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ABSTRACT

A study introduced elementary school students to concept maps--visual representations of a learner's thought processes. Nine teachers with two classes each (kindergarten through fourth grades represented) were taught the terminology of the concept map and were asked to initiate a number of activities in generating concept maps with their children. The children's concept maps provided excellent opportunities for further direct instruction, were developmental, and appeared to be a viable heuristic even for young learners. Teachers reported better test scores, improved understanding of conceptual relations and patterns, and more cooperative class discussions--especially in the peer group mapping events. Children's concept maps became increasingly detailed and complex across grade levels. Second graders seemed to appreciate most fully the need for lists prior to mapping. Both second and third graders initiated concept mapping with the stories and nonfiction writing in which they were engaged, while fourth graders seemed less interested in the experiment though the maps seemed to help their general learning. Concept mapping better prepared the teachers to organize and present their subject matter and to see tangible improvement in children's learning and sharing of ideas in the classroom. (Samples of children's maps are included.) (JD)

Center of Excellence

Basic Skills
Elementary & Secondary Education

Reading/Writing Component Report No. 5

HIERARCHICAL CONCEPT MAPPING:

YOUNG CHILDREN LEARNING HOW TO LEARN

(A VIABLE HEURISTIC FOR THE PRIMARY GRADES)

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Hierarchical Concept Mapping:

Young Children Learning How to Learn

Coming to know is the real goal of all learners. Helping children learn how to learn is the real objective of any classroom teacher. The extent to which a child learns is determined, in part, by his interest in the information (and/or task) and the facility with which he is able to integrate new information into existing knowledge structures. Instructional strategies that enhance the young learner's ability to categorize, organize, and integrate new data into his developing cognitive structure could be powerful indeed as children, from the beginning, are helped to be independent learners.

Rationale

Educational theorist David Ausubel (1963: 1968), and psycholinguist Frank Smith (1982), provide the theoretical framework, while Novak and Gowin (1984), provide the teaching application upon which this project was based. To these constructivists, meaningful learning is a change in one's cognitive structure (Smith, 1982), or a change in the meaning of experience (Gowin, 1981). Meaningful learning, as opposed to rote learning, results when a person consciously and explicitely ties new knowledge to relevant concepts or propositions they already possess.

Put another way, learning is a psycho-generative process in which information is perceived and meaning constructed from the transactions between new data and the knowledge base already organized, categorized, interrelated and stored in the learner's brain. When needed concepts in the knowledge base are hazy or faulty, the learner is at a decided disadvantage. When learners think in terms of relating new data to categories and interrelationships among concepts already assimilated, they are learning how to learn.

Much has been written about ways to help the learner learn, i.e., to organize and relate concepts (semantic maps, semantic webs, structured overviews, graphic organizers, etc.). However, little mention has been made of the nature of the organization of related concepts. One way to meaningfully organize related information into existing knowledge structures is through the use of concept maps (Novak and Gowin, 1984).

While semantic maps or semantic webs evolve from a central idea or core question (Hanf, 1971: Freedman and Reynolds, 1980: Johnson and Pearson, 1984: Johnson, Pittleman and Heimlick, 1986), and structured overviews (Earle and Barron, 1969) and

graphic organizers (Alvermann, 1980) arrange the lesson material in a hierarchy, concept maps represent meaningful relationships between concepts in the form of propositions. These concepts are arranged hierarchically, like structured overviews or graphic organizers, but are connected by propositions that are labled by words in a semantic unit. Concept maps visually represent knowledge structures and the thought processes used when dealing with a particular body of knowledge or schema for purposes of learning. (See figure one)

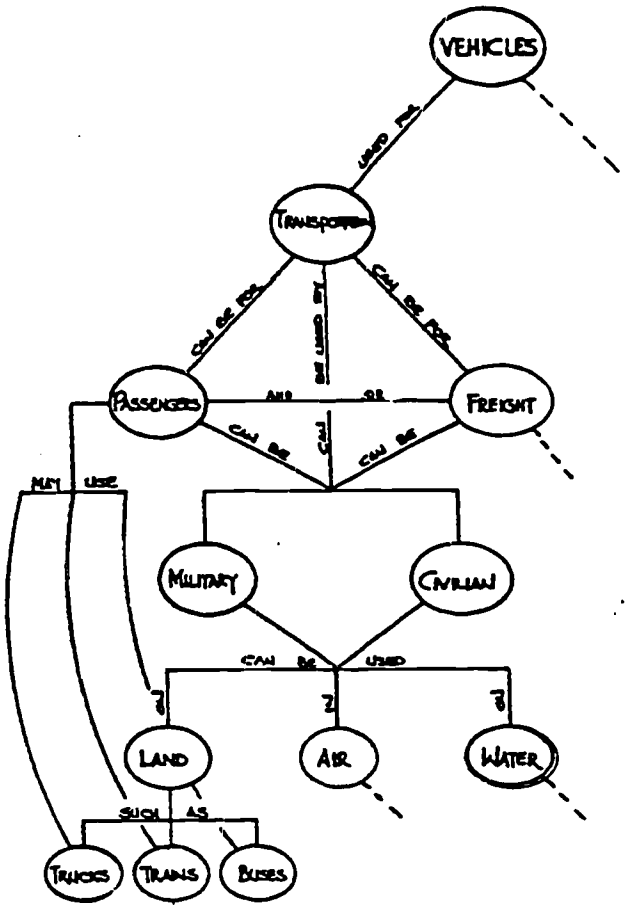


Figure one

This sample map is a visual representation of the knowledge base, cognitive structure, or schema for some aspects of vehicles that most adults possess and understand. The concepts and objects in the map are arranged in descending order from superordinate to subordinate. Each is connected by a proposition which lables the relationship and cross links which show the interrelationships among objects.

Concept mapping has been determined to be effective with college students in helping them construct and retain information (Cardemone, 1975: Stevart, et al., 1979: Rowell, 1978: Novak, 1981) and with the learning of seventh and eighth grade science students (Novak, Gowin and Johansen, 1983). However, the question remains whether concept mapping as a heuristic is

applicable to young children. Therefore, the purpose of this paper is to present some preliminary findings with concept mapping and kindergarten through fourth grade children.

Indroducing Children to Concept Mapping

Nine classroom teachers in middle Tennessee, including six teachers from a large metropolitan inner-city area, participated in this project.

Two classes each, grade levels K-3, and 1-4th grade class are represented. First, the teachers were instructed in the terminology of the concept map using Govin's (1981) terminology (i.e., events, objects, and concepts). Events are defined as anything that happens or can be made to happen. These events can be natural (e.g., lightning, thundershower, earthquake, etc.) or man made (e.g., school play, baseball game, wedding, etc.). Objects are defined as anything that exists and can be observed. This includes naturally occuring objects, (e.g., butterflies, rocks, people, etc..) and man made objects, (e.g., skyscrapers, bridges, books, etc..). A concept is defined as a sign/symbol pointing to regularities in events, or to recordes of events. Concepts are usually indentified by words, but they may be numerical or some other simiotic such as musical symbols. The teachers tried constructing their own maps, then they were asked to employ the following steps in generating concept maps with their children.

