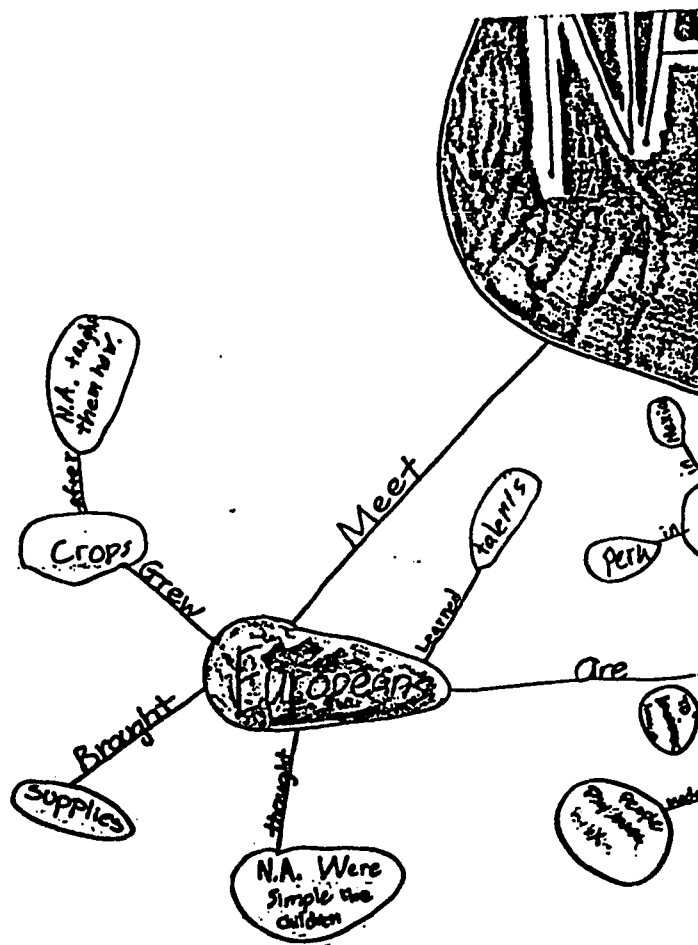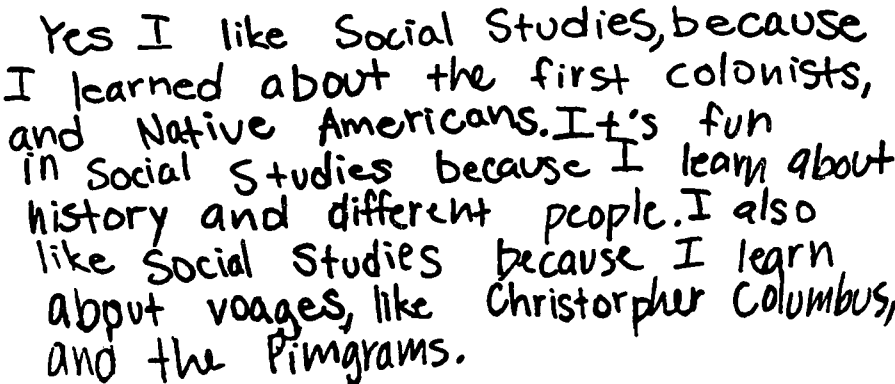
Figure 5
Detail of Group Map with Reworded and Reduced Entries

<u>Student Learning Logs</u>

<u>Attitudes toward Social Studies</u>

Near the end of the four-month study, Log Entry 5 addressed the questions: Do you like social studies? Why/Why not? These questions sought to determine if student attitudes toward social studies 1) changed after instruction in concept mapping, and 2) influenced progress in mapping skill. The first point will be discussed in this section while the second will be addressed in a discussion about individual students (see <u>Stories about Students</u>).

The students' responses were categorized as positive, neutral, or negative. Figures 6, 7, and 8 show examples of each.

> Yes I like Social Studies, because I learned about the first colonists, and Native Americans. It's fun in Social Studies because I learn about history and different people. I also like Social Studies because I learn about voages, like Christorphur Columbus, and the Pimgrams.

Figure 6
A Positive Learning Log Response (Belinda)

I like Social Studies a little bit but only when we read interesting parts. Also because its boring when we read it so many times and because we have to get a test on it.

Figure 7
A Neutral Learning Log Response (Hannah)

I do not like Social Studies because we had to take tests.

Figure 8
A Negative Learning Log Response (Maria)

Twenty of the 26 students made positive entries, 9 boys and 11 girls (see Tables 2 and 3). When the same question was asked at the beginning of the study (Log Entry 1), 9 of these students had made positive entries, 3 were neutral, and 8 were negative. Reasons cited most often for not liking social studies are tests (7 students) and boredom (7 students).

There were 4 students who ended with neutral entries. Anna and Lianne had begun neutral, Wayne had been positive, and Hannah had been negative. All are in the middle achievement group and they had all experienced difficulties interacting with others in group activities.

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Table 2
Attitude Changes toward Social Studies from September to December in Numbers of Boys and Girls

SEP	DEC	(N=11) boys	(N=15) girls	(N=26) total
positive	positive	4	5	9
neutral	positive	3	0	3
negative	positive	2	6	8

Total positive in DEC = 20

SEP	DEC	boys	girls	total
positive	neutral	1	0	1
neutral	neutral	0	2	2
negative	neutral	0	1	1

Total neutral in DEC = 4

SEP	DEC	boys	girls	total
positive	negative	0	0	0
neutral	negative	0	0	0
negative	negative	1	1	2

Total negative in DEC = 2

Table 3
Attitude Changes toward Social Studies from September to December in Numbers of Low, Middle, and High Students

SEP	DEC	(N=4) L	(N=16) M	(N=6) H	(N=26) total
positive	positive	2	5	2	9
neutral	positive	1	0	2	3
negative	positive	1	5	2	8

Total positive in DEC = 20

SEP	DEC	L	M	H	total
positive	neutral	0	1	0	1
neutral	neutral	0	2	0	2
negative	neutral	0	1	0	1

Total neutral in DEC = 4

SEP	DEC	L	M	H	total
positive	negative	0	0	0	0
neutral	negative	0	0	0	0
negative	negative	0	2	0	2

Total negative in DEC = 2

Only two students, Robert and Gretchen (from the middle group), began and ended the study with negative log entries. When interviewed in January Robert said that the reason he did not like social studies in December was because the class had stopped doing concept mapping in groups, something he really liked. Actually, group mapping was still being done but the size of the groups had decreased.

Gretchen wrote that "... the information we're reading is really important but it's boring. And when it's boring I don't feel like concept mapping. I also don't like concept mapping in my group because sometimes (they) argue over the littlest things and that causes our group to have to stay in at recess until we finish."

Log Entry 2 was an attempt to determine if the 11 students who began the study with negative attitudes toward social studies were also negative toward reading either stories or content area textbooks. Only Paul, Iris, and Elizabeth do not like reading content texts. Paul and Iris enjoy reading stories but Elizabeth simply does not like reading *anything*. She wrote, "I think I like math the best!!"

Among those students who were positive or neutral towards social studies in September, five do not like reading textbooks for the following reasons:

"It isn't as great as the other books I read"
(Wayne).

"... because it's sort of boring" (Kathy).

"... because school textbooks are too full of facts"
(Tom).

Zachary likes books about Hawaiiana but not other texts
and Lianne likes reading only the books used in reading
class.

Of the 26 students, 24 enjoy reading stories,
particularly adventures, mysteries, and humor. Some
specific reasons given for liking reading are:

"... because you could learn a lot of words and how
to be a good reader" (Nora).

"... because it helps me to learn more about life"
(Judy).

"... because it is fun and exciting. Also, I improve
my writing skills" (Tony).

"... because books are my friends" (Alex).

Some of the 17 students who like reading content
textbooks cited the following reasons:

"... because it has facts from a long time ago"
(Robert).

"... because it's fun to learn about new stuff"
(Faye).

"... because you can find out interesting things

about the past or when you weren't even born yet"
(Hannah).

Perceptions of Concept Mapping

Log Entry 3 was written after completing instruction
and the first textbook mapping cycle. Students were asked
to write how they felt about concept mapping. Of the 26
students, 24 made positive comments. Words such as *fun*
were included by 15 students with an additional four
calling it *good* and the other five saying concept mapping
helps them learn and/or they like it. Other positive
comments include:

"Now that I understand it better it's really fun!!! I
wish I learned this earlier because it's so much fun"
(Iris).

"I like to map because it's fun, it's different.
There's nothing I don't like" (Steve).

Judy made the neutral comment, "... concept mapping
is okay, but I would like to try something much more
exciting. It's sort of boring." Hannah was more bluntly
negative writing, "I feel that concept mapping is kind of
boring." She added, "Why do we have to work in groups?"

Perceived benefits of concept mapping are revealed by
log entries as follows:

"So far I like it a lot because you get to make your

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own map in your group ... and share ideas with everybody" (Anna).

"I am feeling very happy about concept mapping because I am learning a lot and it is easier to do instead of reading the story over and over" (Debbie).

"I like when the map is done and then I look at it and I'm like I did this and I didn't know anything about the subject" (Tom).

"I am feeling that concept mapping is good because you ... learn how to group things" (Kathy).

"I think doing concept mapping helps you learn because you read in your textbook but at the same time you're learning" (Gretchen).

Zachary pointed out a more practical, though dubious benefit, the use of the adhesive 'hold-it' during writing, "I like the 'hold-it' because it is soft. You can reuse it as many times as you want to." Unfortunately, 'hold-it' provided a source of distraction for both him and Tony.

Doing concept mapping in groups had both positive and negative aspects. Group work was mentioned as positive by ten students with comments like:

"I also like making our maps because you have to cooperate. If you don't like to cooperate you won't have a very good map" (Quentin).

"I feel that concept mapping is fun because we work

in a group and when we need help we can ask them for some help" (Maria).

"Concept mapping is good because you learn to get along with people" (Kathy).

Working in groups was a negative factor for six students. They complained that group members argued, fought, fooled around, got carried away, and did not listen to each other. Zachary, whose distraction by the 'hold-it' interfered with his group's work, complained about his group, writing, "I don't like it when you don't finish and you have to stay in for recess because I could be in the computer room doing my work."

