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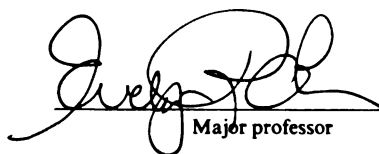
Connecting Ideas, Constructing Meaning, and Monitoring
Performance: Networking In College Classrooms

presented by

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**CONNECTING IDEAS, CONSTRUCTING MEANING,
AND MONITORING PERFORMANCE:
NETWORKING IN COLLEGE CLASSROOMS**

Volume I

By

Christina De Simone

**A DISSERTATION
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ABSTRACT

CONNECTING IDEAS, CONSTRUCTING MEANING, AND MONITORING PERFORMANCE: NETWORKING IN COLLEGE CLASSROOMS

By

Christina De Simone

The lack of adequate comprehension and comprehension monitoring skills in college students has become a concern for both teachers and educational researchers. This study examined the effects of training in a networking strategy on first year college students' comprehension and comprehension monitoring of science texts. The study also examined whether the mental construction of networks was sufficient for comprehension to occur and whether students could generalize their learning of the strategy to other types of texts.

Two intact classes of students participated in this study. Classes were designated as either experimental or control. Experimental participants were taught to construct their own two dimensional networks of the text both on paper and mentally. Modelling, feedback, and practice were used to train the students. Comprehension and comprehension monitoring were assessed at the pretest and at the posttest with multiple-choice questions, a free-written recall task, and an error detection and correction task.

Students trained in the networking strategy recalled significantly more key ideas than those who had not been trained. This was true regardless of whether or not they constructed the networks on paper. In addition, trained students who did not network on paper recalled significantly more non-key ideas than those who were not trained. These effects were also obtained with different texts. Training in the networking strategy did not significantly improve students' performance on a multiple-choice comprehension test nor on comprehension

monitoring tasks. These results suggest that once the networking strategy is acquired, students can use it to recall key ideas in a more expedient manner by constructing networks of ideas mentally.

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CHRISTINA DE SIMONE

1993

This work is dedicated to my husband, Paul, for sharing the joys and pains along the way, and for helping me realize my dream before his own. Thank you for helping me think of problems as challenges to be met rather than as insurmountable barriers.

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CONTENTS

THE PROBLEM	1
THEORETICAL PERSPECTIVE	5
THE STRATEGY	10
Networks as Comprehension Monitoring Tools	18
Expert versus Student-Generated Networks	20
Strategy Instruction	22
RESEARCH QUESTIONS	31
METHOD	35
Participants	35
Design and Variables	36
Materials	37
<i>Texts Used for Assessment</i>	37
Reading Comprehension Texts	37
Comprehension Monitoring Texts	41
<i>Texts Used for Training</i>	44
Strategy Instruction	45
<i>Network Strategy Training</i>	45
<i>Traditional Instruction</i>	49
Procedures	50

Scoring Procedures	52
<i>Reading Comprehension</i>	52
Multiple-Choice	52
Free-Written Recall	53
<i>Comprehension Monitoring</i>	63
RESULTS	64
Comprehension	64
Metacomprehension	85
DISCUSSION	90
CONCLUSIONS	102
IMPLICATIONS	111
LIMITATIONS OF THE STUDY	118
SUMMARY	123
APPENDIX A	125
APPENDIX B	205
APPENDIX C	232
APPENDIX D	246
APPENDIX E	273
APPENDIX F	288
APPENDIX G	294
APPENDIX H	295

APPENDIX I 297

APPENDIX J 303

APPENDIX K 305

APPENDIX L 314

APPENDIX M 323

APPENDIX N 333

APPENDIX O 341

APPENDIX P 350

LIST OF TABLES

TABLE 1. Example of the scoring of one student's free-written recall protocol	64
TABLE 2. Training Sessions Chart	126
TABLE 3. Analysis of Virus Text	196

LIST OF FIGURES

Figure 1. Network on Mouth Infections	12
Figure 2. Key Ideas Recalled: Do not network on paper	68
Figure 3. Non-Key Ideas Recalled: Do not network on paper	69
Figure 4. Non-Key Ideas Recalled: Effect of Passage	71
Figure 5. Non-Key Ideas Recalled: Do not network on paper	72
Figure 6. Key Ideas Recalled: Network on paper	74
Figure 7. Non-Key Ideas Recalled: Network on paper	75
Figure 8. Non-Key Ideas Recalled: Experimental Participants	77
Figure 9. Key Ideas Recalled: Experimental Participants	78
Figure 10. Multiple Choice Gain Scores: Disease - Not On Paper	81
Figure 11. Multiple Choice Gain Scores: Child Abuse - Not On Paper	82

Figure 12. Multiple Choice Gain Scores: Disease - On Paper	83
Figure 13. Multiple Choice Gain Scores: Child Abuse - On Paper	84
Figure 14. Performance on Multiple Choice Tests: Experimental Participants	86
Figure 15. Performance on Metacomprehension Task	88
Figure 16. Performance on Metacomprehension Task	90
Figure 17. Development of Content Learning through Networking	110
Figure 18. Network on Mouth Infections	132
Figure 19. Network on AIDS	155
Figure 20. Network on Food Poisoning	170
Figure 21. Incorrect Network on Bacteria	178
Figure 22. Correct Network on Bacteria	179
Figure 23. Network on Viruses	201
Figure 24. Network on Viruses - A	202
Figure 25. Network on Viruses - B	203
Figure 26. Network on Viruses - C	204

THE PROBLEM

When educators talk about "poor readers", "reading disabilities", and "comprehension problems", images of children struggling to read typically come to mind. Indeed, much of the research has been concerned with identifying, remediating, and preventing comprehension problems among young children (Palincsar & Brown, 1984; Paris & Oka, 1986). A substantial number of adolescents and young adults, however, also have problems understanding text. Older learners appear to have particular difficulty abstracting important information, relating it to ideas in the text, and to their prior knowledge to develop a coherent understanding (Bransford, 1979; Novak & Gowin, 1984; Roth, 1990).

One factor that contributes to older learners' comprehension difficulties is a weakness in comprehension monitoring skills, the ability to detect gaps and contradictions in understanding and the ability to fix them (Englert, Hiebert, & Stewart, 1988; Zabucky, Moore, & Schultz, 1987). Investigations in the area of metacomprehension have shown that learners' have difficulty detecting errors in their understanding of the relationships between ideas and detecting inconsistencies between the

text and prior knowledge (Baker, 1979; Zabucky et al., 1987).

Another reason that older students may have difficulty comprehending text is that the knowledge domain may be new to them (Kirby & Cantwell, 1985). When the domain is new, students may not have prior knowledge which will help them link, anchor, and make sense of the new information (Ausubel, 1963; Cavallo, 1992). For example, Tamir (1968) and Stewart and Dale (1989) found that learners with prior knowledge in specific areas of biology gained the most new knowledge in these areas.

Alternatively, learners may have the relevant prior knowledge but they may fail to access it when necessary. Consequently, new ideas do not become linked with old ones (Roth, 1990). For example, Bransford and Johnson (1972) demonstrated that when students were provided with a hint or title, they were better able to understand the passage than when they were not given such information. In other words, giving students hints or titles allowed them to fit the new information with what they already knew about the topic. Ausubel (1963) calls the interaction of prior knowledge with new concepts "subsumption". In essence, new

information learned is subsumed under more inclusive concepts already known by the learner. Learners who fail to relate ideas fail to make sense of the information.

The texts themselves also contribute to college students' comprehension and comprehension monitoring problems. Many college level texts are expository and many of them have been referred to as "inconsiderate" of their readers (Anderson & Armbruster, 1986). In other words, authors of these texts often do not provide readers with links between ideas nor do they relate ideas found in the text with the readers' experiences. Drawing inferences, however, is not an easy skill even for college students. For example, Britton, Dusen, Glynn, & Hemphill, (1990) found that university students' recall of expository history text was influenced by the number of inferences they were required to make. Those texts which required students to make several inferences were poorly recalled.

The combination of the lack of adequate comprehension skills and increasingly demanding texts challenge students' successful completion of postsecondary studies. One such area where students have difficulty

succeeding is in the sciences. Indeed, Tobias (1990) and Grant (1990) report that a substantial number of students fail their first year science courses. In the Province of Quebec alone, 15% of science students failed their science courses in 1990. This failure rate had been relatively consistent over the previous eight years (Ministère de l'enseignement supérieur et de la science, 1992). Among the reasons reported by Tobias (1990) and Grant (1990) were students' lack of adequate strategies, poor student motivation, and failure on the part of the teacher to relate the information. Because of these weaknesses, college students are not only failing to understand the content and to meet academic requirements, they are also ill-prepared to meet the increasingly complex demands of the workplace (Hurd, 1991). That is, people are expected to relate ideas, predict consequences, evaluate information, and apply fix-up strategies. This lack of preparation has contributed, for example, to a reduction in the scientific and technical capacity of the United States effecting its industrial and economic competitiveness (National Science Board, 1986). For these reasons, this study focuses on the remediation of comprehension and metacomprehension difficulties in adult learners of

the sciences.

THEORETICAL PERSPECTIVE

Traditionally, learners have been perceived as passive recipients of information, "empty vessels" into which the teacher poured information. For their part, students acquired the information in a fairly verbatim and disconnected manner. From a behaviourist perspective (Skinner, 1957), learners were perceived as recorders of information rather than as active manipulators who were trying to make sense of ideas. Moreover, meaning was believed to exist outside the learner. The active manipulation of prior knowledge and of experience by the learner were not considered to be part of the learning equation. Some expert (e.g., the teacher, an author of a textbook) was viewed as being responsible for providing knowledge and for interpreting ideas. These experts were perceived as having the knowledge or the "correct" answer (Skinner, 1957).

This view of reading comprehension implies that understanding is achieved through a process of decoding words to arrive at a common

meaning (Gough, 1972). Consequently, there could only be one interpretation of the ideas presented in a text or a lecture and that interpretation came from experts. Readers' prior knowledge and experiences were not considered to influence what the reader read. Furthermore, any difficulties in comprehension were remediated via drill and practice where the focus was on remediating specific skills such as word decoding rather than on the individual's difficulties in conceptualizing the ideas (Bloom, 1968; Gagné, 1985; Guthrie, 1973).

Today, comprehension is seen as a more complex process than envisioned by early reading researchers (Gough, 1972). According to a constructivist perspective, comprehension is seen as an active process during which learners question, manipulate, select, elaborate, organize, and revise ideas so as to construct an understanding that makes sense to them (Orasanu & Penny, 1986; Paris, Wasik, & Turner, 1991; Spiro, 1980; & Wittrock, 1990). Thus, in this approach, learners play an important role in constructing their own meaning. Learners are not viewed as "absorbing" someone else's ideas. Rather they interpret text and impose meaning according to their prior knowledge and experiences. This is an

active process which entails working with the information in text as well as with the ideas and experiences brought into the learning situation. Comprehension thus proceeds in an interactive rather than sequential manner.

The interactive view (Rumelhart & Ortony, 1977) maintains that readers bring to bear both higher-order (e.g., prior knowledge) and lower-order skills and knowledge (e.g., word decoding skills) to the reading situation. For example, words on a page can be recognized more easily if learners have some familiarity with them than if this background knowledge is missing. In other words, what learners already know influences what they will grasp from the text. Prior knowledge has been found to influence the ways in which learners construct meaning, thus comprehending information (Spiro, 1980). For example, as mentioned earlier, Stewart and Dale found that students with relevant prior knowledge of biology gained the most new knowledge in that area.

A number of studies have also found, however, that erroneous prior knowledge makes the new knowledge difficult to learn and understand. For example, Roth (1986) found that learners who had misconceptions

about photosynthesis ignored new information about the topic and held onto their old and inaccurate beliefs about this process. Constructivists are not suggesting that learners interpret the information in the text in an idiosyncratic manner. Rather, learners must provide evidence as to why they believe that their interpretations are sensible. In this view, the teachers' role is to facilitate students' construction of their own understanding, providing them, whenever necessary, with strategies that help them question and adjust their understandings (Dole, Duffy, Roehler, & Pearson, 1991).

Proponents of the constructivist perspective (e.g., Piaget, 1954; Wittrock, 1990) also hold that the construction of meaning is a continuous process of change. Learners modify their understandings as they gain more and different knowledge and experiences. Therefore, the construction of meaning not only involves incorporating new ideas into existing ones, a process referred to by Piaget as assimilation, but includes the disassembly, reexamination, and rearrangement of ideas so that misconceptions are clarified or new perspectives are adopted. Piaget refers to this process of re-structuring and modifying ideas as

accommodation. In the constructivist view, meaning is constructed and understanding develops not only by adding more ideas but also by changing and re-structuring existing ideas.

Constructivists (e.g., Paris, Wasik, & Turner, 1991; Spiro, 1980; & Wittrock, 1990) view comprehension as an active and dynamic process in which learners make sense of ideas in text in light of their prior knowledge and experience. This view has encouraged a parallel change in approaches to comprehension problems. Constructivists attempt to remediate strategies (i.e., flexible plans) rather than skills (i.e., highly routinized, automatic behaviours). Their objective is to equip learners with strategies with which they can relate ideas, construct meaning, arrange ideas into some organized, well-integrated framework, and evaluate and adjust their understanding (Palincsar & Brown, 1984; Pressley, Johnson, Symons, McGoldrick & Kurita, 1989).

Students need to be taught flexible plans that they can use in a conscious and deliberate manner to remediate comprehension problems. They will use these plans whenever and however it is appropriate for them. This suggests that learners' use of strategies will change as they

become more familiar with them and can integrate them with other strategies (Dole, Duffy, Roehler, & Pearson, 1991; Pressley, Goodchild, Fleet, Zajchowski, & Evans, 1989).

Based on a constructivist view, this study seeks to equip college learners with a strategy which will promote their ability to make sense of text by helping them to relate ideas in a coherent and personally meaningful way. Students will also be taught a strategy to help them monitor their comprehension.

THE STRATEGY

Understanding the relationships among ideas is an important aspect for college students who are faced with a great body of information to comprehend (Cavallo-Liberato, 1992). Networking is a cognitive strategy that is particularly suited to identifying the relationships among ideas. Networking falls under a broader class of strategies called visual-spatial strategies. Like other learning strategies, visual strategies facilitate thinking and learning about the information by condensing, re-organizing, elaborating, and representing the information externally

(Holley & Dansereau, 1984; Schmeck, 1988b). They differ from other learning strategies in that they are graphical illustrations of verbal statements. A distinctive characteristic of the networking strategy is that it uses a number of relationships to link ideas thus enabling the learner to think not only in terms of the fact that ideas are related but that they are related in some particular way. In turn, this leads to a more synthesized and coherent body of knowledge (Van Patten, Chao, & Reigeluth, 1986).

The construction of a network requires that a student identify the important information in a text, discern the relationships between units of information, and represent them in the form of a two-dimensional node-link-node visual representation (Holley & Dansereau, 1984). Concepts are displayed as nodes (boxes or circles) which are connected by particular links which specify the nature of the relationship between concepts. For example, Figure 1 is a simple network depicting information about a topic area in the Health Sciences.

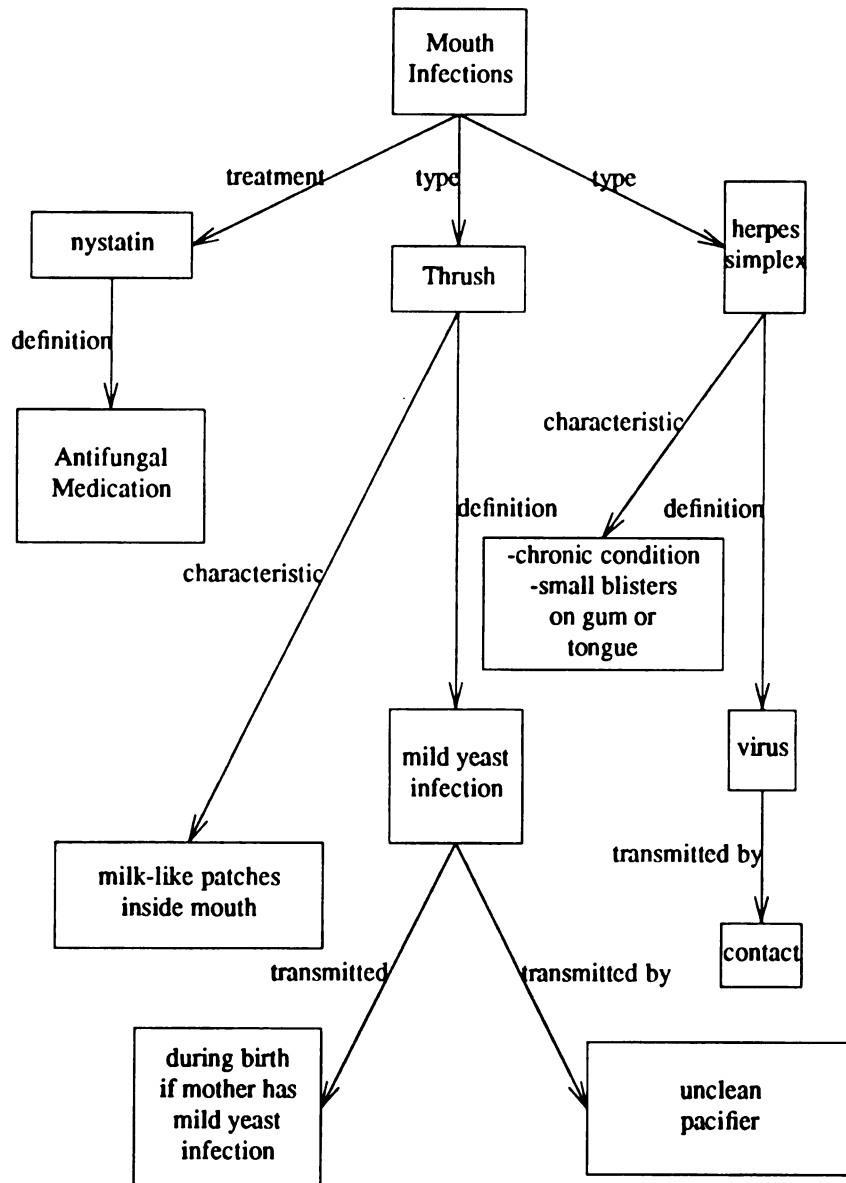
Figure 1. Network on Mouth Infections

Figure 1 illustrates a number of relationships that are used in relating concepts. There are three major categories of relationships: hierarchies, chains, and clusters. Hierarchical links such as 'part' and 'type' designate super-ordinate and sub-ordinate relationships such as in the statement 'Thrush is a type of mouth infection' where the word 'thrush' is represented in the lower node and the word "mouth infection" is represented in the higher node.

Chain links are also of two kinds: 'leads to' or 'analogy'. Neither of these relationships are depicted in Figure 1. However, an example of a 'leads to' relationship is represented in the statement 'Poor eating habits and lack of exercise lead to an increased risk of heart failure.'

Cluster relationships are depicted when the concept in one node is linked by the 'characteristic' or 'evidence' relationship to the concept in another node. We can see a characteristic relationship diagrammed in Figure 1 in the statement 'Milk-like patches inside the mouth are characteristics of thrush.' A more detailed description of the relationships and of the networking strategy is given in the Appendix A.

According to Novak & Gowin (1984), when constructing a network, typically the more general and inclusive concepts (i.e., superordinate concepts) should be placed at the top of the map with progressively more specific, and less inclusive concepts arranged beneath them. This hierarchical structure is somewhat familiar to most students (Minsky, 1975) as many science texts already use this format to represent information. Identical concepts are typically not repeated as the aim is to have a clear picture of the ideas thereby reducing the amount of information to which the learner must attend. In turn, this minimizes the cognitive load (Breuker, 1984).

Networks as Comprehension Tools

Constructing meaning requires that learners need to be aware of important ideas. Knowing the important ideas helps learners to differentiate information which is essential from that which is less important in order to understand the domain (Paris, Wasik, & Turner, 1991). Furthermore, knowing what is important helps learners reduce the amount of information that needs to be remembered, thus minimizing the

cognitive load (Breuker, 1984). Although there are a number of studies which have found that grade school and early high school students have difficulties selecting more important from less important ideas (Brown, 1983), some college students also show this difficulty (Holley & Dansereau, 1984; Mikulecky, Clark, & McIntyre-Adams, 1989), especially when the content is unfamiliar to students and when there is much to learn. As mentioned earlier, when the content is new, learners have little prior knowledge of the domain to help them figure out what is important and what is less so.

Networking may help to construct meaning by functioning as a comprehension tool because it focuses the learner's attention on important concepts. For example, networking has been found to be particularly useful for the recall of main ideas in geology (Holley & Dansereau, 1984; Holley, Dansereau, McDonald, Garland, & Collins, 1979) the human circulatory and renal systems (Rewey, Dansereau, & Peel, 1991), biology (Lambiotte, Skaggs, & Dansereau, personal communication), and psychology (Lambiotte, Peel, & Dansereau, 1992). When students network, they read the text and represent information in

the nodes. Information contained in the nodes needs to be succinctly stated so that the essence of the idea is captured. Stating ideas succinctly helps learners decide what is important and what can be eliminated.

Constructing meaning requires that learners not only recognize the important ideas, but also that they relate them meaningfully (Bransford, 1979). In other words, constructing meaning requires that learners link concepts and ideas both within the text and between the text and their prior knowledge.

Networking emphasizes the relating of ideas. Learners are taught to ask themselves questions such as 'How are these ideas related?', 'Is this idea part of a larger one?', 'Is this an example?' 'How does this idea fit with what I already know?' 'What other characteristics do I know?'. As students ask themselves these questions, they elaborate on their knowledge. In other words, they enrich the ideas by adding more ideas and details as well as by revising others and by generating new relationships and ideas that are not necessarily in the text (diSibio, 1982). Consequently, the more ideas that are integrated and the more new relationships formed, the richer and more coherent is the body of

knowledge that is constructed (Derry, 1990).

The networking strategy requires students to organize their ideas. This makes the ideas more meaningful to them, facilitating their understanding of the ideas (Derry, 1990). Organizing ideas hierarchically in a network seems to contribute to student's understanding (Van Patten, Chao, & Reigeluth, 1986). Organizing ideas in this manner encourages learners to think of ideas which are integrated within others rather than to think of discrete units of information. Thus, when required to, those with a well-organized network would recall the broader ideas first and then the more specific ones (E. Gagne, 1985). This implies that networking may help learners be selective about what they are recalling as opposed to recalling everything.

Better comprehension of the topic and richer recall should result from the combination of thinking about important concepts and their relationships, and the elaboration and organization of information associated with the networking strategy.

Networks as Comprehension Monitoring Tools

Successful comprehension is not only a matter of knowing the important concepts and relating and integrating ideas. Sometimes, comprehension requires that one's understanding of the ideas be evaluated and, if necessary, revised (Palincsar & Brown, 1984; Roth, 1990). This evaluation of one's comprehension and the awareness that there is a problem in one's understanding and that the problem needs to be resolved are part of comprehension monitoring activities (Baker, 1979; Garner, 1987; Markman, 1979; & Paris & Meyers, 1981). The use of networking as a comprehension monitoring tool has great promise, but has been virtually neglected.

Networking may be helpful in stimulating this self-awareness. For example, when the learner abstracts key ideas, discerns relationships, and writes these ideas down on paper, the act of writing them down without unnecessary text serves to focus one's thinking on the crucial elements. This, in turn, makes learners aware of their own understanding of these ideas. Examples of statements that may reflect one's awareness of one's own thinking about the reading material are 'Wait, these two ideas are

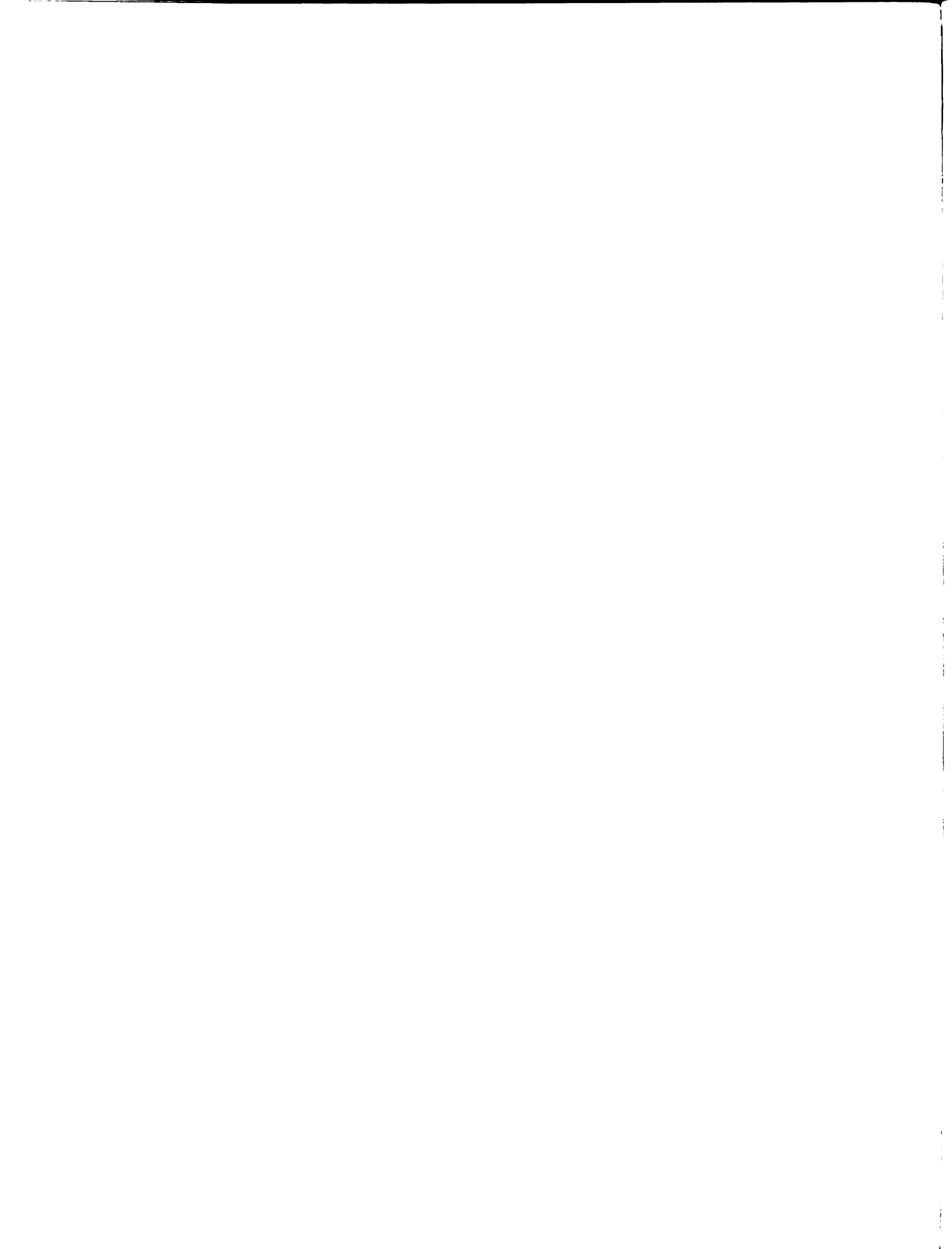
not related in this way, 'This doesn't seem to fit with what I already know'. These are examples of learners evaluating their own comprehension. Teaching college students strategies such as networking is expected to help them to assess their own understanding. This is important as many of these students fail to do so spontaneously (Baker, 1979).

Another aspect of metacomprehension includes the ability to regulate or manage one's comprehension (Brown, Bransford, Ferrera, & Campione, 1983). That is, being aware that there is a problem is only part of effective comprehension. The other half is to be able to fix the problem, i.e., to take some remedial action (Alessi, Anderson, & Goetz, 1979; Garner, 1987). Regulation of comprehension may be fostered by iterating through the arrangement and re-arrangement of the information in a network. As learners re-arrange information in networks, they may be able to discern previously unseen relationships between concepts and to make connections between their prior knowledge and new information. Consequently, the more the learner works with the information, the more their thinking becomes organized, processing deepens, the more

elaborations and new insights occur and the understanding of what is read enhanced (Derry, 1990; Entwistle & Ramsden, 1983; McKeachie, Pintrich, & Lin, 1985). Statements that may reflect one's regulation of comprehension include 'These two ideas should be related this way, and not that way', 'This idea is actually more important than this idea, and therefore should be placed higher up in the network'. When learners engage in these comprehension monitoring activities, they are revising their understanding so that it is more accurate. They can then make appropriate use of it (Hewsen & Hewsen, 1984).

Expert versus Student-Generated Networks

An important issue that faces researchers who use the networking strategy is who constructs the networks: experts or students. Expert-generated maps are those constructed by experts in a particular domain. Student-generated networks, however, require that students become actively involved in thinking, sorting, and organizing information for themselves (Novak & Gowin, 1984; McKeachie et al., 1985). Although student-generated can be time-consuming and difficult to master



(Camperell & Smith, 1982; Holley & Dansereau, 1984), there is some evidence suggesting that learners who are provided with expert-generated maps are deprived of the opportunity to wrestle with the information, had they generated their own networks (Wiegmann, Dansereau, Pitre, Rewey, & McCagg, 1990). In addition, anecdotal evidence garnered from video-tapes suggests that students may be processing expert-generated maps at the "nodal" level (information in the nodes) rather than at the "relational" one (McCagg, 1991). Students appear to have difficulty making sense of the links provided by the experts and consequently either misinterpret them or ignore them, focusing on the information in the nodes. As a result, students may be processing information as discrete units rather than as ideas linked to other ideas. This type of processing may lead to a superficial processing of the relationships between ideas which, in turn, may lead to poor comprehension.

Furthermore, self-generated networks may also provide insight into students' conceptualization of the topic (Novak & Gowin, 1984). For example, a network that contains ideas unrelated to any others might

indicate that the student failed to see the connection between certain ideas. Or a network that seems upside down may indicate a profound misunderstanding of the topic or a new way of looking at the information (Novak & Gowin, 1984). Thus, in addition to helping students to actively construct meaning from text, the student-generated networks may also serve as an assessment tool. For these reasons, students in this study were asked to construct their own networks.

Strategy Instruction

While the above issues were more concerned with the learner, the following sections discuss four issues which also concern teachers and classroom researchers, namely the efficiency, generalizability, retention, and utility of instruction in the networking strategy.

Efficiency. Despite the advantages of networking, it is time-consuming to have students generate their own networks. While it is true that having students use the strategy on classroom curricular materials may help to maximize the amount of time that they can devote to learning the content, this approach may not be the most efficient way of

having students apply the strategy on a long-term basis, especially when there is much content to teach and learn (Prawat, 1989). It is expected that both content and strategy goals can be met if we alter the way in which the strategy is taught so that it can be applied more efficiently in the long run. The strategy adopted in this study was to first have students construct networks of ideas on paper so that they could develop facility with the strategy and then to have them construct networks mentally without having to write them on paper.

Research conducted in reading comprehension with a younger population of learners and in other domains such as writing have shown that mature readers and writers engage in an inner dialogue as they comprehend text (Palincsar & Brown, 1984) or compose, evaluate, and revise writing (Daiute, 1985; Dyson, 1987; Englert, Raphael, Anderson, Anthony, & Stevens, 1991). As students become more familiar with networking and its uses, a similar inner dialogue is expected to occur with students in this study as they construct networks "in their heads" by asking themselves questions such as 'What are the key points in this passage?', 'How can these ideas be grouped together', and 'How are these

ideas related to one another?’ Once these questions become a natural part of learners’ thinking patterns, they can use them to guide their comprehension of the text. Therefore, another objective in this research was to study whether comprehension and recall (of key ideas and of non-key ideas) are dependent on the actual construction of networks on paper or whether the mental construction of networks is sufficient.

Retention. As stated earlier, some learners do not have useful strategies to assist them in understanding the vast amount of information they encounter at the college level. This implies that they need to be taught how to use the strategies both effectively and efficiently. Three components which contribute to students’ success to learn any strategy (including networking) are: modeling, practice, and feedback. As described below, modeling allows the learner to become exposed to the model’s thinking as the strategy is being applied, practice allows the learner to gain facility and expertise with the strategy, and feedback allows the learner to become aware of his/her progress and areas that need strengthening.

Three complimentary modeling approaches have been described in the literature. In one approach, the expert models the strategy (in this case networking) by "thinking aloud" the cognitive processes involved in abstracting key concepts, arranging the concepts spatially, and relating the concepts. This approach ensures that students not only see the network products produced by the expert, but they also see the actions and hear the inner dialogue that the expert uses in implementing the strategy (Englert et al., 1991; Palincsar & Brown, 1984).