1. Have children close their eyes and ask them if they see a picture in their mind when you recite familiar words, e.g., dog, chair, and grass. Use "object" words at first.

2. Print each word on the board after the children respond. Ask children for more examples.

3. Now continue with "event" words such as raining, skipping, and sewing, and ask children for more examples, writing words on the board.

4. Give the children a few words that are unfamiliar, and ask them if they see a picture intheir mind. (Scan through a dictionary and find short words that are likely to be unfamiliar to all children, such as "concept.")

5. Help the children recognize that words convey meaning to them when they represent pictures or meanings in their minds.

6. If you have bilingual students in your class, you might introduce a few familiar foreign words to illustrate that different peoples use different labels for the same meaning.

7. Introduce the word concept and explain that concept is the word we use to mean some kind of object or event "picture." Review some of the words on the board and ask if these are all concepts; ask if these all bring a picture to mind.

8. Write words on the board such as the, is, are, when, that, then. Ask if these words bring a picture to mind. Children should recognize that those are not concept words; they are linking words we use in language to link concept words together into sentences that have special meaning.

9. Label your examples "linking words" and ask students for additional examples.

10. Construct short sentences with two concepts and a linking word, e.g., sky is blue, chairs are hard, pencils have lead.

11. Explain to children that most of the words in the dictionary are concept words. (You might have them circle concept words duplicated from a child's dictionary.) Written and spoken language (except that of very young children) uses concept words and linking words.

12. Point out that some words are proper nouns. Names of specific people, places, or things are not concepts.

13. Have children construct some short sentences of their own using the concept and linking words on the board and some of their own words if they wish.

14. Have one child read a sentence and ask other children which are the concept words and the linking word(s).

15. Introduce the children to the idea that reading is learning how to recognize printed labels for concepts and linking words. Ask if it is easier to read words for which they have a concept in their mind. Point to examples presented earlier of the familiar and unfamiliar concepts and to words such as when, then, while, and there, and ask which are usually easiest to read.

Concept Mapping Activities

1. Make a list of 10 to 12 related and familiar concept words, organizing these from more general, more inclusive concepts to less general, more specific concepts: For example, plant, stem, root leaves, floweres, sunlight, green, petals, red, water, air, would be a good set of related concepts.

2. Build a concept map on the board or overhead projector and introduce this as, perhaps, a "game we are going to learn to play with words, called concept mapping."

3. Have the children recite some of the short sentences (propositions) shown on the map.

4. Ask if anyone knows a way to connect other concepts to the map, such as water, soil (or dirt), yellow, smell, carrot, cabbage.

5. See if anyone can suggest a cross link between the concepts added and other concepts on the map.

6. Have children copy the map from the board and add two to three of their own concepts (and cross links if they can.)

7. Give children lists of related words and have them construct their own concept maps. Children are given the option of choosing which list of words they wanted to map.

8. If space permits, have children show their concept maps on the board and ask a few to explain the story their concept map tells. Avoid criticism of concept maps at this point and overemphasize positive attributes to help make concept mapping a positive experience. You will probably find that the students who often do poorly in other classwork will make good concept maps with good cross links (albeit they may misspell words or write illegibly). This would be a good opportunity to encourage these children. If space is limited, concept map papers might be taped up on walls or cabinets for children (and perhaps parents) to observe and share.

9. Take some time to point out positive features of children's concept maps, e.g., especially good hierarchies or interesting cross links.

10. Select a short (10-13 sentence) familiar story or section from reading materials and duplicate copies for all children. Help them identify some of the concept words in the story and some of the linking words. Select a meaningful passage, that is, one that has some message about the world or about people.

11. Ask the children which concepts are most needed to tell what the story is all about, and have them circle the key concepts in their copy of the text.

12. Have children prepare a list of concepts from the story, Reorganize, listing first the concepts that are most important in the story and going down the list to concepts that are less important. Discuss the children's list and then construct with them a concept map for the story.

13. Have the children construct their own concept map for other stories using activities similar to those for concept maps constructed from word lists.

14. Have some children read their stories to the class using only their concept map. See if the class can determine what the story is about.

15. Finished concept maps for each child should be posted about the room, together with the stories for other people to see.

16. Have the children prepare a concept map for something they know most about (e.g. baseball, swimming, automobiles) and present it to the class. As with other maps, emphasize positive attributes and avoid negative criticism.

17. Encourage children to map any new body of knowledge they are investigating (e.g. life cycle of frog, how to care for the class pet, etc.).

18. Have children write a short story based on their concept maps. Some of these might be read to the class.

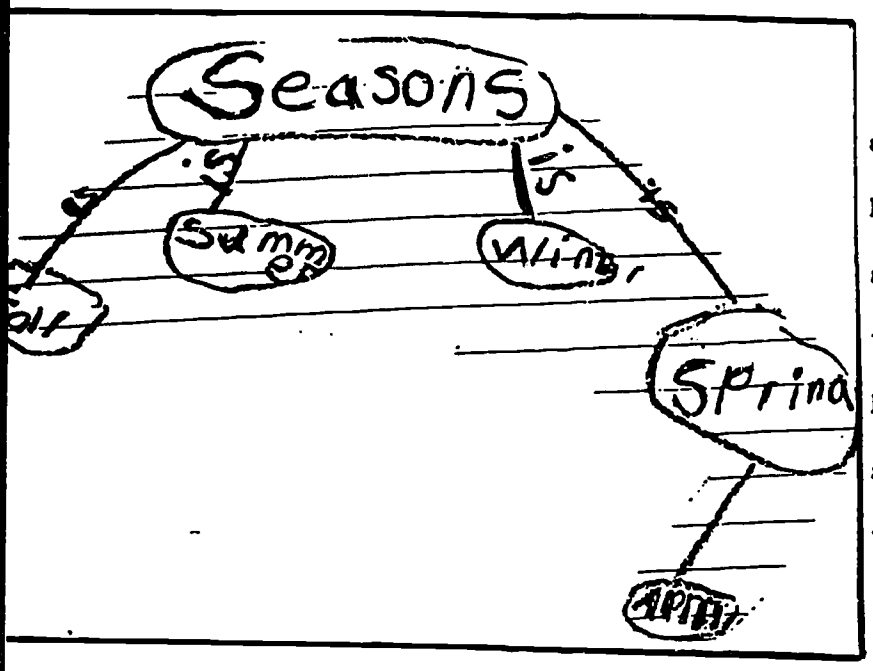
19. Allow children to put their maps on transparencies if possible as one way for them to present to class.