Most students had no suggestions for improvement but three mentioned that using the index cards and 'hold-it' was awkward and confusing. These comments confirmed the teacher's observations and the point was brought up to the class for discussion. By group consensus the system was abandoned and subsequent group maps were written directly on the chart paper.

Log Entry 4 was written after the chapter test but before they were returned with scores. Students were asked if they had used their maps for studying and, if so, had it helped them on the test. All 26 students had used their maps and 19 reported that it had "helped a little bit," had "sort of helped," or had "helped a lot." Six students

said it did not help but three of the six admitted having spent very little time studying. Zachary, the only student in stanine 9 on the SAT, said he had tried to study the maps but found it confusing so he studied from the book.

The self-reporting by students of how long they spend studying is of dubious value, but Paul and Wayne from the middle achievement group (and not known for their high test scores), both scored well on the test while claiming to have studied less than 20 minutes. Wayne (96%) said that he did not think he needed to study more because he knew the chapter content already from making maps in class. Paul (83%) claimed to have studied less than five minutes but he had actively participated in the group mapping activities.

Perceptions of Map Quality

Log entries 5 and 6 were used to tap student perception of what makes a good map. In Entry 5 students were asked to write what they should remember when making a concept map. As mentioned in a previous section, the teacher inadvertently influenced their responses by reminding them of the process chart. Many of the students recalled the list of steps rather than describing specific qualities of maps.

Anticipated qualities such as brevity, inclusion of important concepts, appropriate linking words, differenti-

ation of headings by highlighting them in some way (e.g.,
capital letters, color, size), rewording the text, and
revising for legibility and clarity had all been demon-
strated and discussed in class. Fifteen students mentioned
at least 1 of these qualities, seven recalled 2, and only
one student noted more than 2. Highlighting and/or
revision (e.g., "making drafts," "fixing up") were
mentioned by six students and three of them mentioned
both. Four students said that keeping entries short was
important. Five said to include only the important
information or main ideas, or as Paul wrote, "...to get
rid of what you don't need." Conversely, three students
wrote that copying or putting down *all* information is
important. Only Zachary mentioned using "correct
connecting words," and only Vincent referred to rewording
saying you should remember "... to not copy from the
book."

Log Entry 6 further addressed student awareness of
the qualities of good maps. They were asked to compare
their own two maps (September and December) and to decide
which one was better and why. To elicit qualities that may
not have appeared in either map the students were asked
how they might improve their better map.

Of the five who had mentioned in Log Entry 5 that it
is important to include only the key information when
mapping, four (Faye, Iris, and Zachary from the high group

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and Paul from the middle group) chose their better maps on the basis of better organization, important information, or shorter map entries. Alex, also from the high group, wrote, "I cannot decide which map is better. The (first) map has more information. The (second) map is more complex." When asked which he thought was more important, *more* information or *organized* information, he said, "If it's not organized, information is useless."

Troy and Cassie, from the low and middle groups respectively, based their decisions on "better" informaation and shorter entries. Both had mentioned shorter entries in the previous log entry.

The remaining 19 students made their choices based on the principle that more information is better. In fact, nine of them chose their September maps for this reason. Regarding map improvement Gretchen wrote, "I could not only take the important ideas but I could take every single bit of information down. Then that would make it have more information even though the information isn't that important."

Other suggestions for improvement included "clear-ness" or "neatness" and "highlighting" or "capital letters." Judy explained, " ... so people know that's the main idea." Four students mentioned using better linking words.

Discussion

At the beginning of the study, 10 students (38%) reported liking social studies. Four months later, the number had increased to 20 students (77%). These students are both boys and girls and they represent all three achievement groups. Of the remaining six students, three girls and one boy from the middle group were neutral. All of them experienced difficulties in group activities. Anna and Lianne each gained only 1 point from Map_1 to Map_2 and Wayne gained 2 points, but Hannah increased her score by 5 points.

Gretchen and Robert, also from the middle group, did not like social studies in September or in December. Gretchen's reasons were boredom and group arguments. Robert also cited boredom but he was experiencing many difficulties at home, was underachieving in most of his classes, and had interaction problems in his group. Despite positive comments about concept mapping in their learning logs, neither Robert nor Gretchen made much progress in mapping (see Stories about Students). Boredom is often a problem for high-achieving students but in this class all six students in the high group were positive in December.

Concept mapping was perceived as helpful and/or fun by 24 (92%) of the students including all students from the high group. Ten of them especially liked the group

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activities citing the benefits of sharing the work and learning to cooperate (only six students mentioned group activities negatively). Students also perceived study benefits (73%) of mapping such as organizing information for study, eliminating numerous rereadings of the text, and reducing study time because they were learning during map construction.

Negative attitudes toward reading content textbooks and/or reading in general do not appear to be a major cause of negative attitudes toward social studies nor do they prevent students from making gains in mapping. Of the 11 students who disliked social studies in September, only Elizabeth disliked reading in general and Paul and Iris reported not liking content area reading. However, these students made gains of 2, 4, and 2 points respectively.

A dislike for tests was given as a reason for not liking social studies and high scores on the first class test may have influenced Paul's (83%), Elizabeth's (91%), and Quentin's (100%) attitude change from negative to positive. However, the attitudes of Nora, Cassie, and Maria underwent the same change and they scored between 50% and 59% on the same test.

It is clear from the log entries that concept mapping and its perceived benefits were factors in the high percentage of positive attitudes toward social studies in

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December. However, the positive aspects of group collab-
oration must also be considered.

Awareness of map quality was still developing in
December for most of the students. Just over half (58%)
could collectively name the main qualities. No one named
them all and when asked to apply what they knew to the
task of choosing their own superior map, 73% of the
students (boys and girls from L, M, and H groups) chose
the map with more information regardless of importance or
how it was organized. In view of Mrs. M.'s comments about
her own gradual progress in mapping over an eighteen-month
period this finding is not surprising. It confirms Novak's
(1990) conclusion that concept mapping skill does not
develop quickly but may take "perhaps one to two years if
used only in a single course" (p. 41). It also prompted
Mrs. M. to be more explicit about map qualities in
subsequent social studies classes and to include mapping
in her language arts program.

Stories about Students

More important than group statistics, from a teach-
er's perspective, is consideration of each student's
progress and the circumstances that may influence that
progress. Anecdotal records and learning log entries
reflecting both attitude and awareness can be combined in
"stories" about individuals and provide more insight into

what happened in the study. The following stories are about eight of the fifth grade participants. All 26 stories are important but these particular boys and girls from all three achievement groups are especially interesting (see Appendix J for Individual Maps).

Nora

At the beginning of the study Nora did not like social studies because, she wrote, "I don't like having tests too much." According to Mrs. M. and the SAT results (2.9 grade-equivalent in reading comprehension), she has a lot of difficulty with reading. Despite these difficulties, when asked about stories and textbooks Nora wrote, "I love to read. As long as I know that it's a book I will start to read."

Nearly three-quarters of the way through the 14-week study, Nora scored only 57% on the chapter test, undoubtedly reinforcing her dislike of tests. Nevertheless, at the end of the study she wrote, "Yes, I love Social Studies. Because we get to know a lot about Hopi, Native Americans, Pueblos, Eskimos, Shoshone. And I like to color in the main headings."

A change from not liking to liking social studies and coloring map headings, though not always successfully, represent only part of Nora's progress. She gained 7 points from her first individual map to her last, the

largest gain in the class. She improved her selection of important concepts, extended her map levels from two to three, discontinued writing upside-down entries, used space more appropriately, and increased her proportion of appropriate links. Her biggest difficulty at the end of the study was her inability to paraphrase and she continued to copy information verbatim from the text with no reduction or integration of concepts. Nora was in the same working group as Iris, from the high achievement group. Iris ended the study with reworded but neither reduced entries nor integration, and actually scored only one point more than Nora on her second map.

Nora chose her second map as being "...good because it has more detail in it. Like highlighting and arrows and more information," although her attempt to use the arrow was inappropriate. She suggested improving her maps by making her sentences "... even shorter as much as possible and not long," indicating an awareness of the need to reduce information.

Nora's progress undoubtedly is related to her enjoyment of concept mapping ("... when we all work together as a group"), as well as to the benefits of group prior knowledge discussions and difficult text being read aloud to her by a group reader. Whatever the reason, concept mapping activities allowed her to participate at her own level with the help of group members. Her seven

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point gain on the second map, however, occurred with the benefit of a group reader but without the usual group discussions. She did it on her own.

Troy

Troy's SAT reading comprehension score was 3.0, but his word study score was four grade levels higher at 7.0. He also made progress in mapping. He scored 15 points on his second map, nearly 3 points higher than his own achievement group mean and 1 point higher than the high group mean. He left out some important concepts, omitted links or put nonconcept words in bubbles on both maps, but even on his first map his entries were reworded and somewhat reduced. On his second map, entries were both reworded and reduced, a level of processing reached only by Wayne in the middle achievement group and by Alex in the high group. Troy's apparent word study competence is a possible factor although Wayne and Alex both had word study scores considerably lower than their comprehension scores. Troy introduced an arrow on the second map and effectively integrated three main concepts with one common bubble, demonstrating understanding.

Troy correctly chose his second map as better "because it was better information than the first map I did." When asked what he meant by "better" he said "organized," which is supported by his suggesting that he

could improve by "think(ing) more about what the subject is and look at the page and think what did those people do or what it did." The latter comment reflects his effort to comprehend rather than simply record information.

Except for a somewhat neutral view of social studies in the beginning, Troy said he enjoyed both types of reading, concept mapping, and working in groups. He was pleased with his chapter test score of 72% and at the end of the study he wrote, "I like Social Studies now. Because I know what to do and how to map better." He does.

Wayne and Paul

The stories of Wayne and Paul provide an interesting comparison. Both boys are in the middle achievement group for reading comprehension (SAT score is 5.2), although Wayne's word study score (3.7) is much lower than Paul's (8.6). Both enjoy reading stories but not content textbooks; both like concept mapping; and both scored 10 points on their September maps. December results, however, were very different.