Another modeling tactic is to provide learners with the opportunity to construct networks of the material and to subsequently provide feedback in the form of a model product with annotations indicating how the network was created (Holley & Dansereau, 1984). Providing students with opportunities to construct networks allows them to practice their use of the strategy so that they can gain facility with it (Schneider, 1985). Consequently, the learner is more proficient with the use of the strategy and thus able to apply the strategy without the guidance of others. Appropriate feedback helps the learner identify and remediate specific problems that may inhibit effective application of the strategy (Brophy,

1981; Goldschmid & Goldschmid, 1976).

Another modeling approach involves having pairs of learners read the model network to each other and provide one another with corrective feedback (Holley & Dansereau, 1984; McCagg & Dansereau, 1991). In this approach, novices (students) provide feedback to other students. This helps learners to gradually monitor the application of the strategy for themselves. Brown, Bransford, Ferrara, & Campione (1983) found that this self and other monitoring encourages learners to be actively involved with the strategy and to maintain its use over time. Because of the advantages of all three approaches, in this study students were given the opportunity to see the model in action, to practice creating and using the strategy, and to receive specific feedback about the model from other students.

A critical component of the modeling process is the person who does the modeling. Models who are perceived by learners to be important and competent influence learning in a positive manner (Bandura, 1977). In order for students to use networks to comprehend and monitor their comprehension, they need to see that this is also an important goal to the

classroom teacher and a goal that the teacher can help them to achieve. There is little value in a researcher telling students that they must be active constructors of their learning, if they see that their teachers do not treat this as a worthwhile goal in their classroom. Therefore, it is important that the teacher also start to think of ideas in a constructive manner and model this for the students (Roth, 1990). For this reason, in this study, the classroom teacher participated in the strategy training. This included assisting in the selection of the curricular materials to be networked, demonstrating to her students the use of networks to learn the content, and providing her class with feedback on their use of the strategy.

Generalizability. Part of learning to use a strategy includes transferring that strategy to other situations (Brown et al., 1983) and information (Rewey, Dansereau, Skaggs, Hall, Pitre, 1989). Thus far, research on students' ability to transfer the networking strategy from training materials to new materials has produced mixed results. For example, Rewey et al., (1989) found that although those who were provided with an expert-generated map of the information were able to

recall more information than those who were provided with a text version of the information, both groups were unable to transfer their learning when asked to recall a different text passage. One explanation given of the results was that the transfer text was too difficult for students to learn. Results obtained from a study by Hall, Dansereau, and Blair (1990) study, while not statistically significant, were nevertheless more encouraging. These investigators found that students who either created their own maps or who studied from expert-generated maps were able to transfer the networking strategy to the new texts and showed improvements in recall.

The results of the above mentioned studies indicate that even college learners have some difficulty transferring their learning of the strategy to new texts. Researchers have found that many difficulties of transfer seem to stem from an inability to recognize similarities between the new situation and the training one (Brown, 1982a; Simon, 1979). Research on expert and novice learners has found that those who were able to transfer the strategies, recognized that the tasks (old and new) share certain relevant features (Simon, 1979). To assist students in transferring their

knowledge and skills to a new domain, several researchers (Brown et al., 1983; Brown & Palincsar, 1984; Weinstein, Ridley, Dahl, Weber, 1989) have recommended treating the strategy as an integral part of the course so that training materials are perceived to be related to the actual learning goal. For this reason, in this study, the networking strategy was integrated into the course objectives where it would be thought of as a regular part of the course using content relevant to the course. Thus, an additional objective of this study was to investigate whether training in the networking of texts for a given topic area would improve comprehension and recall of texts from a different topic area.

Utility. Most, if not all, of the studies conducted in networking have not explicitly evaluated the effects of training in the networking strategy on reading comprehension and comprehension monitoring. Rather, the studies have focused primarily on the impact of networking combined with some other strategy (such as note-taking, summarizing, or asking students to use their own strategy) on recall (McCagg & Dansereau, 1991) or on the facilitation of students' higher-order thinking such as the application of concepts in educational psychology (Lambiotte, Peel, &

Dansereau, 1992). The time-consuming nature of any strategy instruction (including networking) remains a concern to college classroom teachers especially since a large part of instruction is oriented to the delivery of content to students, as opposed to teaching how to learn (Brown, Bransford, Ferrera, & Campione, 1983). Moreover, researchers have also contended that extensive strategy training may not be necessary for everyone and may, in fact, lower performance (Tobias, 1982, 1989). However, there is also evidence demonstrating that students who need training benefit when training includes not only a description of the strategy but also how and why to use it (Brown et al., 1983; Paris, Lipson, Wixson, 1983; Pressley, 1986). This type of training maximizes the likelihood that the strategy will be used subsequently (Belmont, Butterfield, & Ferretti, 1982; Snowman, 1984).

Moreover, the decision to train students in a strategy is also influenced by the learning goal. If the goal is to memorize a set of discrete facts, then training will not need to be as extensive and comprehensive nor of the same quality as when the goal is to have students make connections between ideas and to monitor their

understanding of what they read (Brown, Bransford, Ferrera, & Campione, 1983).

Because the use of classroom time, strategy instruction, and student learning are important issues, this study assessed the effects of training in the networking strategy on the comprehension and recall of scientific text.

RESEARCH QUESTIONS

In this section a summary of the research questions is provided along with a brief explanation as to why the questions were addressed. Hypotheses for each question are also stated.

1A. The literature (Brown, Bransford, Ferrera, & Campione, 1983) suggests that external supports are not always needed for mature learners. Networking on paper also takes time. Therefore, the following question is asked "If students are instructed to 'not take the time to network on a piece of paper', will the students who have been trained in the mental construction of networks recall and comprehend disease (trained) passages better than students who have not been trained in the mental

construction of networks?"

1B. Research on students' abilities to transfer the networking strategy from training materials to new materials has produced mixed results (Hall et al., 1990; Rewey et al., 1989). Thus, this study asks the question "If students are instructed to 'not take the time to network on a piece of paper', will the students who have been trained in the mental construction of networks recall and comprehend child abuse (transfer) passages better than students who have not been trained in the mental construction of networks?"

Hypothesis. Students who were trained in the networking strategy and instructed to 'NOT take the time to construct a network on paper' will have a richer recall and comprehension of both the trained and transfer texts than those who were not trained in the networking strategy.

2A. While the construction of networks on paper takes time, it is important to determine its effects on recall and comprehension when students have been trained and instructed to use the strategy versus when students have not been trained yet instructed to use the strategy. Another

question addressed in this study is, "If students are instructed to 'take the time to network on a piece of paper', will the students who have been trained in the construction of networks on paper recall and comprehend disease (trained) passages better than students who have not been trained in the construction of networks on paper?"

2B. As with the previous question, here too the issue of generalizability is examined. The question asked is "If students are instructed to 'take the time to network on a piece of paper', will the students who have been trained in the construction of networks on paper recall and comprehend child abuse (transfer) passages better than students who have not been trained in the construction of networks on paper?"

Hypothesis. Students who were trained in the networking strategy and instructed to 'TAKE the time to construct a network on paper' will have a richer recall and better comprehension of both the trained and transfer texts than those who were not trained in the networking strategy.

3. Of those learners who have been trained in both the mental construction of networks and the construction of networks on paper,

which of these applications of the networking strategy leads to improved recall and comprehension. Thus, the following question was addressed, 'Is recall and comprehension dependent on the actual construction of networks on paper or is the mental construction of networks sufficient? And, are the outcomes dependent on the type of passage learned?

Hypothesis. It is expected that students who were trained in the networking strategy should perform equally well in terms of recall and comprehension regardless of whether they construct networks on paper or not.

4. Although tasks encountered at the college level require that students evaluate and monitor their comprehension, not all college students can meet the demands. Thus, students need training in this area. The impact of the networking strategy on comprehension monitoring has been neglected thus far. Thus, this study asks the question "Are students who use the networking strategy better able to monitor their comprehension of science texts than those who have not been explicitly trained in this strategy?"

Hypothesis. It is expected that students who were trained in the networking strategy will be better able to monitor their comprehension of science texts than those who have not been trained in this strategy.

METHOD

Participants

College students from two introductory health science classes participated in this study. One of these classes served as the experimental group (n=24) and the other as the control group (n=20). The average age of the students was 19 years and all were female. The classes were held at different times: the experimental class was held in the Fall semester and the control class was held in the Winter semester. The control group had the advantage of an extra half year of experience in college, therefore the experimental group was at a comparative disadvantage. Thus, the study was a conservative test of training in the networking strategy. The same instructor taught both classes.

The participants in the experimental group were of mixed ethnic and linguistic backgrounds. Ten of these students had been recommended for

a remedial writing and reading course. In contrast, control participants were predominately from English-speaking backgrounds and only two students had been recommended for such remediation.

Design and Variables

This study had a pre-post test non-equivalent control group nested design. There were two within-subject factors: Passage Topic (trained vs. transfer) and Posttest Network Task ('not taking the time to network on paper' vs. 'taking the time to network on paper.'). There was one between-subject factor: treatment condition (networking strategy instruction versus traditional instruction).

The main dependent variables were students' reading comprehension measured with a multiple-choice test and a free-written recall task. Students' comprehension monitoring assessed with an error detection and correction task.

Materials

Texts Used for Assessment

Reading Comprehension Texts

Reading comprehension was assessed in two subject areas: disease and child abuse. The disease passages were used to assess students' abilities to use the networking strategy on content similar to that for which they had received training. The child abuse passages were used to assess students' abilities to transfer the networking strategy to content which was also part of the course but for which they were not specifically trained to use the strategy.

The three expository passages on disease were selected from a textbook entitled 'Physically handicapped children: A medical atlas for teachers' (for passages see Appendices B and C). The specific Disease topics in this area were: Diabetes (Christiansen & Hintz, 1982), Asthma, and Cystic Fibrosis (Harvey, 1982). These passages averaged 800 words in length. These passages were selected in conjunction with the

classroom teacher for use as course content.

The passages on Disease were at the 10th grade level according to the Fry Readability Formula. To further assess the readability of these passages, 10 graduating high school students who were not part of the study read and evaluated the passages. They rated most of the passages as "easy to read". Approximately 6 of these students rated the Diabetes passage as "not as easy to read". Students contended that this text was not particularly difficult but it was rather complex requiring them to "unpack" ideas, that is to make inferences and write down information in order to keep it straight in their minds.

The three child abuse passages were selected from the 'British Medical Journal' (see Appendices D and E). The specific topics in this area included: Emotional Abuse and Neglect (Skuse, 1989), Suffocation, (Meadow, 1989), and Non-Accidental Injury (Speight, 1989). The average length of these passages is similar to that for the passages on disease. The readability level of these passages also averaged at the 10th grade level according to the Fry Readability Formula. Unfortunately, except for the classroom teacher's observation that these passages

appeared to be easier to read than the ones on Disease, no further assessment of these passages was possible.

These six passages served as the basis for the reading comprehension test. Reading comprehension was assessed with four tasks: prior knowledge, free-written recall, knowledge integration, and multiple-choice) (see Appendix B). Only the free-written recall and multiple-choice tasks were used for this study and only these were described here.

Free-Written Recall Task. This task has been used by several investigators as a measure of comprehension (Bartlett, 1932; Englert et al., 1991; Irwin & Mitchell, 1989). During the free-written recall task learners were asked to recall "everything that they can remember about what they have just read". Meyer (1975) noted that people will remember what they found to be important. Presumably, people will devote more attention, puzzle over, and elaborate on ideas which they find meaningful. The products of the free written recall exercise reflect what individuals thought to be important. This contrasts with measures of comprehension that ask the learner to respond to specific questions, in other words, to recall what the examiner thought to be important.

Therefore, the free-written recall task is used in order to obtain a relatively unbiased measure of students' recall.

In this study, students were instructed to silently read the text passage until they thought they understood it. Students were instructed orally to turn over their texts when they had finished reading and understanding the text. Then, they were asked to write down "everything they could remember about the passage, doing your best to use your thoughts as if you were telling the information to a friend without looking back".

Multiple-Choice Test. A more traditional measure of comprehension was obtained with a multiple-choice test which consisted of 12 multiple-choice questions, each having four options. Each of the twelve items for each passage were constructed by the researcher in collaboration with the classroom teacher. Test items consisted of text explicit (factual recall) items and items which required the student to make text implicit and script implicit inferences (Pearson & Johnson, 1978). Text implicit items require that the answer be obtained by combining information from different parts of the text. Script implicit items require the reader to draw upon his/her own experiences. Independent raters categorized the test

items as being text explicit, text implicit, and script implicit. Items which generated disagreements were either discarded or re-written. After item analysis, six to 11 items per passage were retained. Thus, there were a different number of items per test passage. There were a total of six passages. The reliability of individual test passages ranged from .71 to .90, as measured using the Spearman-Brown split-half method.

Comprehension Monitoring Texts

Four shorter passages averaging 226 words in length were used for the comprehension monitoring task (see Appendices F and G). Three passages (Hemophilia, Sickle Cell Anemia, and Leukemia) were selected from the same source as the disease passages used for the reading comprehension task. A passage on Meningitis was selectewd from a textbook entitled 'Infections in children: A sourcebook for educators and child care providers' (Andersen, Bale, Blackman, & Murph, 1986). All passages were selected in the same manner as the longer passages and they represented the same major topic area, namely disease. The specific topics, however, differed from those of the longer passages. Using the

Fry Readability Formula, the passages used for the comprehension monitoring task averaged at the 9.5 grade level. A group of high school students serving as pilot subjects rated these as "easy to read".

Once the overall readability of the texts had been assessed, inconsistencies were introduced into each of them. The placement of inconsistencies in texts is a commonly used method to assess one's ability to detect anomalies in text (Baker & Anderson, 1982; Markman, 1979; Zabrocky, 1989). In this study, three types of inconsistencies were placed into each of the four texts. One such type was "inconsistent information", where ideas in one sentence conflict with those of another. For example, 'Because of the adequacy of certain early vaccines for measles, some individuals may still be susceptible to the disease'. Rather, the sentence should read: 'Because of the **inadequacy** of certain vaccines for measles, some individuals may still be susceptible to the disease.

Another type of inconsistency referred to as an "inappropriate relationship", inaccurately expresses the relationship between concepts. For example, 'The causes of hepatitis A are fever, diarrhea, or generally a sick feeling.' Rather, the sentence should read: 'The **symptoms** of

hepatitis A are fever, diarrhea, or generally a sick feeling.'

The third type of inconsistency is the "prior knowledge inconsistency", where the information in the text contradicts the reader's prior knowledge of the topic. For example, 'Iron is found in milk.' Rather, the sentence should read 'Iron is found in **liver**'.

In order to minimize the possibility of a response bias in students, the placement of the sentence with the inconsistency was varied. The placement of certain types of inconsistencies or confusions was in part determined by the nature of the information presented in the text. For example, in order to create an inappropriate relationship an appropriate relationship needed to be found in the text and then changed.

To confirm the classification of these types of inconsistencies, independent raters were asked to determine whether inconsistencies could be identified and classified as either prior knowledge, informational, or relational. Definitions of the terms were given to the raters (see Appendix H). Raters were able to find the inconsistencies and were able to classify them with 88% agreement. These anomolous texts

served as the basis for the comprehension monitoring task.

Comprehension Monitoring Task. One direct way of assessing students' abilities to detect errors in text is to have them underline the part of the text that does not make sense to them. This approach was used here. In addition, students in this study were also asked to rewrite the questionable section of the text so that it would make sense. More specifically, students were presented with two texts at each of the pretest and the posttest. After reading each passage, students were asked to notice whether they had become aware of anything in the passage not making sense to them. They were then instructed to "underline the part(s) that was(were) giving you trouble or did not make sense to you" and then to "write down how you would change what you underlined so that it does make sense" (see Appendices F and G).

Texts Used for Training

The texts used for training were drawn from an article on AIDS and a textbook chapter on Infection and Immunity covering the topics: Bacteria, Food Poisoning, Cold Viruses, and Viruses. These texts ranged

between 200 words to 800 words and were selected from a textbook entitled 'Core Concepts in Health, 5th edition' (Insel & Roth, 1988). According to the Fry Readability Formula, the readability level of these passages was at the Grade 10 level. (These texts can be found in the Training manual in Appendix A.) The article on AIDS was 1000 words and was selected from a textbook entitled 'Infections in Children: A sourcebook for educators and childcare providers' (Andersen, Bale, Blackman, & Murph, 1986). According to the Fry Readability Formula, the readability level of this passage is at Grade 11. All passages were selected in cooperation with the classroom teacher as components of the course content.

Strategy Instruction

This section describes the strategy training that took place in the experimental class.

Network Strategy Training

Prior to designing the strategy instruction, the investigator read about the strategy, observed two instructors use a version of the strategy

described here with their own students, and pilot tested the networking strategy with a group of first year college students. The information gathered from these sources led to the creation of the training method used in this study (see Appendix A for details).

The networking strategy training consisted of approximately 10 hours of class instruction spread across five weeks. It was designed to be an integral part of the health science course that students were enrolled in. Twice a week, with the help of the classroom teacher, students were taught to use the strategy with regular classroom content and were instructed to use it during the regular class period.

The focus of the instruction was to teach students to analyze text in terms of concepts and relationships and to construct networks portraying the text content in terms of these concepts and relationships. This instruction took the form of 30 minute (on average) **demonstrations** where both the classroom teacher and the investigator showed students how to identify important concepts and how to link them, 30 minute individual **practice sessions** where students were instructed to create maps of information presented in their texts, and 15 minute **discussion**

sessions either in small groups or with the whole class. Small group discussions allowed students to work together on the use of the strategy and to provide one another with feedback. Large group discussions also served this purpose but they also served as a means for students to ask content questions or to request clarifications by the teacher. In addition, individual feedback on the use of the strategy was provided to students by both the teacher and the investigator.

Students were provided with definitions of relationship terms as a guide to distinguishing between the different types of relationships in the text. Students were also encouraged to add other relationships to the list and to think about how the concepts and ideas were related rather than to merely memorize relationship terms.

Students were also taught to use networks as comprehension monitoring tools to evaluate their understanding of the information. This was accomplished by presenting students with a network which contained deliberate errors in the information. They were required to identify these errors and revise the network so that it accurately represented the ideas in the text. While doing this task, they were encouraged to ask themselves

questions such as 'Are these concepts appropriately related?', 'If not, what is the correct relationship?' 'Does the network need to be better organized so that it accurately portrays what the author was trying to say?', 'Is there some confusion in the networker's mind and how can I revise the network so as to clarify the confusion?'. Feedback was also provided to the students in the form of a corrected network.

In addition, students were trained to use networks to make explicit links between the information newly acquired from the text and their prior knowledge of the topic. The teacher constructed a network of the text and then, students observed her linking her prior knowledge into the network. They were also instructed to pay particular attention to the types of questions the teacher asked herself to facilitate this linking process. The following are examples of such questions: 'What do I already know about this topic?', 'How are the ideas in the text related to what I know? Is what I know a cause?, An example?', 'Where can I best link what I know to what's in the text?', and 'Is what I know consistent with what the author has presented in the text?'

After approximately seven hours of training, students were asked to network "mentally" in order to reduce the time required to network on paper and to have students become more efficient in the use of the strategy. They were instructed to think about the key concepts and their relationships and to organize these ideas as they read the text, without actually constructing the network on paper.

Traditional Instruction

The control class was identical in content to the experimental class and taught by the same teacher in the following semester. In the control class, the teacher delivered the content to the students only via lectures and group discussions. In this case, students were given a brief definition of a network and were exposed to a network prototype on an overhead projection for two minutes so as to be able to complete the pretest and posttest tasks. After the study was completed, however, both the investigator and the classroom teacher intended to give those in the control group comparable training in the networking strategy to that given to the experimental group. This was to ensure that all students

participating in this study received the opportunity to benefit from the instructional strategy described here. Unfortunately, because of classroom limitations, students in the control group only received about half the amount of training. As a result, students were given the option of requesting further training from the investigator if so desired.

Procedures

A total of three pretests were administered during the first few days of classes and five posttests were administered soon after training was completed. All testing took place during students' regular Health Science class period, each session lasting a maximum of 90 minutes. Pretesting began with the reading comprehension test which was conducted during two consecutive classroom meetings. The first session involved a disease (trained) passage. The second session involved a child abuse (transfer) passage. For each passage type, students completed a prior knowledge test prior to reading the text and a free-written recall, knowledge integration, and multiple-choice test after reading the text. Pretesting of comprehension monitoring using the error detection task

was conducted in a third session.

Just prior to training, a measure of the experimental participants' abilities to network was also taken. This measure was not taken of the control participants'. To do so would have provided them with the opportunity to become familiar with the strategy and consequently bias the results. Experimental participants were then trained in networking on passages about diseases. Control students studied the same passages in a traditional manner.

Posttesting in reading comprehension (using two passages on disease and two on child abuse) was conducted in four sessions. The posttests consisted of the same comprehension tasks as in the pretest with the addition of networking immediately following the reading of the passage under two different conditions. In the first posttest network condition, students were asked to 'not take the time to network on paper' ("mental" networking) and in the second posttest network condition students were asked to 'take the time to network on paper.' Because the investigator did not want the control group's performance to be influenced by networking, all participants were exposed to the "not on paper" condition

first. Posttesting of comprehension monitoring was conducted in a fifth session.

Participants received each of the passages only once. The three disease and three child abuse passages used to assess reading comprehension were counterbalanced across testing conditions, as were the four disease passages used for assessing comprehension monitoring.

All participants were also interviewed after posttesting was completed to determine how they went about 'not taking the time to network on paper.'

Scoring Procedures

Reading Comprehension

Multiple-Choice

Students' answers on the multiple-choice test were scored in accordance with a pre-determined key. A correct response was assigned a value of 1 and an incorrect response was assigned a value of 0.

Free-Written Recall

Expert Texts. The free-written recall data were scored in several stages. First, the six assessment passages were segmented into idea units. Idea units have been used as the unit of measurement by investigators as they allow one to focus on the substance of the student's recall (Adams, Carine, & Gersten, 1982; Anderson, Reynolds, Schallert, & Goetz, 1977; Aulls, Browns, Cohen, Klein, Michaud, & Pare, 1987; Meyer, 1975). An idea unit has been defined as a distinct meaningful piece of information and is generally equivalent to a clause (Dillinger, 1985), but in cases where a clause contains more than one idea, each one is counted separately. For example, the sentence "Asthmatics can have an attack because of over-exertion, allergies, and excitement" is segmented into three idea units: 1) Asthmatics can have an attack because of over-exertion; 2)... because of allergies; and 3)... because of excitement. There were two reasons why idea units were selected as the unit of measure in this study. First, because idea units can be smaller than clauses, it is easier to distinguish between what is accurate and inaccurate. When the unit of measure is too large and the information is not completely

accurate, it is more difficult to decide whether the entire unit reflects accurate or inaccurate knowledge. The end result might be an overrepresentation or underrepresentation of accurate knowledge. Second, the use of a smaller unit of measure would allow the investigator to better identify the elements of the idea unit, concepts and relationships. This information was eventually to be correlated with the concepts and relationships found in the students' networks. Because the aim was to correlate the two sources of information, it made sense to score the data in a similar manner.

Idea units have been identified in the literature by either locating the verb or relationship term between the concepts (Mayer, 1989; Schmidt, De Volder, De Grave, Moust, & Patel, 1989), or by identifying important ideas and then selecting other ideas that described these important ideas (Meyer & McConkie, 1973). Based on the works of Mayer (1989) and Schmidt et. al., (1989), in this study, idea units were identified according to a set of rules which involved taking individual sentences and segmenting them into concepts and relationships. If they contained relatively contrasting examples, types, characteristics, causes, and

elaborations each of these was considered a new idea unit (see example about asthmatics given above). The use of rules to identify idea units ensured that raters were consistent in identifying idea units. To some extent, syntactical markers such as punctuation and subject-predicate combinations were also used to aid in the identification of these units. (For a detailed description of the coding process, see manual included as Appendix I)

The reliability of the segmentation of passages into idea units was determined by having two independent coders identify the idea units in the six passages. Reliability in the form of percent agreement between the two coders was calculated and ranged between 85% and 95% for the six passages. In cases of disagreement, the two raters reviewed previous examples and together came to a consensus.

Second, ideas were rated as "key" or "non-key". Unfortunately, this dictotomous choice proved difficult. In order to resolve the difficulty, the investigator used a similar procedure to one used by Brown & Smiley (1977). Two raters rated each idea unit on a scale of 1 to 5 in terms of its importance or centrality. A rating of '1' was assigned to an idea unit

which was not important or key in the text and a rating of '5' was assigned to an idea unit which was important or key in the text. (A more detailed description of the instructions given to the raters can be found in Appendix J.)

Any idea which was rated as '4' or '5' by both raters was deemed a "key idea". Others were deemed as "not key". Percent agreement was calculated between the two raters for each text passage. Values for the passages ranged from 65% (for one passage) to 88%. An agreement between the raters was defined as whether there was agreement that an idea was "key" or "not key". In cases of disagreement, the two raters reviewed previous examples and together came to a consensus.

The two procedures described above led to six master templates corresponding to the number of assessment passages. These templates were used as guides in scoring the students' protocols for the recall of ideas (see Appendices K-P).

Student Protocols. Students' protocols were segmented into idea units using the segmentation procedure described above. Then students'

idea units were matched against those found in the template. To determine the accuracy of the student's idea unit, an intermediate step was taken which required breaking down the idea unit into its constituent elements (concepts and relationships). These elements were scored, then combined into the corresponding scores for the idea unit in question. In addition to determining the accuracy of the idea unit, the quality (whether the idea was key or not) was assessed. The following describes the process of scoring student protocols.

First, students' protocols were segmented into idea units using the same segmentation procedure as used with the expert texts. Second, students' idea units were matched against those found in the experts' templates. The students' idea units were scored for accuracy of concepts and relationships. According to Novak and Gowin (1984), concepts are indicated by important content words or short phrases. Relationships are words which link other words or phrases. Generally, relationships can be identified by the verb. For example, in the sentence 'Cystic Fibrosis leads to the production of excess mucus', the words "Cystic Fibrosis" and "production of excess mucus" are thought of as the concepts and the

words "leads to" express the causal relationship which links the two concepts.

Each idea unit was conceptualized as having two concepts and one relationship. One of these concepts was found on the left side, the relationship was located in the middle, and the other concept was found on the right. Another way of visualizing this was in terms of networks by means of a node-link-node structure. The nodes represent the concepts and links represent the relationship between the concepts.

Because students in this study were asked to read and recall information from a particular text, concepts were thought of as either 'present' in the text or 'absent' from the text. Concepts were deemed to be 'present' if the student recalled it verbatim or paraphrased its gist. Concepts were deemed to be 'absent' if they were not in the text regardless of whether they were accurate or not. Relationships, however, were thought of as either 'accurate' or 'inaccurate'.

Reliability was calculated on 20% of the protocols by the investigator and an assistant. Percent agreement was 85% for concepts and 93% for

relationships. Disagreements were resolved in the same manner as described earlier. Because agreement between the investigator and the assistant was high, the remainder of the protocols were scored by the investigator only.

The quality of the idea unit was assessed next (i.e., whether the idea recalled was "key" or "non-key"). Again, this required simply matching the idea unit found in student's protocol with one found in the expert's text.

To reiterate, each student protocol was segmented into idea units. These idea units were matched against those distilled from the expert's text. The student's idea units were assessed for accuracy by examining its elements, concepts and relationships. Each idea unit was also assessed for its quality.

Now that the reader has a sense of what was evaluated, the following describes how accuracy values were assigned to each element of the idea unit. Recall that evaluating the elements of the idea unit was an intermediate step needed to evaluate the entire idea unit.

Values were assigned to each element of the idea unit in the following way. (For an illustration see Table 1.) For each idea unit, a maximum of 2 points were allotted for recalling concepts (as there were two concepts per idea unit) deemed as 'present in the text' (see rows 1, 5, and 6 under 'C' columns in Table 1). If one or both concepts were deemed as "partially present in the text", then partial marks (.5) were assigned to the concept(s) in question (see rows 2, 3, and 4 under 'C' columns). If, however, one or both concepts were deemed as "not present in the text", then a value of 0 was assigned to the concept(s) in question (see row 7 under 'C' columns).

Relationships were valued at "1" if they were deemed "correct" and at "0" otherwise. Correct relationships were valued at "1" only if both concepts were valued at either "1" or "0.5" (see rows 1-5 under 'R' column). That is, no credit for a relationship was given if the concepts were incorrect. In all other cases, relationships were deemed to be incorrect and thus valued at "0" (see rows 6 & 7).

An intermediate "total" (ToT.) value was computed for each idea unit recalled by the student. This was determined simply by summing the

previously determined concept values with the relationship value for that idea unit (see ToT. column)

To reiterate, scores were assigned to each element of the idea unit. The following describes how the intermediate values were assembled into the final values used in the analyses.

For each idea unit generated by the student, if the intermediate total value was 3.0 an idea unit value (IUV) of 1.0 was assigned (see IUV columns for rows 1 and 5). If an intermediate total value of 2.5 had been computed, an IUV of 0.5 was assigned (see row 2 & 4). In other words, partial credit was assigned. Otherwise, an IUV of 0.0 was assigned (see rows 3, 6, & 7). In this case, the student's recall of the idea unit was so poor that it was not worth assigning even partial credit.

Each student idea unit whose IUV was 0.5 (see row 2) or greater (see rows 1 & 5) was then compared to the corresponding idea unit in the expert-generated text. If the idea unit had been deemed "key" in the expert's text, it was deemed to be "key" in the student's protocol (see "key" column). Otherwise, it was deemed "not key" (see "not key"

column). Furthermore, if the idea unit was "key", then the idea unit value was copied into the "key" column. Otherwise, a 0 was put in the key column. If, however, the idea unit was "nonkey", then the idea unit value was put under the nonkey column. Otherwise, a 0 was put under the nonkey column.

For each student whose idea units had been scored as described above, the scores described were totalled. However, only the scores for key and non-key ideas were used in the analyses conducted here as including the other scores would have meant including redundant information. The existence of this redundancy was verified statistically later on.

Thus, scoring students' protocols for concepts and relationships enabled the determination of the number of key idea units. This was calculated as the sum of the scores in the "key" column and non-key idea units which was calculated as the sum of the scores in the "non-key" column recalled by the student.

Comprehension Monitoring

Student responses on this task were given a score of 0, 1, or 2. A score of 0 was assigned when the student failed entirely to detect the inconsistency as indicated by an absence of underlining or if an accurate section of the text was incorrectly underlined. A score of 1 was assigned when the student detected the inconsistency, i.e., the student underlined the anomalous section of the text but either failed to make a correction or made an inaccurate one. A score of 2 was assigned when the student detected the inconsistency and made an appropriate correction. That is, the student underlined the anomalous section of the text and made an accurate correction.

TABLE 1. Example of the scoring of one student's free-written recall protocol

	C	R	C	Tot.	IUV	Key	NonKey
1.	1	1	1	3.0	1.0	1.0	0.0
2.	1	1	0.5	2.5	0.5	0.5	0.0
3.	0.5	1	0.5	2.0	0.0	0.0	0.0
4.	0.5	1	1	2.5	0.5	0.0	0.5
5.	1	1	1	3.0	1.0	0.0	1.0
6.	1	0	1	2.0	0.0	0.0	0.0
7.	1	0	0	1.0	0.0	0.0	0.0
Totals	N/A	N/A	N/A	N/A	N/A	1.5	1.5

Each line indicates the scores of one idea unit recalled by the student.

C= concept; R= relationship; Tot.= total concept and relationship score for one idea unit; IUV= idea unit value;

Type= the quality of the idea; Key= value for key idea; NonKey= value for non-key.

Summary: This student is said to have recalled 3 idea units; 11 concepts; 5 relationships; 16 units of information (C+R); 1.5 Key Ideas; and 1.5 Non-Key ideas.

RESULTS

Comprehension

Free-Written Recall. Raw scores on key ideas, non-key ideas, relationships, and concepts were converted to z-scores so as to make the tests on disease and child abuse comparable. Using these z-scores, tests were conducted to determine whether the data were normally distributed,

whether the variances were homogeneous, and the degree to which the four measures provided redundant information.

All free-written recall data were assessed for normality using: a) the normal probability plot graphical test (Stevens, 1986); b) Shapiro-Wilks and Lilliefors statistical tests; and c) the skewness and kurtosis values for the distributions. These data were found to approximate normality on all three tests.