20. From here on, almost any classroom activity should be relatable to concepts and concept maps. Help them to see that one concept map can be linked to another and that all of the concepts we have are even in some remote way linked to each other. This cross-linking is what makes us "smart." (adapted from Gowin & Novak, 1984, pp. 25-31)

Children's Concept Maps

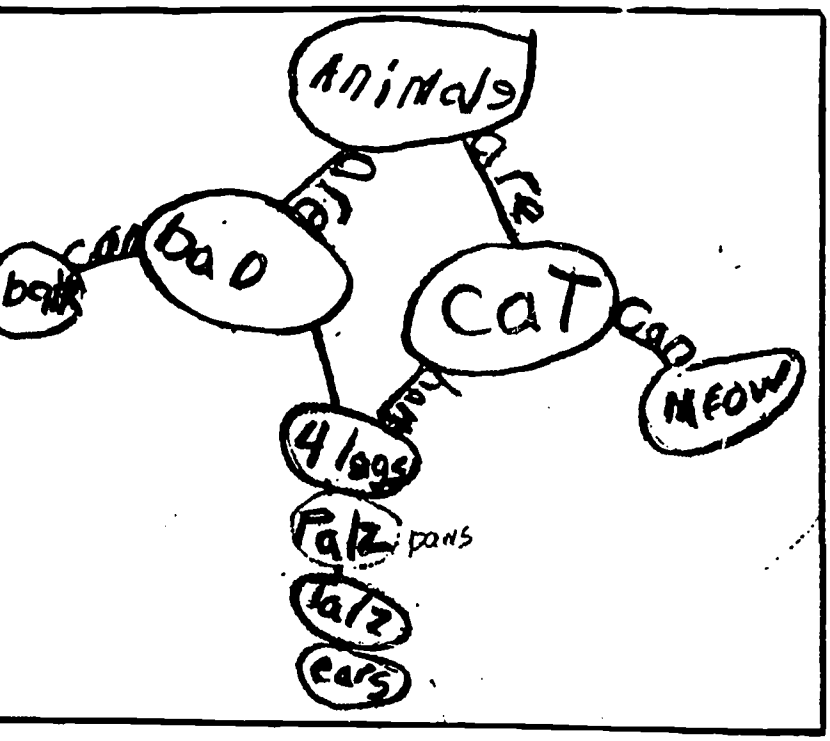
From January to May of 1986, the children demonstrated their understanding of concepts in their maps. As the children generated their own schema, three major phenomena became apparent: a) maps provided excellent opportunity for further direct instruction, b) concept mapping is developmental, and c) concept mapping appears to be a viable heuristic even for very young learners. The following are but a few examples of maps developed by the children in the cooperating classrooms.

Kindergarten:

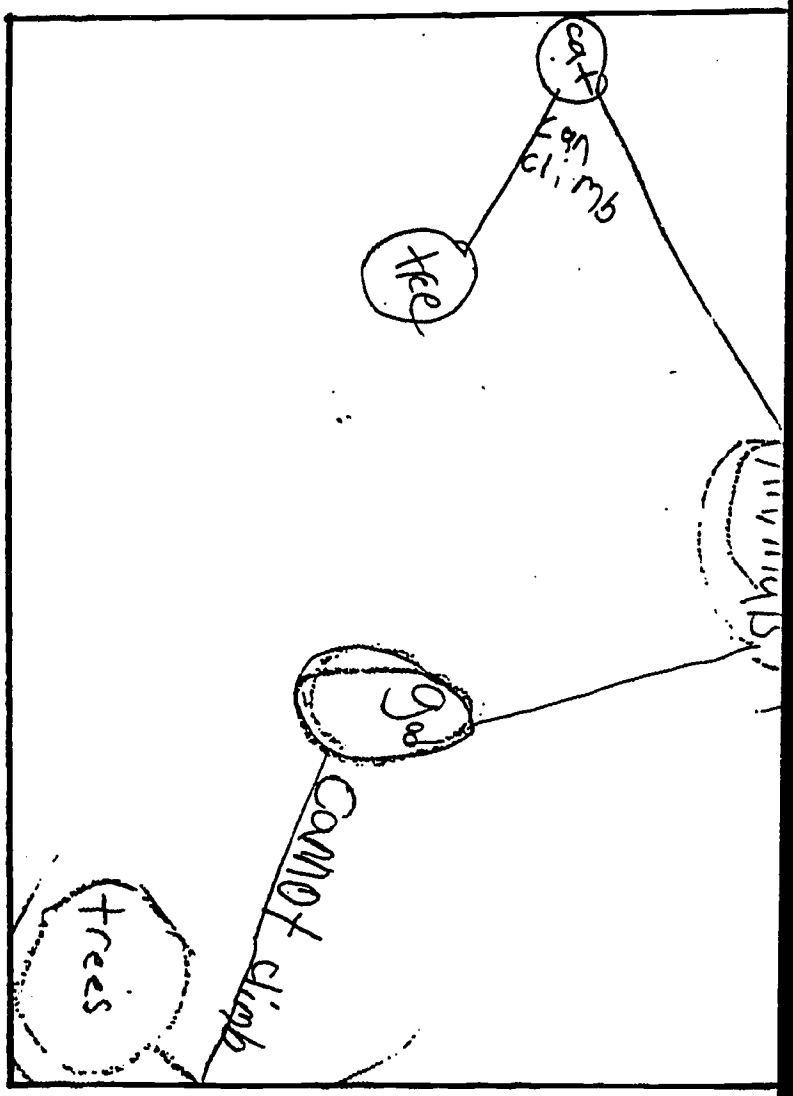


a) One of the very first maps René drew was a map about the seasons. This map helped the teacher as she discussed with Rene the order of the seasons, which months are in what seasons, and so on.

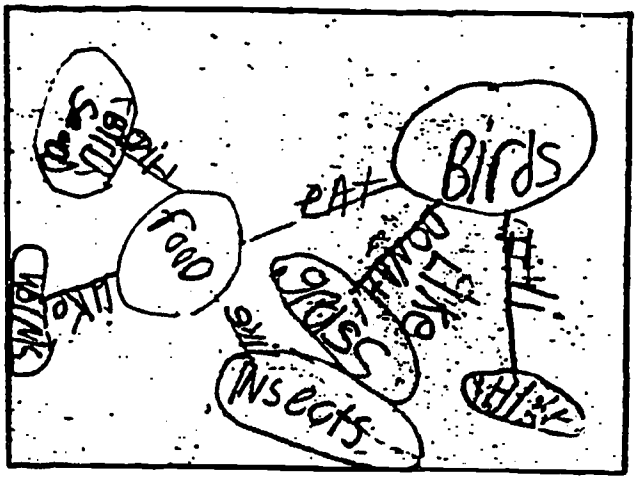
b) Bryan's first attempt at generating his own map was with animals. Clearly Bryan has the beginnings of a good organizational structure for the concept "animals."



c) One of Tammy's animal maps shows an added level of sophistocation in the cross link in the middle, i.e., both dogs (bad) and cats have 4 legs, paws, tales, and ears--



d) While Rickey shows an interest in what animals can do. One benefit of these maps was helping the children see how to relate what other animals have and what other animals can do.



e) Amie's map of birds is interesting. At one point Amy mapped that birds eat grass. Her teacher questioned her. "Are you sure birds eat grass? Amie said she didn't really know and her teacher suggested that she go to the library and try to find out. Amie did and when she came back she wrote. "Birds do not like grass."