Paul gained 4 points on the December map by choosing more important concepts, using more appropriate links, reducing somewhat his still verbatim entries, and adding directional arrows (appropriate though unnecessary). He scored points for highlighting and space on both maps.

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Wayne improved his links and spatial presentation though he still did not highlight headings. Unlike Paul, who progressed only from verbatim to reduced verbatim entries, Wayne's first map was verbatim and the second was both reworded and reduced. Unfortunately, in Wayne's rewording and reduction he not only omitted trivia, he also omitted important concepts. He was one of only two students who did not use Hopi as the main topic but focused on the Hopi climate. He chose his September map as better because "It has more information. It is much bigger in many ways." His suggestion for improvement was to "... find more information. I could make it bigger so it will look like I have more information." While being aware that he had left things out of his second map he was unaware of his competence in text reduction and paraphrasing.

Another difference between the boys is that Wayne began the study liking social studies and when asked again at the end he wrote, "Not really because when we changed with different people and boxes it is kind of difficult to remember where is what." His feelings reflect a continual difficulty he had in group interaction. Conversely, Paul had little difficulty in his group writing in December, "I still like Social Studies because it is fun and I pay attention when we have (it). I also like it because I think we have a good group and because we get along well." These comments were from a boy who responded in September

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to "Do you like Social Studies?" with "No, because we only read and have tests." It should be noted that Paul scored 83% on his chapter test without studying for very long. Mrs. M. observed Paul's consistent involvement in the group mapping activities and attributes his success to it.

Elizabeth

Elizabeth is the only student who does not like reading in any form although her SAT comprehension score of 5.9 puts her in the upper middle achievement range. She dislikes social studies "... because it is boring, because of the tests," and prefers math and music. However, she wrote about concept mapping, "I think it is very fun. I really enjoy it. I like working in a group ... when you share the work it is easier and everybody gets to do a part." Elizabeth perceives mapping as beneficial in studying. She scored 91% on the chapter test despite little studying and a math test the same day. She explained, "It (mapping) helped a lot in my test. I mostly remembered everything."

In her December map, Elizabeth changed from verbatim entries to reworded ones and she integrated the two main concepts of Hopis and their corn both adapting to the dry weather. There were still redundancies and inappropriate linking words but progress in map production was evident to the raters though not to Elizabeth. She preferred her

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September map "... because it has more information and the main headings can be seen." She suggested improvement by highlighting the main headings, making the bubbles with fewer words, and writing more clearly -- all constructive suggestions. Her dislike for reading and social studies did not prevent her from improving her mapping skill. She conceded in December, "Now I don't really care about S.S., but it's OK. I like music the best... This year you have made S.S. really interesting. I never used to like S.S."

Alex

Alex is near the top of the high group in reading comprehension (11.8) but his word study score is much lower (6.2). He is an avid reader, super-achiever, and a public television fanatic as reflected by his extensive prior knowledge. He wrote, "I like being the one with the most information." He scored 100% on his chapter test, one of only three students to do so.

He was the only student who claimed previous experience with webbing (no links) and he enjoyed concept mapping, writing that it "...is about the same thing (as webbing)." He was the only student to make reworded and reduced entries on his first map using general headings like environment and food (to include both scarce animals and corn). He included all of the important concepts, used space and headings effectively, and developed concepts to

four levels. Only his links (some were concepts themselves) and lack of integration across concepts lost him points, but he scored 16, the highest in the class. Only Tom reached 16 points but on his *second* map.

Alex's second map showed integration with arrows and shared bubbles. All of his links were appropriate and he highlighted his headings. Unfortunately he left out nearly half of the judged important concepts so he scored 18 points. Indecision as to which map is better was caused by his realization that the second one was lacking in infor- mation and yet was "more complex." When asked which is more important, more information or complexity, he said "if information isn't organized it's pretty useless."

Gretchen

Gretchen, from the upper middle group (SAT 7.0), is the only girl who disliked social studies from the beginning to the end of the study. In one log entry she wrote that she did not like Social Studies because she did not like reading and she got "tired and bored." Gretchen wrote that "It's not the teacher that's boring it's the social studies itself," but in her next entry she said she likes reading social studies textbooks "... because it helps you learn."

She perceived benefits in concept mapping. "I feel comfortable doing concept maps.... I think doing concept

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mapping helps you learn because you read in your textbook but at the same time you're learning." She thought the maps helped her study for her test (she scored 80%) but that she could have done better by studying longer than she had.

Despite little change in her feelings about social studies, there was a small change from 12 to 13 points in December. Her entries had been predominantly verbatim in September and changed to being mostly reworded but not reduced. From the beginning most of her links were appropriate and she was able to pick out most of the important concepts. Her first map was spatially clearer but there were no attempts to highlight the main concepts. On the December map she attempted to integrate two concepts with an arrow showing that both the Hopi and their houses did not have doors. Both maps demonstrate understanding of general and specific concepts.

Robert

Robert's story does not have the happy ending of the others. He is also in the upper middle group (SAT 7.8) but he made little progress in mapping (from 9 to 10 points). Neither of his maps included all the important concepts and both were developed to only one level with no heading differentiation or integration. His links improved on the second map (supported by his log entry that said "Don't

put a word you can see in your head on the line") but then he had a total of only four links. His entries, which had been reworded in the first map, regressed to being verbatim, but they were reduced. In both map tasks he finished much earlier than the others. He chose his first map as better "... because it had more information and because it looked better." To improve, he suggested, "I would read it a couple times then put the more important information in." He said his second map was messy because he was fooling around (an accurate self-appraisal).

He likes reading both stories and textbooks, but he disliked social studies from the beginning, "... because it's boring", to the end of the study when it was still "...sort of boring."

He wrote that he likes concept mapping "...because it's fun. Before I thought it would be boring but now I like ... everything about concept mapping." However, despite frequent mediation by Mrs. M., his group members complained continually that he was not participating and was causing trouble.

Robert's difficulties are not confined to the social studies class. He has had family problems all semester, has problems with group interactions both in and out of class, and is underachieving in school work. Hopefully the situation will change and Robert can become a contributing group member, making more progress than he has to date.

The stories are not all positive, but they illustrate that concept mapping is a text processing strategy that these fifth grade students enjoyed, regardless of gender, achievement level, and attitudes toward social studies. They also illustrate that factors of instruction (e.g., group collaboration) and personal situations are important to success or failure for different students.

With one exception these students all made progress in mapping competence and many perceived mapping as beneficial to studying. Some subcomponents were mastered more easily than others and even when students improved they were not always aware of it. On the contrary, some students who could say what makes a good map did not necessarily produce one. With information like this and some guidelines for "good map" criteria, Mrs. M. can make her instruction and guidance more explicit and more individualized.

The Teacher's Story

A year before beginning this study, Mrs. M. agreed to participate in a pilot concept mapping program. She was optimistic and when asked what she hoped to accomplish she wrote in her journal,

> I am hoping the strategy will be applied and
> transferred to all areas. (The students) will walk
> away not only with social studies knowledge but a new
> and helpful strategy as well (September, 1991).

She felt that social studies was the class that often was pushed aside for other events unless the teacher really enjoyed it herself. She did not.

Two months later Mrs. M. noticed an increase in student participation. She also said that she enjoyed mapping but was having difficulties maintaining student interest. The class had gotten bogged down in recording the journeys of European explorers on a timeline instead of in map form.

The class began constructing their group maps in February and Mrs. M. reported changes in some of the students who had been passive previously. She noted more confidence and participation among them. About herself she wrote,

> This is an ongoing learning process for me. When we started this I can honestly say I'd never studied this way - using maps. I felt very uneasy using maps and I was a bit apprehensive. However, I see how it helps the kids and helps me make connections and relationships between information (February, 1992).

When planning the social studies program for the 1992-1993 fifth grade class the following weaknesses of the pilot program, as perceived by both Mrs. M. and the researcher, were discussed thoroughly. First, the introduction of mapping had been too gradual because the students' mapmaking abilities had been underestimated and because of wasted time with the timeline exercise. Second,

too much emphasis had been placed on improving recall rather than on comprehension. The process of reading text, recalling and mapping information without looking back, and confirming with the text had become tedious and boring to all involved and had drifted from the original intention of processing text for understanding. Third, the use of linking words had been overlooked.

In the new program students were involved in mapping in the first week of school and comprehension was given top priority. Linking words were included from the beginning and Mrs. M. struggled along with the students stating,

> When I was doing my own concept map I constantly got hung up on trying to figure out a connecting word and still do. When I ask the kids what we should use as a connecting word . . . I'm not all that sure myself (September, 1992).

At the time, Mrs. M. also was struggling with how she would grade the students. She made her own maps of the text for reference and tried to apply Novak and Gowin's (1984) scoring scheme to student maps with little success. She also decided which key concepts she felt students should learn, much as the raters did when developing their scoring criteria.

In October Mrs. M. noticed that the students seemed to have "a better grasp of linking words (which) might have something to do with the fact that I feel more comfortable." By the end of October she remarked at how

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consistently most of the students were "involved" in their group mapping efforts. Until then she had been skeptical about teacher education films of students working in groups and thought that they worked so well only because they were being filmed. She wrote,

> I can honestly say now that when a technique truly does work and is good, the kids will just naturally take it and fly.

In Mrs. M.'s last journal entry she reflected on the progress she and her students made, realizing that concept mapping is a long term commitment and that there "still needs to be a lot of fine tuning done." She began using mapping in her language arts class and was able to use the Concept Map Scoring Guidelines to evaluate those maps as well as those in social studies. The last paragraph of her entry summarizes nicely her involvement in the study:

> Well, as you know, at first I did not particularly care for concept mapping. It was something that 'sounded' good, but I was unsure of teaching it in my classroom and I was unsure of the success rate it would find. However, as I learned more about concept mapping I saw the value in it, but still did not feel comfortable teaching it. I was pleasantly surprised though when I found myself learning how to map from and with the kids. That only goes to show that you do not necessarily need to know all that there is about something to teach it. You just have to be willing to take the risk. By the way, now I do like concept mapping because I can see how the kids enjoy learning so much more (January, 1993).