Homogeneity of variance was assessed using the Box-M test. The results were found to be non-significant ($p > .05$), i.e., the variances were homogeneous.

A Stepdown Analysis confirmed that using all four dependent measures would involve redundant information. A Stepdown analysis of the variables key ideas, non-key ideas, relationships, and concepts (in this order), revealed that only key ideas and non-key ideas contributed unique sources of variation. Relationships and concepts did not. Therefore, relationships and concepts were dropped from the analyses described in this study.

The first research question was 'If students are instructed to not take the time to construct a network on paper, will the students who have been trained in the mental construction of networks recall disease and child abuse passages better than students who have not been trained in the mental construction of networks?'

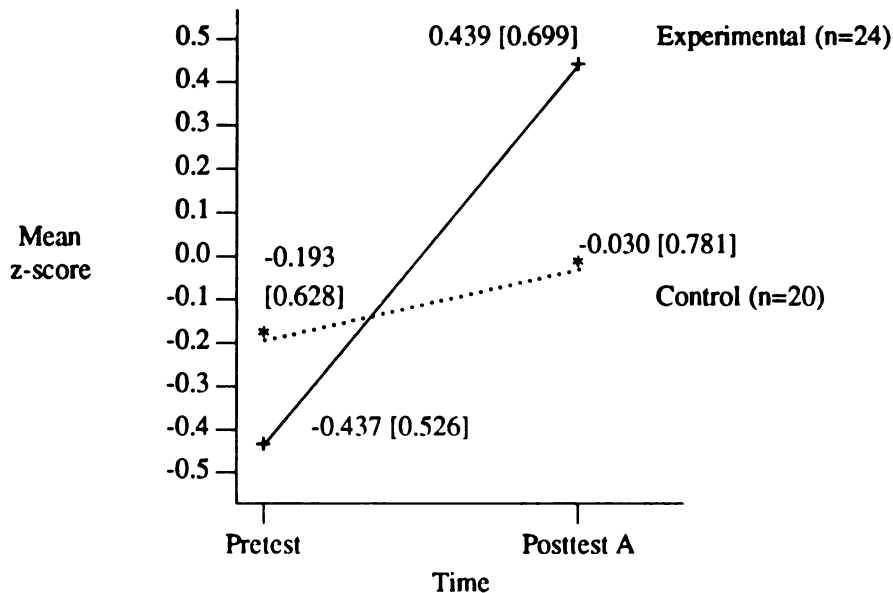
A 2 X 2 X 2 repeated measures multivariate analysis of variance (MANOVA) was conducted where Time (pre vs. post) and Passage (trained: disease; transfer: child abuse) were the repeated factors and Group (Experimental vs. Control) was the between group factor. The dependent measures included in this analysis were number of key and non-key ideas. Significant interaction effects were examined using post hoc comparisons in the form of dependent and independent t-tests. An adjustment for error rate for each dependent and independent t-test conducted was made using the Bonferroni adjustment.⁽¹⁾

1. For each significant interaction effect two dependent t-tests were conducted. Thus, $\alpha = .05/2 = .025$. The same procedure was used for the independent t-tests, $\alpha = .05/2 = .025$.

A significant main effect of Time was discovered [Pillais, Hotellings, Wilks, & Roys, $F(2,36)= 13.07$, $p=.001$]. The univariate F value ($dfs=1,37$) was significant for only key ideas, $F= 26.87$, $p=.001$. An examination of the means revealed that all participants recalled significantly more key ideas at the posttest than at the pretest.

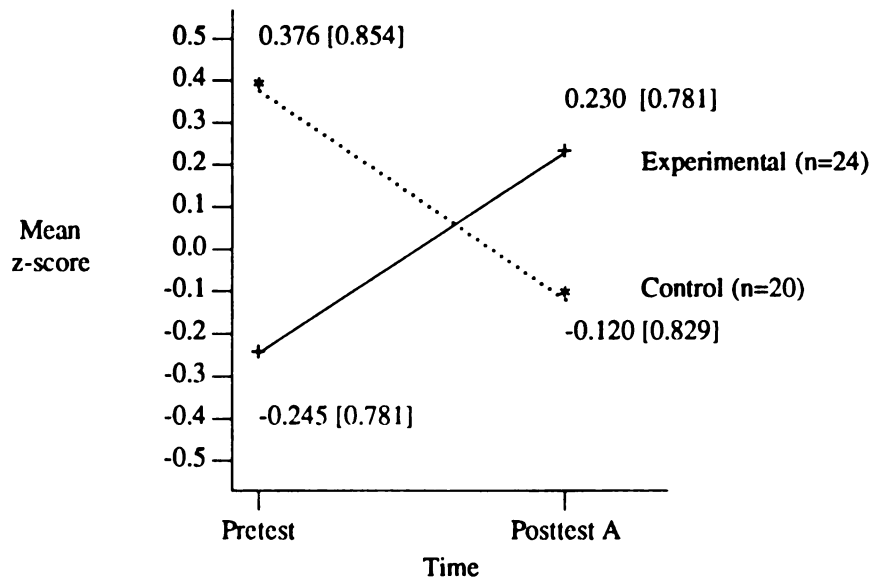
However, this finding was qualified by the following significant interactions. First, a significant Group by Time interaction was obtained, [Pillais, Hotellings, Wilks, & Roys, $F(2,36)=9.60$, $p=.001$]. Univariate F values ($dfs=1,37$) were significant for both dependent measures: key ideas $F=9.03$, $p=.005$ and non-key ideas $F=12.96$, $p=.001$. Dependent t-tests examining Time differences within each group revealed that the experimental group made significantly greater gains from pretest to posttest in terms of the number of key ideas recalled $t(23)= -5.33$, $p=.001$ (see Figure 2) and the number of non-key ideas recalled $t(23)= -2.76$, $p=.011$ (see Figure 3). By contrast, the control group's performance on the number of key ideas remained relatively stable over time (slight increase) but recall of non-key ideas declined significantly from pretest to posttest, $t(19)=2.82$, $p=.011$.

Figure 2. Key Ideas Recalled: Do not network on paper



For each mean value, the corresponding standard deviation appears in square brackets (i.e., []).

In addition, independent t-tests which were conducted to examine Group differences at each level of Time revealed that experimental participants did significantly surpass the control group's recall of key ideas at the posttest ($p = .042$). However, this difference was not statistically significant after the Bonferroni adjustment was applied ($.05/2 = .025$). In addition, there was no significant difference between the groups at the posttest for the recall of non-key ideas ($p > .025$). There

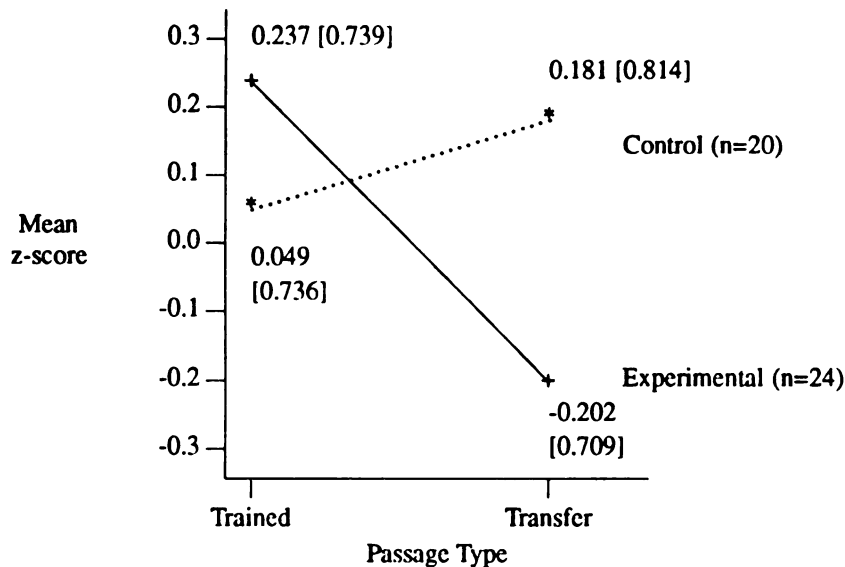
Figure 3. Non-Key Ideas Recalled: Do not network on paper

For each mean value, the corresponding standard deviation appears in square brackets (i.e., []).

were, however, significant initial differences between the two groups for the number of non-key ideas recalled, $t(42)=2.51$, $p=.016$. These initial differences were not corrected for. Experimental participants initially had lower recalls of non-key ideas than did the controls. However, experimental participants surpassed controls at the time of the posttest. By contrast, the control group's performance declined.

In addition, a significant Group by Passage interaction was also found [Pillais, Hotellings, Wilks, & Roys, $F(2,36)=5.88$, $p=.006$]. Univariate F values ($dfs=1,37$) were significant only for non-key ideas, $F=12.01$, $p=.001$. Dependent t-tests examining Passage differences within each group revealed that the experimental group recalled significantly more non-key ideas on the trained passages than they did on the transfer passages, $t(23)= 3.60$, $p=.002$. This difference did not exist for the control group, ($p=.173$) (see Figure 4).

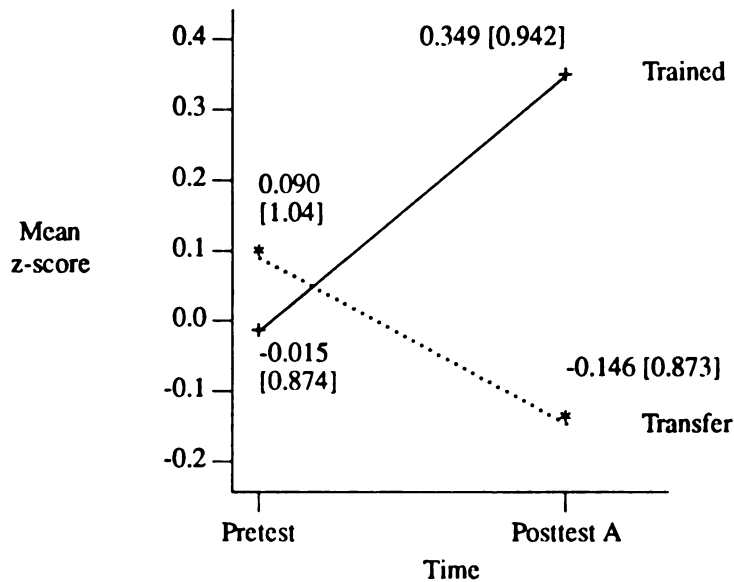
As well, a significant Time by Passage interaction was found [Pillais, Hotellings, Wilks, & Roys, $F(2,36)= 4.50$, $p=.018$]. Univariate F values ($dfs=1,37$) was significant for non-key ideas only, $F=8.23$, $p=.007$. Dependent t-tests examining Time differences within each passage revealed there was a significant difference from pretest to posttest in the recall of non-key ideas from the disease passages, ($p=.038$). Again, this difference was not statistically significant after the Bonferroni adjustment was applied ($.05/2 = .025$). There was no significant difference from pre to post in the recall of non-key ideas from the child abuse passage (See Figure 5).

Figure 4. Non-Key Ideas Recalled: Effect of Passage

For each mean value, the corresponding standard deviation appears in square brackets (i.e., []).

To summarize, the analyses conducted above revealed that experimental participants made significantly greater gains in the recall of key and non-key ideas than the control students. In fact, the number of non-key ideas recalled declined significantly among the control students. Experimental participants' performance, however, did not significantly differ from that of controls' at the posttest. Finally, although there was no

Figure 5. Non-Key Ideas Recalled: Do not network on paper



For each mean value, the corresponding standard deviation appears in square brackets (i.e., []).

significant difference in the participants' recall of key ideas by passage, experimental participants' did recall significantly more non-key ideas on the trained passages than they did on the transfer passages. This difference did not exist for control participants.

A second 2 X 2 X 2 repeated MANOVA was conducted to answer the research question 'If students are instructed to 'take the time to construct

a network on paper, will the students who have been trained in the construction of networks on paper recall disease and child abuse passages better than students who have not been trained in the construction of networks on paper?’

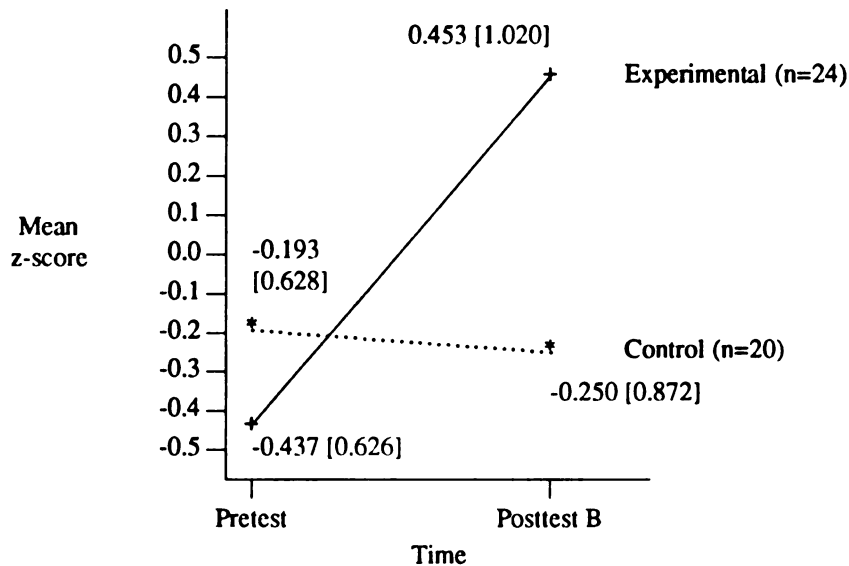
A significant main effect for Time was present [Pillais, Hotellings, Wilks, & Roys, $F(2,35)=7.65$, $p=.002$]. The univariate F value ($dfs=1,36$) was significant for key ideas only [$F(1,36)=13.81$, $p=.001$]. An examination of the means revealed that all participants recalled significantly more key ideas at the posttest than at the pretest. However, this finding was qualified by the subsequent interaction effect.

As predicted, the MANOVA revealed a significant Group by Time interaction, [Pillais, Hotellings, Wilks, & Roys, $F(11,35)=11.32$, $p=.001$]. Again both univariate tests were significant: key ideas [$F(1,36)=15.02$, $p=.001$] and non-key ideas [$F(1,36)=13.44$, $p=.001$].

Dependent t-tests examining Time differences within each group revealed that the experimental group made significantly greater gains from pretest to posttest in terms of the number of key ideas recalled

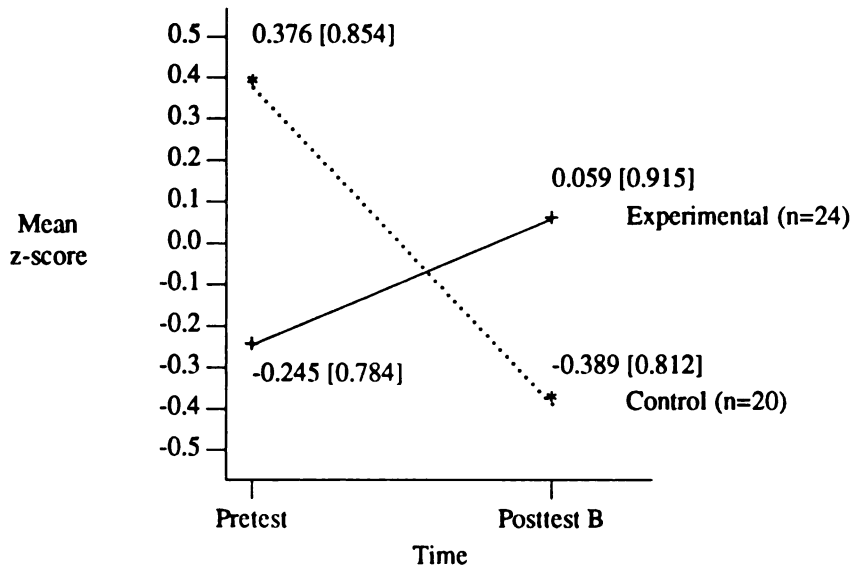
$t(23) = -4.27, p = .001$. (See Figure 6.)

Figure 6. Key Ideas Recalled: Network on paper



For each mean value, the corresponding standard deviation appears in square brackets (i.e., []).

Statistically significant gains were not made for the number of non-key ideas recalled $t(23) = -1.84, p = .079$. By contrast, the control group's performance on the number of key ideas and non-key ideas recalled declined from pretest to posttest. This decline reached statistical significance only for the non-key ideas, $t(19) = 4.24, p = .001$. (See Figure 7.)

Figure 7. Non-Key Ideas Recalled: Network on paper

Independent t-tests which were used to examine Group differences at each level of Time revealed that not only did experimental participants make significantly greater gains over time in the number of key ideas they recalled, they also significantly surpassed the control group's performance at the time of the posttest, $t(42) = -2.43$, $p = .019$. No initial differences were found between the two groups in terms of their recall of key ideas, ($p = .168$). There were initial differences in the two groups'

recalls of non-key ideas ($p=.016$).

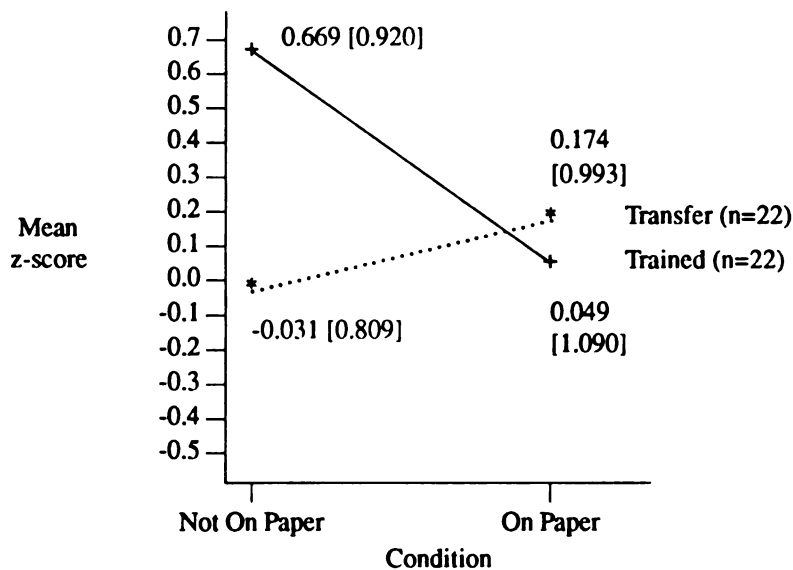
To summarize, the analyses conducted above revealed that experimental students' recall of key ideas significantly improved at the posttest, surpassing that of the control students. In contrast, control students' recall of non-key ideas significantly declined at the posttest.

A 2 X 2 repeated MANOVA where Network Condition (mental construction of networks vs. construction of networks on paper) and Passage (trained and transfer) were the repeated factors was conducted to answer the research questions 'Is recall dependent on the actual construction of networks on paper or is the mental construction of networks sufficient?' And, 'Are the outcomes dependent on the type of passage recalled? Because these questions could only be meaningfully asked of the experimental participants, only their data were analyzed.

MANOVA revealed a significant Network Condition by Passage interaction effect, [Pillais, Hotellings, Wilks, & Roys, $F(2,18)=3.65$, $p=.047$]. The univariate F value ($dfs=1,19$) was significant for non-key ideas only [$F(1,19)= 7.56$, $p=.013$]. Dependent t-tests were conducted to

examine Passage differences at each type of network condition revealed that when experimental participants were asked to 'not take the time to construct a network on paper', they recalled significantly more non-key ideas from the disease passage than when they were instructed to 'construct a network on paper', $t(21) = 2.83, p = .010$ (see Figure 8).

Figure 8. Non-Key Ideas Recalled: Experimental Participants

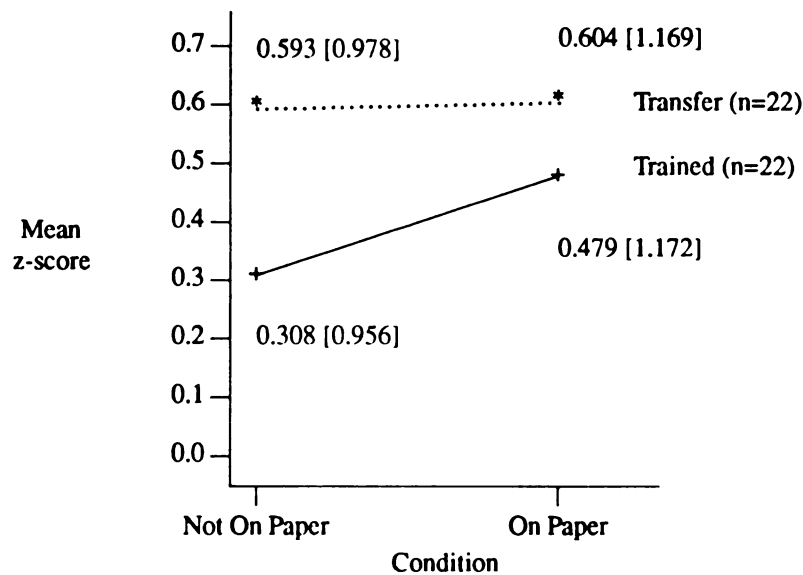


For each mean value, the corresponding standard deviation appears in square brackets (i.e., []).

Network conditions did not significantly affect recall of non-key ideas of child abuse passages ($p = .289$). As expected, the above interaction effect

did not exist for the recall of key ideas ($p = .771$) (See Figure 9).

Figure 9. Key Ideas Recalled: Experimental Participants



For each mean value, the corresponding standard deviation appears in square brackets (i.e., []).

Multiple-Choice. Again raw scores were converted to z-scores and tests were conducted to determine whether the data was normally distributed, whether the variances were homogeneous, and whether there were initial group differences. Using the same tests for normality mentioned above, these data were found to approximate normality according to all three tests, only a few of the variables did not.

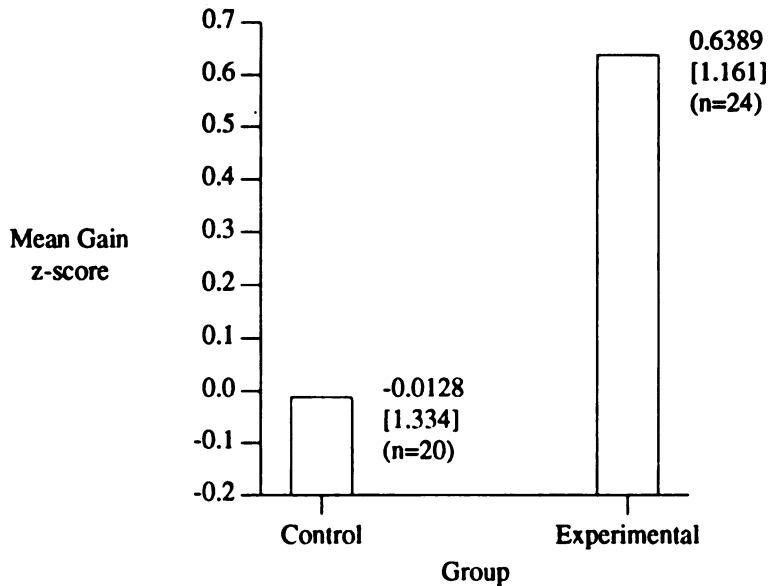
Homogeneity of variances was assessed using the Bartlett-Box F test. Except for one variable, the variances between the two groups were found to be homogeneous. However, the F-statistic is robust to violations of homogeneity of variances when the sample size for the two groups are equal or approximately so. Therefore, this violation did not pose a serious threat to the validity of the analyses.

T-tests for independent groups were used to check for initial group differences. These t-tests assessed performance on multiple-choice tests for the two passages. Initial differences were found for both passages. Compared with the experimental participants, the control group answered more of the pretest multiple-choice items correctly on both the disease and the child abuse passages, $p < 0.05$.

The fact that these data were reasonably normally distributed, the variances for most variables were homogeneous, and the fact that there were initial differences on both pretests suggested an analysis of covariance (ANCOVA) was appropriate to answer the research questions posed earlier.

ANCOVA is useful as a means of adjusting for initial group differences. However, both the assumption that the dependent variable and the covariate (in this case the pretest) are well correlated with one another (i.e., the dependent variable and the covariate have a linear relationship) and the assumption of homogeneity of slopes were violated. The violation of these assumptions lead to the use of gain scores.

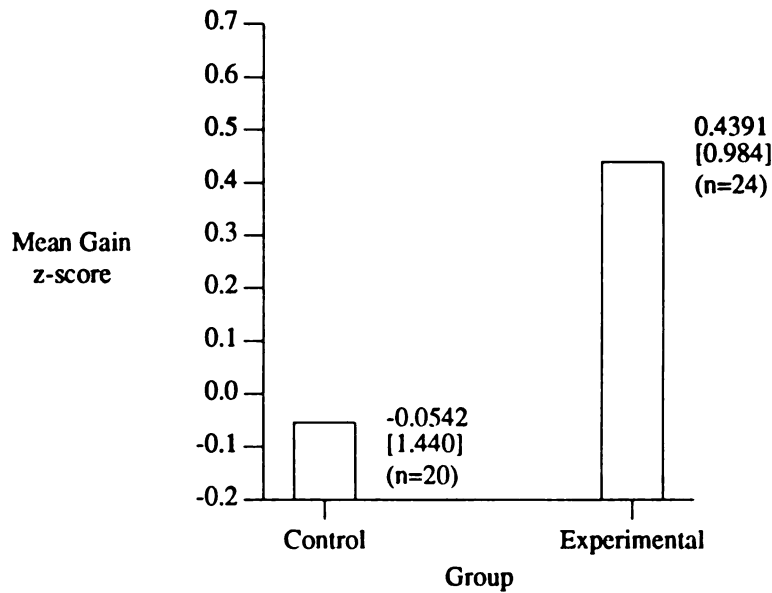
The use of gain scores, however, lead to answering slightly different questions from the ones proposed. The first question was 'If students are instructed to 'not take the time to network on paper', will students who have been trained in the mental construction of networks improve their comprehension of the disease passages more than students who have not been trained in the mental construction of networks?' To answer this question the pretest scores on disease were subtracted from the posttest scores on disease and a t-test for independent groups was used on these scores. The results showed that the difference in the gain scores of the two groups was not statistically significant, $t(42) = -1.73$, $p = .091$, although the mean gains were in the predicted direction (see Figure 10).

Figure 10. Multiple Choice Gain Scores: Disease - Not On Paper

For each mean value, the corresponding standard deviation appears in square brackets (i.e., []).

When the above analysis was conducted with the child abuse passages, the results from the t-tests revealed that the gains between the two groups were not statistically significant, $t(42) = -1.34$, $p = .186$, although the mean gain values were again in the predicted direction (see Figure 11).

Figure 11. Multiple Choice Gain Scores: Child Abuse - Not On Paper

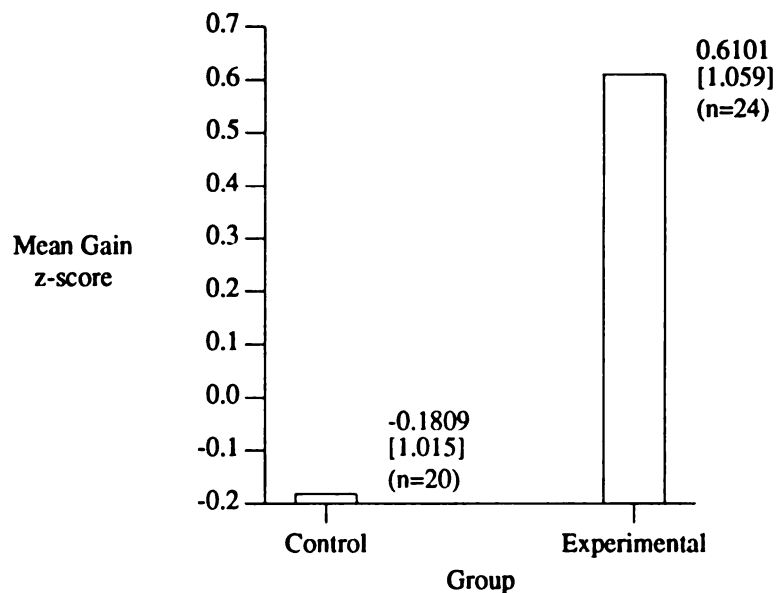


For each mean value, the corresponding standard deviation appears in square brackets (i.e., []).

The next question addressed was 'If students are instructed to 'take the time to construct a network on paper', will students who have been trained in the construction of networks on paper improve their comprehension of the disease passages more than students who have not been trained in the construction of networks on paper?' The results showed that the difference between the groups were statistically

significant, $t(42) = -2.51$, $p = .016$, (see Figure 12).

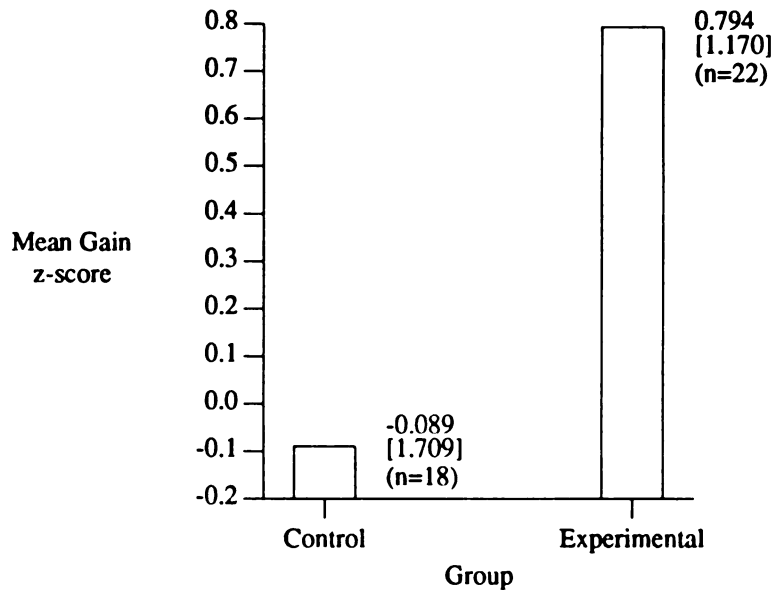
Figure 12. Multiple Choice Gain Scores: Disease - On Paper



For each mean value, the corresponding standard deviation appears in square brackets (i.e., []).

When this analysis was performed on the child abuse passages, the results were not significant, $t(38) = -1.94$, $p = .060$, although the mean gains were in the predicted direction (see Figure 13).

Given that four t-tests were conducted, the Bonferroni adjustment was applied ($.05/4 = .012$). After applying this adjustment, none of the

Figure 13. Multiple Choice Gain Scores: Child Abuse - On Paper

For each mean value, the corresponding standard deviation appears in square brackets (i.e., []).

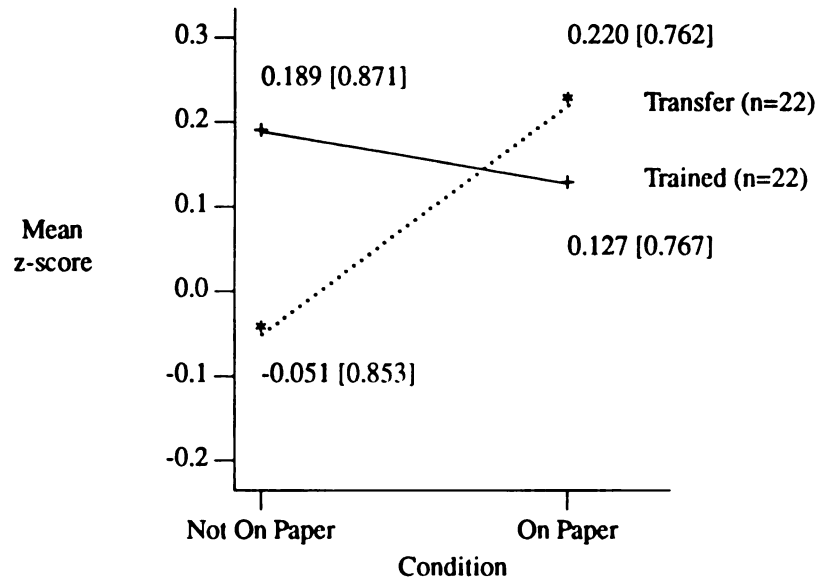
results were statistically significant. Despite the statistical non-significance, the pattern in these data reflect that obtained with the free-written recall data. In general, as noted by the positive gain scores, experimental participants improved from pretest to posttest in the number of multiple-choice items they were able to answer correctly. By contrast, as noted by the negative mean values, control participant's performance declined from pretest to posttest.