Clearly even kindergarten children understand the notion of visually displaying what they are thinking and of abstractly representing the organization of their knowledge. It is equally apparent that even kindergarten children learn from mapping activities.

The following is an interviewer with one of the kindergarten teachers done after a few days with the technique.

Interviewer:

(I) "What do you find most helpful about concept maps?"

(T) "It really lets me see immediately where the children are not understanding a relationship between one concept an another... and it helps them see that too once I show it to them. They say, "Oh!" so even at this early age you can see misconceptions quickly in order to set that misconception correct."

(I) "What are some of your general impressions about the concept map"?

(T) "They're a lot of fun to do. The children are asking to go the library. They want to do more research. They want to get more books. They want more information so they can add to their maps and that's the thrilling part of this...this is the third day we've done concept maps and yesterday some of the children started asking me, and today the whole class really was wanting to go to the library to research their own particular interest."

(I) "What do the children themselves tell you about concept maps? Do they find them difficult or hard?"

(T) "They haven't really said they were difficult or hard. They have enjoyed doing them...We had done some work on maps before-on mapping a room. They immediately related concept maps to the maps of the room. We hid some buried treasures and drew maps to try and find it. So that was fun. And then this just really excited them to think that you could do other kinds of maps....

(I) "Do you find that they are starting to organize their ideas better as a result of concept maps?"

(T) "Yes, when we did the maps about animals those ideas came from them. We had done our morning story and it had to do with animals... and as we talked about the animals, and the dogs and cats, they started saying "What kinds of things are alike about dogs and cats. What things were different?" They brought the concepts that were the same abut the two animals in the middle, and the things that were opposite - that were not common to both animals - to the sides. So that were a lot of fun to do. It was really interesting to see that they understood that much."

(I) "Can you relate concept maps to a writing activity?"

(T) "Yes, we haven't gotten that far yet, but I would like to see after we do more concept maps and get to a point where they could have one really finished, then they could write a paragraph or simple sentences about their concept maps....Another

thing that's been interesting to me is that the children are zeroing in on what a concept is and what a linking vowrd is. They'll ask each other is that a concept? "Close your eyes can you see it? Yeah, I can see 'swimming.' "

(I) "That's what Adam said this morning. It's an idea that makes you think of..."

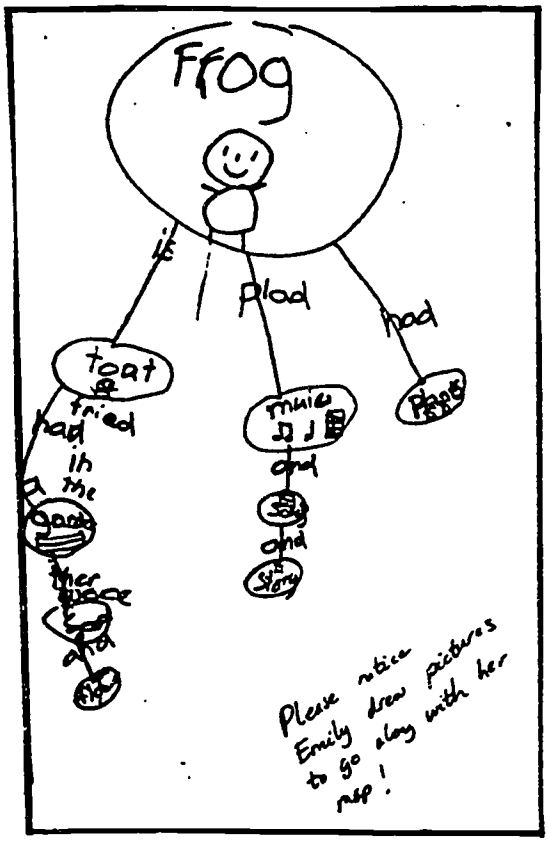
(T) "You can close your eyes and you can see it in your mind!"

(I) "Yes, you can see it in your mind. That was interesting."

(T) "And it's interesting too to hear them using that language. To hear them talking about concepts. "Is that a concept?" (Laughter)

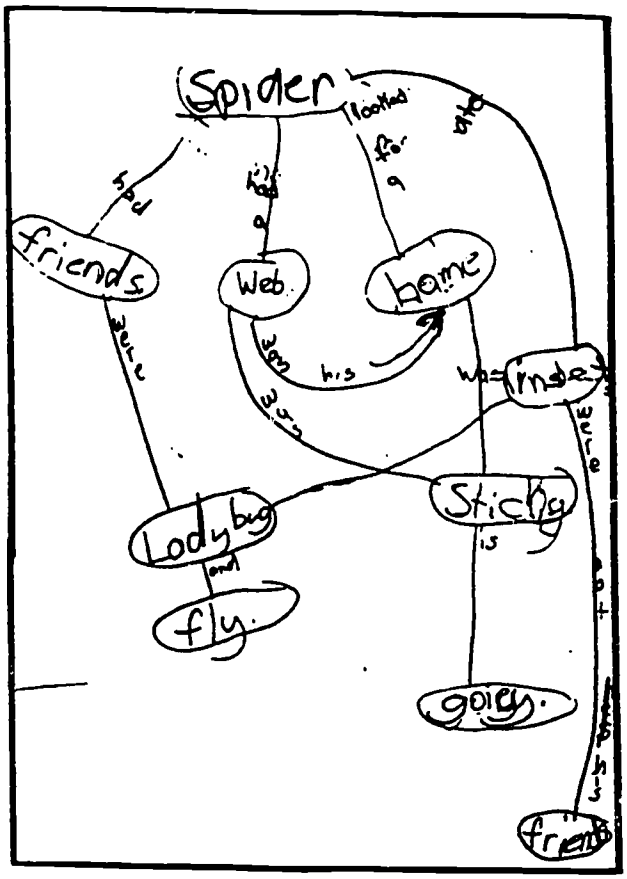
FIRST GRADE:

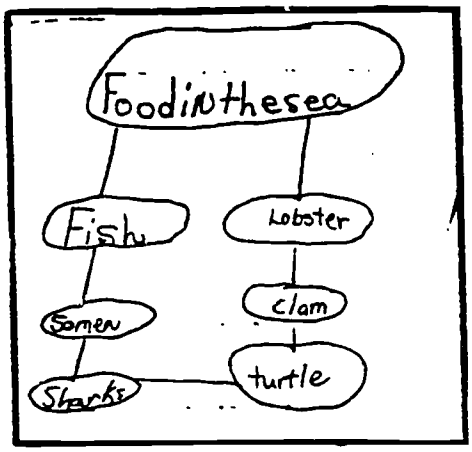
"Children's concept maps become increasingly detailed and complex across grade levels.



a) Emily's map about a story from the basal is more sophistocated than any of the kindergarten children's map.