She made two recommendations for teachers who are considering concept mapping in their classrooms. The first is to convince another teacher to do it at the same time

so there is someone else involved in planning and discussion of implementation. She felt that she had needed the support and observations of the researcher to keep her going until she began to see for herself the benefits of concept mapping.

Her second recommendation is to provide daily concept mapping instruction at the beginning of the year to get the students involved as quickly as possible. Once her students were constructing maps in their groups it was easier to maintain momentum and interest in less frequent sessions.

CHAPTER 5
CONCLUSIONS AND IMPLICATIONS

Quantitative and qualitative data were gathered and analyzed in this in-depth study of 26 fifth graders learning concept mapping (45 sessions over 14 weeks). The small, nonrandom sample limits statistical inference but the information gained and the resulting evaluation instrument are important for researchers and teachers.

Three research questions guided the study. The first question addressed the nature of concept mapping and how it develops over time. An analysis of concept maps revealed two major components -- content organization and presentation. Content organization has five distinct subcomponents: concept selection, type of entry, linking words, levels of concept development from general to specific, and integration of concept segments. Presentation has three subcomponents: heading differentiation, use of space, and use of arrows to show changes in directional relationships. These eight subcomponents can be scored separately using specific guidelines.

The study did not identify phases of development in the sense of maturational stages, an interesting possibility for further long-term research. It did, however, identify certain subcomponents which were more difficult to master than others. While the ability to select and develop concepts from general to specific

levels was evident for most of the class, the processes requiring higher levels of comprehension (i.e., appropriate links and integration) were less evident. Presentation subcomponents that were present in group maps were absent in most of the individual maps. This situation is probably due to faulty task instructions in the testing situation rather than actual task difficulty.

The second question addressed identifiable differences in maps produced by students at different reading comprehension levels; by boys and girls; and by students with either positive or negative attitudes toward social studies. While there was a significant overall gain from Map_1 to Map_2, the average gain score is highest for the low achievement group. However, such variation in the subcomponent scores is less evident. Links and integration, the subcomponents that posed difficulties for some of the low achievement students, proved difficult for some of the high group students as well.

There is no significant difference between the mean gain scores of boys and girls. The only subcomponents to show variation by gender are concept selection and type of entry. Girls showed superior progress in concept selection while more boys than girls reworded their entries. The interaction of these two subcomponents is one possible explanation. Another could be a difference in how boys and girls translate information into map form. Another

explanation could be that girls tend to conform to academic tasks more than boys and find it more difficult to change from copying text verbatim to paraphrasing.

At the end of the study, 20 of the 26 students were positive toward social studies (only 9 had begun the study with positive attitudes), 4 were neutral, and 2 were negative. The latter two students, a boy and girl from the middle achievement group, had begun the study with negative attitudes toward social studies, but both felt positively about concept mapping. They each gained 1 point on Map2 but the boy's map (10 points) was less well developed than the girl's (13 points). A negative attitude toward social studies did not appear to interfere with the girl's adequate mapping performance. Since the boy had general social and academic difficulties, it is unlikely that his attitude toward social studies was responsible for his poorer performance. One can conclude that although a negative attitude toward social studies does not preclude the development of mapping competence, learning to map can improve attitudes toward social studies.

The third question addressed the kind of criteria that should be used to evaluate fifth grade concept maps. The scoring procedures developed by Novak and Gowin (1984) were found to be inappropriate for the specific task of mapping text. An alternative set of evaluation criteria was developed which incorporates Novak and Gowin's scoring

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of map levels (general to specific) with more detailed
scoring of the other subcomponents and mapping processes
such as paraphrasing and organizing concepts (see Appendix
E for Concept Map Scoring Guidelines). The criteria were
found to be applicable to maps of both expository and
narrative text.

Conclusions

Concept mapping is a potentially powerful learning
strategy that is accessible to fifth grade students at any
reading achievement level. It appears to have particular
benefits for those students at the lower levels. Compe-
tence in concept mapping requires a long-term investment
in time and energy by both the teacher and the students.
However, more positive attitudes toward social studies,
collaboration in negotiating meaning and organizing
information, and the perceived benefits of mapping as a
study tool make the investment worthwhile.

The potential of concept mapping as a measure of text
comprehension is another benefit. Unlike comprehension
questions which cue the student to what is important in
the text, the production of a concept map provides
quantifiable evidence that students can or cannot make
that judgment on their own. Further support is evident in
the similarities of the processes involved in mapping and
summary writing, particularly those of paraphrasing text

and integrating ideas. Competence in both of these processes reflects higher levels of comprehension.

Implications

The potential of concept mapping to empower students with a beneficial learning strategy and teachers with an alternative measure of comprehension makes it a candidate for inclusion in the teacher education curriculum. It should not, however, be relegated to a chapter on study skills for elementary school students but should be introduced as a tool for prospective teachers to use themselves. Teachers are unlikely to present it to their own students unless teacher educators have provided opportunities for *their* students to develop concept mapping competence in addition to knowledge about the strategy and its benefits for all learners. Without such an effort it will remain one of the many strategies read about in study skills textbooks and soon forgotten.

The Concept Map Scoring Guidelines (or other scoring criteria) should be used to inform concept mapping instruction and research. Students who find a particular subcomponent to be difficult, for example, might benefit from more specific instruction about that subcomponent. Subcomponents that appear to be more difficult for girls than boys (such as paraphrasing and reducing text) should be investigated further to determine if the difficulty is,

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in fact, gender-related. If it is not, it could reflect a general reluctance of students to change from a rote learning strategy that includes copying text verbatim to the deeper text processing strategy of concept mapping. Should this be the case then the implication is clear for introducing concept mapping of text in the lower grades before patterns of rote learning are firmly established.

The significant positive correlation between mapping and summary writing scores after only four months of mapping instruction and no instruction in summary writing warrants further research into the possible transfer of mapping competence to summary writing. Long-term instruction in mapping that begins in the early elementary grades could help prepare upper elementary school students for learning how to write summaries.

If the effectiveness of any reading strategy that requires deeper processing of information is dependent upon how much time and energy students invest (Anderson & Armbruster, 1984) then it is reasonable for teachers to invest their time and energy in a strategy that students enjoy and can benefit from using. If that strategy is also useful to the teacher in providing information about students' prior knowledge and comprehension of text, *and* it can be evaluated consistently, so much the better. Concept mapping is such a strategy.

APPENDIX A

Eight Information Processing Strategies

Strategies:	(1) Content DR-TA Haggard (1985) *p.72	(2) PReP Langer (1982) *p.73	(3) Group Mapping Davidson (1982) *p.75-76	(4) Know-Want Learn Activity Ogle (1986) *p.226-27
Conditions:				
1. direct use of prior knowledge (not presumed by teacher)	YES	YES	NO	YES
2. prior know-ledge organized before reading text	NO	NO	NO	NO
3. explicit links between prior knowledge/text	YES	NO	NO	YES
4. active explor-ation of conflicts between text and prior knowledge	**	NO	NO	**

* In D. Lapp, J. Flood, & N. & Farnan (Eds.).(1989). Content Area Reading and Learning: Instructional Strategies. Englewood Cliffs, NJ: Prentice-Hall.

*** indicates that although not described as such, the strategy could be adapted easily to reflect the characteristic.

Strategies:	(5) Conceptual Mapping Lapp & Flood (1989) *p.235-43	(6) Concept-Text-Application Wong & Au (1985) *p.249	(7) Inference Training Hansen & Hubbard (1984) *p.249	(8) Previewing Graves, Prenn, & Cooke (1985) *p.249
Conditions:				
1. direct use prior knowledge (not presumed by teacher)	YES	NO	NO	NO
2. prior knowledge organized before reading text	YES	NO	NO	NO
3. explicit links between prior knowledge/text	YES	**	**	**
4. active exploration of conflicts between text and prior knowledge	NO	NO	NO	NO

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Three Passages Adapted for Concept Mapping Instruction

What a Mutt!

She's a famous athlete who never won a championship. She's a TV star who never signed an autograph. She's Mutley: part terrier, part cocker spaniel, and all talent!

Mutley and her owner, Gene Alba, live in California. Mutley is the smartest of all Alba's pets. She wasn't always such a lucky dog. As a puppy she was caged at the pound. Alba found her and took her home. The two have been together ever since. Alba helped make Mutley a TV star.

Alba used to teach people how to ski. When he skied, Mutley tried to run beside him. She couldn't keep up in the deep snow. So Alba decided to build "Mutley specials." He fastened two small skis in the middle to keep them together. Then he fastened four baby shoes to the skis. Alba coached Mutley as if she were a child. First he skied with the dog between his legs. Next he let her ski while he held a safety rope.

Soon Mutley was sliding down the ski slopes. She had a new life as a one-dog talent show. Alba is also a deep sea diver. He built Mutley her own diving gear. On her first dive she swam across the bottom of the swimming pool in ten minutes. She has made about 200 dives in lakes and in the ocean. Mutley also waterskis and rides on Alba's motorcycle.

Mutley's tricks have led to worldwide TV shows. The former stray dog also helps other strays. Mutley helps promote kindness to animals and raises money for animal shelters. Mutley is a famous mutt, but she still likes to play, rest, and go running with Alba ... when she isn't working.

National Geographic World, April 1990 (pp. 8-10).

Earthquakes

For many years to come - especially if you live in California - you'll remember October 17, 1989, as an important and scary day. It was earthquake day!

At 5:04 in the afternoon, the earth in and around San Francisco shook. For 15 seconds, the land acted like an ocean. People in cars saw roads rise up and roll toward them. A farmer standing in his field became sick. Buildings swayed. Chairs and kitchen stoves slid around like toys.

The quake began underground near Loma Prieta, a mountain northeast of Santa Cruz. It was the second largest quake in California since 1900. Scientists rated the 1989 Loma Prieta quake at 7.1 on the Richter scale. That's the most widely used measure of how strong an earthquake is. A 7.1 quake is a very big one.

Sixty-two people died in the Loma Prieta quake. The damage to San Francisco and nearby counties was very costly.

A lot of people died, but the damage might have been much greater. Buildings swayed during the quake, but few of them fell down. If they had, many more people would have died. The way buildings are built can change how much damage there is. Also, the type of soil they rest on is important. Other things can make damage higher or lower too.