The final analysis addressed the question 'Is comprehension dependent upon the actual construction of networks on paper or is the mental construction of networks sufficient?' For reasons mentioned earlier, this question was addressed using only the experimental groups' data. These data were analyzed using a 2 X 2 repeated measures ANOVA where both Passages (disease and child abuse) and Condition (construction of networks on paper vs. construction of networks mentally) were the repeated factors. The results showed that the main effect of Condition did not reach statistical significance, $F(1, 21) = .57$, $p = .460$, thus supporting the prediction that no differences would be found between the two network conditions. Again no significant Condition by Passage interaction were found here ($p = .239$). Means and standard deviations are displayed in Figure 14.

Metacomprehension

Raw scores on detection and correction were used in the analysis described here. Tests were conducted to determine whether the data was normally distributed, whether the variances were homogeneous, and whether there were initial group differences. In addition, the data were

Figure 14. Performance on Multiple Choice Tests: Experimental Participants



For each mean value, the corresponding standard deviation appears in square brackets (i.e., []).

checked for significant treatment by order interactions.

The normality tests described earlier found these data not to be normally distributed in most cases. Again, homogeneity of variances between groups was assessed using the Bartlett-Box F test. The variances between the two groups were found to be homogeneous only for the posttest detection scores and pretest correction scores but not for the

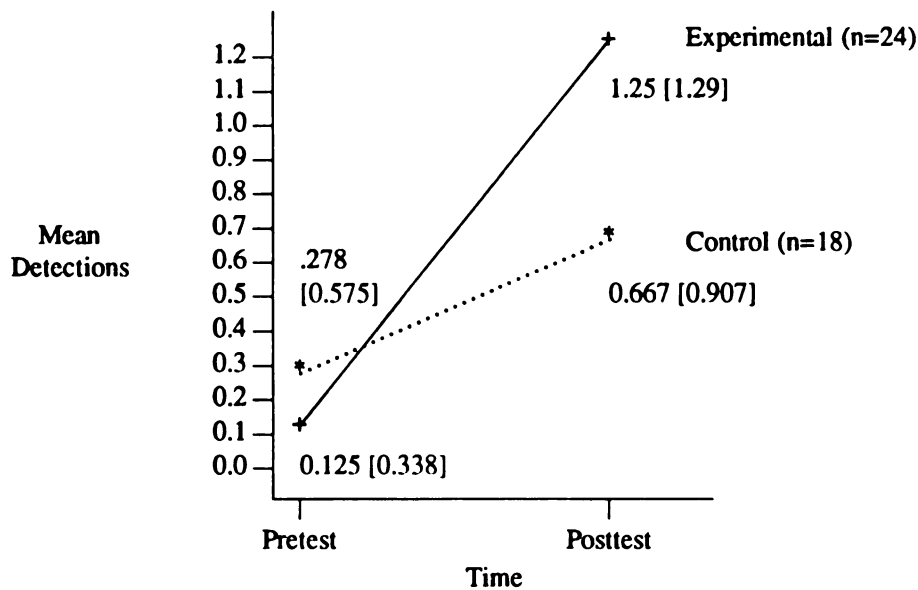
pretest detection scores ($p=.001$) nor for the posttest correction scores ($p=.010$). The sample sizes and their similarities lent the tests of normality and the Barlett-Box F test sufficient robustness to withstand violations of the assumptions of normality and homogeneity of variances. Therefore, parametric statistics were used to analyze these data.

A 2 (Group) X 2 (Time) X 2 (Order) X 2 (Passage Set) repeated measures analysis of variance on the detection scores indicated a significant interaction between treatment conditions (experimental vs. control) and the order of passages (first vs. second) ($p < .05$). In other words, the groups detected more inconsistencies when they dealt with certain orderings of the passages. Controls subjects were better at detecting inconsistencies when they worked with the anemia and meningitis passage first followed by the hemophilia and leukemia passages. In contrast, experimental participants were better at detecting inconsistencies when receiving the hemophilia and leukemia passages first followed by the anemia and meningitis passage.

The above analysis revealed a significant main effect of Time, $F(1,34)=14.79$, $p=.001$, indicating that all participants improved in their

ability to detect errors in text. Although there was no significant Group by Time interaction effect, $F(1,34)=1.95$, $p=.172$, the means were in the predicted direction. Experimental participants improved in their ability to detect inconsistencies from pretest to posttest more than did controls (see Figure 15).

Figure 15. Performance on Metacomprehension Task

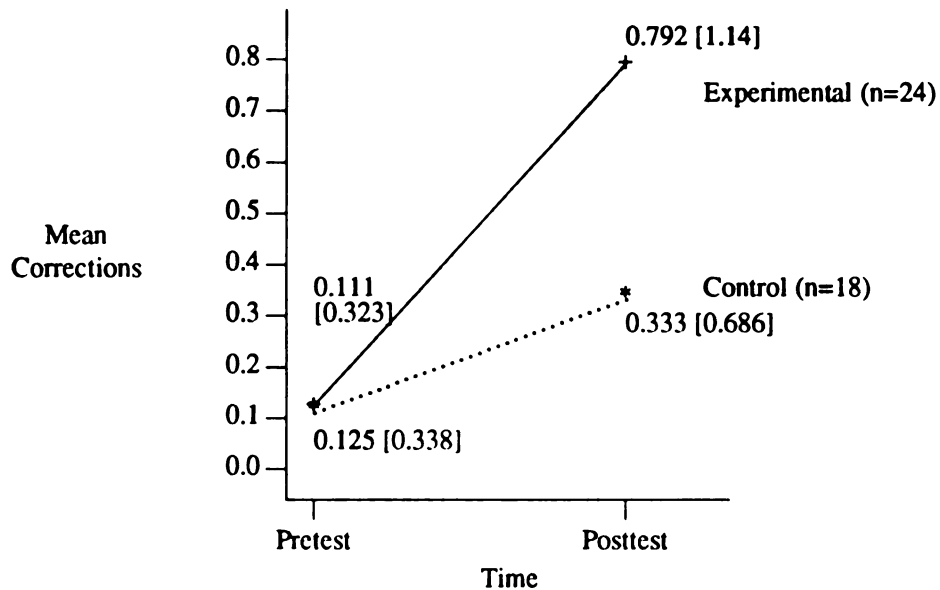


For each mean value, the corresponding standard deviation appears in square brackets (i.e., []).

A second 2 X 2 X 2 X 2 repeated measures analysis of variance was conducted on the correction scores. No significant group by order effects

were found in this case. Again, there was a main effect of Time, $F(1,34)=10.32$, $p=.003$, indicating that all participants improved in their ability to correct the errors they found in the text. As in the first analysis, in this case, there were no significant Group by Time interaction effect, $F(1,34)=.86$, $p=.359$, although the means were in the predicted direction (see Figure 16).

To summarize, the abovementioned analyses reveal that groups were significantly influenced by the order in which the passages were given in their ability to detect inconsistencies. All participants improved significantly in their ability to detect and correct errors in text, but there was no significant difference between the two groups' abilities to detect or correct text.

Figure 16. Performance on Metacomprehension Task

For each mean value, the corresponding standard deviation appears in square brackets (i.e., []).

DISCUSSION

The first research question concerned the effect of training on the recall and comprehension of science texts when instructed to 'not take the time to construct a network on paper'. It had been predicted that among subjects who were told to 'not take the time to network on paper', those who were trained would have better recall and comprehension of

Health Science texts than those who were not trained.

There were no significant differences between the two student groups' posttest scores on the multiple-choice test nor on the free-written recall task. Despite this lack of a significant difference between the groups' scores at the posttest, those who were trained in the networking strategy had improved their recall of key ideas and of non-key ideas significantly more than those who were not trained. In contrast, the recall of key ideas by untrained participants increased only slightly while that of non-key ideas declined significantly. As well, their performance on the multiple-choice test declined but the decline was not significant.

An explanation for the experimental group's significant gains may be that the training in the networking strategy helped them to create a framework for relating information in the text and organizing it prior to engaging in the posttest task of 'not taking the time to construct networks on paper'. Because experimental participants had a means of thinking about the important ideas, and relating and organizing them, they may have been better able to make sense of the ideas and to think of them as a unified whole rather than as discrete bits of information. Therefore, they

were better able than the control participants to think of important ideas, organize, and to assemble them into meaningful relationships.

The reader will recall, however, that the experimental participants did not significantly improve their performance when comprehension was measured by a multiple-choice test. This may be explained by the nature of this specific multiple-choice test. The test consisted primarily of questions requiring literal recall of facts. The test might have been able to detect gains had it contained more higher-level inferential questions. A salient feature of a network is its system of linked concepts. Several researchers (Britton, Dusen, Glynn, & Hemphill, 1990; Lambiotte, Peel, & Dansereau, 1992) have found that networks are more suited to tasks which require students to make higher-level inferences and to build relationships than they are to tasks which require literal comprehension or minimal inferencing.

Taken together, these results suggest that students may be learning to focus on understanding the higher-order concepts in the text and their relationships, rather than memorizing facts in isolation.

The first research question was also concerned with the effects of training versus no training on learner's abilities to generalize their learning of the strategy to texts on which they had not received training. It was expected that those who were trained in the strategy would be able to generalize the strategy and would thus comprehend and recall texts which were similar to the ones used during training and those which were not.

Experimental participants who used the strategy generalized their learning of key ideas to the new text. The benefits did not generalize to the recall of specific ideas: they recalled significantly more specific ideas from the disease (trained) passages than from the child abuse (transfer) passages. Thus, regardless of the passage read, networking seems to contribute particularly to the recall of key ideas. This is consistent with previous work on networking (Holley & Dansereau, 1984; Holley et al., 1979; Rewey et al., 1991). These results suggest that even when students who have been trained in networking do not take the time to network on paper, networking facilitates the recall of key ideas and does so regardless of the type of passage read. In other words, the networking

strategy helped learners recall ideas that were important to them regardless of the passage topic.

In contrast, the use of networking as an aid to remembering non-key ideas was less transferable when the content was different. Learners may have had difficulty remembering the specifics from child abuse (transfer) passages because training on using the networking strategy focussed on main ideas.

The second research question concerned the effect of training on the recall and comprehension of science texts when instructed to 'take the time to construct a network on paper'. It was predicted that those who were trained in the strategy and had been instructed as above would have better recall and comprehension of Health Science texts than those who were not trained in the strategy.

The results revealed that not only did experimental participants improve their recall of key ideas significantly more than did control participants, but the experimental participants' recall significantly surpassed the other groups' at the posttest. Experimental participants did

not, however, significantly surpass control participants nor did they significantly improve in recalling non-key ideas nor in answering multiple-choice items. By contrast, control participants, who had not been trained in the network strategy significantly declined in their recall of non-key ideas from pretest to posttest. A slight decline was also evident in their recall of key ideas and in their performance on the multiple-choice test.

One reason why the two groups differed significantly at the posttest may have to do with the way in which they were asked to apply the strategy. Participants were asked to construct networks on paper and therefore may have been better able to keep track of the key ideas since these ideas were concretely represented on paper. In other words, the actual writing down of the information may have served as useful "scratch pad" helping them to see the important ideas (Breuker, 1984). It may, however, have been more difficult to keep track of all the non-key ideas on paper as even this external "scratch pad" is limited. In fact, training in the construction of networks on paper included informing students that they should be selective about what they put down on paper.

In other words, students were instructed to emphasize central ideas and include a few non-key ideas if they felt that these would help them to better remember the key ideas. Too many non-key ideas would clutter their networks and they would lose the key ideas along with the overall meaning of the passage.

The fact that control participants declined in their recall of both key and non-key ideas suggests that permitting students to put their thoughts on paper was not sufficient to assist them with comprehension and recall. This may have been due to the fact that they could not master the information without training and practice in a particular organization of information and way of thinking about text. In other words, the task of writing ideas in the form of a network without training in actively thinking and puzzling over the ideas may have interfered with comprehension.

It had also been expected that those who were trained in the networking strategy would be able to generalize the strategy and thus to comprehend and to recall both passages which were similar to the ones used for training and those which were less so. The lack of a significant

difference between the trained and transfer passages revealed that experimental participants were able to transfer their learning of the strategy to child abuse passages for both key and non-key ideas. Because participants were constructing networks on paper, it may have been easier to keep track of the secondary ideas in both passages: those similar in content to the training passages and those which were dissimilar. These results suggest that experimental participants had learned to use the networking strategy as a means of thinking about ideas regardless of the text that was read rather than as a skill to be used in a rigid manner. In other words, experimental participants had learned to make strategic use of the strategy (Paris, Wasik, & Turner, 1991).

The third question concerned only the experimental participants. It sought to contrast, the effects of networking 'not on paper' versus networking 'on paper' on recall and comprehension. It was expected that participants would perform equally well in either application of the networking strategy and that performance would be generalized from one passage to another.

Comprehension as measured by the multiple-choice test and the recall of key ideas was not dependent on the way in which networking was used (on paper or not), nor did it depend on which passage was read. This indicates that students may have internalized the strategy well enough that they did not need to rely on external support to help them recall key ideas. As indicated by the results of the key ideas and multiple-choice task, they could now bypass the stage of writing information down and still benefit from the networking strategy. The fact that students could derive comprehension benefits by using either modality of networking suggests that they perceived the networking strategy as a versatile tool to be used for understanding rather than, as simply a tool for creating nodes and links which were to be drawn on paper.

In contrast, recall of non-key ideas was significantly influenced by both the modality in which networking was used and by the passage read. Students recalled significantly more details from the disease passage when they were instructed to 'not take the time to construct a network on paper' than when they did construct a network on paper. This impact of condition was not evident for the recall of non-key ideas for the child

abuse passage. In other words, experimental subjects' recall of non-key ideas from the child abuse passage did not differ significantly between the two networking conditions. This finding is discussed in more detail below.

The fourth question concerned the effects of the networking strategy on comprehension monitoring. It was expected that the networking strategy would improve the comprehension monitoring (detection and correction of error) skills of those who received networking training as opposed to those who did not. The results showed an unexpected Group by Order interaction for the detection data. This means that the order in which passages were presented to students affected the groups' abilities to detect inconsistencies in the text. In this case, control students detected more inconsistencies when they were presented with the order anemia-meningitis/hemophilia-leukemia, whereas experimental participants detected more inconsistencies when they were given texts in the order hemophilia-leukemia/anemia-meningitis. This order effect may have arisen because the control participants were exposed to more information about meningitis than were the experimental participants. A

local outbreak of meningitis occurred during the testing of the control participants. This outbreak was frequently the subject of media reporting at the time. This may have facilitated the control groups' reading of subsequent passages even though the passages discussed different diseases, hemophilia and leukemia. However, the experimental participants may have felt that the hemophilia and leukemia passages were more difficult to understand and thus read the passages more carefully.

The results also showed that Time had a significant effect. In other words, regardless of the experimental condition, participants detected and corrected more text anomalies at the posttest than at the pretest. This is in line with other findings that comprehension monitoring skills are not only a function of the strategy used but also of factors such as knowledge of the particular content domain. In other words, if students know more about the topic in question or about related topics, they are better able to correct textual errors (Brown, Bransford, Ferrera, & Campione, 1983). As students progressed through the semester they may have learned more about these topics (anemia, meningitis, hemophilia, and leukemia) both

directly from the classroom teacher's instruction in these topics or related topics and from other sources such as television and newspaper articles.

Networking did not significantly improve students' comprehension monitoring skills (either detection or correction), although the means were in the predicted direction. The fact that these results did not reach statistical significance may be attributable to the fact that experimental participants had not been explicitly instructed to construct a network of the text they were to correct. If they had they been instructed to do so, they may have been better able to detect and to correct errors. It was assumed that students would use the strategy spontaneously. However, past studies have shown that participants are unlikely to be self-motivated and to use the strategy without explicit instruction to do so, especially in new situations (Paris & Oka, 1986; Paris, Wasik, & Turner, 1991).

Although it cannot be proven, students may have constructed networks in their "heads" to detect and correct errors in the text. However, this application of the networking strategy may not have been powerful enough to detect errors. It may be that when the goal is to

assess one's understanding, students should construct networks on paper so that errors could become more visible and therefore detected and revised.

CONCLUSIONS

This study has helped to identify what network training and networking can and cannot do. Training students to network is principally useful for recalling key ideas whether students network on paper or not. When students were not trained to network, there was no significant improvement in comprehension. Indeed, sometimes their performance declined (i.e., when recalling non-key ideas). Therefore, adequate training in the networking strategy and networking appear to enhance comprehension. Moreover, when recalling key ideas it does not seem to matter whether these networks are constructed on paper or not.

This study also tells us something about why networks improved comprehension. Networks improved comprehension because network training and networks assisted learners in constructing meaning by requiring them to relate ideas and to actively wrestle with the

information by integrating new ideas with old ideas to make sense of the information. For example, during training in the use of the networks, students were taught to write information in the nodes that reflected their understanding of the concepts rather than simply repeating the information in the text. They were told not to write down ideas that they did not understand but rather to seek explanations and clarifications and to think back to other ideas and experiences that would help them make sense of the information. Students were taught to elaborate (flesh out, expand, and revise) ideas by asking themselves questions such as 'What other examples, causes, evidences do I know that will help me to understand this idea?' and 'Are these ideas consistent with what I already know?' Similarly, in linking concepts together they were encouraged to use their own relationship terms and to use the list of relationships provided to them as a guide. Furthermore, during training in the networking strategy students were also informed that individuals differ in the way they organize information and therefore there is no one "correct" organization. In other words, students were encouraged to construct their own organizations provided that they could make sense of them and

explain them to others.

Indeed, a preliminary examination of networks produced by experimental participants has proven to be interesting. Some experimental participants started from a situation where information in the text was simply extracted and put into nodes with neither linking nor an exact description of the nature of the relationship. They moved onto a position where information from the text was paraphrased and summarized and ideas were specifically linked, some even using their own relationship terms.

This study also tells us the networking strategy can be used both on paper and not on paper and still contribute to improved comprehension of text. The construction of networks on paper is not necessary for comprehension to occur. These results highlight the importance of students having a strategy which they can use effectively and efficiently to learn a given domain. In particular, students benefit from recognizing that there are certain relationships (symptoms, causes, examples, types) needed to understand the domain. Thus, the focus becomes more on the relationship between ideas rather than the individual words, sentences, or

paragraphs. By initially constructing the networks on paper, learners may be internalizing a set of relationships specific to the domain which can then be used whenever they work with a topic within that domain, once a particular topic is recognized as being of the same domain. This set of domain specific relationships can then be used by the student to facilitate the mental construction of subsequent networks for other topics in the same domain making the necessary adjustments to the relationships in light of the differences encountered with the new topic. This implies that learners can be efficient constructors of meaning, not having to construct networks from "scratch" when the differences between the topics are minor. This also means, however, that learners do not use the strategy in a routine manner as they would a skill. Rather, learners use the information from previously constructed networks modifying the application of the strategy. This results in a more efficient use of the strategy (Duffy, 1993).

Students may be more likely to use a strategy that is effective as well as efficient. In other words, students may be more willing to construct networks 'not on paper', if they are able to understand and construct

meaning as well as they would had they devoted considerable time writing and revising networks on paper. Students can derive maximum benefits for a low cost in terms of time and effort. Moreover, students may be further encouraged to use the strategy if they are shown that networks whether on paper or not, may not need to be constructed for each new subject but rather that topics within a domain share certain common relationships. They must think about and devote more effort to relationships which are new or different.

Networking might help to improve comprehension monitoring if students are explicitly taught to use it for this purpose. As the reader may recall, networks did not significantly improve students' comprehension monitoring (detection and correction), although the results were in the predicted direction. As mentioned earlier, constructing meaning may at times require that ideas are evaluated and revised. The literature has shown that even college students have a difficult time monitoring their comprehension as they fail to engage in these activities spontaneously. However, networking may have failed to have a substantial impact on students' comprehension monitoring skill because they were not

explicitly taught to use the strategy for the development of this skill.

If networking is to be used, proper training should first be provided. Students who did not receive appropriate training and then were instructed to use the strategy declined in their recall of non-key ideas. In addition, although their recall of key ideas did not decline, it did not improve. The literature on strategy training indicates that for learners to use a strategy and generalize its use, the strategy must be modelled such that learners are informed and shown when to use the strategy, how to use it, and why it is appropriate (Paris, Lipson, & Wixson, 1983). In addition, students must be given opportunities to practice using the strategy. They need feedback to use the strategy correctly.

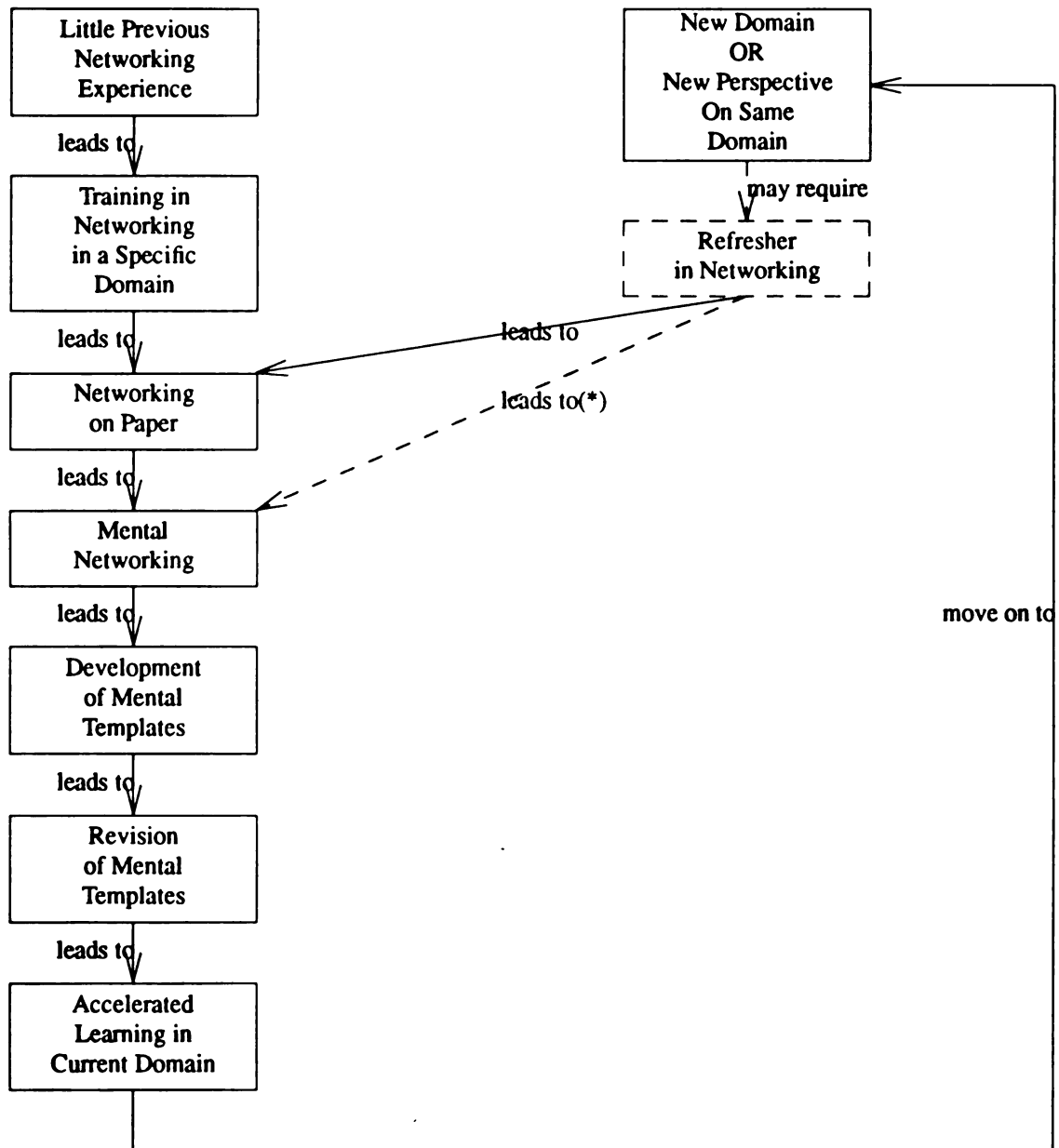
This study has also shed some light on the process by which an individual develops the ability to network and the types of networks generated. One can initially conceive of the learner as having little or no knowledge of the networking strategy much like the control participants in this study. If they were to use the strategy without receiving training, their performance would be no better than if they had not used the networking strategy and may in some cases be worse.

Training in the networking strategy provides learners with opportunities to learn how to think about ideas and their interrelationships. Once learners internalize the strategy, they need no longer construct networks on paper but are now able to think about the text in terms of a set of ideas, their relationships, grouping, and organization. This use of networks helps learners recall key ideas and non-key ideas and may eventually improve performance on multiple-choice tests.

Learners may subsequently decide to construct networks on paper when dealing with new content domains or if there are too many ideas to keep track of. Learners may eventually opt to use a mental template approach in which they mentally superimpose existing templates on content to be learned. This is different from mentally constructing the networks which implies a more deliberate and conscious processing of the information. When learners use these mental templates they are extracting information from the text to fill in the nodes of the templates (networks), the relationships and organization of the network are already fairly well established.

The use of the blank mental template would be useful to the learner if the topic to be learned was recognized as being similar to an earlier topic and the learner's goal was simply add to existing knowledge. In this case, the learner would not be faced with learning many new relationships and ideas and therefore would not need to create a new network from scratch. In fact, creating a new network when not needed may result in inefficient use of learners' time and effort.

If, on the other hand, the goal was to move to a new topic that was different from the previous one or if the task required viewing ideas on a previous topic from a different perspective, a template approach would not be appropriate. The learner would need to either construct the network on paper or mentally, as they would need to wrestle with ideas, modify, and integrate them. Thus, in moving to a new domain, learners may iterate anew through the process of constructing networks on paper, then mentally, and then of refining the domain-specific relationships into a new blank mental template. This process is illustrated in Figure 17.

Figure 17. Development of Content Learning through Networking

* Alternate path if the new domain or perspective is sufficiently close to the previous one.

IMPLICATIONS

The process described in Figure 17 has implications for the way in which we think about and use strategies. The process in Figure 17 illustrates that the learner's use of a cognitive strategy such as networking is not static, but undergoes continuous change with use. This change progresses through the construction of networks on paper, then not on paper (mentally) and then to the development and refinement of a mental template. The results of this study suggest that researchers and teachers need not only be concerned with instructing students "how to" use a strategy, but also how to continually develop and refine its use. Paris, Lipson, and Wixson (1983) refer to strategies as being "skills under consideration".

In other words, strategies are conscious, deliberate, and open to inspection; they can be evaluated for their utility and appropriateness. Students need to learn to ask themselves questions such as 'Why is the strategy useful?', 'When is it useful?', 'In what form is it useful?' and 'Can I be more efficient?'. Understanding how strategy use undergoes change with practice and increased knowledge may help us to know how

to promote maintenance and generalization of the strategy. These are important as students often relinquish a strategy and have a difficulty using it spontaneously when moving to new domains and tasks.

The dynamic view of strategy use espoused here also allows consideration of motivation to learn and efficiency of learning. Students may modify the strategy with practice so that they are more likely to use it. Students may come to see that the networking strategy shares similarities with other strategies, but that there are also differences. As the students understand the nature of the strategy and why and when to use it, their use of the strategy is likely to become more efficient. It may be that those who fail to maintain and to generalize the strategy are those who use the strategy in a static manner: as a procedure, a behavioural set of instructions rather than as an opportunity to transform it into a meaningful strategy that works for them.

In constructivist terms, those who use the strategy in a static manner are failing to link it with what they already know about strategies and failing to recognize its similarities to and differences from other strategies. They may also fail to recognize the conditions under which the

networking strategy is appropriate. Instead, they may perceive it as another tool in isolation to be used in an unmodified manner and only when instructed to do so. For these learners, the strategy is perceived as being under the control and responsibility of someone else, not themselves. Consequently, these learners may benefit from attribution retraining techniques where they are taught to assign responsibility for their own thoughts and efforts rather than to someone's efforts (Dole, Duffy, Roehler, & Pearson, 1991).

Interestingly, in this study, students who continued to use the strategy even after the study was completed reported that they were constructing networks on paper to organize their thoughts in preparation for a writing assignment or to help them summarize ideas in their courses. These students also said that they preferred to construct networks "in their heads" whenever possible as it was more efficient that way. Another group of students said that they no longer used the strategy as it took too much time. These students equated networking with writing the networks down on paper rather than as a versatile thinking tool.

Areas for further research include the collection of process data to determine whether learners of this strategy do in fact proceed in the manner illustrated in Figure 17. Further investigation in this area might focus on answering the following questions: 'How do learners use and think about networking as they become more expert with the strategy and with their understanding of the content? Do the networks of a "mature" networker with a solid understanding of the content resemble the networks of the expert in the domain? What cognitive and motivational processes do students who construct networks 'not on paper' and on paper engage in? Are there differences in these processes and what can these differences be attributed to?'

Additional data which has been collected as part of this study but not yet analyzed can also help us to better understand the relationship between networks and comprehension. Continuing analysis will address the question of whether richer, better organized, and more complex networks enhance recall and understanding of the topic than networks which are not as well-organized, rich or complex?

Networks might also provide information as to whether students have processed information at a surface level or at a deep level. For example, learners with a surface understanding of the information might represent information in the nodes as copies of the information in the text revealing that they have not attempted to wrestle with the ideas and to construct a meaning that is of use to them. Furthermore, concepts may be linked but the exact nature of the relationship may not be described. Therefore, a next step is to examine networks for the degree of integration and change that students engage in.

Although this study focused on the student, there are also important implications for classroom teachers. Feedback from the classroom teacher who participated in this study indicated that when she used this strategy, she thought about the content differently than she had previously. Each revision of a network sparked new insights into the domain. The teacher reported that constructing networks of the information revealed her own misconceptions and knowledge gaps. This implies that the teacher felt uncomfortable enough that she was motivated to resolve her misconceptions and knowledge gaps. Posner,

Strike, Hewson, Gertzog (1982) contend that being aware that there is a shortcoming in one's understanding and being dissatisfied with this state are conditions which are necessary for conceptual change to occur. Teachers' willingness to change their thinking about content and the way in which it is taught provides a good model for students who are expected to think about ideas and to know how to apply them rather than simply to memorize a set of discrete facts.

This teacher's focus shifted to covering fewer topics well and deeply rather than covering many topics at a surface level. This meant that she took more time to answer student questions, challenged their own understanding, asked them to relate ideas, and drew on their prior knowledge. The focus shifted away from imparting knowledge to helping students think critically and relationally.

Changes in teachers' thinking about content and instructional strategies contribute to improvements in curriculum and assessment. During this study, it was difficult to develop questions tapping inferential thinking about the domain. Indeed, the development of such measures requires considerable time and content area expertise. At the conclusion

of the study, the classroom teacher observed that after having devoted a semester to the use of the networking strategy, she was now better able to design test questions and to become more selective about the textbook she used in her classroom. This suggests that teachers and researchers need practice using strategies themselves before imparting them to students. Educational institutions should provide both teachers and researchers the needed support that will enable them to study such beneficial learning and teaching strategies.

Change, even that brought about by a learning or teaching strategy such as networking, will occur gradually. Indeed, the classroom teacher in this study noted that while she had the opportunity to invest the extra time required to use the networking strategy and did so, many students and teachers may have neither the time nor the willingness to pursue such an exploration of ideas. In this study, classroom time was limited and students did not have the opportunity to go through several iterations of a network on every topic they were required to learn during class time. After having trained students in the networking strategy, teachers can encourage their students to construct networks as homework assignments.

In this way, students can begin the process leading through the mental construction of networks to the refinement of blank mental templates. In turn, when appropriate students will eventually fill these templates in with specific conceptual and relational knowledge more expeditiously. At other times, they will need to work with the information adding to it and modifying it. This approach creates the opportunity for students to think about ideas and to apply these ideas to new situations. Such opportunities are important if college students are to be successful in their studies and in meeting the higher-level task demands of the workplace (Perkins, 1991).

LIMITATIONS OF THE STUDY

One important weakness of this study is that no process data were collected. This makes it difficult to determine whether students did in fact network "in their heads" when they were instructed to 'not take the time to network on paper'. However, interview data were collected and students reported thinking about relationships between ideas and trying to categorize, organize, and revise them. As with other self-report

measures, it is difficult to know whether students did indeed do the activities they claimed to do. Students were not asked to "network mentally" because it would have been impossible to establish either whether students actually did create networks mentally or the form these networks might have taken. This would have required the collection of process data like think-alouds. In this case, the collection of think-alouds would have been intrusive and disrupted the classroom environment.