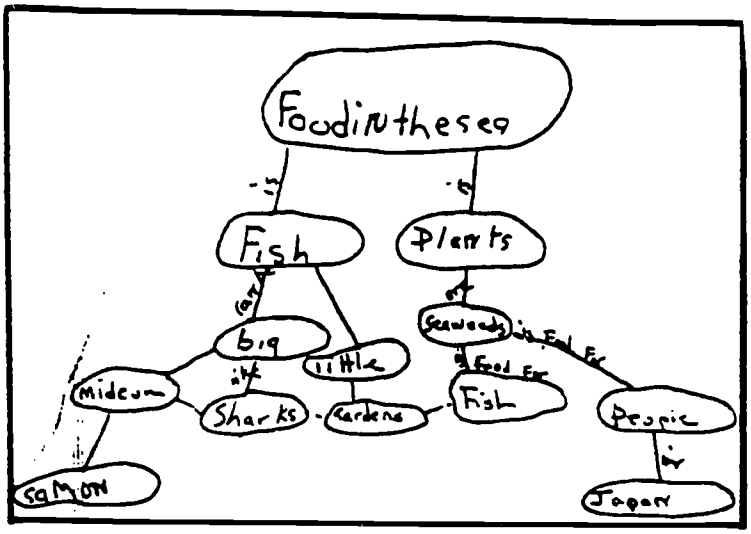
b) And David used multiple cross links to show how events relate.





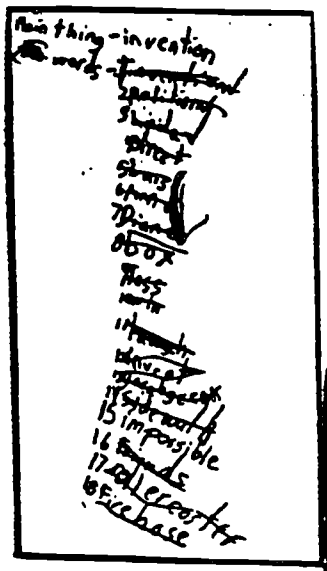
c) These early maps show that first grade children are learning as they interact with the teacher and the material. Note, Jamie's first map on food from the sea.

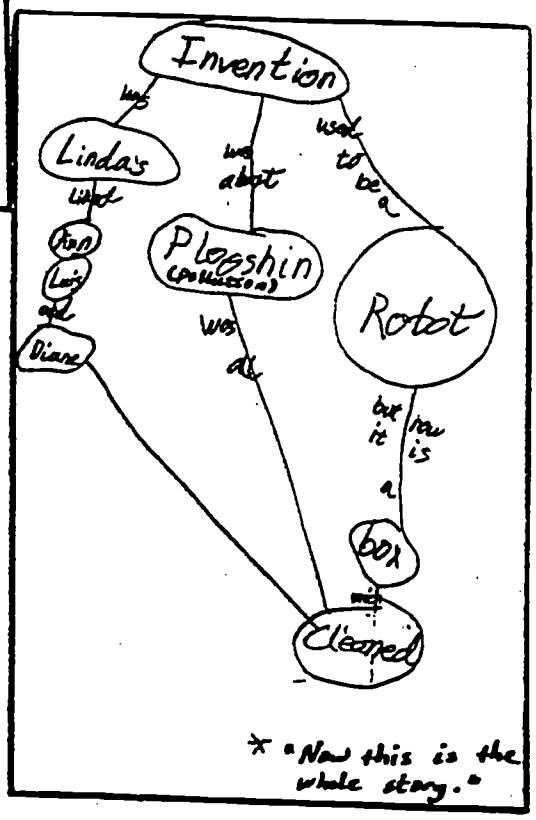
After a few days, during which the teacher and Jamie discussed his map and Jamie read more he produced this revised concept map.



SECOND GRADE

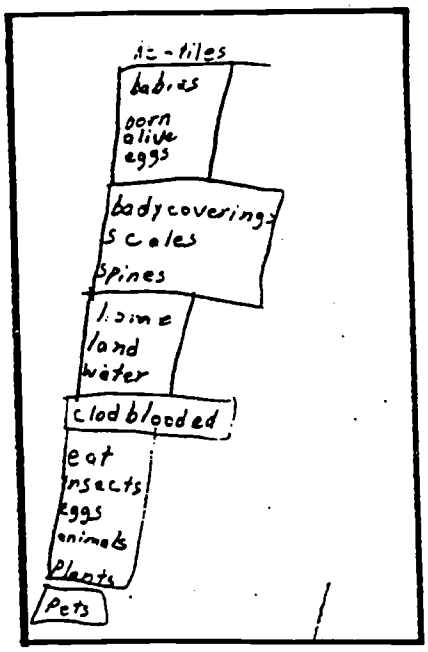
In the second grade, the children seemed to more fully appreciate the need for lists prior to mapping.