Earth that moves is a fact of life, say scientists. Our Earth's outside layer, or crust, is broken into about a dozen huge plates of rock. Although you cannot feel them moving beneath your feet, they do move. Like huge rafts at sea, the plates float slowly on partly melted rocks that lie under the crust.

As plates slip and slide, cracks may form in the crust. Some cracks, where there are special kinds of movements, are called faults. Earthquakes move along these faults.

Earthquake prediction and past experience help people to prepare for future earthquakes. They can plan and build buildings and roads that will not fall down when the earth shakes. They can make older buildings stronger. And, just as important, they can learn what to do when an earthquake hits - and they can practice doing it. Learning how to prepare will help people when an earthquake really hits.

National Geographic World, March 1990 (pp. 8-10).

Keeping Track of Hurricanes

A violent storm hits the southeastern coast of the United States. Rain pours down in solid sheets. The wind gusts up to 200 miles an hour. It uproots trees and tears the roofs off buildings. Utility poles topple, bringing down power lines. Storm-driven waves batter the shore. Floods spread across low-lying areas.

This terrible storm is called a hurricane. It is one of the strongest storms on earth. Each year, hurricanes hurt more people and damage more buildings than any other kind of storm.

In 1970, nearly 500,000 people were killed during one such storm. It struck the coastal islands of Bangladesh, a nation in Asia. The strongest hurricane to hit the United States struck Galveston, Texas in 1900. That storm killed 6,000 people.

Hurricanes are made up of strong winds, clouds, and rain. They begin over warm seas to the south. The giant storms may grow to be more than 300 miles across.

Hurricanes contain a lot of energy. The energy one storm gives off in a day could make electricity for the whole United States for a few years.

These storms are a problem for coastal land where large numbers of people live. In the United States, more people live near the sea today than ever before. Luckily, the loss of life in this country from hurricanes has been much smaller in recent years. There are better ways of letting people know that a hurricane is coming.

Hurricanes no longer take people by surprise. Satellites far above the earth send pictures of beginning storms to the National Oceanic and Atmospheric Administration. People there study the pictures to learn how quickly a hurricane is growing. The pictures also show which way the storm is moving.

A series of tracking stations reaching from Texas to Maine tracks storms that come within 250 miles of the coast. The United States Air Force flies airplanes into some storms to measure their size and strength.

The National Hurricane center, in Miami, Florida, gathers all this information. People at the center send out a "hurricane watch" if a storm is within two days of hitting land. They send out a "hurricane warning" if a storm is going to hit within 24 hours. With such a warning, people caught in the storm's path have time to move to safety.

National Geographic World, September 1980 (pp. 10-13).

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APPENDIX C

Two Passages for Individual Mapping Sample

Native Americans called the Hopi live where there is little rain. Plants can live only in the few damp places of this dry land. There are few big animals so a hunter must work hard and travel great distances to find enough food. Life is hard in this land, but for thousands of years people have been able to adapt to this harsh climate. Adapt means to change when you have to.

The Hopi have learned to stay alive in this very dry land. They plant crops that grow well in a dry environment. Hopi corn plants are tough and hardy and they grow with little water. Each corn seed sends out very long roots that reach water deep in the earth. Hopi corn grows close to the ground so the wind does not blow it or dry it

Farmers from other places may think the small plants and colored kernels look strange. But this corn is adapted to life in the desert.

The Hopi are native Americans. By Hopi custom, a house belongs to the woman who gets it from her mother. A husband comes to live at his wife's house. Women construct houses and maintain them when they need repair. Walls are usually big, flat stones held together by dried mud. High on the walls are one or two small holes for light and air. Few trees grow where the Hopi live, so the men drag sweet smelling cedar logs from mountains far away to support the roof.

Until about a century ago, the Hopi built their houses without doors. They entered their houses through a hole in the roof and they used ladders to get down to other floors.

Many Hopi houses were apartment houses. A big one had more than nine hundred rooms. Many of the houses remain standing hundreds of years later. The desert has little rain to damage them and the houses were well built and cared for.

Adapted from The United States. (1980). Center for the Study of Instruction, New York: Harcourt, Brace, Jovanovich (pp. 10, 12, 13).

Two Passages for Individual Summary Sample

In the old days, Eskimos knew almost nothing about the outside world. Now, many people from outside have brought their foods to the Eskimos. They have brought tools to make work easier. They have brought guns to hunt reindeer and seals, and they have brought machines and medicines.

Not everything the outsiders brought has been good for the Eskimos, though. The once plentiful seals and reindeer are now scarce. Even with guns, an Eskimo would now have trouble getting enough to eat by hunting. Outsiders also brought diseases like smallpox with them. Many Eskimos died before medicines were able to help them.

Many Eskimos now live in small wooden houses. Snowmobiles pull their sleds. Their boats have motors. Airplanes carry people and mail everywhere. Eskimo children now go to schools much like yours and they do not spend much time learning to hunt, fish, and sew skins together.

Eskimos lived by hunting animals. But they lived in the cold where there were never enough animals in one place to feed people all year long. Families had to keep traveling to find food. They traveled alone. For weeks or months they did not see any other people.

Sometimes they used skins to make a tent. Other times they used the material nearest to them - snow - to build a quick shelter. Sometimes houses made of snow-blocks are called "igloos" but this Eskimo word means any kind of shelter.

To keep warm inside and protect them from wind and storms, Eskimos often built their igloos partly underground. These houses were made of materials from the environment, such as earth, driftwood, and sometimes stones. Some walls were made of boards. An extra room or two opened off the long tunnel entrance. A bench along the wall was used for eating and sleeping.

Adapted from The United States. (1980). Center for the Study of Instruction, New York: Harcourt, Brace, Jovanovich (pp. 27, 32, 33).

APPENDIX E

Concept Map Scoring Guidelines

Content Organization

concepts   % of total important concepts required by
rater consensus (varies with passage)

    1 point for   0- 25%
    2 points for 26- 50%
    3 points for 51- 75%
    4 points for 76-100%

type   predominant type of entry

    1 point if verbatim
    2 points if verbatim but reduced
    3 points if reworded but not reduced
    4 points if reworded and reduced

links   valid if they are nonconcept words·showing
appropriate relationship between bubbles

    1 point for 1 valid link
    2 points for more than 1, up to 1/2
    3 points for more than half but not all
    4 points for all valid links

levels   deepest valid level of development of one
concept (general to specific)

    1 point for 1 level (main topic to heading)
    2 points for 2 levels(adding subheading, etc.)
    3 points for 3 levels
    4 points for 4 or more levels

inte-   1 point if bubbles are shared by 2 or more
gration   subheadings/headings

Presentation

1 point each for evidence of a) heading
differentiation (color, capitals,
size); b) use of space (not too crowded,
legible); and c) appropriate use of arrows

Possible Total = 20 points

Summary Scoring Guidelines

ideas   % of total important ideas required by
                   rater consensus (varies with passage)

                   1 point for some   (less than half)
                   2 points for most (half or more)
                   3 points for all

integration   how ideas are combined

                   1 point if ideas are in separate sentences
                   2 points if two or more ideas are logically
                     combined in one sentence

processing   whether text has been copied or paraphrased
level
                   1 point   if verbatim
                   2 points if reworded

number of   1 point if total is within raters' maximum
words   (varies with passage)

Total Possible points = 8

APPENDIX G

Raw Data: Map$_1$ and Map$_2$ Scores
(N = 24, M_1 = 10.4, M_2 = 12.7)

Note: Code letters stand for the first letter of the pseudonyms except O (Tom), X (Alex), and Y (Tony).

Code	Group	Conc M_1/M_2	Type M_1/M_2	Links M_1/M_2	Level M_1/M_2	Integ M_1/M_2	Pres M_1/M_2	Totals M_1/M_2
Girls (n = 14, M_1 = 10.1, M_2 = 12.2)
N	L	2/4	1/1	0/2	2/3	0/0	0/2	5/12
A	M	3/3	1/1	2/2	3/4	0/0	1/1	10/11
B	M	3/3	3/3	2/2	4/2	1/0	1/2	14/12
C	M	3/3	1/1	2/2	3/3	0/0	1/2	10/11
D	M	2/4	3/1	3/3	2/4	0/1	1/0	11/13
E	M	4/3	1/3	1/1	3/3	0/1	1/1	10/12
G	M	3/3	1/3	3/3	4/3	0/0	1/1	12/13
H	M	4/3	1/3	2/3	2/2	0/0	0/3	9/14
J	M	3/4	3/3	3/3	4/3	0/1	1/1	14/15
K	M	4/4	1/3	2/3	2/4	0/0	1/1	10/15
L	M	2/2	2/2	2/2	2/3	0/0	1/1	9/10
M	M	4/3	1/1	0/2	3/3	0/0	0/0	8/09
F	H	4/3	1/1	0/3	2/3	0/0	1/1	8/11
I	H	4/3	1/3	2/2	3/4	0/0	1/1	11/13
Boys (n = 10, M_1 = 10.9, M_2 = 13.4)
S	L	2/3	3/3	0/3	2/1	0/0	0/0	7/10
T	L	2/2	3/4	2/2	2/4	0/1	2/2	11/15
P	M	2/3	1/2	2/3	3/3	0/0	2/3	10/14
R	M	3/2	3/2	2/4	1/1	0/0	0/1	9/10
W	M	4/1	1/4	2/3	3/2	0/0	0/2	10/12
Y	M	2/3	3/3	2/2	3/4	0/0	0/1	10/13
O	H	3/4	2/3	3/3	2/4	0/1	1/1	11/16
Q	H	3/3	3/3	2/2	4/3	0/1	0/1	12/13
X	H	4/2	4/4	2/4	4/4	0/1	2/3	16/18
Z	H	4/4	3/3	2/3	4/3	0/0	0/0	13/13

Low (n = 3, M_1 = 7.7, M_2 = 12.3)
Middle (n = 15, M_1 = 10.4, M_2 = 12.3)
High (n = 6, M_1 = 11.8, M_2 = 14)

APPENDIX H

SAT Raw Scores for Reading Comprehension and Map1 Scores
($N = 24$)