In subsequent studies, process data in the form of a sub-sample of think-alouds should be collected to determine what underlying cognitive processes are used as students construct their networks. The collection of process data may also reveal which aspects of the strategy students find easier or more difficult to internalize. This information can then be used to develop better training methods. Moreover, process data can be expected to help pinpoint whether students actually monitor their comprehension.

A mismatch between the training task and the assessment task used for comprehension monitoring may explain the nonsignificant findings for this variable. During training students were given networks that

contained flaws or missing information. Students were required to correct flaws and/or fill in the missing information based on their knowledge of the topic and what is in the text. However, during the assessment they were given texts that contained inconsistencies and they were required to find and correct them. Thus, students were not trained to use networks to evaluate and monitor their understanding of text. It is not surprising then, that they did not show improvements on the comprehension monitoring task. Therefore, future studies in this area should consider explicitly teaching students how to use networks to evaluate their comprehension of text.

Training in the use of networks as comprehension monitoring tools may also have been too brief. Students were given approximately one hour of training in using the strategy for comprehension monitoring. As mentioned earlier, even college students have a difficult time monitoring their comprehension and therefore need appropriate instruction to assist them to do so. Unfortunately, because time was limited, it was difficult to provide students with the time they needed to use networking for comprehension monitoring.

Another limitation of the study was that the teacher taught the experimental class during the first semester and then the control class during the second semester. When teaching the control class, the teacher was instructed to conduct her class as usual (i.e., as she would have before becoming involved in the study) and not to construct networks.

It is possible, however, that the teacher could have been constructing networks of ideas "in her head" and therefore implicitly taught the course by linking ideas, organizing them in some hierarchical manner starting with the central concepts first to progressively more specific concepts. Thus, there may have been some degree of contamination of the control condition by virtue of having it follow the treatment condition. In fact, on one occasion, despite the teacher's repeated attempts to explain certain immunology concepts to control participants, and having them work in groups so that they could help each other learn, students were still confused. In desperation, but with relative ease, the teacher drew a network of the ideas on the board for the students in order to help them see where they were having difficulty. Because of her facility with the strategy, it is possible that the teacher was covertly using networking

with this class. This might help to explain why control participant's recalls of key ideas were not significantly diminished.

This scenario also illustrates the dilemma that teachers involved in classroom research face. On the one hand, the teacher recognized that a study was taking place and therefore it was important for her to maintain her objectivity. On the other hand, as described by Wong (1993), the teacher did not stop being a teacher just because she was participating in a study. In fact, her first responsibility was to being just that, a teacher and all that it implies. Consequently, she used the experimental technique which had been successful in the past in teaching this content. According to Wong (1993), by behaving like a researcher, the teacher's role was being comprised. It was not until the teacher made a decision to use the strategy with the control class that she regained control of the "teacher" role.

Both teacher and investigator were novices at implementing the strategy in a classroom situation. At times this caused problems such as underestimating the time it would take students to learn to use networking for various purposes such as monitoring their comprehension.

Therefore, it is recommended that one semester be used to pilot test the strategy in the classroom. This way both teacher and investigator have the freedom to explore the strategy and make it their own without having to be too concerned about data collection.

Lack of random assignment of students to classes was another problem experienced in this study. This meant that students in the control class were at an advantage in that they had a half year of college instruction more than the experimental participants. In addition, the control participants had better writing and English language skills than did their experimental counterparts. Despite these advantages, experimental participants outperformed those in the control group. However, the differences that did appear may have been on the underestimated. Had both groups started out comparably, there may have been more significant differences between the two groups.

SUMMARY

In this study, learners were viewed as actively constructing their own understanding of ideas presented in science texts. In instruction in

networking strategy was examined and it was found to be useful for linking and constructing ideas. Networks may also be useful tools for drawing inferences from a text and for monitoring comprehension. Learning benefits can be attained with the networking strategy which would be unavailable without it. This study also explored the development of learners' abilities to create and to use networks. Research should now carefully examine the developmental process suggested here so that the most effective training can be implemented while our understanding of the networking strategy is improved. Networking also seemed to have helped the teacher in this study to improve her thinking in the domain as well as her instruction by seeing her role more as one where students are assisted in constructing meaning. It is expected that such conceptual changes within the teacher will be reflected in improved students' learning in this domain as well as in others.

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**CONNECTING IDEAS, CONSTRUCTING MEANING,
AND MONITORING PERFORMANCE:
NETWORKING IN COLLEGE CLASSROOMS**

Volume II

By

Christina De Simone

**A DISSERTATION
Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of**

DOCTOR OF PHILOSOPHY

College of Education

**Department of Educational Psychology,
Counselling, and Special Education**

1993

APPENDIX A

APPENDIX A

NETWORKING STRATEGY TRAINING MANUAL

Lessons & Materials for Networking Strategy Training

Experimental participants were given training in the network strategy. This training consisted of approximately 10 hours of class time spread across several weeks and was integral to the course. Students networked only certain topics in the content area. This was because not all topics were amenable to networking and there was limited amount of time to train students. Throughout this period, the teacher and the researcher worked collaboratively in training students to network. This manual gives a detailed description of the network strategy training. Included at the outset of this manual is a chart of the lessons outlining major topics for each training session, how these sessions were conducted (format), and time allotted for each lesson.

TABLE 2. Training Sessions Chart

Training Schedule			
Day	Total Time	Session Topics	Session Format
1	40-45 mins.	Students talk about their own learning strategies and are introduced to the Networking Strategy.	- whole-group discussion (10 mins.); - lecture (15 mins.); - practice (15-20 mins.)
2	50-60 mins.	Introduction to Relationships.	- lecture (20-25 mins.); - practice and feedback (30 mins.);
3	80 mins.	Students share their experiences about Networking with others and learn to link their prior knowledge with new knowledge.	- Completion of day 2's networks (10 mins.); - small group discussion (15/20 mins.); - whole-group discussion (20 mins.); - lecture (30 mins.)
4	110 mins.	Students observe demonstration of networking and practice.	- modelling (40 mins.); - practice/feedback (60 mins.).

Training Schedule (Cont'd)			
Day	Total Time	Session Topics	Session Format
5	40-60 mins.	Continuation of Day 4	- modelling & practice (40-60);
6	40 mins.	Students evaluate accuracy of information and structure of network	- practice and feedback (20 mins.) - instruction (20 mins.)
7	75 mins.	Students learn to construct networks efficiently by learning to construct them mentally	- demonstration of the strategy (20/25 mins.) - practice session (45/50 mins.)
8 and 9	120 mins.	Students learn to use networking on longer sections of text.	- small groupwork (15-20 mins.) - instruction and feedback (100 mins.)

Lesson -Day 1 of Training- Total Time: 40-45 minutes

Students talk about their own learning strategies and are introduced to the Networking Strategy.

Major Activities. The first day of training consisted of the following three major activities: a 10 minute discussion of students own study and comprehension methods; an approximately 15 minute introduction to the concept of networking with a concrete example; and an opportunity for students to construct a network for which approximately 20 minutes were devoted to this activity. In this lesson, students focused on selecting the key ideas and arranging them on paper. In the next session, they were introduced to the relationships.

Objectives. The major objective of this first session was to find out which study methods students were familiar with so as to encourage them to use their own strategies in learning the new strategy, networking. For example, students who typically read text by highlighting material were encouraged to use their highlighter to highlight key information in the passage. Moreover, it was important to have students work with the new

strategy as soon as possible so as to make the strategy concrete for students and making it possible for them to become aware of the differences between this new strategy and their own methods.

Procedures. The presentation started by asking students to describe the methods they use to understand information. For example, 'Do you ever draw pictures or diagrams when reading?' 'If not, what methods do you use?' 'How do these methods work for you?' Following this discussion, students were introduced to the basic parts of a network and were shown a completed network on an overhead. (See network on 'Mouth Infections' at the end of this lesson.)

More specifically, students were told that:

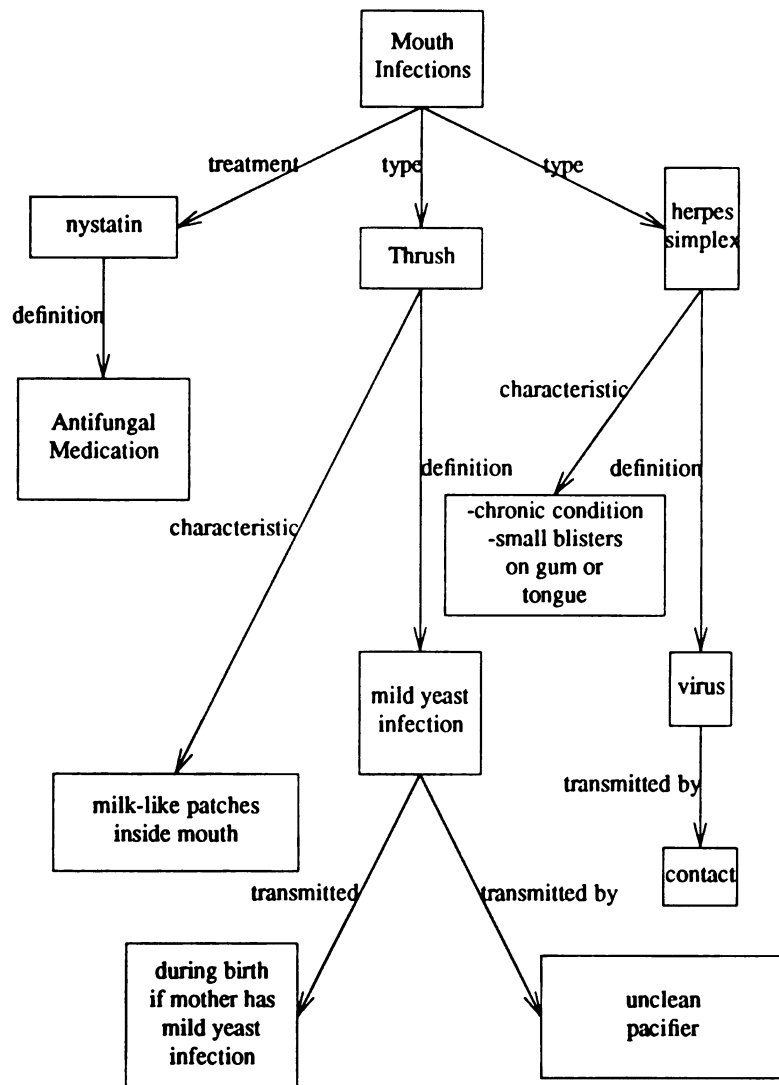
1. Networks are comprised of nodes which usually come in the shapes of boxes or ovals, lines which link the nodes, and arrowheads which tell the direction of the relationship between the nodes. In general, networks have a hierarchical appearance.
2. While pointing to the nodes, the investigator said that: The contents of the nodes contain relatively important or general ideas (as

represented by the top-most node), less important ideas (as represented by the next level of nodes), and further down the network are quite specific ideas.

3. Then pointing to the lines, students were informed about the importance of relationships. More specifically, the investigator said that: Relationships connect ideas and thus help to organize information and facilitate understanding.

Following this brief introduction, students were asked to read a section entitled the 'Causes of AIDS' (this section is presented at the end of this lesson). Here students were instructed to focus on abstracting the important information, listing these on a sheet of paper, and then arranging them on paper. At this point, they were instructed to not concern themselves with the relationships aspect of this process. To facilitate arranging of the concepts, post-it notes were distributed to students. ⁽²⁾

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2. While students are constructing their networks, the trainer should see if students are having difficulties abstracting important ideas from less important ones. If so, the trainer may need to give them some training on what constitutes an important idea with a less important idea from a less important idea. A handout like the one enclosed on Day 4 of this manual may serve as a starting point. Given the conditions in this study, this training this training was provided on day 4. Note that this handout may be used at any time during the training and it is not necessarily restricted to any one session. Moreover, not every one will need this aspect of the training.

Figure 18. Network on Mouth Infections

Lesson - Day 2 of Training - Total Time: 50-60 minutes*Informing Students of Relationships and Practice Session.*

Major Activities. The second day of training consisted of the following activities: an introductory session on relationships of which 15 to 20 minutes were devoted to this exercise and a half hour practice session where students practiced linking concepts extracted during first lesson. During the practice sessions students were also provided with feedback.

Objectives. To acquaint the student with the idea of relationships between concepts and having them apply relationships to concepts.

Procedures. To accomplish the activities and goals stated above, a booklet describing the relationships was given to students (see booklet of relationships at the end of this lesson). Prior to having students use the information in this booklet, both the classroom teacher and the investigator read and explained the information in the booklet to the students. The purpose of this booklet of relationships was to provide students with some guidance on the relationship terms typically found in

their Health Science text. This list was by no means exhaustive and students were allowed to use their own relationship labels provided that they accurately described the link between the concepts.

RELATIONSHIPS FOR NETWORKING

In this booklet you will find:

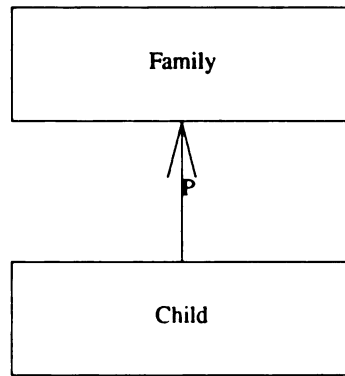
- A. Description of Relationships**
- B. Summary of Relationships**
- C. Common abbreviations**

The following list describes many of the relationships-concepts that you will be coming across as you work on your Health/Hygiene material. As you read on, you will see that there are three major categories of relationships: Hierarchies; Chains; and Clusters. Each of these major categories are subdivided into more specific relationships, e.g., part, type; leads to, analogy; and characteristic, evidence. These relationships are, in turn, subdivided into other yet more specific relationships.

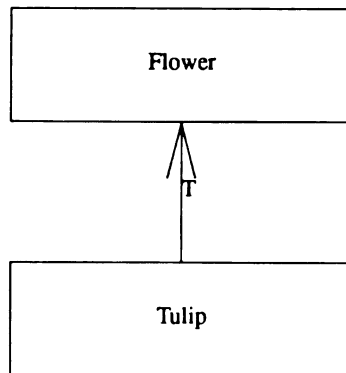
- A. Hierarchies: We use this relationship when the information presented lower down in a box or circle can be connected to the information in a box or circle presented higher up in the diagram.

There are two types of hierarchical relationships: 'part' and 'type'. Some of the key words used to identify 'part' relationships are "part of", "segment of", and "portion of".

An example of the 'part' relationship is contained in the sentence- A child is part of a family. Thus, the word "child" (represented in the lower circle or box) would be connected to the word "family" (represented in a higher node).



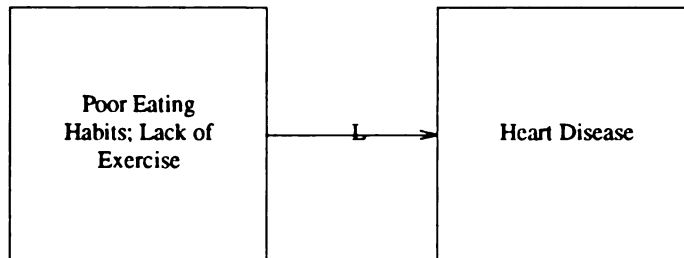
Some of the key words used to identify a 'type' relationship are "type of", "category of", "example of", "kind of". An example of the 'type' relationship is illustrated in the sentence- "A tulip is a type of flower". Thus, the word "tulip" (represented in the lower node) would be connected to the word "flower" (represented in a higher node) by a 'type' relationship.



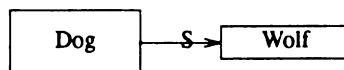
- B. **Chains:** We use this relationship when the idea presented in one box or circle is connected to the idea in another box or circle by either the 'leads to' or 'analogy' relationship.

Some of the key words used to identify the 'leads to' relationship are: "leads to", "results in", "causes", "is a tool of", "produces", and the like.

An example of a "leads to" relationship is in the statement-"Poor eating habits and lack of exercise lead to an increased risk of heart disease."



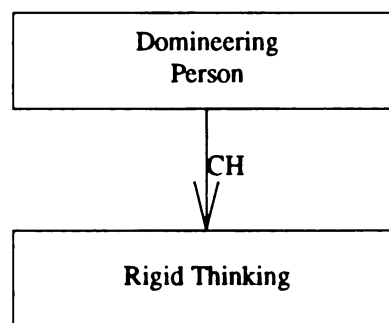
Some of the key words used to identify the "analogy" relationship are "similar to", "analogous to", "like", and "corresponds to". In the example, "a dog is similar to a wolf", the word "dog" would be connected to the word "wolf" by a 'like' or 'similar to' relationship.



- C. **Clusters:** We use this relationship to connect an idea in one circle or box to the ideas in another circle or box by the words 'characteristic' or 'evidence'.

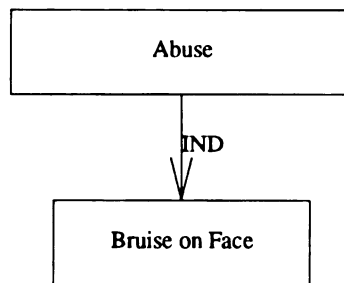
The key words used to identify the "characteristic" relationship are: "has", "characterized", "feature", "property", "trait", "aspect", "attribute".

An example of the 'characteristic' relationship is: "Rigid thinking is a personality trait of a domineering person." The term "rigid thinking" would be connected to the words "domineering person" by a 'characteristic' relationship.



The key words used to identify the "evidence" relationship are "indicates", "illustrates", "demonstrates", "supports", "documents", "proof of", "confirms", "evidence of".

An example of the "evidence" relationship is: "A bruise on the face may indicate abuse". The term "bruise on the face" would be connected to the term "abuse" by an 'indicates' relationship.



Although there are these major categories of relationships, there are others too which you will encounter as you are working with the information in this class. These include: victims, symptom, prevention, detection, diagnosis and treatment.

The following provides a description of these relationships:

1. Victims: refers to a person (adult or child) that is attacked, infected, or injured under various conditions. For example,

hemophilacs can be potential victims of the AIDS virus. Thus, the word "hemophilacs" would be connected to the word "AIDS" by the "victim" relationship.

2. Symptom: similar to the term "indicates". For example, a symptom of Lyme Disease is fatigue. Thus, the word "fatigue" would be connected to the terms "Lyme Disease" by the "indicates" relationship.
3. Prevention, Detection, Diagnosis, and Treatment or Remediation are part of managing an illness or injury. Sometimes these terms are placed on the lines or the network and at others they are placed in the box or circle. Examples of these types of relationship-concepts can be found in the networks on AIDS.

In addition to the relationships described above, you may also find or come across other important relationships.

The following are abbreviations of commonly used relationship terms:

- A. Part (p)**
- B. Type (t)**
- C. Leads (l)**
- D. Causes (c)**
- E. Similar (s)**
- F. Characteristic (ch)**
- G. Evidence (e)**
- H. Victims (v)**
- I. symptom (sy)**
- J. Prevention (pr)**
- K. Detection (de)**
- L. Diagnosis (di)**
- M. Treatment (tr)**

Lesson - Day 3 of Training - Total Time: 80 minutes

Students Shared their Experiences about Networking and Learn to Link Prior Knowledge to Text

Major Activities. During this lesson, students were expected to do the following. Students were given 10 minutes to complete their networks from the previous sessions. Share their networks with someone in the class checking for accuracy of the use of the strategy and the content information. Approximately 20 minutes was devoted to this activity. And, to think about and communicate to the rest of the class the advantages and disadvantages of the strategy. twenty minutes were devoted to this activity.

This discussion was supplemented with the investigator's and teacher's own knowledge of networking. Approximately 30 minutes was also devoted to having students look over a teacher-generated network of AIDS passage and discussion of content (see passage and network at the end of this lesson). At the end of the lesson, students submitted their networks to the teacher and the investigator for feedback.

Objectives. The major goal of this lesson was to have students actively reflect over their experience of having networked and its effects on their understanding of the content. By sharing their networks with others, students were encouraged to demonstrate their declarative (knowing what), procedural (knowing how), and conditional knowledge (knowing when) of the networking strategy. By submitting their networks and by being introduced to a teacher-generated network, students had the opportunity to receive feedback on their understanding of the content and their use of the strategy.

Procedures. Initially, students were asked to get together with 1 or 2 classmates to summarize the essential features of networks and to discuss the advantages and disadvantages of networking. As well, they were to discuss the content information on the AIDS passage. During this time, both the teacher and the investigator offered students their guidance in understanding the strategy and the content. This was followed by a summary session of the small groups' discussions. In addition, the investigator complemented this summary session with the following points:

- Networking is a means of organizing the information in the text.
- It is used mostly when the goal is to describe or explain information such as when the author wants to describe types of disease, causes of the disease, a procedure such as how the circulatory system works.
- It has been used in the applied and physical sciences as well as to help one understand narrative stories.
- The actual physical appearance of the network will vary somewhat from individual to individual. (To illustrate this point, the investigator pointed to different networks created by the students.) This was an important point to emphasize as students often become bogged down with the physical appearance of their networks rather than paying attention to the accuracy of the information represented by the network.
- The strategy is especially useful when one has a large section of the text to learn, although it can be used with smaller sections of text.
- It forces the student to think about the important concepts and relationships between the concept and thus it will require the user to

spend time doing it.

After this discussion, the teacher presented her own network of the AIDS passage on a large sheet of bristol board (see partial network and text enclosed). Here, the teacher focused on the content per se, bringing her **prior knowledge of the content area** and showing the links between her old and new knowledge. For example, the teacher asked herself questions such as 'What do I already know about this topic?', 'How are the ideas in the text related to what I know?', 'Is what I know a cause?', 'Where can I best link what I know to what's in the text?'

Acquired Immune Deficiency Syndrome (AIDS)³

Acquired immune deficiency syndrome (AIDS) is a recently identified disease in which the body's immune system is seriously impaired, resulting in a dangerous susceptibility to infectious organisms and cancerous cells that the normal immune system recognizes and destroys. There is no known cure for AIDS, and death from infection or cancer is believed inevitable. However, there do appear to be less severe variations of this disease, sometimes called AIDS-related complex (ARC), with manifestations that are less life-threatening. Whether all individuals with ARC will eventually develop AIDS remains to be seen. Since the first recorded case in 1981, AIDS has been found almost exclusively in certain populations, including homosexual and bisexual men, drug addicts sharing contaminated needles, hemophiliacs and others receiving blood products, and prostitutes. Children of mothers in these groups have also contracted AIDS during pregnancy or the birth process.

Until a vaccine to prevent the disease is available, the incidence of AIDS among both adults and children is likely to increase.

Cause

The apparent cause of AIDS is Human T-lymphotropic Virus Type III/lymphadenopathy-associated virus (HTLV-III/LAV), which brings about a generalized disturbance in the regulation and functioning of the body's immune system. Antibodies to this virus have been detected in the blood of all AIDS victims and in large percentage of people in the high-risk groups. In contrast, antibodies to HTLV-III/LAV are rarely found in the blood of groups with no known risks. Moreover, HTLV-III/LAV itself

3. Reprinted from *Infections in children: A sourcebook for educators and child care providers* Acquired Immune Deficiency Syndrome (AIDS) (pp. 139-143) by R.D. Andersen, J.F. Bale Jr., J.A. Blackman, J.R. Murph, 1986, Gaithersburg, Maryland: Aspen Publishers, Inc. © 1986. Copyright © 1986 by Aspen Publishers, Inc. Reprinted by permission.

has been cultured from the saliva, tears, blood, and semen of affected patients.

An infected individual may not develop symptoms for several years after the initial infection, yet the virus is harbored in the body and can potentially infect others. The modes of transmission are intimate sexual contact (multiple sexual partners increase the risk), shared contaminated needles, and transfusions of infected blood products. Infected mothers can transmit the agent to their offspring during pregnancy or during the birth process. Therefore, the offspring of women who have antibodies to HTLV-III/LAV, or whose sexual partners have antibodies to this virus, are at risk for the developing the disease.

A very important question for caretakers and parents alike is whether an affected child poses a risk to others in a foster home, day-care setting, or early intervention program. Before this question can be answered, much needs to be learned about how the disease is spread. However, it is unlikely that AIDS is transmitted through causal contact. Family contacts apparently do not contract the disease despite close living situations. Nor do health workers in hospitals caring for AIDS patients appear to be at significant risk of contracting the disease. It is probable that frequent, repeated exposure to the causative agent exchange of infected body fluids is necessary to contract the disease.

Experience with other infectious agents with apparently similar modes of transmission (e.g., hepatitis B and cytomegalovirus) suggests that simple hygienic measures, such as good hand washing after contact and proper disposal of diapers, significantly reduces, and may even eliminate, the risk of infection.

Signs and Symptoms

HTLV-III/LAV produces a spectrum of illness, ranging from few or no symptoms to the fatal form of the disease, called AIDS. How severely a person is affected may depend on personal and environmental factors.

All of the signs and symptoms of AIDS result, directly or indirectly, from injury to the immune system. In the adult, these may include

profound fatigue, persistent fevers, diminished appetite, weight loss, enlarged lymph nodes, dry cough, persistent diarrhea, thrush (a whitish-colored yeast infection of the mouth), a tendency to bruise easily, and purplish or discolored growths on or beneath the skin or mucous membranes of the mouth, anus, nasal passages, or under the eyelids.

The symptoms are somewhat more variable and nonspecific in children. The most common features are failure to thrive, developmental delay, enlarged liver and spleen, chronic diarrhea, upper respiratory infections, ear infections, thrush, and recurrent pneumonias. Children with AIDS are also prone to serious, life-threatening bacterial infections, such as meningitis, pneumonia, and infection of the blood(sepsis).

The first sign of AIDS in the adult is typically a fever that may last weeks or months, followed by the onset of rather unusual infections or malignancies. One such infection is a pneumonia caused by *Pneumocystis carinii*, a protozoan organism that usually affects persons whose defense mechanisms are compromised by severe malnutrition or chemotherapy for cancer. A malignancy often seen in adults with AIDS is a rare, lethal cancer called Kaposi's sarcoma, manifested by the discolored growths described above.

Diagnosis

AIDS is diagnosed primarily on the clinical signs and symptoms of the disease, but laboratory test results can strengthen the diagnosis. The first test for persons who manifest symptoms of AIDS-and for those who have been exposed to the virus or who belong to a high-risk group is for specific antibodies in the blood. In response to infectious organisms, certain blood cells called lymphocytes produce antibodies that attach to the invaders, enabling other cells to capture and destroy them. When exposed to HTLV-III/LAV, lymphocytes produce antibodies specifically directed toward this virus. These antibodies can be detected by a simple, inexpensive blood test. This is not a test for AIDS, but for antibodies to the virus that apparently causes AIDS.

Tests for antibodies to HTLV-III/LAV are usually accurate. However, they may yield positive results even when there are no antibodies present,

and, conversely, the results may be negative despite the presence of antibodies.

Another, more specific test for AIDS involves culturing HTLV-III/LAVE itself from body fluids, such as blood, saliva, and semen.

Tests of the various components of the immune system can also aid in diagnosis. The physician can look for abnormalities of the immune system that are more typical of AIDS than of other immunological disorders.

Diagnosis can be more difficult in children than in adults. This is because certain common viral infections can temporarily suppress the immune system, mimicking AIDS. Also, a number of congenital hereditary immune deficiency syndromes have features in common with AIDS. Association with a high-risk group would suggest AIDS.

Management

The most desirable approach to managing this disease is, of course, prevention. There is no evidence that AIDS can be spread by casual contact. Cautions are in order, however, for individuals with multiple sexual contacts, especially among homosexual populations, and for drug addicts who may use contaminated needles. The risks to recipients of blood transfusions-including hemophiliacs, premature infants, and accident victims-should decrease as antibody screening tests are routinely used on banked blood. As for children who acquire AIDS from the mother during pregnancy and the birth process, prevention will be possible only if the disease is controlled in the adult population.

Intense research is being conducted on agents that may augment the immune system or interrupt virus replication. Therefore, treatment strategies are likely to change.

Apart from preventative measures, current management procedures are basically limited to early detection and treatment of complications. Therefore, children with AIDS or any immune deficiency should be carefully observed for signs of infection. When infections do occur, antimicrobial treatment must begin immediately.

Every effort should be made to keep children with AIDS alive and as healthy as possible, especially since breakthroughs in treatment could occur at any time. These children grow poorly due to chronic diarrhea, so it is important to encourage adequate caloric and nutrient intake. Also, poor nutrition can further compromise the immune system. Sometimes children with AIDS must receive their nutritional needs directly through the veins (intravenous alimentation). Unfortunately, this procedure can provide a direct route for other infectious organisms to enter the body.

Management for AIDS also includes dietary supplements to insure the high number of calories and nutrients necessary for a child with chronic illness. Along with medical and nutritional care, children with AIDS need opportunities for socialization and developmental stimulation.

Complications

In both children and adults with AIDS, the complications result from the body's inability to mount an appropriate immune response to foreign substances. All age groups are susceptible to unusual infections, such as the pneumonia caused by the protozoan agent *Pneumocystis carinii* and oral yeast infections (thrush or candidiasis). Because infants have not had a chance to develop antibodies to common bacteria, they are prone to serious bacteriological infections as well. Infants have also been reported to contract cancer, although malignancies are more common among adults.

The final consequence of AIDS appears to be death from infection or cancer. In the meantime, children suffer from poor growth, recurrent infections, diarrhea, and the social stigma that accompanies the disease.

Recommendations

Children with AIDS should be provided with as normal an environment as possible, including opportunities for social, emotional, and developmental nurturing.

School or day-care settings may increase the affected child's exposure to infectious agents, against which the impaired immune system is not effective. Because children with AIDS are highly susceptible to infections, they should be kept away from others with illnesses. Any sign of illness (e.g., fever, irritability, changes in behavior) should be reported to a nurse or physician promptly.

For most infected school-aged children, the benefits of an unrestricted setting outweigh the risks of their acquiring potentially harmful infections. Moreover, there is apparently no risk of these children transmitting HTLV-III/LAV. Therefore, they should be allowed to attend school and after-school day-care.

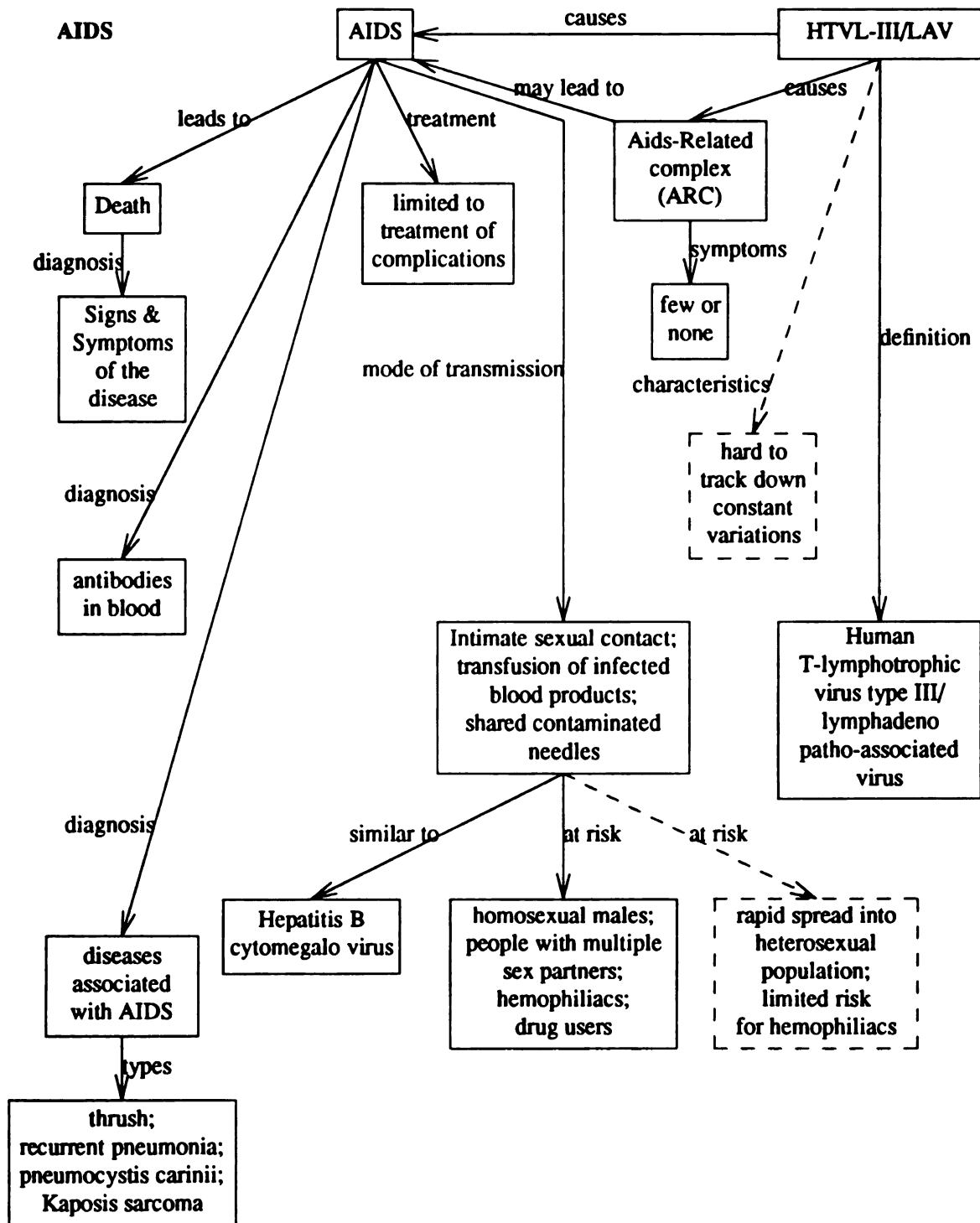
Until more is known about transmission of the virus in group care settings, HTLV-III/LAV-infected preschoolers or neurologically handicapped children of any age who bite or drool, who lack control over their body secretions, or who have uncoverable oozing lesions should be cared for and educated in settings that minimize exposure of other children to infected blood or body fluids.