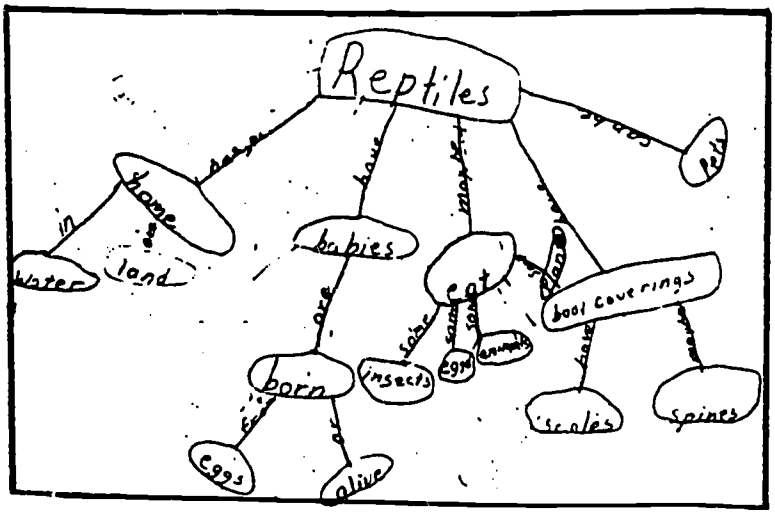


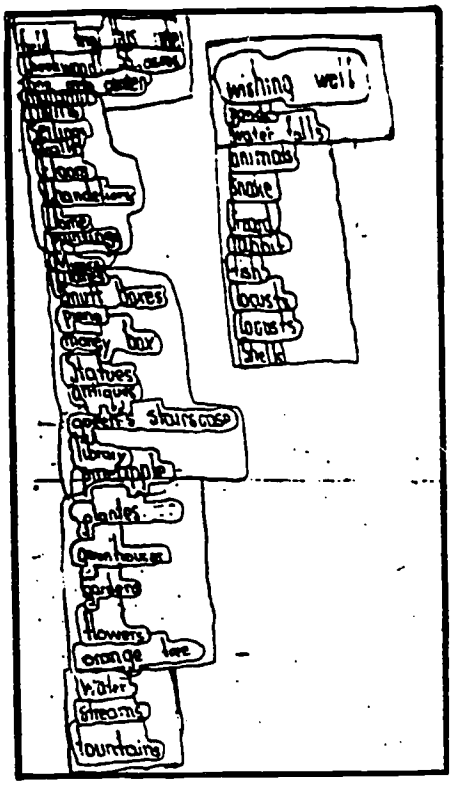


a) This is Jackie's self-generated list and map following a story she had read. Jackie was quite pleased with the way her map got at the gist of the story, and she said, "Now this is the whole story," as she presented her map to her teacher.

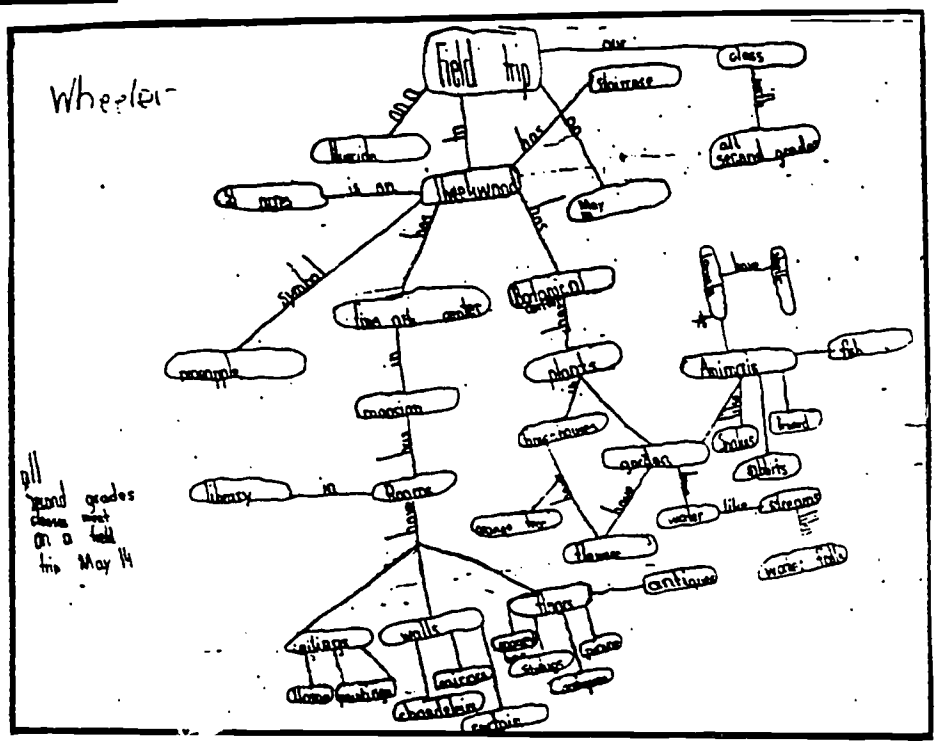
b) And Rodney's self-generated list and map because he was interested in reading about snakes and other reptiles.







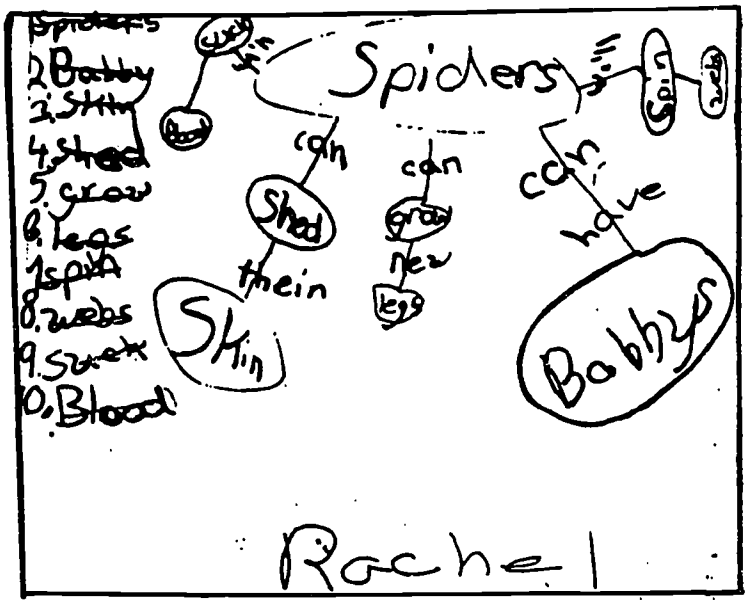
c) Billy's list and map of a field trip the children took is wanderful. By the end of May, many of the children were producing very complex maps. Note that some of the nature of the hierarchy (far right, half way down) is lost, probably due to space constraints. This provided the teacher an opportunity to encourage Billy to re-think some aspects of his map.