Code	SAT	M_1
A	36	10
B	47	14
C	39	10
E	43	10
F	53	8
G	47	12
H	37	9
I	55	11
J	50	14
L	36	9
M	40	8
N	22	5
O	51	11
P	40	10
Q	51	12
R	49	9
S	28	7
T	24	11
U	39	9
V	30	9
W	40	10
X	55	16
Y	40	10
Z	59	13

APPENDIX I

Raw Data: Summary$_1$ and Summary$_2$ Scores
(N = 23)

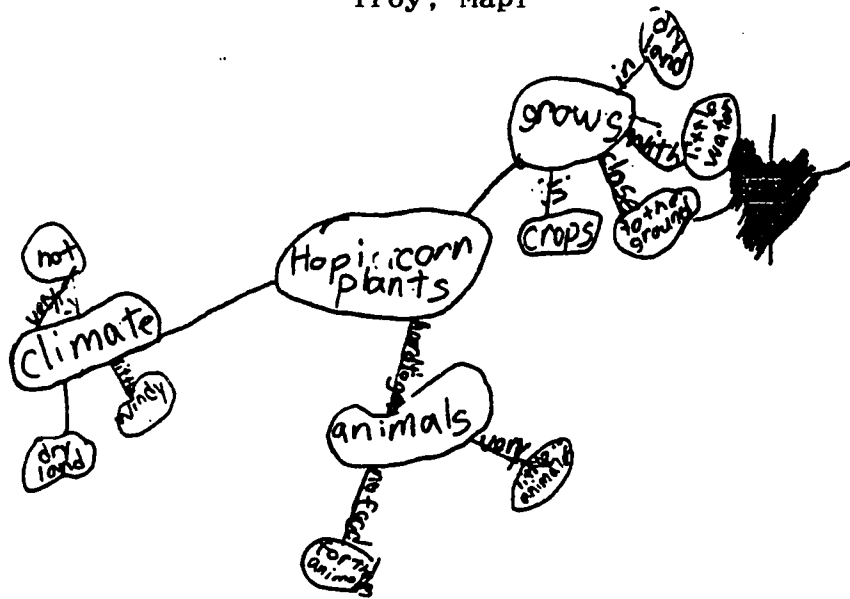| Code	Summary$_1$ (M = 4.8)	Summary 2 (M = 5.1)
A	4	5
B	4	5
C	4	5
D	5	7
E	5	6
F	4	4
G	6	5
H	5	5
I	6	5
J	4	6
K	4	4
L	4	4
M	4	4
N	4	4
O	7	6
P	6	5
Q	6	6
S	6	5
T	4	6
U	4	4
W	4	4
X	5	6
Z	6	6

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Individual Concept Maps

Nora, Map1

Map2
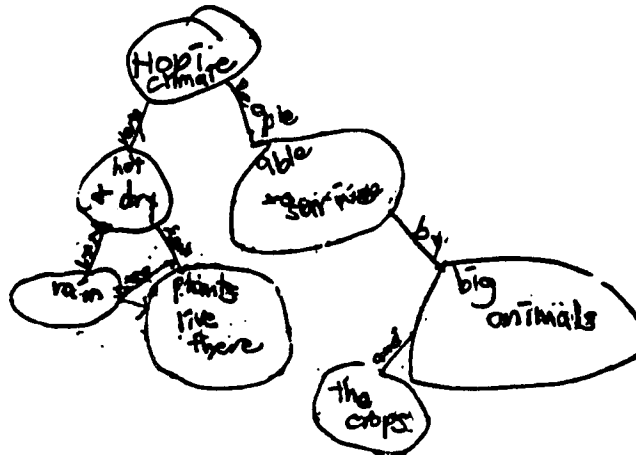
Troy, Map1

Map2

150

desert has little rain to damage the houses.

Hopi house were apartment houses

Hopi Americans

house belongs to man who made it from mother

Houses

big not stones in muj

come

customs

a question we ask and house

big not grow where Hopis live so men get sweet-smelling over logs.

a walls are too small hot

construct houses

big one had over 900 rooms!

many

get in their houses by ladders to get to different floors.

houses are standing now

Map2

Hopi climate

hot + dry

are our rivers

rain

plants live there

the crops

big animals

151

Map2

152

Map2

153

Alex, Map1

Map2

154

Map1 content (concept map):
- Hopi
- Native Americans
- crops
- like corn plants
- have adapted to live in the desert
- the land adapted once more to change
- with just a little water
- the Bean corn scattered long potatoes with water keep in memory
- Transformed cactus from adding rice
- where there is little rain
- great distance for food
- People have been able to adapt now crops

Map2

Map2 content (concept map):
- Hopi
- Native Americans
- built their own houses
- made with flat stones and mud
- made and Passed it from mother to daughter
- women
- maintained also houses built
- Many were Apartments
- some were still standing years later
- big and had more than 900 rooms
- didn't have door since doors
- and instead got through the roof
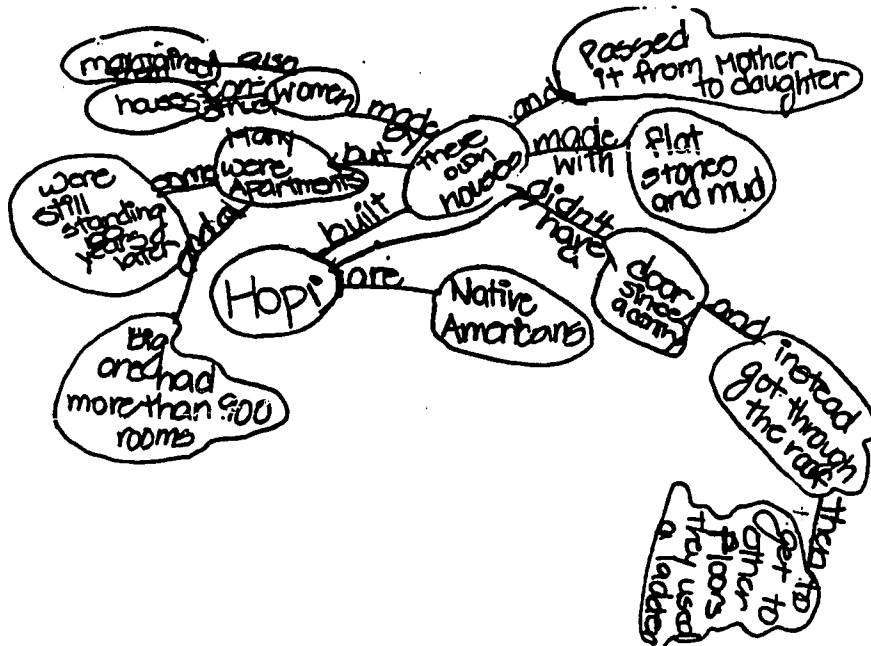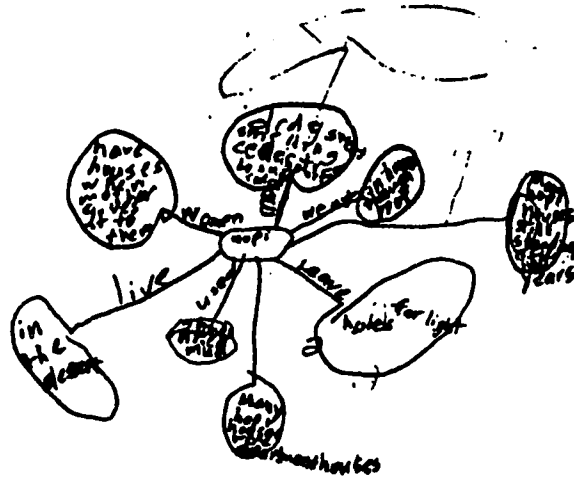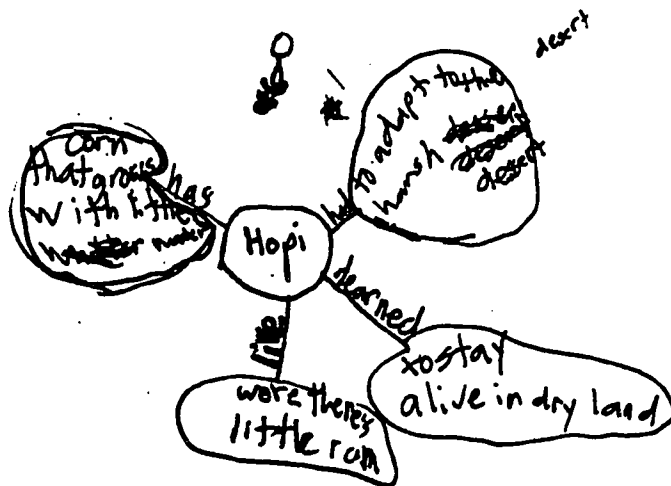- then to get to other floors they used a ladder

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Robert, Map1

Map2

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REFERENCES

Alexander, P. A., & Judy, J. E. (1988). The interaction of domain-specific and strategic knowledge in academic performance. _Review of Educational Research_, _58_(4), 375-404.

Anderson, R. C., Reynolds, R. E., Schallert, D. L., & Goetz, T. E. (1977). Frameworks for understanding discourse. _American Educational Research Journal_, _14_, 367-381.

Anderson, T. H., & Armbruster, B. B. (1984). Studying. In P. D. Pearson, R. Barr, M. L. Kamil, & P. Mosenthal (Eds.), _Handbook of Reading Research_ (pp. 657-679). New York, NY:Longman.

Armbruster, B. B., Echols, C. H., & Brown, A. L. (1982). The Role of Metacognition in Reading to Learn: A Developmental Perspective. _Volta Review_, _84_(5), 45-56.

Armbruster, B. B., Osborn, J. H., & Davison, A. L. (1985). Readability Formulas May Be Dangerous to Your Textbooks. _Educational Leadership_, _42_(7), 18-20.

Ault, C. R. Jr. (1985). Concept Mapping as a Study Strategy in Earth Science. _Journal of College Science Teaching_. _15_(1), 38-44.

Ausubel, D. (1960). The Use of Advance Organizers in the Learning and Retention of Meaningful Verbal Material. _Journal of Educational Psychology_, _51_, 267-272.