Good hygienic practices are prudent in caring for children with AIDS. Care providers should wash their hands with soap after intimate contact, dispose of diapers and waste products properly, and disinfect toys and other objects that may have virus-containing saliva on them (use one part chloring bleach to ten parts water). As an additional barrier to possible but unlikely transmission, disposable gloves could be worn when handling infected children, especially if exposure to blood or body fluids is likely. While holding and cuddling infants and young children with AIDS appear to be safe practices, kissing in such a way that the child's saliva comes into contact with the caretaker's mouth poses a theoretical risk of transmission.

Good nutrition is very important. A dietician can help develop a plan for a child who may have a poor appetite yet needs more than the usual number of calories because of chronic illness. Supplements to the diet can provide a high number of calories and nutrients in relatively small quantities of food.

Since the child with AIDS is often from a deprived social situation, social workers and other support personnel should assist parents and caretakers with the complex and expensive medical management problems caused by this disease.

Knowledge about AIDS is expanding rapidly. Child care workers should consult the health department for the most up-to-date recommendations. A special hotline provides updates on AIDS from the Centres for Disease Control, Atlanta, Georgia. Phone 1-800-342-AIDS.

Figure 19. Network on AIDS

Lesson - Day 4 & 5 of Training- Day 4- Text Comprehension- Total time for Day 4: 110 minutes

Major Activities. Modeling the various aspects of networking (pre-networking, networking, and post-networking) was the focus of these two lessons.

Objectives. The objectives of these networking activities was to show students how to comprehend and monitor their comprehension of the text using the networking strategy.

Procedures. During this time students were expected not only to observe the models but were also encouraged to practice the steps. The materials used to train students was a small section on Food Poisoning from the Health/Infection chapter (see text on Food Poisoning and network at the end of this lesson) and students were given a hand-out which summarized the three aspects of networking (see handout at the end of this lesson).

Pre-Networking Activities: Becoming Familiar with Text.

The essence of these activities was to convey to students the mental processes involved in networking. The demonstration of this lesson was shared by the investigator and the classroom teacher.

1. The investigator informed students that the first step was to draw upon one's background knowledge about the topic area.

The teacher asked herself the question, 'What else do I already know about this topic?'

The investigator conveyed to the students that drawing upon one's prior knowledge is an activity which help the reader become familiar with the important ideas in the text as well as to help the reader to start to think of the new information in light of the old.

Immediately following this explanation, students were given the opportunity to do these this activities. ⁽⁴⁾

2. The investigator informed students that the second step was to read the passage.

The teacher asked herself the following questions 'What is the author saying?' 'What terms does the author use to convey the information?' and 'How are they being presented?' 'What are some of the important ideas?'

The investigator conveyed that the reason for doing this step was to help oneself in starting to think about the important information and possible relationships.

Students were encouraged to read the text and to jot down the important concepts and ideas.

4. Because of predicted time constraints, students had been asked to do this activity the day previous as a homework assignment.

Networking Activities

The goal of this lesson was to demonstrate the actual construction of the network which entailed laying out the key concepts, labeling the relationships, and arranging them spatially.

1. The investigator conveyed to students that after becoming familiar with the text, the next step (step 3) was to lay out the concepts.

The teacher laid out the concepts gathered before reading the text (prior knowledge) and those gathered during reading the text. The teacher drew a circle around these concepts.

The investigator mentioned that at this point the teacher was not too concerned about the exact arrangement of these concepts nor about the relationships. The focus rather was on thinking which ideas were important and which were less important and to get an initial picture of the arrangement of concepts.

The investigator invited students to lay out the concepts they had listed previously.

2. The trainer communicated to the class that the fourth step was to think about how the concepts were related to one another and to label the relationships. This included relating prior knowledge information and information gathered after reading the passage.

Here the teacher asked the questions 'How are the concepts I extracted from the text related to one another?' and 'How are these concepts related to what I already knew about the topic?'

The investigator informed students that thinking about how ideas are related would allow them to devote more time to the information and should facilitate understanding of the information. In addition, linking concepts both in terms of those found in the text and those stored in one's head would permit them to store the information in a connected manner which, in turn, should facilitate remembering.

Students were encouraged to think about how the concepts they extracted both in terms of those found in the text and those inside their heads were related. Here students were given a red pencil to

connect their prior knowledge concepts with those abstracted from the text.

3. In step 5, the investigator informed students that in order to give their networks a sense of direction, the arrows should be used.

The teacher wrote down the arrowheads and asked herself the question 'In what direction do I want people to read the information and 'What type of direction do I want to convey, e.g., one-way, two-way?'

The trainer invited students to use the arrowheads on their own networks.

Food Poisoning⁽⁵⁾

Food poisoning is not always a consequence of direct infection. It can be caused by food that has been standing at temperatures that allow bacteria to grow. These bacteria produce toxins that can cause severe illness and high fever, and it is wise not to eat food that has been standing in a warm place for more than six hours. Among foods that can give rise to severe infection are insufficiently cooked poultry, unwashed eggs, and occasionally prepared meats, such as sausage. Infections arising from contaminated food are caused by organisms called **salmonella** and are therefore known as **salmonellosis**.

The most lethal bacterial poison carried by food is that of the botulinum organism. These organisms grow in the absence of air-for instance, in improperly canned food, which is a common cause of **botulism**. Home-canned foods are the chief offenders. The earliest symptoms of botulism-weakness, dizziness, and nausea-occur about twenty-four hours after eating contaminated food. If the person consumes enough toxin, these early symptoms may give way to respiratory paralysis, which can lead to death. Sterilizing foods by cooking before canning kills the organism. The toxin itself is broken down by boiling the canned food for ten minutes.

5. *Core concepts in health, 5th edition*: Food poisoning (p. 469) by P.M. Insel and W.T. Roth. 1988, Mountain View, California: Mayfield Publishing Company. Copyright 1988 by Mayfield Publishing Company. Used by permission of the publisher.

Student Handout

PRE-NETWORKING ACTIVITIES

1. BEFORE READING TEXT

- a. 'What do I know about this topic?'

2. READ TEXT

- a. pay attention to keep terms
 - b. read for meaning
 - c. Ask yourself 'What is the author saying here?'
- Ask yourself 'How can I say it so that it makes sense even to my friends?'

3. LIST CONCEPTS

(Try not to write sentences)

- a. on a sheet of paper
- b. or on post-it notes

NETWORKING ACTIVITIES

1. ARRANGE CONCEPTS IN ON YOUR SHEET.

- a. Thus, do not get too bogged down with the relationships here.
- b. The focus here should be on thinking about which ideas are more important and which are less important.

2. THINK ABOUT HOW THE IDEAS ARE RELATED

- a. Both in terms of the ideas presented in the text and those related to your own background information.
- b. At this point, you should be using your booklet on relationships. You may want to connect the ideas using your own words and then checking to see where your labels fit with the ones given in the booklet.
- c. Remember, that by relating ideas you begin to see how these ideas are connected and this strengthens your understanding of the material.

3. USE THE ARROWHEADS

- a. Ask yourself: 'In what direction do I want people to read the information?', 'What type of direction do I want to convey this information?'

POST-NETWORKING ACTIVITIES

- A. Check to see if the physical structure of the diagram looks like a network. Use your 'Student Verification Form' (see end of this lesson).
- B. Check to see if the information is accurate and that it makes sense.
To accomplish this go back to the text.

Lesson - Day 5 of Training- Text Comprehension Cont'd : Total Time: 40-60 minutes

Post-Networking Activities

The next two steps involved evaluating the accuracy of the information and the accuracy of the structure of the network. The former step was particularly important for detecting inconsistencies in understanding.

1. The investigator communicated to students that this 5th step required them to evaluate the contents of the information represented in the network.

Here the teacher asked herself the following question 'Does the information I have represented in the nodes and relationships make sense?' Are there any inconsistencies within the network and the information presented in the text?' If so, what can I do to fix these inconsistencies?

The investigator informed students that checking the accuracy of

the information was more important than looking to see if they have a "pretty" network. If they carried around false information this would impede their learning of the material. They were also told that by paying attention to what was written in their texts they may find that the author had communicated less than accurate information or that ideas may not always be fully explained.

Students were instructed to check for inconsistent or incomplete information as presented in their networks.

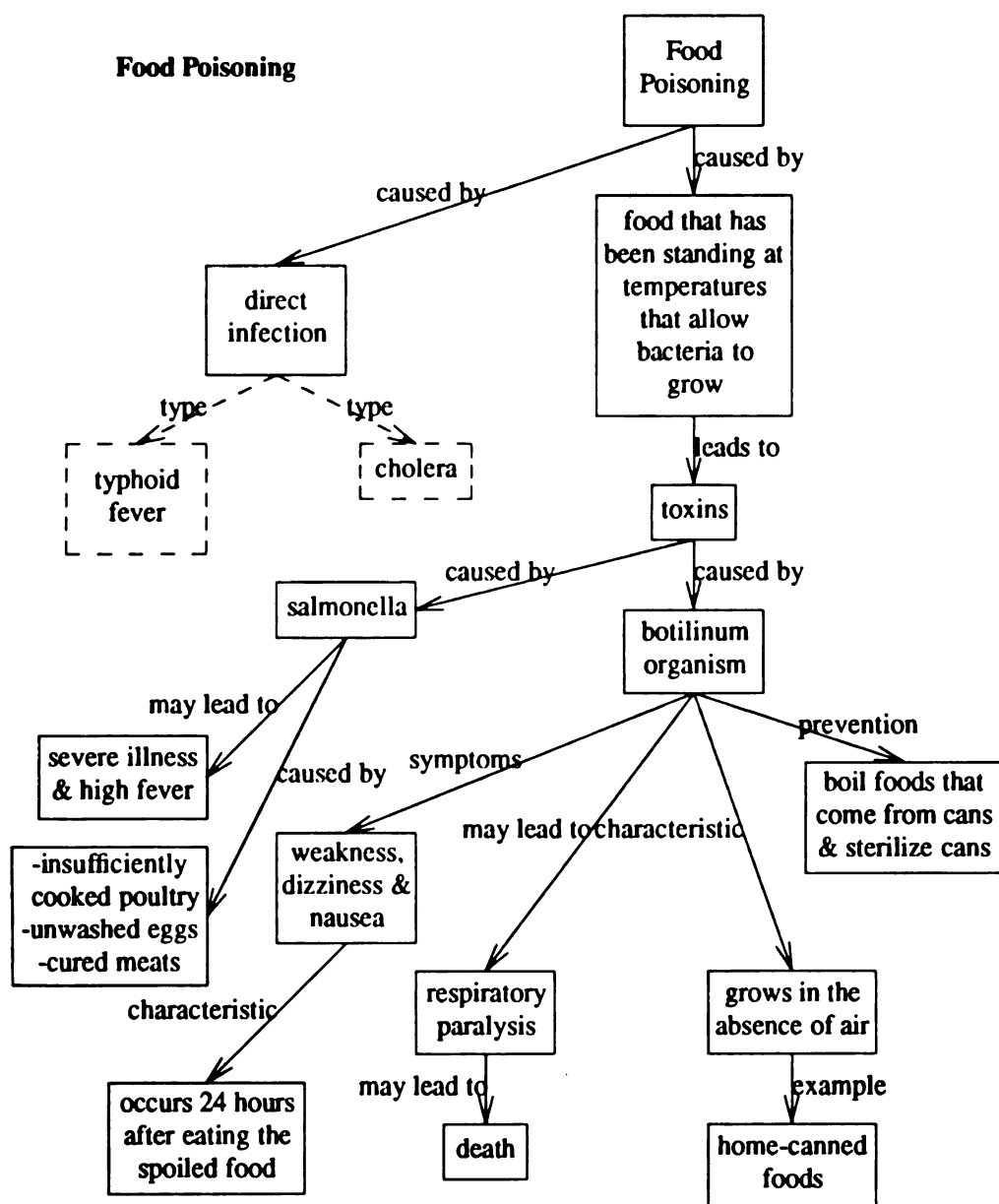
2. The investigator informed students that the 7th step was to evaluate if all the elements of a network have been used. The investigator shared with the students that making sure that the strategy was used accurately should help them to get the best use of it and therefore should facilitate their understanding of the information.
3. Again the teacher asked herself the question: 'Does this look like a network?' Do I have the concepts in the nodes?, Have I labelled the links?, 'Did I use the arrowheads? (See handout enclosed entitled 'Students' Verification Form' at the end of this lesson.)

Students were then asked to check their networks for these elements. At the end of this lesson, students were given a completed network of the Food Poisoning text as feedback.

Student Handout**Student's Verification Form**

These questions are to guide you in evaluating the physical structure of your network. You can answer most of these questions using a "yes/no" form.

1. Did the student use nodes (boxes or circles)?
2. Did the student represent concepts with the nodes?
3. Did the student use lines to connect the information?
4. Did the student name the lines with a specific relationship?
5. Did the student use the relationships provided by the investigator?
6. Did the student create other relationships?
7. Did the student use arrowheads?
8. Overall, does the network look hierarchical?

Figure 20. Network on Food Poisoning

Lesson - Day 6 of Training- Total Time: 40 minutes*Evaluating Understanding via Networks and Evaluating Networks*

Major Activities Students revised a network.

Objectives. The goal of this lesson was for students to have additional opportunity to evaluate networks in terms of the accuracy of the information and the accuracy of the structure of the network.

Procedure. Students were given a network on Bacteria to work on (see enclosed at the end of this lesson). This network was constructed with deliberate errors in the content or missing information. Students were asked to take their texts on Bacteria (text enclosed at the end of this lesson) and to compare the information they will have read in the texts to the networks. If they saw any inconsistencies or missing information, they were to adjust their networks accordingly. Approximately 20 minutes was devoted to this activity. At the end of this lesson, students were given a **corrected version** of this network (see enclosed) and the classroom teacher proceeded to explain the content to the students and the importance of reading information carefully. Approximately 20

minutes were allotted for the teacher's explanation. Students were later asked to write down why they thought it was important to check their understanding. To complete this exercise, students were given the enclosed handout.

Student ID: _____

Date: _____

Class: _____

Student Handout

Instructions to Students

On the next page of this exercise booklet is a network that was constructed by someone else. The information presented in this network was taken from the section on 'Bacteria' in the chapter 'Immunity/Infection'.

Your task is to check to see if the information represented in this network is accurate and that it makes sense to you.

This means that you will have to check to see if the information presented in the boxes and the information connecting the two boxes is accurate. Questions such as 'Are these concepts appropriately labelled?', 'Does the network need to be better organized so that it accurately portrays what the author is trying to say?' can be used to evaluate the accuracy of the information.

To help you to check this information you will need to read and to occasionally refer back to the section of the text entitled 'Bacteria' (see text at the end of this lesson). In addition, you will need your Booklet on Relationships.

If you find that information from the network is inaccurate or some of it is missing, please make your revisions on the network itself using a pencil. If you think that it is better for you to make your changes on another sheet of paper, use the paper provided. Please, write your name so I can return these to you.

Student ID: _____

Date: _____

Class: _____

Now that you have made your revisions, answer the following two questions in point form.

'Why do you think it's important to check information given to you?'

Do you think that your diagram looks like a network? List here what you would look for to determine whether it looks like a network or not?

Why do you think it is important to check for these things?

BACTERIA⁽⁶⁾

Bacteria, which can be seen under a light microscope, are generally 100 to 1,000 times larger than viruses. But they are considerably smaller than mammalian cells, most of which can each hold 50 to 100 bacteria.

Of several thousand species of bacteria, approximately 100 cause disease in humans. Most bacteria are neither parasites nor pathogens, however, and many are quite beneficial. Unlike viruses, many (but not all) disease-causing bacteria do not have to enter cells to cause infection. They generally thrive on, around, and between human cells and can cause harm through the toxins and poisonous enzymes that they produce. (Some bacterial toxins are among the most powerful poisons known. One-fourth of a teaspoon of a toxin released by the tetanus organism can kill over 10,000 people.)

Some of the toxins and poisonous enzymes bacteria produce work locally, killing and dissolving the cells near the site of the infection. The damaged cells become food for the bacteria. The infection then spreads deeper into the surrounding tissue, producing boils, abscesses, soreness, and the like. Other bacterial products are carried by the bloodstream, causing fever or affecting vital organs and systems (such as the nervous system in a tetanus infection). Some pathogenic bacteria have no specific toxic attributes. They grow to large numbers and cause damage by obstructing vital organs of the host-the lungs in pneumonia, for example-and by consuming materials needed by host cells for sustenance.

Generally speaking, bacterial infections require attention. Chief among these are skin infections such as small abscesses or boils, which, when unattended, can give rise to major complications. Such superficial

6. *Core concepts in health, 5th edition*: Bacteria (pp. 468, 469) by P.M. Insel & W.T. Roth, 1988, Mountain View, California: Mayfield Publishing Company. Copyright 1988 by Mayfield Publishing Company. Used by permission of the publisher.

skin infections are generally caused by bacteria known as **staphylococci** and **streptococci**. If the infection persists, it may cause a more serious disease known as **impetigo**, which requires a physician's attention. **Acne** is caused by relatively innocuous bacteria growing in hair follicles (pores that give rise to hair). These bacteria plug the pores and produce inflammatory substances that cause pus formation. Good hygiene often can remove **sebum** and other substances that such bacteria require.

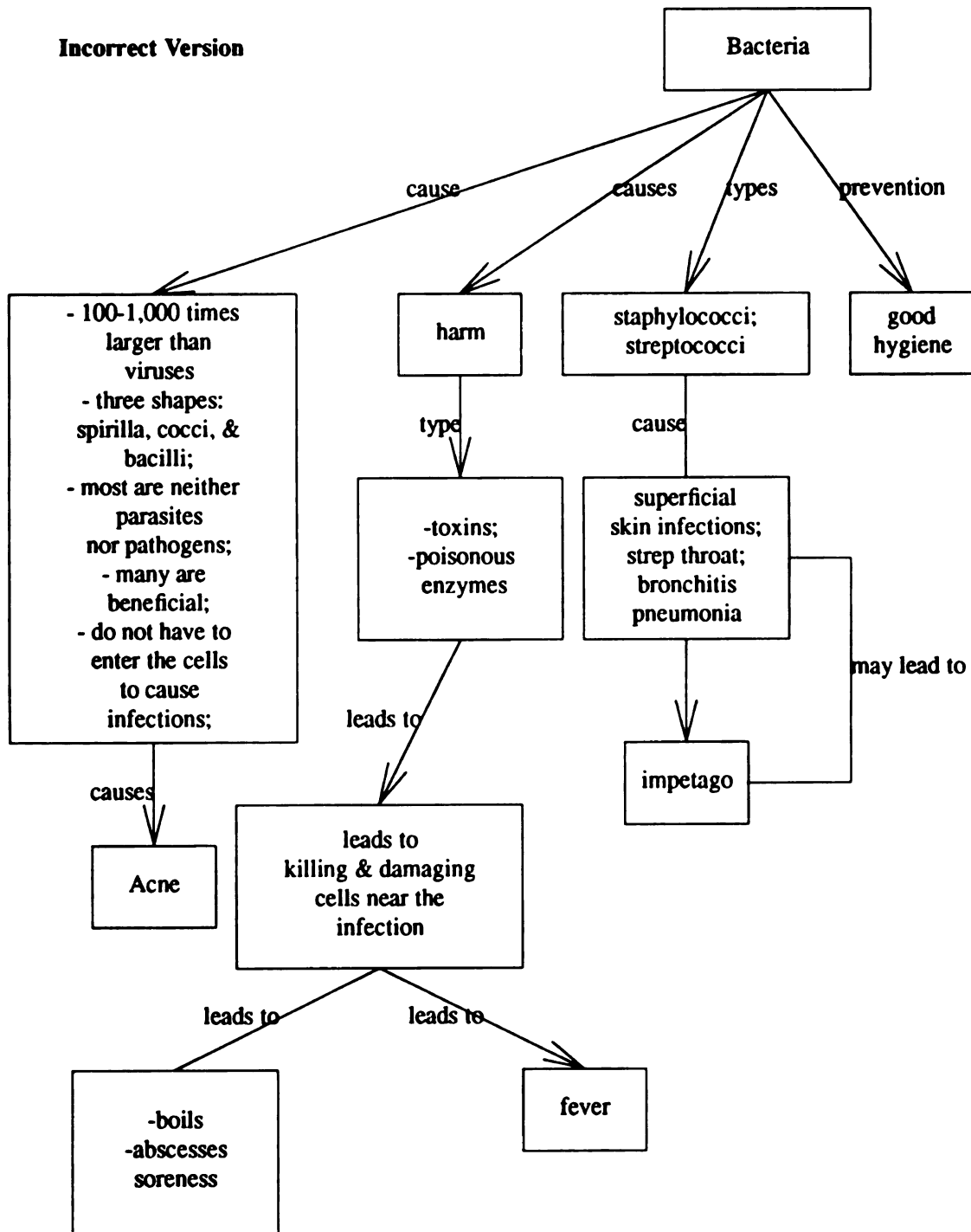
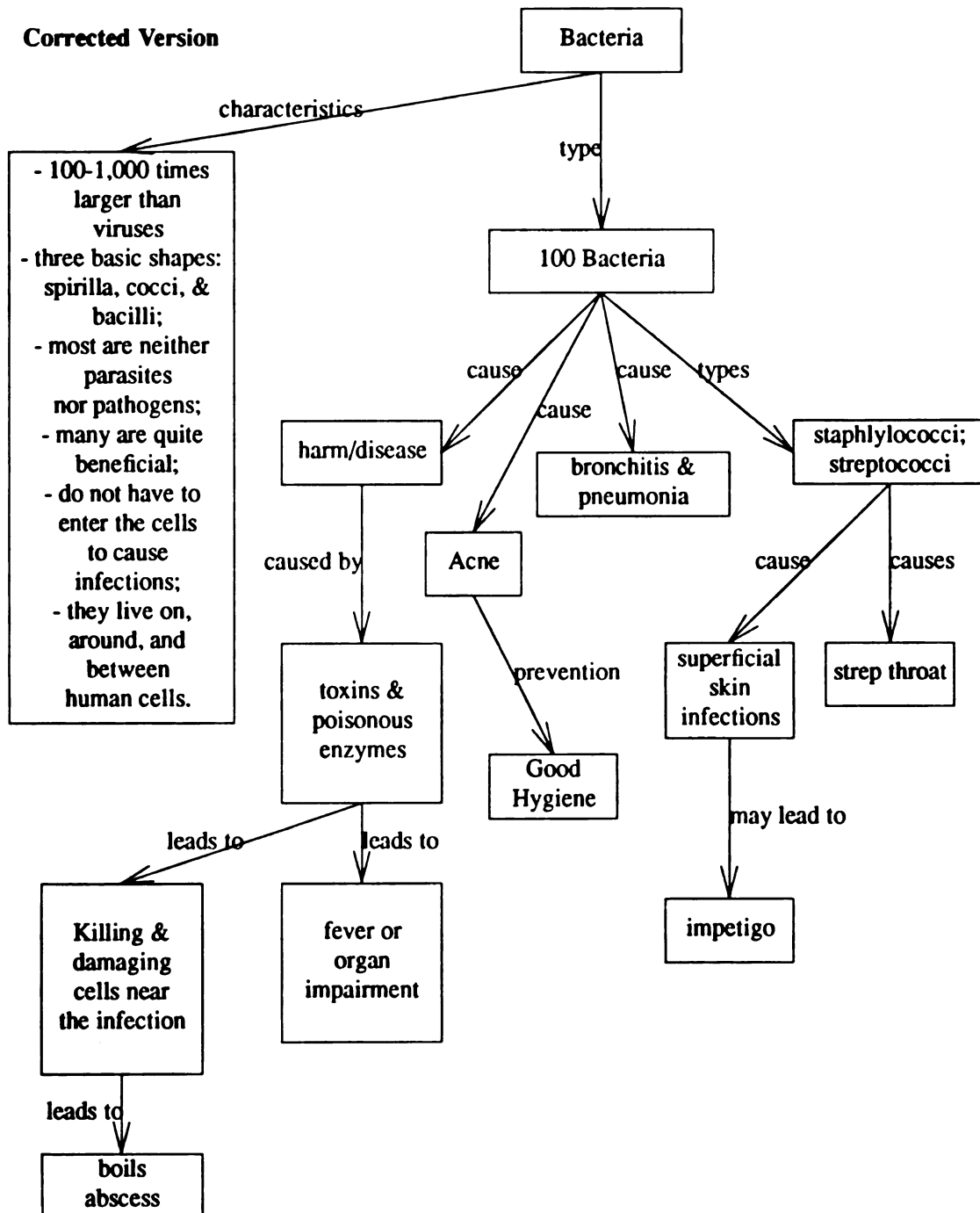
Figure 21. Incorrect Network on Bacteria

Figure 22. Correct Network on Bacteria

Lesson - Day 7 of Training: Total Time: 75 minutes*Networking Efficiently*

Objectives. The goal of this lesson was for students to use the method efficiently as well as effectively by having them "mentally" construct networks.

Procedures. Students were handed a passage on the Cold Virus (text enclosed at the end of this lesson). They were asked to read the passage but instead of writing out the network, they were asked to try to this mentally without actually transcribing the network onto paper. The investigator demonstrated this procedure to the students by asking herself the questions such as the following: 'How are these two ideas related?', 'How can I organize these ideas so that they make sense?', 'Does this make sense in light of what the author said earlier?' This demonstration took approximately 25 minutes. For the next 50 minutes, students were then asked to do the same covering as much of the text as possible. Students also completed the enclosed exercise and were later provided with feedback.

The Common Cold⁽⁷⁾

Since the discovery of penicillin in 1928 more progress has been made toward preventing and treating infectious diseases than in all the rest of medical history combined. Small pox has now been eradicated, typhoid fever has become a rarity, and pneumococcal pneumonia is both curable and, now, preventable. Yet no means has been found, to date, to eliminate or cure the common cold, which, it has been estimated, costs \$5 billion each year in lost wages and medical expenses.

In fact, the common cold is not a simple matter; rather, it is a complex of symptoms. It is caused by any one of a group of viruses (more than 120 different viral strains that produce common cold symptoms in humans have been isolated). The common cold is primarily an infection of the lining membrane of your upper respiratory tract, including your nose, sinuses, and throat. This delicate membrane reacts to infection by swelling its rate of mucus formation, leading to congestion, stuffiness, and a great deal of nose blowing. Because your nasal cavity no longer functions as a resonating chamber, a characteristic change in your voice quality also occurs. Increased mucus flow usually causes a postnasal drip, which is irritating and contributes to the familiar "scratchy" throat and cough.

Your sinuses, which normally empty into the nasal cavity, may become blocked by excessive swelling of the membranes. The resulting increase in sinus pressure may cause a headache. In similar fashion, swelling in the upper part of your throat can block your Eustachian tubes-the two narrow canals that lead to your ears. This blockage can cause accumulation of fluid and pressure in your middle ear, which may be painful. Less commonly, an unpleasant spinning sensation known as

7. *Core concepts in health, 5th edition*: The common cold (pp. 475-476) by P.M. Insel & W.T. Roth, 1988, Mountain View, California: Mayfield Publishing Company. Copyright 1988 by Mayfield Publishing Company. Used by permission of the publisher.

vertigo may result.

A cold is usually self-limited, lasting about one or two weeks. At any time during the course of a cold, bacteria (such as staphylococci or pneumococci) can be secondary invaders, bringing on painful infections of the sinuses and ears. However, the old warning that, if you don't take care, a cold will turn into pneumonia, is hardly ever true. Pneumonia and most other infections of the lower respiratory tract begin in the bronchi and the lungs rather than in the upper respiratory tract.

Most people stay home from work or school because of generalized symptoms-muscle aches, weakness, and fatigue. The extent of these symptoms varies from person to person. Although mild elevation of temperature can occur with the common cold, a rectal temperature above 101 degrees fahrenheit is usually a sign of a more serious viral or bacterial infection. If you have fever above 101 degrees, taken rectally, for more than two days, you should seek medical advice.

Americans spend more than \$900 million a year for cold and cough remedies. Advertisers have claimed preventive and curative virtues for vitamins, alkalizers, lemon drinks, antihistamines, decongestants, timed-release capsules, bioflavonoids, nose drops and sprays, quinine pills, aspirin mixtures, laxatives, inhalers, aromatic salves, liniments, room air sprays, and a variety of other products. There are at least 300 over-the-counter (OTC) products-most of which are a combination of ingredients marked for treating symptoms of the common cold. Many of these drugs do neither good nor harm to the cold victim, but there is no doubt that they benefit the drug manufactures.

Everyone has heard of the sure-fire formulas for preventing a cold. Popular home methods include a cold shower, regular exercise, and a hot rum toddy. Some people swear by cod liver oil, tea with honey, citrus fruit juices (or massive doses of vitamin C), or keeping their feet dry. At one time, many large firms encouraged their employees to submit to inoculations with cold "vaccines". And splendid results from these programs were regularly reported. But such vaccines, like many other "scientific" (or folk) remedies, gradually have been abandoned as experience and controlled testing have proved their uselessness in

preventing colds. Now, just as fifty years ago, Americans on the average will suffer two or three colds a year, the acute infectious stages of which will last about a week or two (although a cough or postnasal drip may linger), regardless of any physical measure, diet, or drug used to try to head off colds. U.S. Public Health Service (PHS) studies show that, during the winter quarter of the year, 50 percent of the population experiences a common cold; during the summer quarter, the figure drops to 20 percent.

It is unfortunate that the name "cold" has been given to the common cold, but minor, malady. The name has led many people to infer that the common cold is somehow caused by walking bareheaded in the rain, not wearing enough winter clothing, or getting caught in a draft. There is as yet no evidence that the common cold ever occurs in the absence of an infecting organism. Moreover, studies have shown that chilling does not predispose one to infection with the cold virus (or viruses). The increased incidence of colds in winter reflects the fact that people spend more time indoors, thereby facilitating the transfer of viruses from person to person. In fact, one is less likely to catch a cold after exposure to the elements than after mixing with a convivial group of sniffers and sneezers at a fireside gathering.

The common cold, it is now reasonably certain, is not only spread by sneezing and coughing but also by shaking hands and handling contaminated articles. The home, office, classroom, bus, or any other place where people gather is a good spreading ground. But resistance seems to vary greatly among individuals, so that not everyone exposed to a common source of infection becomes ill. Moreover, the natural factors-whatever they are-that contribute to resistance in an individual may operate at one time and not another. Thus it is not uncommon for some unlucky person to have a "bad year", suffering from as many as five or six colds, and then remain in excellent health during the following year or two. These variations in resistance and the irregular pattern in the occurrence of colds make it extremely difficult to evaluate the effect of any medication on the course of the common cold.

Student ID: _____

Date: _____

Class: _____

Student Handout**In-Class Exercise**

Read the passage on 'The Common Cold' (pp. 475-476) but this time do not take the time to network the information on a piece of paper.