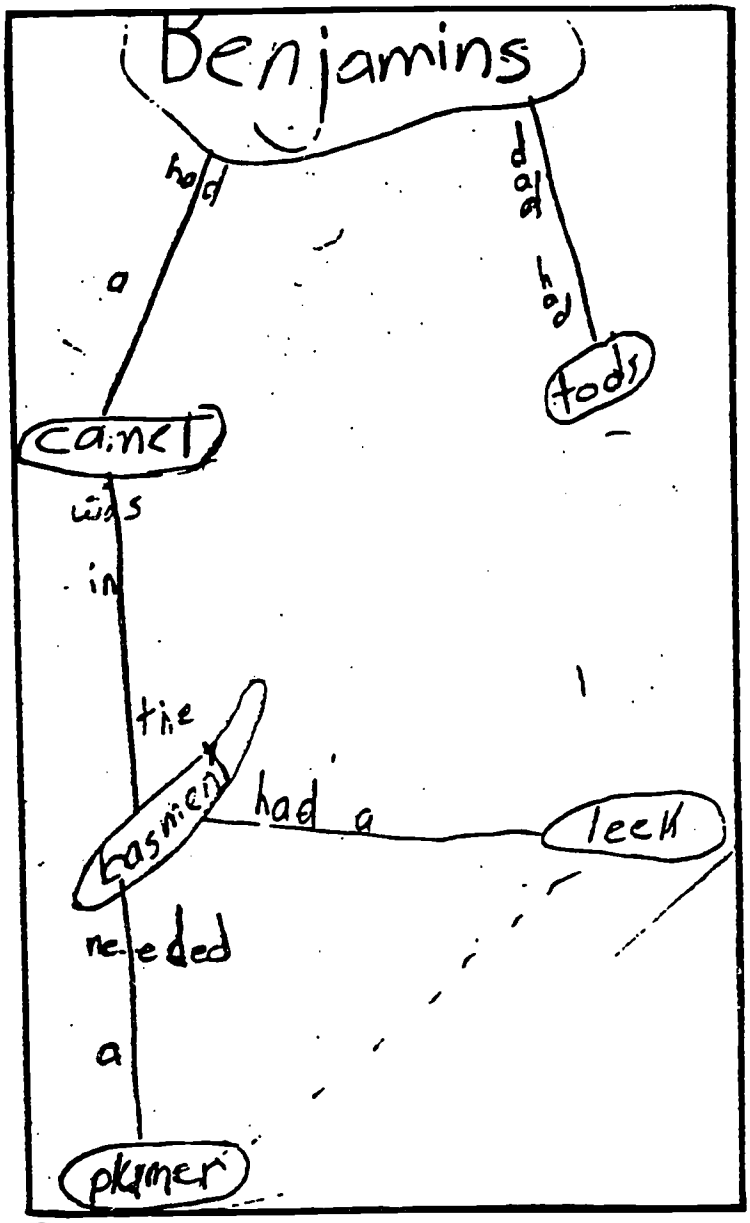


THIRD GRADE

In both the third and some of the second grade classes, the children initiated using concept mapping with the stories and non-fiction writing in which they were engaged.

a) Rachael mapped out what she knew and what she had learned about spiders before she wrote a factual piece on spiders for a science project.





b) Brandon mapped out the central point of a story before he wrote another ending. Note that a connection is made by using a broken line between needing a 'plumer' and the 'leek' in the basement. Even though the proposition 'because' is not on the connection, Brandon has demonstrated his awareness of this casual link.

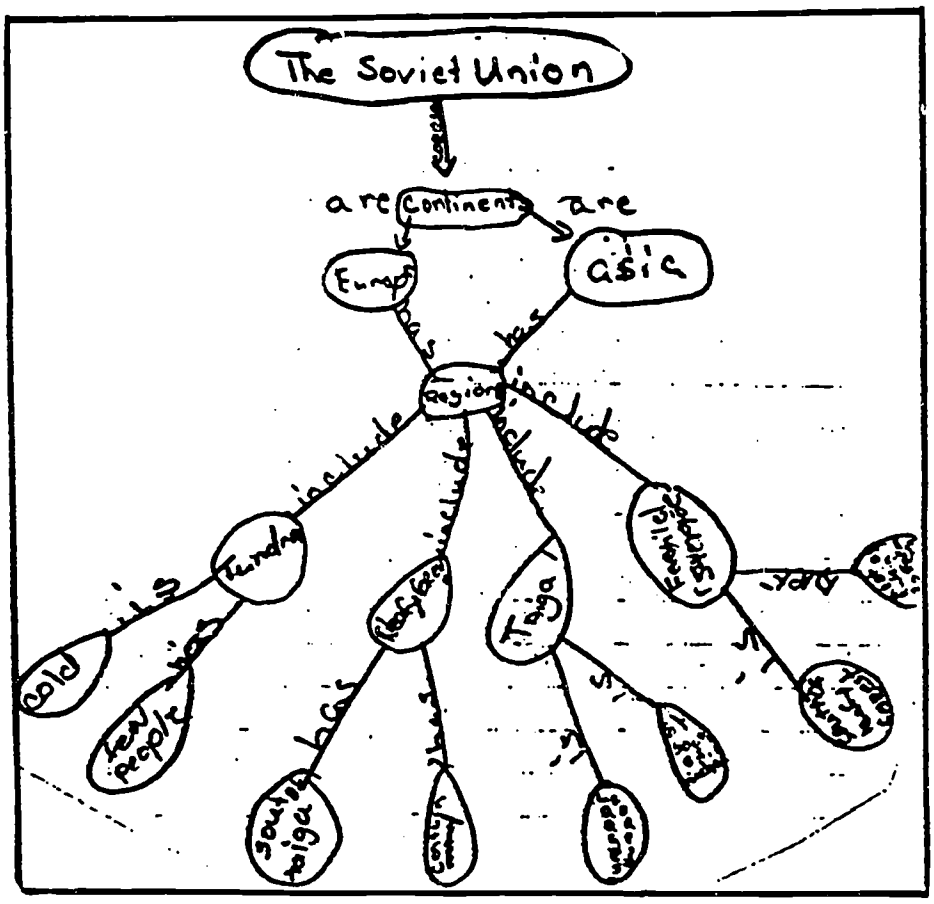
At 2nd and 3rd grades, the children frequently tried to map a concept they didn't really understand, to see if they could 'fugure it out'. They reported that mapping helped clarify and "tell us where something doesn't go." The mere fact that they kept doing it seemed significant.

During one "author's chair" event (in which the children can read their own work) in one of the second grade classrooms, a child was reading a draft of a story on which she was working. The story didn't make a great deal of sense and the children questioned her at length when she finished reading. Finally, one of the children said, "Alright! Let's map it and then we'll know what's missing."