Bail, F. (1989). A Modified Tetrahedral Model for Exploring Questions About Learning Phenomena. Unpublished Course Notes for EDEP 661, University of Hawai'i, p. 74.

Baker, L. & Brown, A. L. (1984). Metacognitive Skills and Reading. In P. D. Pearson, R. Barr, M. L. Kamil, & P. Mosenthal (Eds.), _Handbook of Reading Research_ (pp. 353-394). New York: Longman.

Barron, R. F. (1979). Research for the Classroom Teacher: Recent Developments of the Structured Overview as an Advance Organizer. In H.L. Herber & J. D. Riley (Eds.), _Research in Reading in the Content Areas, The Fourth Report_, (pp. 171-176). NY: Syracuse University.

Bayer, A. S. (1990). _Collaborative Apprenticeship Learning_. Mountain View, CA: Mayfield Publishing.

Belmont, J. M., Butterfield, E. C., & Ferretti, R. P. (1982). To Secure Transfer of Training Instruct Self-management Skills. In D. K. Detterman & R. J. Sternberg (Eds.), How and How Much Can Intelligence Be Increased? (pp. 147-154). Norwood, NJ: Ablex.

Bereiter, C. (1991). Implications of Connectionism for Thinking about Rules. Educational Researcher, 20(3), 10-16.

Bransford, J. D. & Johnson, M. K. (1972). Contextual Prerequisites for Understanding: Some Investigations of Comprehension and Recall. Journal of Verbal Learning and Verbal Behavior, 11(6), 717-726.

Bransford, J., Sherwood, R., Vye, N. & Reiser, J. (1986). Teaching thinking and problem solving. American Psychologist, 41(10), 1078-1089.

Bransford, J. D., Stein, B. S., Shelton, T. S., & Owings, R. A. (1981). Cognition and Adaptation: The Importance of Learning to Learn. In J. H. Harvey (Ed.), Cognition, Social Behavior and the Environment (pp. 93-110). Hillsdale, NJ: Erlbaum.

Brown, A. L., Bransford, J. D., Ferrara, R. A., & Campione, J. C. (1983). Learning, Remembering, and Understanding. In J. H. Flavell & E. M. Markman (Eds.), Handbook of Child Psychology: Vol. 3, Cognitive Development (pp. 77-166). NY: Wiley.

Brown, A. L., & Campione, J. C. (1978). Permissible inference from the outcome of training studies in cognitive development research. Newsletter of the Institute of Comparative Human Development, 2, 46-53.

Brown, A. L. & Campione, J. C. (1984). Three faces of transfer: Implications for early competence, individual differences, and instruction. In M.E. Lamb, A.L. Brown, & B. Rogoff (Eds.), Advances in Developmental Psychology (Vol. 3), (pp. 143-192). Hillsdale, NJ: Erlbaum.

Brown, A. L., Campione, J. C., Bray, N. W., & Wilcox, B. L. (1973). Keeping Track of Changing Variables: Effects of Rehearsal Training and Rehearsal Prevention in Normal and Retarded Adolescents. Journal of Experimental Psychology, 101(1), 123-131.

Brown, A. L., Campione, J. C., & Day, J. D. (1981). Learning to Learn: On Training Students to Learn from Texts. Educational Researcher, 10, 14-21.

Brown, A. L. & Day, J. D. (1983). Macrorules for Summarizing Texts: The Development of Expertise. <u>Journal of Verbal Learning and Verbal Behavior</u>, <u>22</u>, 1-14.

Brown, A. L. & Palincsar, A. S. (1989). Guided, cooperative learning and individual knowledge acquisition. In L. B. Resnick (Ed.), <u>Knowing, learning, and instruction: Essays in honor of Robert Glaser</u> (pp. 393-451). Hillsdale, NJ: Erlbaum.

Brown, J. S., Collins, C., & Duguid, P. (1989). Situated Cognition and the Culture of Learning. <u>Educational Researcher</u>, <u>18</u>(1), 32-42.

Burmeister, L. E. (1974). <u>Reading Strategies for Secondary School Teachers</u>. Reading, MA: Addison-Wesley.

Buzan, T. (1983). <u>Use Both Sides of Your Brain.</u> NY: E. P. Dutton.

Collins, A., Brown, J. S., & Newman, S. E. (1989). Cognitive Apprenticeship: Teaching the crafts of reading, writing, and mathematics. In L. B. Resnick (Ed.), <u>Knowing, Learning and Instruction: Essays in Honor of Robert Glaser</u> (pp. 200-239). Hillsdale, NJ: Erlbaum.

Danner, F. W. (1976). Children's Understanding of Intersentence Organization in the Recall of Short Expository Passages. <u>Journal of Educational Psychology</u>, <u>68</u>, 174-183.

Dansereau, D. F., Collins, K. W., McDonald, B. A., Holley, C. D., Garland, J. C., Diekhoff, G., & Evans, S. H. (1979). Development and Evaluation of a Learning Strategy Training Program. <u>Journal of Educational Psychology</u>, <u>71</u>(1), 64-73.

Derry, S. J. (1990). Learning Strategies for Acquiring Useful Knowledge. In B. F. Jones & L. Idol (Eds.), <u>Dimensions of Thinking and Cognitive Instruction</u> (pp. 347-379). Hillsdale, NJ: Erlbaum.

Dishner, E. K. & Olson, M. W. (1989). Content Area Reading: A Historical Perspective. In D. Lapp, J. Flood, & N. Farnan (Eds.), <u>Content Area Reading and Learning: Instructional Strategies</u> (pp. 2-13). Englewood Cliffs, NJ: Prentice Hall.

Earthquake. (1990, May). <u>National Geographic World</u>. pp. 8-10.

159

Edelsky, C. & Harman, S. (1988). One More Critique of Reading Tests - With Two Differences. <u>English Education</u>, <u>20</u>(3), 157-171.

Eisner, E. W. (1990). Who Decides What Schools Teach? <u>Phi Delta Kappan</u>, March, 523-526.

Elliott, D. L., Nagel, K. C., & Woodward, A. (1985). Do Textbooks Belong in Elementary Social Studies? <u>Educational Leadership</u>, <u>42</u>(7), 22-24.

Evangelauf, J. (1990). Reliance on Multiple Choice Tests Said to Harm Minorities and Hinder Reform: Panel Seeks a New Regulatory Agency. <u>The Chronicle of Higher Education</u>, course handout.

Fish, S. (1980). <u>Is There a Text in This Class?: The Authority of Interpretive Communities</u>. Cambridge, MA: Harvard University Press.

Frase, L. T. (1967). Learning from Prose Material: Length of Passage, Knowledge of Results, and Position of Questions. <u>Journal of Educational Psychology</u>, <u>58</u>, 266-272.

Gardner, H. (1991). <u>The Unschooled Mind: How Children Think and How Schools Should Teach</u>. New York: Basic Books.

Garner, R. (1985). Text Summarization Deficiencies Among Older Students: Awareness or Production Ability? <u>American Educational Research Journal</u>, <u>22</u>(4), 549-560.

Ghatala, E. S., Levin, J. R., Pressley, M., & Lodico, M. G. (1985). Training Cognitive Strategy Monitoring in Children. <u>American Educational Research Journal</u>, <u>22</u>(2), 199-215.

Glaser, R. (1984). Education and Thinking. <u>American Psychologist</u>, <u>39</u>, 93-104.

Haggard, M. R. (1989). Instructional Strategies for Developing Student Interest in Content Area Subjects. In D. Lapp, J. Flood, & N. Farnan, (Eds.), <u>Content Area Reading and Learning: Instructional Strategies</u> (pp. 70-80). Englewood Cliffs, NJ: Prentice Hall.

Hare, V. C. & Borchardt, K. M. (1984). Direct Instruction of Summarization Skills. <u>Reading Research Quarterly</u>, <u>20</u>(1), 62-78.

Harris, A. J. & Sipay, E. R. (1985). How to Increase
    Reading Ability: A Guide to Developmental and Remedial
    Methods (8th ed.). NY: Longman.

Harris, A. J. & Sipay, E. R. (1990). How to Increase
    Reading Ability: A Guide to Developmental and Remedial
    Methods (9th ed.). NY: Longman.

Haywood, H. C. (1988). Bridging: A Special Technique of
    Mediation. The Thinking Teacher, 4(2), 4-5.

Heimlich, J. E. & Pittelman, S. D. (1986). Semantic
    Mapping: Classroom Applications. Newark, DE:
    International Reading Association.

Herber, H. L. (1970). Teaching Reading in Content Areas.
    Englewood Cliffs, NJ: Prentice-Hall.

Herber, H. L. (1978). Teaching Reading in the Content
    Areas (2nd ed.). Englewood Cliffs, NJ: Prentice-Hall.

Holley, C. D., Dansereau, D. F., McDonald, B. A., Garland,
    J. C., & Collins, K. W. (1979). Evaluation of a
    Hierarchical Mapping Technique as an Aid to Prose
    Processing. Contemporary Educational Psychology, 4,
    227-237.

Hurricanes, Keeping Track of. (1980, September). National
    Geographic World, pp. 10-13.

Johnson, D. D. & Pearson, P. D. (1984). Teaching Reading
    Vocabulary (2nd ed.). New York: Holt, Rinehart &
    Winston.

Jones, B. F. & Idol, L. (1990). Conclusions. In B. F.
    Jones & L. Idol (Eds.), Dimensions of Thinking and
    Cognitive Instruction (pp. 511-532). Hillsdale, NJ:
    Erlbaum.

Kintsch, W. & van Dijk, T. A. (1978). Toward a Model of
    Text Comprehension and Production. Psychological
    Review, 85(5), 363-394.

Klare, G. R. (1976). A Second Look at the Validity of
    Readability Formulas. Journal of Reading Behavior, 8,
    129-152.

Klare, G. R. (1989). Understanding the Readability of
    Content Area Texts. In D. Lapp, J. Flood, & N. Farnan
    (Eds.), Content Area Reading and Learning:
    Instructional Strategies (pp.34-42). Englewood Cliffs,
    NJ: Prentice Hall.