Now, without looking back at your text, write down everything you can remember about what you just read.

Now answer these questions. Again, do not look back at anything you read or wrote previously.

1. What are the causes of a cold?

2. What are the characteristics of a cold?

3. What are effective means of preventing a cold?

4. What are ineffective means of preventing a cold?

5. How is a cold transmitted?

Find a classmate and share your answers. If you do not understand an answer that is given by your classmate, ask them to clarify it. You will be helping yourself and your partner. Here are some questions you may want to ask your partner.

How did you find it when you were not networking the information on a piece of paper? Were you thinking in terms of important concepts/ideas and relationships anyway? Did you network the information on a piece of paper? Did you try networking the information in "your head"? What did you do? When do you think it is a good idea to construct networks on paper? When do you think it is a good idea to construct similar networks not using paper?

Lesson -Days 8 & 9 of Training - Total Time: 120 minutes*More Practice on Longer Text*

Major Activities. To use the networking strategy on longer sections text (see text on Virus).

Objectives. The goal of this phase was to facilitate transfer of the networking strategy to larger sections of the text.

Procedures. Students constructed a network of the information on Viruses (see text on a subsequent page). Students were given 50 minutes to do this exercise. They then shared these networks with other members of the class. This took approximately 15 to 20 minutes. At this time, the investigator provided feedback to the students and highlighted the similarities and differences in the students networks. In addition, the classroom teacher prepared an analyses of the Virus text showing how she derived the key concepts and relationships. (See text analysis product enclosed at the end of this lesson.) She explained this procedure to the students and gave reasons for her answer. This activity took an additional 50 minutes. In addition, students were asked to submit their

networks for individual feedback. Students were also given a network as feedback (see network at the end of this lesson).

Text analysis on Virus Text

The following analysis of the text on Virus was performed by the classroom teacher. The analysis is by no means exhaustive but it is rather comprehensive. Its purpose was to show students how the classroom teacher used the words in the text to help her discern relationships between concepts. After students had had a chance to construct their own networks of the text, copies of this analysis were distributed to students. Throughout this demonstration, the teacher informed her class that the relationship term is generally found by looking at the verb. She also told students that there were times when the text was fairly explicit in signaling the relationships between the concepts but that was not always the case.

Viruses⁽⁸⁾

Viruses, the smallest of pathogens, are borderline between living and nonliving matter. They are visible only with an electron microscope. The pure virus particle appears to have no metabolism of its own. Viruses lack all the enzymes essential to energy production and protein synthesis in production and protein synthesis in normal animal cells, and they cannot grow or reproduce by themselves. They must lead a parasitic existence inside a cell, borrowing what they need for growth and reproduction from the cells they invade. Once a virus is inside the host cell, sheds its protein covering and its genetic material takes control of the cell and tricks it into manufacturing more viruses like itself. Different viruses infect different kinds of cells, and the seriousness of the diseases they cause depends greatly on which kind of cell is infected. The viruses that cause colds, for example, attack upper respiratory tract cells, which are constantly cast off and replaced. The disease is therefore mild.

Polio virus, in contrast, attacks nerve that cannot be replaced and the consequence, such as paralysis, are severe.

Over 150 viruses are known to cause diseases in humans. Illnesses caused by viruses are the most common forms of contagious disease. They include most of the minor ailments that cause transitory illness and are rarely precisely diagnosed. Among these are the common cold, a variety of undiagnosed and short-lived respiratory infections, influenza, gastrointestinal upsets that cause diarrhea and can last for only twenty-four hours, and assorted aches and pains. More serious are the diseases that occur mainly in childhood and frequently cause a severe rash, such as measles, chicken pox, and mumps. Smallpox, which used to be the

8. *Core concepts in health, 5th edition: Viruses* (pp. 462, 468) by P.M. Insel & W.T. Roth, 1988, Mountain View, California: Mayfield Publishing Company. Copyright 1988 by Mayfield Publishing Company. Used by permission of the publisher.

most severe of these diseases, has now been eliminated, thanks to a worldwide vaccination program carried out by the World Health Organization (WHO) in the 1960s and 1970s. The herpes viruses are a large and important group of viruses. They are remarkable in that, once infected, the host is never again free of the virus. The virus lies latent within certain cells, ventures forth from time to time to produce symptoms.

The virus lies latent within certain cells, and ventures forth from time to time to produce symptoms

Normally, the immune system keeps these viruses in check. However, when the immune system is depressed--for instance, by drugs used to aid organ transplantation--the herpes viruses may cause life-threatening disease. The most familiar example of these infections is that caused by herpes simplex virus Type 1. This virus produces sores that last from a few days to a week or two and appear mainly on the face around the mouth. (Herpes of the eye can be extremely serious and can lead to loss of vision.) A second kind of herpes virus (Type 2) gives rise to a painful and recurring genital disease of similar duration. Another herpes virus causes both chicken pox and "shingles".

Infectious mononucleosis (or mono), is also caused by a herpes virus. This disease is spread by close contact, and usually affects children and young adults. The virus attacks white blood cells and its symptoms may even look like leukemia. About three weeks after contact, the infected person has a severe sore throat with painful neck, lethargy, and fever.

Antibiotics have no effects on the disease process. With adequate rest, there are no long-term consequences; however, if the disease is neglected, the spleen may rupture. Loss of the spleen leads to a lifelong increase in susceptibility to infection.

More severe infections caused by viruses are AIDS; poliomyelitis (or polio), a disease of the nervous system; and hepatitis, a liver inflammation.

There are two major kinds of hepatitis. One is mainly transmitted by blood transfusions or hypodermic injection and is common among drug

addicts (Hepatitis B), and the other is transmitted through fecal matter and spread through infected food or drink (Hepatitis A). Hepatitis A causes a less severe disease, and is particularly prevalent in areas with poor hygienic conditions. It can also be spread readily wherever water is contaminated with sewage; for instance, in swimming areas close to sewage outlets. The disease is usually mild, although it is generally weakening and requires a long period of bed rest. Hepatitis B infection is generally more serious, and it may lead to extensive liver damage, a chronic carrier state, and even liver cancer. Certain viruses can also cause cell proliferation. The human disease clearly based on this property is warts, which generally is very mild but can become extremely severe if the resistance of the infected individual breaks down. There are many members of the human wart virus family and some of them appear to be responsible for cancer of the uterine cervix in women. Another virus, called HTLV-1 and distantly related to the AIDS virus, causes a rare leukemia in adults (T-cells leukemia). As our knowledge of the molecular biology of cancer increases, other tumors may turn out to be caused by viruses, but at present the majority of human cancers seem to be caused by other factors.

TABLE 3. Analysis of Virus Text

Viruses, the smallest of pathogens, **are** borderline between living and nonliving matter.

[All these bolded words are verbs which indicate the characteristics of the viruses.]

They **are** visible only with an electron microscope. The pure virus particle **appears to have** no metabolism of its own. Viruses **lack** all the **enzymes** essential to energy production and protein synthesis in production and protein synthesis in normal animal cells, and they **cannot** grow or reproduce by themselves. They **must** lead a parasitic existence inside a cell, **borrowing** what they need for growth and reproduction from the cells they invade.

Once a virus is inside the host cell, it **sheds** its protein covering **and** its genetic material takes control of the cell **and** tricks it into **manufacturing** more viruses like itself.

["Once": be careful, this may indicate a sequence of actions. The word "manufacturing" indicates an effect.]

Different viruses infect **different** kinds of cells, and the seriousness of the diseases they **cause** depends greatly on which kind of cell is infected.

[The word "different" signals more than 1 category.]

The viruses that **cause** colds, **for example**, attack upper respiratory tract cells, which are constantly cast off and replaced. The disease is **therefore** mild.

[The words "for example" indicate an example of the category- e.g., colds are mild diseases".]

Polio virus, **in contrast** attacks nerve that cannot be replaced and **the consequence**, such as paralysis, are severe.

["In contrast" refers to the other category, e.g., type relationship. The word "severe" is opposed to "mild" in the previous sentence. This indicates that there are two types of viruses having different consequence.]

Over 150 viruses are known to cause diseases in humans. Illnesses caused by viruses are the most common forms of contagious disease. They include most of the minor ailments that cause transitory illness and are rarely precisely diagnosed.

Among these are the common cold, a variety of undiagnosed and short-lived respiratory infections, influenza, gastrointestinal upsets that cause diarrhea and can last for only twenty-four hours, and assorted aches and pains.

More serious are the diseases that occur mainly in childhood and frequently cause a severe rash, such as measles, chicken pox, and mumps.

Smallpox, which used to be the most severe of these diseases, has now been eliminated, thanks to a worldwide vaccination program carried out by the World Health Organization (WHO) in the 1960s and 1970s.

The herpes viruses are a large and important group of viruses. They are remarkable in that, once infected, the host is never again free of the virus.

The virus lies latent within certain cells, ventures forth from time to time to produce symptoms.

[The words "contagious disease" implicitly means that there are 2 types of diseases: contagious and non-contagious diseases. However, the author does not specifically mention the latter type of disease.]

[The words "more serious" introduces another category of diseases. The words "frequently causes" may be translated into "may lead to".]

[Another main category announced here by the word "are".]

[The words "lies" and "venture" are characteristics.]

The virus **lies** latent within certain cells, and **ventures** forth from time to time to **produce** symptoms

Normally, the immune system keeps these viruses in check. However, when the immune system is depressed--for instance, by drugs used to aid organ transplantation--the herpes viruses may cause life-threatening disease. The most familiar **example** of these infections is that caused by **herpes simplex virus Type 1**. This virus **produces** sores that last from a few days to a week or two and appear mainly on the face around the mouth.

(Herpes of the eye can be extremely serious and can lead to loss of vision.) A **second kind** of herpes virus (Type 2) gives rise to a painful and recurring genital disease of similar duration. Another herpes virus **causes** both chicken pox and "shingles".

Infectious mononucleosis (or mono) **is also caused by** a herpes virus. This disease **is spread by** close contact, and **usually affects** children and young adults.

The virus **attacks** white blood cells and its symptoms may even look like leukemia.

About three weeks **after** contact, the infected person **has** a severe sore throat with painful neck, lethargy, and fever.

[The word "produces" is similar to the "leads to" relationship.]

[The phrase "a second kind" introduces another category. The phrase "gives rise to" implies a "leads to" relationship.]

[The phrase "is also caused by" is yet another disease caused by herpes. The phrase "is spread by" signals a mode of transmission.]

[The words "usually affects" signals main victims. The word "attack" indicates an effect relationship.]

[The word "has" indicates a list of symptoms.]

Antibiotics have **no effects** on the disease process. With adequate rest, there are no long-term consequences; however, **if the disease is neglected, the spleen may rupture. Loss of the spleen leads to a lifelong increase in susceptibility to infection.**

More severe infections caused by viruses are AIDS; poliomyelitis (or polio), a disease of the nervous system; and hepatitis, a liver inflammation.

There are two major kinds of hepatitis. One is mainly transmitted by blood transfusions or hypodermic injection and is common among drug addicts (Hepatitis B), and the other is transmitted through fecal matter and spread through infected food or drink (Hepatitis A).

[The words "transmitted through" and "spread through" signal mode of transmission.]

Hepatitis A **causes** a less severe disease, and is particularly prevalent in areas with poor hygienic conditions. It **can also be spread** readily **wherever** water is contaminated with sewage; **for instance**, in swimming areas close to sewage outlets. The disease is **usually mild**, although it is generally weakening and requires a long period of bed rest. Hepatitis B infection is generally **more serious**, and it **may lead** to extensive liver damage, a chronic carrier state, and even liver cancer.

Certain viruses can also **cause** cell proliferation. The human disease clearly **based** on this **property** is warts, which generally is **very mild** but can become **extremely** severe if the resistance of the infected individual breaks down. There **are many** members of the human wart virus family and **some of them** appear to be **responsible for** cancer of the uterine cervix in women.

Another virus, called HTLV-1 and **distantly related** to the AIDS virus, **causes** a rare leukemia in adults (T-cells leukemia).

As our knowledge of the molecular biology of cancer increases, other tumors may turn out to be caused by viruses, but at present the majority of human cancers seem to be caused by other factors.

[Another large category of viruses is introduced here the word "certain".]

[The phrase "distantly related to" refers to similar to.]

Figure 23. Network on Viruses

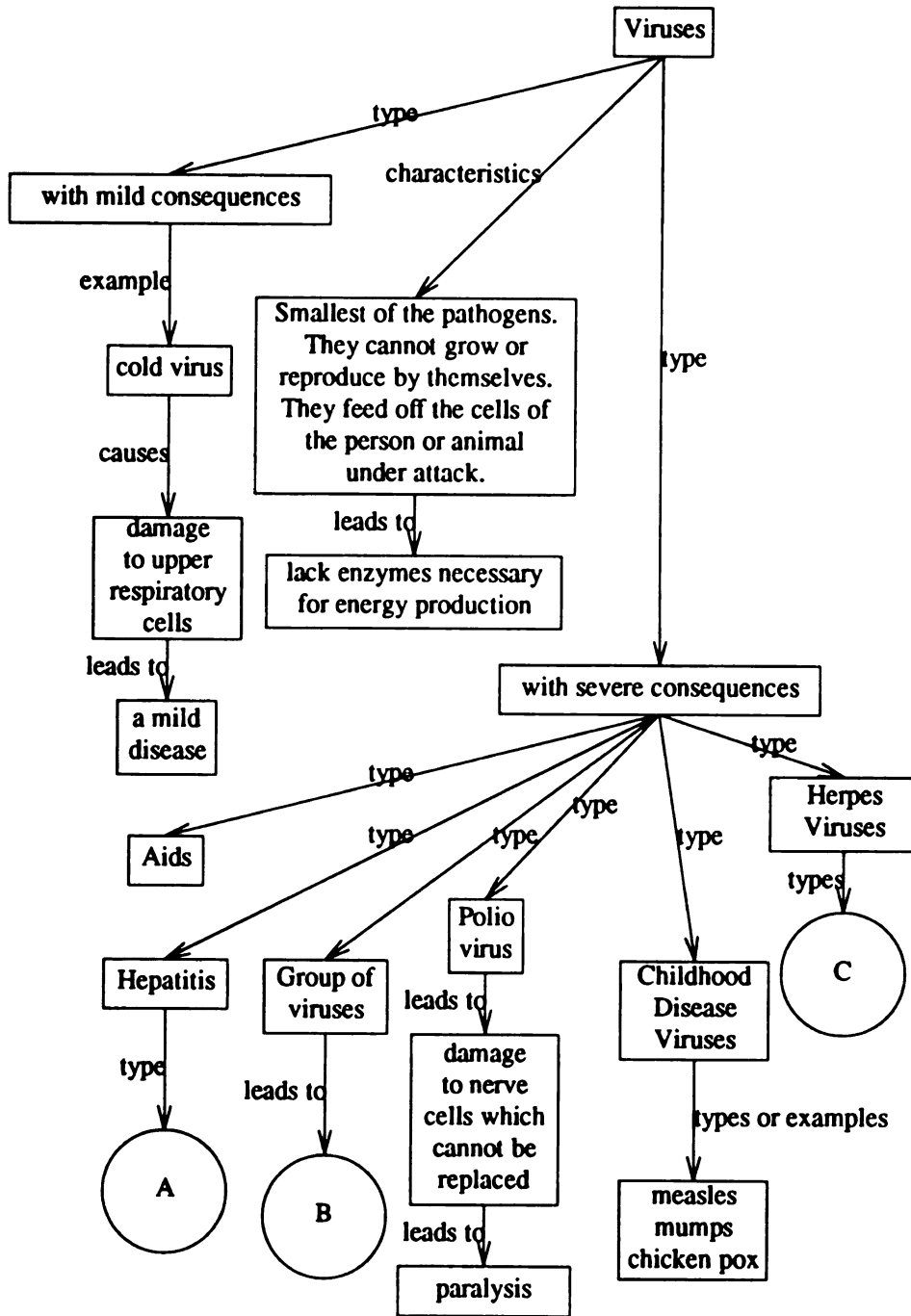


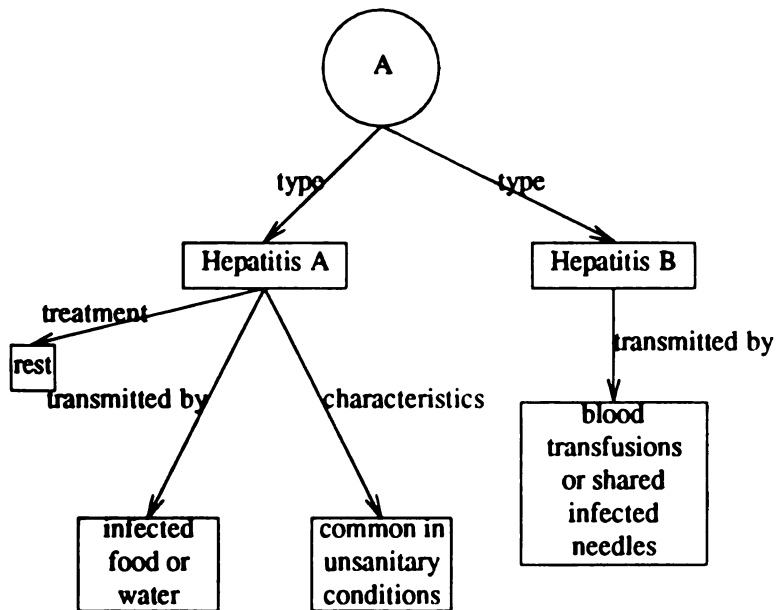
Figure 24. Network on Viruses - A

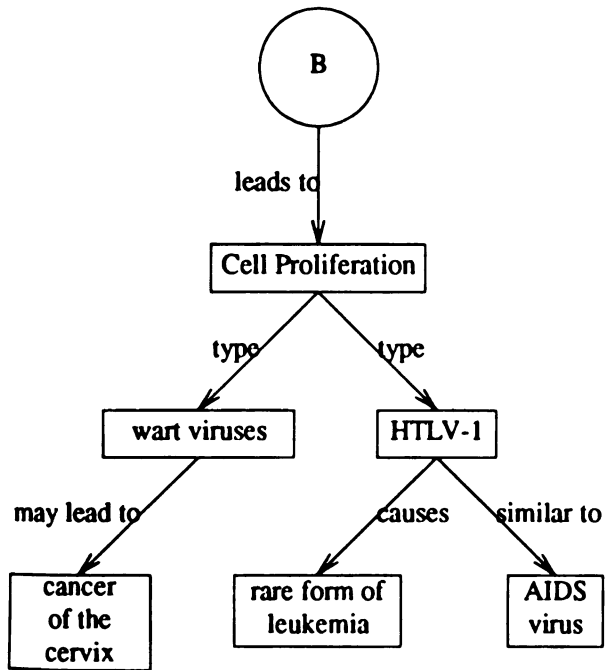
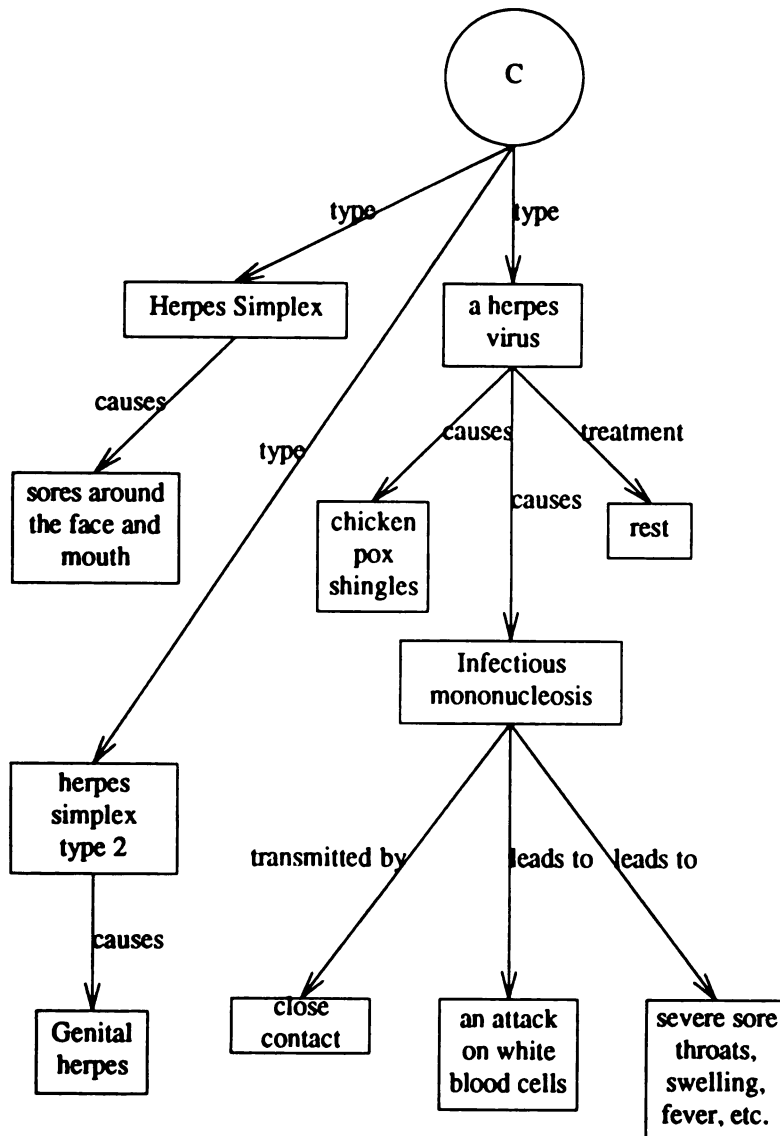
Figure 25. Network on Viruses - B

Figure 26. Network on Viruses - C

APPENDIX B

APPENDIX B**Comprehension Pretest on Asthma**

Student Code: _____

Date: _____

Class: _____

Time Taken: _____

Important Instructions to Students

In this booklet you will be asked to read a passage and to perform four (4) tasks. Please read the instructions carefully and ask questions about the instructions if they are not clear to you.

We expect that these four activities will take you approximately one (1) hour. Although we want all of you to be working on the same task at the same time, if you need a little extra time for any of the exercises please let us know.

Do not proceed to the next exercise until you are instructed to do so. Do not look back or ahead to any of the other exercises unless you are specifically instructed to do so.

For each of the answer sheets provided, we ask you to write down your student identification code number and to record the time it takes

you to complete the various activities on the space(s) indicated.

Because not all of you are working on the same passages, if you have any questions, do not address them so that everyone can hear you. Instead, just raise your hand and I will come to your desk to answer your questions and/or concerns.

We ask you to not discuss any of the tasks you will do here today with any one else, especially with people in this class.

On the last page of this booklet is a Student's Checklist. When you have completed all the exercises, follow the instructions there.

Student Code: _____

Date: _____

Class: _____

Time Taken: _____

Part I: Prior Knowledge Exercise

Instructions to Students:

During this first exercise, we want you to: list or write down in point form what you know about Asthma.

Use the space provided below and on the next page. You have approximately 10 minutes to list what you know about Asthma. We will keep you informed of the time.

Stop! Do not proceed to the next page until you are asked to.

Part II: Free-Written Recall Exercise

Instructions to Students:

You are now doing the second task.

On the following page is a text passage that talks about some aspect of a disease that may occur in children.

Turn to the next page and read the text passage until you think you understand it. We do not expect that it will take you longer than 15 minutes to read this passage.

Once you think you understand the passage, please turn to the lined paper provided. Record the amount of time it took you to read the passage on this lined paper where indicated.

Turn to the next page once you have finished reading this page.

Read this passage until you are confident that you understand it.

ASTHMA⁽⁹⁾

Asthma, one of the most common chronic diseases of childhood, is frequently encountered in the classroom. Asthma may be best described as a labored, wheezing breathing caused by interference with the normal flow of air in and out of the lungs. The discussion in this passage will be limited to allergic asthma and thus will not consider other nonallergic causes of wheezing.

The basic causes of asthma are little understood. Our knowledge of them is expanding rapidly, however. The individual with "allergy" was at one time felt to have a deficiency in antibodies, which allowed substances such as pollens, house dust, animal danders, molds, and foods to react against the individual's own tissues. Our present belief is just the opposite. The allergic individual has an over-abundance of antibodies to certain substances, and these antibodies react in heightened response whenever the allergy-producing substances (allergen or antigen) are inhaled or ingested into the body. The union of the antigen and antibody leads to an explosive reaction and release of chemicals from the mast cells of the body (histamine, serotonin, bradykinin, SRS-A). These chemicals, in turn, produce the symptoms we call allergy. The allergic reaction can take place in various parts of the body, such as the nose (allergic rhinitis or hay fever), lungs (asthma), eyes (allergic conjunctivitis), and skin (eczema or hives). One of the most serious reactions occurs in the lungs.

It is still not clear why the allergic individual reacts so explosively to substances that, in a nonallergic individual, are inoffensive and tolerated.

9. *Physically handicapped children: A medical atlas for teachers, 2nd edition: Asthma* (pp. 31-33, 35-36) by B. Harvey, M.D., 1982, Allyn & Bacon. Used by permission of the publisher.

Two basic factors are at work when asthma occurs. First, there is a constitutional predisposition on the part of the individual to form antibodies, and second, she must have contact with the offending substances (allergens) to which she will react. The substances to which a predisposed person may become allergic and against which she will make antibodies can be divided broadly into ingestants and inhalants. In this section we will talk about ingestants only. Younger children are more prone to have asthma from ingestants. Some of the most common offenders in early childhood are milk, eggs, nuts, chocolate, wheat, and citrus fruits. As a child grows older, she generally tends to develop greater tolerance for foods, but some people continue to have severe reactions to a variety of specific foods. Another large class of ingestants is drugs. A reaction to drugs is highly variable from one individual to another. It can be very mild in some (itching or hives) and overwhelming in others (asthma or shock). The degree of allergic reaction or the intensity of asthma seems unrelated to the amount of drug ingested. One penicillin tablet can be as dangerous as 20 to the allergic individual.

Asthma usually starts as isolated episodes of wheezing which are relatively mild and of short duration. The initial attacks are most often precipitated by respiratory infections. With time, as allergic exposure and difficulties continue, attacks become more frequent and can occur under almost any circumstances, any season of the year, day or night, indoors or outdoors. All too often the causative factors are unknown to the individual. Since the interval between exposure to allergens and the onset of an attack is quite variable and may, at time, be many hours, the precipitating factors go unrecognized.

Later, when attacks are less frequently precipitated by infection, there often will still be a clear running nose before the onset of wheezing. Rather than being a cold, this may represent nasal allergy, and, after a time varying from minutes to hours, it is followed by the onset of a characteristic dry, hacking, nonproductive cough. The cough is so typical that the parents and child both realize that wheezing will soon commence. If the attack is at all severe, the child's activity will diminish considerably. He will sit with his shoulders hunched forward, laboring hard to breathe. His whole chest moves with each respiratory effort, his

nostrils may flare, and the noise of his breathing is easily audible. He may appear quite anxious and apprehensive. If the attack is very severe, there may be blueness of his fingertips and lips.

Not all asthmatic attacks will be so marked, and some are mild enough to require little treatment. With many children, especially early in the course of the disease, the episodes will terminate abruptly and the child will be free of any wheeze until the next acute attack occurs. In other children, especially as the duration of the disease is prolonged, the wheeze will not end abruptly but will gradually decrease in severity and will persist in mild form between acute exacerbations. Thus, some children with rather marked asthma can be heard to wheeze all through the day in a very mild, almost inaudible way. Wheezing will become quite audible only in responses to running, laughing, cold weather, and irritants.

Part II: Free-Written Recall Exercise

Instructions to Students:

You are still working on the second exercise.

Using the space provided, write down everything you can remember about what you just read. Use only your BLACK pencils.

Do not look back at the text. Do your best to write things using your own words and thoughts as if you were telling a friend.

Double-space your work. Please, record the amount of time it took you to do this exercise. This exercise is expected to take approximately 15 minutes.

Student Code: _____

Date: _____

Class: _____

Time Taken: _____

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There are approximately 20 lines visible. The paper has a slightly textured appearance and is set against a dark background.

Student Code: _____

Date: _____

Class: _____

Time Taken: _____

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Student Code: _____

Date: _____

Class: _____

Time Taken: _____

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There are approximately 20 lines visible. The paper has a slightly textured appearance and is set against a dark background.

Student Code: _____

Date: _____

Class: _____

Time Taken: _____

[illegible]

Student Code: _____

Date: _____

Class: _____

Time Taken: _____

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There are approximately 20 lines visible. The paper has a slightly textured appearance and is set against a dark background.

Student Code: _____

Date: _____

Class: _____

Time Taken: _____

Part III: Linking Exercise

Instructions to Students:

You are now working on the third exercise.

Use the red pencil provided and go back to what you just wrote in black.

Your task is to add in anywhere in the free-written recall exercise you just did what else you know about Asthma that was not in the text.

This exercise is expected to take approximately 10 minutes. Write down on this sheet (using your red pencil) how long it took you to do this exercise.

Stop! Do not proceed to the next page until you are asked to.

Student Code: _____

Date: _____

Class: _____

Time Taken: _____

Part IV: Multiple-Choice Exercise

Instructions to Students:

You are doing the fourth exercise.

Twelve (12) multiple-choice items follow. We ask you to answer all of them. Choose the best answer for each item and circle your answer on the test paper. Please, make sure that if you change your mind on any of the answers that you completely erase your old answer.

This exercise is expected to take you approximately 15 minutes. Mark down how long it takes you to complete this exercise on the space indicated on the answer sheet.

Go on to the next page.

Student Code: _____

Date: _____

Class: _____

Time Taken: _____

Multiple-Choice: Asthma

1. Initial asthma attacks are most often precipitated by
 - a. respiratory infections
 - b. emotional upsets
 - c. changes in weather conditions
 - d. poor diet
2. A very small amount of a drug such as penicillin
 - a. can produce a severe allergic reaction
 - b. is insufficient to produce a severe reaction
 - c. can produce a severe allergic reaction only if the child has previously been exposed to the drug
 - d. will always produce a mild allergic reaction

Go on to the next page.

Student Code: _____

Date: _____

Class: _____

Time Taken: _____

3. The precipitating factor of an asthma attack
 - a. can always be identified
 - b. may be hard to identify
 - c. is impossible to identify
 - d. can only be identified in older children
4. The two basic factors involved in asthma are
 - a. a constitutional predisposition and the presence of an allergen
 - b. the presence of an allergen and the presence of bacteria
 - c. an infectious predisposition and the presence of an allergen
 - d. the presence of antihistamines and the presence of antibodies

Go on to the next page.

Student Code: _____

Date: _____

Class: _____

Time Taken: _____

5. An ingestant is a substance
 - a. injected
 - b. produced by the digestive tract
 - c. swallowed
 - d. inhaled
6. A cause of asthma is
 - a. a deficiency of antibodies to certain substances
 - b. an over-abundance of antibodies to certain substances
 - c. an imbalance of antibodies to certain substances
 - d. defective antibodies to certain substances

Go on to the next page.

Student Code: _____

Date: _____

Class: _____

Time Taken: _____

7. A characteristic of asthma is
- a. allergic reaction in the lungs
 - b. allergic reaction in the eyes
 - c. allergic reaction in the nose
 - d. wheezing
8. Wheezing
- a. is a cause of an allergy
 - b. is a symptom of an allergy
 - c. leads to an allergy
 - d. is a type of allergy

Student Code: _____

Date: _____

Class: _____

Time Taken: _____

9. A child in your class has been diagnosed as having severe allergic reactions to all nuts. This means that the child
- a. must not eat any nuts nor any foods containing nuts or nut oils
 - b. may have peanut butter and coconut
 - c. must not eat any nuts but can have foods cooked in nut oils
 - d. may have baked goods with a small amount of coconut frosting or a couple of nuts.

Student Code: _____

Date: _____

Class: _____

Time Taken: _____

10. Suzie is a little girl in your class and she says to you that "Tommy makes her sneeze". What about this situation would you want to check.
- a. Tommy's personality
 - b. The fabric softeners and detergents used to wash Tommy's clothes.
 - c. The type of foods Tommy likes to eat home.
 - d. Dismiss Suzie's comment as irrelevant.

Student Code: _____

Date: _____

Class: _____

Time Taken: _____

11. In a severe asthma attack, fingertips and lips may become blue because
- a. normal breathing is impaired, decreasing the amount of oxygen available
 - b. normal breathing is impaired, increasing the amount of oxygen available
 - c. normal breathing is stimulated, decreasing the amount of oxygen available
 - d. normal breathing is stimulated, thus increasing the amount of oxygen.