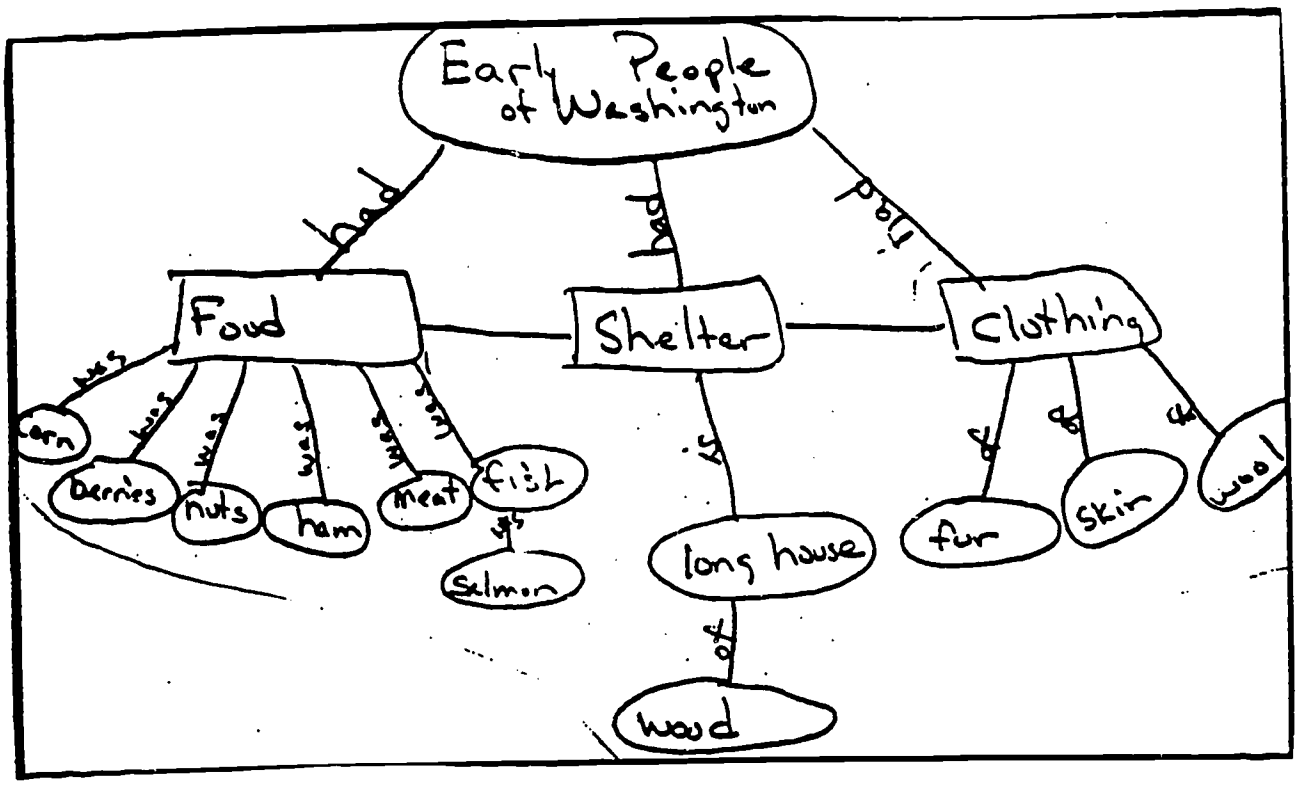
FOURTH GRADE

Interestingly, the fourth graders didn't seem to want to experiment with mapping as much as the younger children. They tended to want to use the maps to work with material they were studying. Perhaps this was more due to the nature of their various classes than the nature of fourth graders. Many of their maps were very advanced and the fourth grade teacher reported improvement in the children's general learning. The following are three of the best concept maps produced by fourth graders in a soical studies class. One group was studying settlement in the Northwest territories while another was studying the Soviet Union.

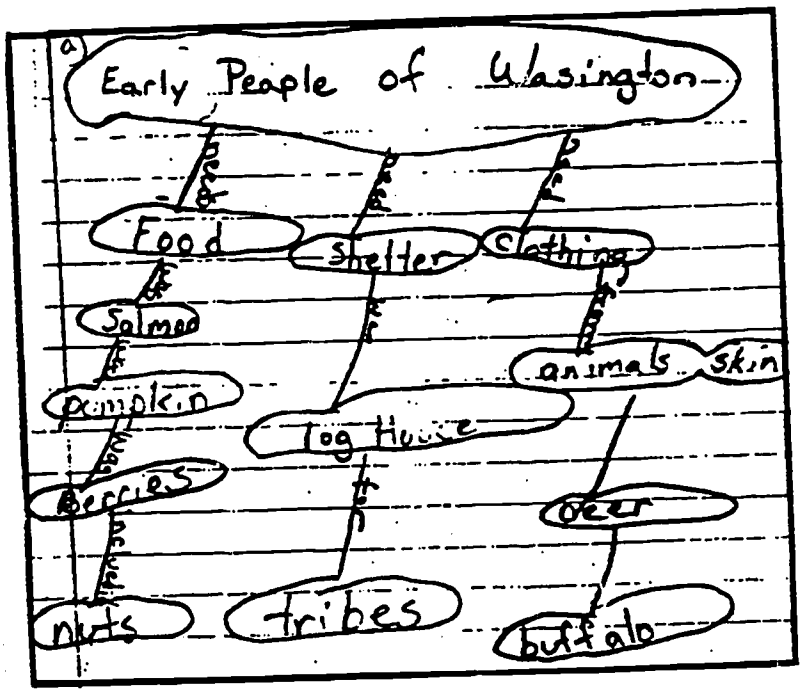
a) Douglas



b) Tony



c) André



According to the classroom teachers, the children's chapter tests improved, their participation in class discussion was much better, and they appeared obviously enthusiastic about class as a direct result of mapping activities. As one of the teachers reported. "All the children could participate successfully. The notion of concept mapping just seemed to make sense to them and they could really get into it."

A major aspect of the mapping activities noted by the author's and the classroom teachers was that the times when the children engaged in peer group mapping events, were the times when they were the most cooperative and responsive. This social interaction aspect of concept mapping activities is considered to be a crucial aspect of learning how to learn (Gowin, 1981).

In addition, the teachers felt that concept maps helped them organize their subject matter better and they all reported seeing positive changes in the children's understanding of conceptual relationships. Every teacher, including the kindergarten teachers felt that concept maps helped children with organizational patterns (i.e., comparison-and-contrast cause-effect, etc.)

The fourth grade teacher also reported finding material in her textbooks that was sometimes disjointed and poorly written. Many children had difficulty reading and understanding these texts.

Discussion

We are encouraged with our preliminary findings with concept maps. Most importantly, the teachers felt that concept mapping better prepares them to organize and present their subject matter, enables them to think indepth about the topics to be taught, and see tangible improvement in children's learning and sharing of idease in their classes. Likewise, children, for the most part, feel good about themselves when using concept maps to organize their thoughts. They find that concept maps aid in preparing them to learn about a topic and serve as a useful aid in reviewing the children demonstrated that they were functioning at various levels of ability and awareness regardless of grade placement but that some aspect mapping are clearly developmental.

Concept maps are a visual representation of a learner's thought processes. They reveal how an individual child perceives ideas and relationships. The explicit linking of concepts in the form of propositions by linking words and cross links advances understanding.

Concept mapping is a way to show both teachers and children that knowledge is more than fact gathering. Concept mappings can increase student/teacher awareness of and capacity for meaningful learning. The key to meaningful learning occurs as a result of children being able to see how information is related to their prior knowledge. Meaningful learning is also enhanced as a result of social interactions that allow children to share experiences in arriving at meaning.

This sharing and exchanging of ideas during concept mapping events, i.e. social interactions, seems to be especially important for helping disadvantaged children become more successful learners.

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