Lapp, D. & Flood, J. (1989). Using Conceptual Mapping as an Effective Strategy in Content Area Instruction. In D. Lapp, J. Flood, & N. Farnan (Eds.), Content Area Reading and Learning: instructional Strategies (pp.235-243). Englewood C_iffs, NJ: Prentice Hall.

Lapp, D., Flood, J., & Farnan, N. (Eds.), (1989). Content Area Reading and Learning: Instructional Strategies. Englewood Cliffs, NJ: Prentice-Hall.

Leu, D. J. Jr. & Kinzer, C. K. (1987). Effective Reading Instruction in the Elementary Grades. Columbus: Merrill Publishing.

Linn, M. C. & Petersen, A. C. (1985). Emergence and Characterization of Sex Differences in Spatial Ability: A Meta-Analysis. Child Development, 56, 1479-1498.

Margulies, N. (1991). Mapping Inner Space: Learning and Teaching Mind Mapping. Tucson, AZ: Zephyr Press.

Marzano, R. J., Brandt, R. S., Hughes, C. S., Jones, B. F., Presseisen, B. Z., Rankin, S. C., and Suhor, C. (1988). Dimensions of Thinking: A Framework for Curriculum and Instruction. Alexandria, VA: Association for Supervision and Curriculum Development.

Mason, J. M. & Au, K. H. (1990). Reading Instruction for Today (2nd ed.). Glenview, IL: Scott, Foresman.

Matthews, M. H. (1987). Sex Differences in Spatial Competence: the Ability of Young Children to Map Primed Unfamiliar Environments. Educational Psychology, 7(2), 77-90.

McNeil, J. & Donant, L. (1982). Summarization Strategy for Improving Reading Comprehension. In J. Niles & L. A. Harris (Eds.), New Inquiries in Reading: Research and Instruction (pp. 215-219). Rochester, NY: National Reading Conference.

Meyer, B. J. F. (1977). The Structure of Prose: Effects on Learning and Memory and Implications for Educational Practice. In R. C. Anderson, R. J. Spiro, & W. E. Montague (Eds.), Schooling and the Acquisition of Knowledge. Hillsdale, NJ: Erlbaum.

Meyer, B. J. F., Brandt, D. M., & Bluth, G. J. (1980). Use of Top-Level Structure in Text: Key for Reading Comprehension of Ninth-grade Students. Reading Research Quarterly, 16(1), 72-103.

Novak, J. D. (1990). Concept Maps and Vee Diagrams: Two
Metacognitive Tools to Facilitate Meaningful Learning.
Instructional Science, 19(1), 29-52.

Novak, J. D. & Gowin, D. B. (1984). Learning How To Learn.
New York: Cambridge University Press.

Novak, J. D., Gowin, D. B., & Johansen, G. T. (1983). The
Use of Concept Mapping and Knowledge Vee Mapping with
Junior High School Students. Science Education, 67(5),
625-645.

Okebukola, P. A. & Jegede, O. J. (1988). Cognitive
Preference and Learning Mode as Determinants of
Meaningful Learning Through Concept Mapping. Science
Education, 72(4), 489-500.

Ormrod, J. E. (1990). Human Learning: Theories,
Principles, and Educational Applications. New York:
Merrill Publishing.

Osborn, J. H., Jones, B. F., & Stein, M. (1985). The Case
for Improving Textbooks. Educational Leadership, 42(7),
9-16.

Patton, M. Q. (1986). Utilization-Focused Evaluation (2nd.
ed.). Newbury Park, CA: Sage Publications.

Pearson, P. D. (1985). Changing the Face of Reading
Comprehension Instruction. The Reading Teacher, 38,
724-737.

Pichert, J. W., & Anderson, R. C. (1977). Taking different
perspectives on a story. Journal of Educational
Psychology, 69, 309-315.

Pintrich, P. R. (1987). Motivated Learning Strategies in
the College Classroom. Paper presented at the American
Educational Research Association, April.

Prawat, R. S. (1989). Promoting access to knowledge,
strategy and disposition in students: A research
synthesis. Review of Educational Research, 59(1), 1-41.

Pressley, M., Snyder, B. L., & Cariglia-Bull, T. (1987).
How can good strategy use be taught to children?
Evaluation of six alternative approaches. In S.M.
Cormier & J.D. Hagman (Eds.), Transfer of Learning
(pp. 81-120). San Diego, CA: Academic.
Resnick, L. B. (1987a). Learning In School and Out.
Educational Researcher, 16(9), 13-20.

Resnick, L. B. (1987b). Education and Learning to Think. Washington, DC: National Academy Press.

Resnick, L. B. (Ed.). (1989). Knowing, Learning, and Instruction: Essays in Honor of Robert Glaser (pp. 1-14), Hillsdale, NJ: Erlbaum.

Roehler, L. R., & Duffy, G. G. (1984). Direct Explanation of Comprehension Processes. In G. G. Duffy & L. R. Roehler (Eds.), Comprehension Instruction (pp. 265-280). New York: Longman.

Roth, K. J. (1990). Developing Meaningful Conceptual Understanding in Science. In B. F. Jones & L. Idol (Eds.), Dimensions of Thinking and Cognitive Instruction (pp. 139-175). Hillsdale, NJ: Erlbaum.

Rothkopf, E. Z. (1966). Learning from Written Instructive Materials: An Exploration of the Control of Inspection Behavior by Test-like Events. American Educational Research Journal, 3, 241-249.

Rumelhart, D. E. (1980). Schemata: The building blocks of cognition. In R. Spiro, B. Bruce, & E. W. Brewer (Eds.), Theoretical issues in reading comprehension: Perspectives from cognitive psychology, linguistics, artificial intelligence, and education. Hillsdale, NJ: Erlbaum.

Rumelhart, D. E. (1985). Toward an Interactive Model of Reading. In H. Singer & R. B. Ruddell (Eds.), Theoretical Models and Processes of Reading (3rd ed.) (pp. 722-750). Newark, DE: International Reading Association.

Salomon, G. & Perkins, D. N. (1989). Rocky roads to transfer: Rethinking mechanisms of a neglected phenomenon. Educational Psychologist, 24(2), 113-142.

Schallert, D. L. & Roser, N. L. (1989). The Role of Reading in Content Area Instruction. In D. Lapp, J. Flood, & N. Farnan (Eds.), Content Area Reading and Learning: Instructional Strategies (pp. 25-33). Englewood Cliffs, NJ: Prentice Hall.

Sherrard, C. (1989). Teaching Students to Summarize: Applying Textlinguistics. System, 17(1), 1-11.

Singer, H. & Donlan, D. (1980). Reading and Learning from Text. Boston, MA: Little, Brown.

Stauffer, R. G. (1969). Teaching Reading as a Thinking Process. NY: Harper & Row.

Stice, C. F. & Alvarez, M. C. (1987). Hierarchical Concept Mapping in the Early Grades. Childhood Education, 64(2), 86-96.

Sullivan, J. (1978). Comparing Strategies of Good and Poor Comprehenders. Journal of Reading, 21, 710-715.

Taylor, B. M. (1980). Children's Memory for Expository Text After Reading. Reading Research Quarterly, 15(3), 399-411.

Taylor, B. M. (1982). A Summarizing Strategy to Improve Middle Grade Students' Reading and Writing Skills. The Reading Teacher, 36, 202-205.

Taylor, K. K. (1984). Teaching Summarization Skills. Journal of Reading, 27, 389-393.

Threadgill-Sowder, J., Sowder, L., Moyer, J., & Moyer, M. B. (1985). Cognitive Variables and Performance on Mathematical Story Problems. Journal of Experimental Education, 54(1), 56-62.

Tierney, R. J. & Cunningham, J. W. (1984). Research on Teaching Reading Comprehension. In P. D. Pearson, R. Barr, M. Kamil, & P. Mosenthal (Eds.), Handbook of Reading Research (pp. 609-655). New York:Longman.

Tracy, D. M. (1987). Toys, Spatial Ability, and Science and Mathematics Achievement: Are They Related? Sex Roles, 17(3/4), 115-138.

The United States (1980). Center for the Study of Instruction. New York: Harcourt Brace Jovanovich.

Vacca, R. T. & Vacca, J. L. (1989). Content Area Reading (3rd ed.). Glenview, IL: Scott, Foresman.

Vacca, R. T., Vacca, J. L. & Rycik, J. A. (1989). Text and Context in Content Area Reading: Planning and Organizing Successful Learning Environments. In D. Lapp, J. Flood, & N. Farnan (Eds.), Content Area Reading and Learning: Instructional Strategies (pp. 320-329). Englewood Cliffs, NJ: Prentice Hall.

Vygotsky, L. S. (1978). Mind in Society: The Development of Higher Psychological Processes (M. Cole, J. John-Steiner, S. Scribner, & E. Souberman (Eds. & Trans.). Cambridge, MA: Harvard University Press.

Waters, H. S. (1978). Superordinate-subordinate structure in Semantic Memory: The Roles of Comprehension and Retrieval Processes. Journal of Verbal Learning and Verbal Behavior, 17, 587-597.

Watts, G. & Anderson, R. C. (1971). Effects of Three Types of Inserted Questions on Learning From Prose. Journal of Educational Psychology, 62, 387-394.

Weinstein, C. E., & Mayer, R. E. (1986). The teaching of learning strategies. In M. C. Wittrock (Ed.), Handbook of Research on Teaching (3rd ed.) (pp. 315-327). NY: Macmillan.

Weinstein, C. E., Goetz, E. T., & Alexander, P. A. (Eds.). (1988). Learning and Study Strategies: Issues in Assessment, Instruction, and Evaluation. San Diego,CA: Academic Press.

What A Mutt. (1990, April). National Geographic World, pp. 5-9.

Winograd, P. & Hare, V. C. (1988). Direct Instruction of Reading Strategies: The Nature of Explanation. In C. E. Weinstein, E. T. Goetz, & P. A. Alexander (Eds.), Learning and Study Strategies: Issues in Assessment, Instruction, and Evaluation (pp. 121-139). San Diego, CA: Academic Press.

Wood, D. (1988). How Children Think and Learn. New York: Basil Blackwell.