Go on to the next page.

Student Code: _____

Date: _____

Class: _____

Time Taken: _____

12. When an educator witnesses a child having an asthma attack, she should first
- a. stay calm and reassure the child
 - b. remove the child from the room
 - c. give the child an injection of antihistamine
 - d. leave the child in the hands of an assistant and call the parents

Student's Checklist

Please make sure that you have attended to the following:

- 1. Your student identification code number is on each answer sheet.**
- 2. The date is on each answer sheet.**
- 3. The time it took you to do each exercise is marked.**

Thank you for your time.

Note

After performing an item analysis of the multiple choice test in this appendix, the following items were retained for final analysis: 1, 2, 4, 5, 6, 8, 11, 12.

APPENDIX C

APPENDIX C

Passages on Disease with Accompanying Multiple Choice Questions

DIABETES MELLITUS⁽¹⁰⁾

Diabetes mellitus is a disorder of carbohydrate, protein, and fat metabolism, which may become apparent any time between early infancy and old age. In juvenile diabetes mellitus, the body's main energy source, a sugar known as glucose, cannot be used normally because the body cannot make a hormone known as insulin.

In juvenile diabetes mellitus, the pancreas is unable to make insulin. It follows that the use of glucose as an energy source will be disturbed. When there is no insulin, the glucose cannot move into the cells as fast. Moreover, the resulting shortage of glucose in the cells indirectly stimulates the liver to produce even more glucose. The amount of glucose present in the blood thus rises, and the amount of glucose passing through the kidney in the blood also is increased. The function of the kidney is to make urine out of blood. Normally, the kidney completely extracts the glucose from the blood, so that no glucose appears in the urine. When the amount of glucose delivered to the kidney reaches a certain level, however, the kidney suddenly finds itself unable to extract the excess glucose, and glucose begins to appear in the urine. As this happens, the amount of urine increases, because the glucose carries water with it. Thus, one of the first signs of diabetes is polyuria (the production

10. *Physically handicapped children: A medical atlas for teachers, 2nd edition:* Juvenile Diabetes Mellitus (pp. 269-272, 274) by R.O. Christiansen, M.D., R.L. Hintz, M.D., 1982, Allyn & Bacon. Used by permission of the publisher.

of large amounts of urine). Since glucose in the blood cannot enter the cells, the body acts as if no food were being ingested, and fat is broken down for energy, just as in starvation. The patient now experiences polyphagia (the eating of excessive amounts of food) and weight loss. Tiredness and weakness also develop. If nothing is done, the diabetic will soon develop diabetic coma (technically known as ketoacidosis) and, if untreated, may die. If an individual is going to develop diabetes, there is nothing that will forestall its development. Nothing that the individual did or ate caused the diabetes to appear. Likewise, it is not true that eating sweets will bring on diabetes. In addition, some people do not develop diabetes until they are adults. This is known as adult-onset diabetes.

The development of juvenile diabetes mellitus is strongly influenced by heredity, but the degree to which it is an inherited trait is not yet known. Diabetes is much more prevalent in children whose close relatives have the disease. A child is more likely to develop diabetes if both parents have diabetes than if just one has diabetes, is more likely to develop diabetes if a parent has the disease than if an aunt or an uncle has diabetes, and is more likely to develop diabetes if an identical twin has the disease than if a brother or sister had diabetes. This fact and other evidence makes scientists think that some other factors, perhaps viral, are needed - in addition to heredity - to produce juvenile diabetes mellitus. Since diabetes appears any time between a few months and several decades after birth, and since there are many forms diabetes can take (juvenile diabetes, adult-onset diabetes, obesity-associated diabetes, etc.), it is not possible to predict who will or will not develop diabetes and what type of diabetes he will have.

Given that the diabetic needs insulin to allow the cells to utilize glucose for energy, too much insulin may be harmful. When an excessive dose of insulin is given, the amount of the sugar in the blood falls drastically. Certain organs in the body, and particularly the brain, cannot utilize fatty acids and thus have an absolute requirement for glucose as their sole energy source. If not enough glucose reaches the brain, then certain symptoms appear: headache, dizziness, irritability or other changes in personality, blurred vision, nausea, vomiting, profuse

sweating, fast heart rate, cold hands and feet, and eventually, convulsions, coma, and death. These are the symptoms of an insulin reaction, or a hypoglycemia episode (low blood sugar). An insulin reaction is more likely to occur at the time of peak action for the insulin. If a diabetic receives too much NPH (longer lasting) insulin at 7:30 A.M., for example, an insulin reaction would be likely to occur some 8 hours later, or at 3:30 P.M. The symptoms of insulin reaction, unlike those of ketoacidosis (too little insulin), are rapid in onset. Thus, they must be recognized and treated promptly if serious problems are to be avoided. Normally, the administration of concentrated sugar in some form will terminate the insulin reaction in a matter of 2 to 3 minutes. Sweetened fruit juices (such as orange juice), nondietetic carbonated beverages, or fruit-flavored hard candies (such as Life-Savers) are the best sources of rapid sugar. If the diabetic does not respond promptly to sugar or vomits what is given, medical aid must be sought immediately to avoid further problems.

Multiple-Choice: Juvenile Diabetes

1. The body's main energy source is:
 - a. insulin
 - b. sugar
 - c. water
 - d. glucose
2. The production of large amounts of urine
 - a. leads to diabetes
 - b. is caused by diabetes
 - c. is a symptom of diabetes
 - d. is an example of diabetes
3. Heredity
 - a. causes juvenile diabetes
 - b. influences the development of juvenile diabetes
 - c. leads to the development of juvenile diabetes
 - d. characterizes the development of juvenile diabetes
4. The function of the pancreas is to
 - a. get rid of insulin
 - b. store insulin
 - c. produce insulin
 - d. assist in the production of insulin

5. If a child's mother is diabetic, then the child
 - a. will certainly be diabetic
 - b. will certainly not have diabetes
 - c. will not have diabetes because the father must be the carrier of the disease
 - d. may have diabetes as well
6. Diabetes is caused by
 - a. eating too many sweets
 - b. having two parents with diabetes
 - c. the body's inability to produce insulin
 - d. the body's inability to produce glucose
7. The body's inability to use sugar properly:
 - a. leads to the body's inability to make insulin
 - b. is caused by the body's inability to make insulin
 - c. is defined by the body's inability to make insulin
 - d. is exemplified by the body's inability to make insulin
8. An insulin reaction is caused by
 - a. too little insulin in the body
 - b. too much insulin in the body
 - c. too much glucose in the body
 - d. not enough glucose in the body

9. When having an insulin reaction, which of the following best describes the reason for giving a 2 year old diabetic child a lollipop? Lollipops,
 - a. dissolve quickly in the mouth
 - b. have a concentrated amount of sugar
 - c. are easily available
 - d. are a treat for children
10. If all sugar intake were replaced by Nutrasweet, it will
 - a. reduce the rate of juvenile diabetes
 - b. increase the rate of juvenile diabetes
 - c. not change the rate of juvenile diabetes
 - d. decrease the rate of inherited diabetes
11. Billy is suspected of having diabetes. In order to test this, doctors will take a sample of his
 - a. pancreatic juice, urine
 - b. urine, blood
 - c. blood, insulin
 - d. insulin, pancreatic juice
12. The diet of the diabetic child must have
 - a. very little sugar one day but lots of sugar the next day
 - b. no sugar at all
 - c. the same amount of sugar each day, especially in large quantities
 - d. the same small amount of sugar each day

Note

After performing an item analysis of the multiple choice test in this appendix, the following items were retained for final analysis: 2, 4, 8, 9, 10, 11.

CYSTIC FIBROSIS⁽¹¹⁾

The most common, usually fatal, hereditary disease of childhood, cystic fibrosis, was not described until 1936.

One of the most popular alternate names for cystic fibrosis is mucoviscidosis. This is a descriptive term which means the widespread presence of abnormally thick, viscid mucus. This name came into use once it was apparent that various aspects of the disease could be attributed to an abnormal mucus secreted, not only in the pancreas and the lungs, but in other organs as well. Various investigators were able to show that the walls of the stomach, the intestine, the salivary glands, and the liver all secrete abnormal mucus. In 1952 it was discovered that children with cystic fibrosis have an abnormal concentration of salt in their sweat. This peculiarity of the sweat glands was the first evidence that non-mucous secreting glands were also involved in this disorder. Cystic fibrosis is now considered to involve all the secreting glands of the body, except those that secrete into the bloodstream.

Cystic fibrosis is considered to be a simple recessive genetic disorder. To be affected the child must inherit two cystic fibrosis genes, one from each parent. Persons who have only one cystic fibrosis gene and one normal gene are carriers of the disorder, but there are no significant abnormalities associated with being a carrier.

The discovery of an abnormal protein isolated from the blood of children with cystic fibrosis and from carriers of this gene may become the basis for carrier identification.

A child with cystic fibrosis may come to a doctor's attention in a variety of ways. The disease may be evident at birth in those children

11. *Physically handicapped children: A medical atlas for teachers, 2nd edition: Cystic Fibrosis* (pp. 255-256, 258-259, 262) by B. Harvey, M.D., 1982, Allyn & Bacon. Used by permission of the publisher.

whose predominant abnormality is of the intestinal tract. A lack of the normal pancreatic juice during fetal life can result in a grossly thickened material replacing the normal stool that babies pass in the first day or two of life. Inability of the child to pass this material causes obstruction of the intestine, and surgery is required to relieve it.

Intestinal involvement is often not severe enough to manifest itself at birth, but it will be evident later, when the child's stool shows the effect of insufficient pancreatic juice. Pancreatic juice supplies enzymes that break down ingested proteins, carbohydrates, and fats. Fortunately, other organs of the intestinal tract also supply enzymes that break down proteins and carbohydrates, as well as some fats. A child with cystic fibrosis with significant involvement of the pancreas will have stools that are frequent, bulky, greasy, and very foul in odor, due to the excretion of undigested fats. The child may lose calories in his stool, so that either he will have a voracious appetite to make up for the calorie loss, or he will fail to gain weight adequately.

Involvement of the lungs results in an increased frequency and more prolonged course of respiratory infections. The child who develops a cold is subsequently apt to have a persistent cough for several months or to develop an episode of pneumonia or bronchitis secondary to this cold. Once infection is firmly lodged in the chest, one can expect cough to become chronic and to be present most of the time. Cystic fibrosis should be considered, therefore, in children with chronic cough or frequent episodes of bronchitis or pneumonia.

Since plugs of mucus in the bronchial tubes can partly obstruct the flow of air, particularly on expiration, wheezing may occur secondary to this type of obstruction. Consequently, some children are initially diagnosed as asthmatic, before the correct diagnosis of cystic fibrosis is considered.

The high salt content of sweat can cause problems in the summertime, particularly for the active child who perspires freely. If enough salt is lost in the sweat, the child may become acutely ill and require hospitalization in order to receive the needed rapid, intravenous replacement of the salt lost.

There are at least two things which the teacher of a cystic fibrosis child might bear in mind that can help improve the quality of the child's experience at school: (1) The child may cough frequently. The lung disease is not communicable. It is most important that the child cough out the mucus and not keep it in the lungs. Do not embarrass the child when she is coughing by looking at her or stopping the normal class routine. (2) The child with cystic fibrosis will have an increased appetite and may well take seconds and thirds during times when the class is eating. This should be encouraged. In fact, you may even consider encouraging the rest of the children to eat less fat by providing them with fresh fruits and vegetables.

Multiple-Choice: Cystic Fibrosis

1. Cystic fibrosis is also called mucoviscidosis because there is (are)
 - a. an abnormal concentration of salt in the mucous
 - b. a lack of mucus
 - c. an abnormally thick mucus
 - d. abnormal pancreatic cells
2. When a child coughs,
 - a. coughing should be accepted as a useful mechanism to get rid of mucus
 - b. coughing is a sign of an infection, there the child should be isolated
 - c. coughing should be discouraged as it will damage the lungs
 - d. coughing requires an immediate postural drainage treatment
3. A consequence of the lack of pancreatic and intestinal enzymes for the cystic fibrosis child is
 - a. a failure to gain weight
 - b. frequent lung infections
 - c. a predisposition to constipation
 - d. a ballooned abdomen

4. A child having cystic fibrosis can be misdiagnosed as having
 - a. asthma
 - b. hay fever
 - c. bronchitis
 - d. emphysema
5. During the warmer weather, the diet of a child with cystic fibrosis must
 - a. contain more salt than during colder weather
 - b. contain less salt than during colder weather
 - c. should alternate between lots of salts and very little salt
 - d. should not be increased if the child leads a relatively active life
6. Which of the following is a good rule to have in your class when you have a child with cystic fibrosis
 - a. going to the bathroom at very specific times of the day so that children learn to control their bodily functions
 - b. minimize the amount of fat children ingest so that they develop good eating habits and learn how to prevent high blood pressure
 - c. make sure that children play outside for at least one (1) hour on warm sunny days so that they may get plenty of exercise and vitamin D
 - d. make sure that children come to school dressed appropriately and comfortably so that they are not too hot nor too cold

7. The stools of the cystic fibrosis child will be bulky, greasy because of
 - a. insufficient amount of pancreatic juice
 - b. abnormal concentration of salt in their sweat
 - c. secondary complications such as pneumonia
 - d. mucus which plugs the bronchial tubes
8. For a young child with cystic fibrosis, catching a cold is
 - a. no more a health risk than for another child
 - b. a more serious health risk than for another child
 - c. a less serious health risk than for another child
 - d. is not a health risk
9. The child with cystic fibrosis living in Switzerland will
 - a. lose more body salt than if this child was living in Singapore
 - b. retain more body salt than if this child was in living Singapore
 - c. have the same amount of body salt in either of the two places
 - d. have a similar amount of body salt in either of the two places
10. The life expectancy of persons suffering from cystic fibrosis is
 - a. reduced to a few years
 - b. between 10 and 15 years
 - c. is the same as someone who does not have the disease
 - d. is continually being extended due to progress in respiratory tract infection control and enzyme replacement drugs

11. What do you think is the reason for clapping on the back of a child with cystic fibrosis?
 - a. Clear the lungs from mucus
 - b. Help the food travel along the esophagus
 - c. Stimulate the secretion of digestive enzymes
 - d. Drive the mucus into the alveolae
12. A child with cystic fibrosis may have a protruding abdomen because of the
 - a. presence of large quantities of pancreatic juice
 - b. frequency of postural drainage
 - c. continual use of antibiotics
 - d. presence of large quantities of stools.

Note

After performing an item analysis of the multiple choice test in this appendix, the following items were retained for final analysis: 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12.

APPENDIX D

APPENDIX D**Comprehension Posttest “A” on Non-Accidental Injury**

Student Code: _____

Date: _____

Class: _____

Time Taken: _____

Important Instructions to Students

In this booklet you will be asked to read a passage and to perform five (5) tasks. Please read the instructions carefully and ask questions about the instructions if they are not clear to you.

We expect that these five activities will take you approximately one (1) hour and 35 minutes. Although we want all of you to be working on the same task at the same time, if you need a little extra time for any of the the exercises please let us know.

Do not proceed to the next exercise until you are instructed to do so. Do not look back or ahead to any of the other exercises unless you are specifically instructed to do so.

For each of the answer sheets provided, we ask you to write down your student identification code number and to record the time it takes you to complete the various activities on the space(s) indicated.

Because not all of you are working on the same passages, if you have any questions, do not address them so that everyone can hear you. Instead, just raise your hand and I will come to your desk to answer your questions and/or concerns.

We ask you to not discuss any of the tasks you will do here today with any one else, especially with people in this class.

On the last page of this booklet is a Student's Checklist. When you have completed all the exercises, follow the instructions there.

Student Code: _____

Date: _____

Class: _____

Time Taken: _____

Part I: Prior Knowledge Exercise

Instructions to Students:

During this first exercise, we want you to: list or write down in point form what you know about Non-Accidental Injury.

Use the space provided below and on the next page. You have approximately 10 minutes to list what you know about Non-Accidental Injury. We will keep you informed of the time.

Stop! Do not proceed to the next page until you are asked to.

Part II: Reading Exercise

Instructions to Students:

You are now doing the second task.

On the following page is a text passage that talks about some aspect of a disease that may occur in children.

Turn to the next page and read the text passage until you think you understand it but do not take the time to network on a piece of paper.

We do not expect that it will take you longer than 40 minutes to do this exercise. Record the amount of time it took you to do this exercise on the text itself where indicated.

Now, turn to the next page.

Remember to read this passage until you are confident that you understand it but do not take the time to network it on a piece of paper.¹²

NON-ACCIDENTAL INJURY¹³

The diagnosis of physical abuse (non-accidental injury) is a difficult intellectual and emotional exercise. It is one of the most difficult subjects in clinical work, needing time, experience, and emotional energy. The biggest barrier to diagnosis is the existence of emotional blocks in the minds of professionals. These can be so powerful that they prevent the diagnosis even being considered in quite obvious cases.

All those working with children should be warned that their overwhelming impulse on confronting their first case will be to want to cover it up.

The most important step in diagnosing non-accidental injury is to force yourself to think of it in the first place.

Non-accidental injury is one of the most important diagnoses in clinical pediatrics as it can so vitally influence a child's future life. At worst it is a matter of life and death for the child, and short of death there may still be possible brain damage or handicap. Though high risk cases are currently in a minority, the diagnosis remains crucially important in every case. This is because non-accidental injury is often a marker for emotional abuse and deprivation that can cause progressive and possibly permanent damage to a child's developing personality. This principle is especially relevant in children of school age. In such children the risk of death may be extremely small, yet non-accidental injury in older children

12. For Posttest B, students were instructed to "take the time to network on paper".

13. "ABC of child abuse: Non-accidental injury" by N. Speight, 1989, *British Medical Journal*, 298, 879-881. Copyright 1989 by British Medical Journal. Used by permission.

is almost inevitably associated with longstanding disturbance of the parent-child relationship.

Non-accidental injury is not a full diagnosis, it is merely a symptom of disordered parenting. The aim of intervention is to diagnose and cure (if possible) the disordered parenting. Simply to aim at preventing death is a lowly ambition. In some cases the occurrence of physical abuse may provide an opportunity for intervention.

There are no hard and fast rules and no easy answers for diagnosis. The following list constitutes seven classic "pointers" to the diagnosis. None of them is diagnostic, neither does the absence of them exclude the diagnosis of non-accidental injury.

1. There is a delay in seeking medical help (or no medical help is sought).
2. The story of the "accident" is vague, is lacking in detail, and may vary with each telling and from person to person. (Innocent accidents tend to have vivid accounts that ring true.)
3. The account of the accident is not compatible with the injury observed.
4. The parents' affect is abnormal. Normal parents are full of creative anxiety for the child. Abusing parents tend to be more preoccupied with their own problems - for example, how they can return home as soon as possible.
5. The parents' behaviour gives cause for concern - for example, they soon become hostile, they rebut accusations that have not been made, and they leave before the consultant arrives.
6. The child's appearance and his interaction with his parents is abnormal. He may look sad, withdrawn, or frightened. There may be visible evidence of a failure to thrive. Full blown frozen watchfulness is a late stage and results from repetitive physical and emotional abuse over a period of time. The absence of frozen watchfulness does not exclude the diagnosis of non-accidental injury.

7. The child may say something. Always make a point of interviewing the child in a safe place in private. This is one of the virtues of admission to hospital. Interviewing the child as an outpatient may fail to let the child open up as he is expecting to be returned to the custody of the abusing parent in the future.
8. Some forms of injury are by their nature virtually diagnostic of non-accidental injury. These include finger tip bruising, especially when it is multiple; cigarette burns; lash marks; retinal and subdural hemorrhages, which can occur after a shaking injury without other evidence of bruising or fracture.

When physicians diagnose cases of child abuse, they should first approach the parents as they would in other clinical cases, introduce themselves, shake hands, and proceed logically through the history, examination, provisional diagnosis, and decision making.

Secondly, they should not jump to conclusions one way or the other. They should try to proceed slowly and deliberately, keeping their mind open as long as possible. They should take a provisional social history to form a picture of the family background and how likely it would be for abuse to occur there.

While the physicians have the responsibility to make the correct diagnostic, the importance of the inter-professional team-work cannot be overemphasized. First, the complexity of many child abuse cases may mean that a whole range of different agencies are involved in dealing with a child abuse case; second, the emotional stress experienced by workers in child abuse is minimized if professionals have the opportunity to share their difficulties and find support from colleagues. Professional team work is increasingly accepted as the most appropriate method of working in the area.

Part III: Free-Written Recall Exercise

Instructions to Students:

You are now doing the third exercise.

Using the space provided, write down everything you can remember about what you just read. Use only your BLACK pencils.

Do not look back at the text. Do your best to write things using your own words and thoughts as if you were telling a friend.

Double-space your work.

Please, record the amount of time it took you to do this exercise.

Student Code: _____

Date: _____

Class: _____

Time Taken: _____

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There are approximately 20 lines visible. The paper has a slight shadow on the right side, suggesting it's resting on a surface.

Student Code: _____

Date: _____

Class: _____

Time Taken: _____

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There are approximately 20 lines visible. The paper has a slightly textured appearance and is set against a dark background.

Student Code: _____

Date: _____

Class: _____

Time Taken: _____

This image shows a single sheet of white paper with horizontal black lines, resembling notebook paper. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Student Code: _____

Date: _____

Class: _____

Time Taken: _____

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There are approximately 20 lines visible. The paper has a slight shadow on the right side, suggesting it's resting on a surface. There is no handwriting or other markings on the paper.

Student Code: _____

Date: _____

Class: _____

Time Taken: _____

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Student Code: _____

Date: _____

Class: _____

Time Taken: _____

Part IV: Linking Exercise

Instructions to Students:

You are now working on the fourth exercise.

Use the red pencil provided and go back to what you just wrote in black.

Your task is to add in anywhere in the free-written recall exercise you just did what else you know about Non-Accidental Injury that was not in the text.

This exercise is expected to take approximately 10 minutes. Write down on this sheet (using your red pencil) how long it took you to do this exercise.

Stop! Do not proceed to the next page until you are asked to.

Student Code: _____

Date: _____

Class: _____

Time Taken: _____

Part V: Multiple-Choice Exercise

Instructions to Students:

You are doing the fifth exercise.

Twelve (12) multiple-choice items follow. We ask you to answer all of them. Choose the best answer for each item and circle your answer on the test paper. Please, make sure that if you change your mind on any of the answers that you completely erase your old answer.

This exercise is expected to take you approximately 15 minutes. Mark down how long it takes you to complete this exercise on the space indicated on the answer sheet.

Go on to the next page.

Student Code: _____

Date: _____

Class: _____

Time Taken: _____

Multiple-Choice: Non-Accidental Injury

1. A central reason why non-accidental injuries are often NOT reported is because people
 - a. do not want to get deeply involved with child abuse cases.
 - b. do not know what to look for in a child abuse case even as trained professionals in the area.
 - c. believe that there is a lack of support from doctors.
 - d. may find it difficult to believe that the abuse has occurred despite the evidence.

Go on to the next page.

Student Code: _____

Date: _____

Class: _____

Time Taken: _____

2. Which of the following characteristics can make the diagnosis of non-accidental injury easier?
- a. The parent has postponed seeking medical help; the account of what happened is vague; and the parent is very concerned about the child.
 - b. The parent has postponed seeking medical help; the account of what happened is vague; and the parent is very concerned about his/her own needs.
 - c. The account of what happened varies from person to person; the parent is very concerned about the child; and the parent has sought medical attention promptly.
 - d. The child seems frightened; the parents are very concerned about the child; and the child wants to stay with the parents.

Go on to the next page.

Student Code: _____

Date: _____

Class: _____

Time Taken: _____

3. Mary is an early childhood educator who wants to actively help abused children. Because work in the area of child abuse is emotionally draining, what recommendation would you make? She should
- a. work only a few hours a week.
 - b. work alone.
 - c. be a member of a team of educators.
 - d. work with a team of various professionals.
4. Which one of the following signs indicates that the child is most likely suffering from an accidental injury rather than intentional injury?
- a. finger tip bruising.
 - b. scraped knees.
 - c. bleeding of the retina.
 - d. bruised cheeks.

Go on to the next page.

Student Code: _____

Date: _____

Class: _____

Time Taken: _____

5. In diagnosing non-accidental injury you should interview
 - a. only the parents.
 - b. only the child who was hurt.
 - c. only those who reported the injury.
 - d. all involved.
6. Injured school-aged children who give unreasonable explanations for their injuries should be interviewed to find out more about their
 - a. activities with their friends.
 - b. relationship with children of other cultures.
 - c. relationships with their parents.
 - d. medical and academic history.

Go on to the next page.

Student Code: _____

Date: _____

Class: _____

Time Taken: _____

7. In cases of child abuse, high levels of stress are often experienced by the
- a. child's family.
 - b. child herself.
 - c. team investigating the abuse.
 - d. all of the above.
8. What is common between the abuser and the abused?
- a. Poor social relationships.
 - b. Frozen watchfulness.
 - c. Defense reaction.
 - d. Failure to thrive.

Go on to the next page.

Student Code: _____

Date: _____

Class: _____

Time Taken: _____

9. One result of making abused children repeat their story in private could be to
- a. have them share the burden of the abusive experience.
 - b. increase their trust in adults.
 - c. alienate their parents and make them less likely bring their child in for treatment next time.
 - d. prove to children that parents who abuse their children really do not love them.

Student Code: _____

Date: _____

Class: _____

Time Taken: _____

- 10.** Which one of the following behaviours would you be inclined to diagnose as non-accidental injury?
- a. witness a parent forcibly lock a child in the closet.
 - b. hearing a parent say to the child that "she is clumsy and no good".
 - c. witness a young child (3 years old) help a parent with small household chores.
 - d. witness a parent slap his child's face.
- 11.** You have a child in your class who occasionally has a difficult time sitting down. How would you handle this situation?
- a. Tell the child that he must obey the class rules and remain seated.
 - b. Talk with the child privately.
 - c. Inform the parents of the child's behaviour.
 - d. Let the child remain standing if he wishes.

Student Code: _____

Date: _____

Class: _____

Time Taken: _____

- 12.** Which one of the following is NOT a reason for a child's reluctance to report an abusive parent?
- a. The child really enjoys being abused.
 - b. The child loves her parents.
 - c. The child may fear for her own safety.
 - d. The child may fear that the abusive parent will be taken away.

Student's Checklist

Please make sure that you have attended to the following:

1. Your student identification code number is on each answer sheet.
2. The date is on each answer sheet.
3. The time it took you to do each exercise is marked.

Thank you for your time.

Note

After performing an item analysis of the multiple choice test in this appendix, the following items were retained for final analysis: 1, 2, 3, 4, 6, 7, 8, 9, 10, 11, 12.

APPENDIX E

APPENDIX E

Passages on Child Abuse with accompanying multiple choice questions.

SUFFOCATION¹⁴

Asphyxia is an uncommon but serious form of child abuse. The most common form is smothering and the abuser is usually the child's mother, who uses her hand, a pad of rolled up clothing, or a pillow to cause mechanical obstruction to the child's airways. Less commonly she presses the child's face against her chest, encloses the child's head in a plastic bag or strangles by pressure on the child's neck.

Smothering happens to young children under the age of 3 years, most being infants under the age of 1 year. They may appear to doctors either as sudden unexplained deaths ("cot deaths"), moribund "near miss cot deaths," or repetitively as cyanotic or floppy children whom the mother claims to have had an episode at home - which is presumed by doctors to have been an apneic attack (the child temporarily stops breathing) or a seizure. (If a mother describes a young baby as having stopped breathing or having seemed unconscious for a short time a doctor will probably consider that the baby has had an apneic attack, whereas in an older child he or she is more likely to consider the same description to have been a seizure.)

14. "ABC of child abuse: Suffocation." by R. Meadow, (1989), *British Medical Journal*, 298, 1572-1573 Copyright 1989 British Medical Journal. Used by permission.

Between 2 and 10 % of babies currently labeled as dying from the sudden infant death syndrome have probably been smothered by their mothers. Many of these have had previous recurrent episodes of apnea or seizures that may have been investigated thoroughly in a conventional radiological, biochemical, or electrophysiological way without proper consideration being given to child abuse as a possible cause. Warning features that the sudden infant death syndrome may have been caused by a mother smothering her child are:

1. Previous episodes of unexplained apnea, seizures or "near miss cot death"
2. An infant aged over 6 months
3. Previous unexplained disorders affecting that child
4. Other unexplained deaths of children in the same family.

For some children the smothering is associated with other forms of child abuse, particularly physical abuse.

Some mothers smother their child when they are feeling violent hatred towards their baby, others do it in a repetitive systematic way, taking their child regularly to the doctor each time that they have smothered their child for long enough to make him or her unconscious.

Smothering is violent; a young child who cannot breathe struggles and tries to get air. The smothering needs considerable force, even when a child is young: the child has to be laid down on his back or against something firm for the mother to press hard on his face, alternatively the child is clutched closely into her chest. Despite the obvious violence entailed the signs may be very few. In general, someone who is asphyxiated tends to develop multiple spots on the face, particularly on the eyelids, as a result of the raised blood pressure, lack of oxygen, and retention of carbon dioxide. There may be swelling of the face too. Hand pressure on the face may leave thumbmarks or fingerprints around the nose or mouth or abrasions inside the mouth with bruising of the gums; but more often smothering is done with a pillow or with clothing and no external pressure marks are visible, and quite often neither spots nor

swelling in the face are apparent. All forms of asphyxiation may be associated with some bleeding from the nose or mouth, but not always. Thus a smothered infant may show no signs at all to the most qualified doctors. Although generally the smothering has to persist for a minute to cause seizures - longer to cause brain damage and perhaps two minutes (depending upon other circumstances) to cause death - damage may be more sudden and catastrophic if the child, as a result of the sudden assault, has a cardiac arrest or vomits and chokes.

Unexplained episodes of apnea (interrupted breathing) or a seizure are commonly reported by mothers of young babies. Sometimes an anxious mother perceives illness that is not there or overinterprets the periodic breathing and normal movements of a healthy baby. Therefore, in all such cases it is worth trying to get a description of the episodes from another relative. This is particularly important if the mother is suspected of causing the episodes.

True apnea, in which the breathing stops for 20 seconds or more and is followed by relatively slow heart activity, blueish skin colour, or paleness, is frightening and often unexplained. It is more likely in small preterm babies and usually starts in the neonatal period. In early life both respiratory viral infection and whooping cough can be associated with spells of apnea in previously well infants; the apnea may come before the cough or other respiratory signs by a few days. Whenever apnea starts unexpectedly in a previously well baby it must be investigated thoroughly. As well, home life must be investigated.

Multiple-Choice: Suffocation

1. Which one of the following statements is true about intentional suffocation? It is
 - a. a common type of child abuse.
 - b. an uncommon type of child abuse.
 - c. very often accomplished by placing the child's head in a plastic bag.
 - d. very often accomplished by strangling the child.
2. Which one of the following is always true about intentional smothering?
 - a. It leads to death.
 - b. Breathing stops for 20 seconds or more.
 - c. It is violent.
 - d. There is a logical explanation.
3. Intentional suffocation is often mistaken for
 - a. sudden infant death.
 - b. seizure.
 - c. apnea.
 - d. all of the above.

4. Inexperienced or anxious mothers may consider their babies breathing as
 - a. abnormal.
 - b. a sign of leukemia.
 - c. a sign that the baby is having a dream.
 - d. a sign of stomach upset.
5. Intentional smothering can go undetected because
 - a. it may be confused with cases where the child naturally stops breathing.
 - b. after the first incident the child dies.
 - c. the parent is truly concerned about the child.
 - d. there is always a clear and logical explanation.
6. What conclusions can you draw about a parent who smothers her child?
 - a. The parent does not realize that they are going to such extremes because the child is so passive.
 - b. Abusive parents often smother their child instead of hitting them because smothering is less violent and requires minimal physical strength.
 - c. The abusive parent may choose to smother rather than hit her child because smothering is less likely to leave visible signs.
 - d. Because parents do not actually expect to kill the child, they rarely smother another child again.

7. **Intentional suffocation means that the hurt inflicted on the child**
 - a. **is a result of a birth defect.**
 - b. **is purely an accident.**
 - c. **involves a carefully organized plan.**
 - d. **involves an impulsive reaction which is not carefully thought out.**
8. **In this passage, one important idea is that**
 - a. **intentional suffocation may often be mistaken for other conditions.**
 - b. **mothers are to blame whenever signs of suffocation are detected.**
 - c. **children with a history of apnea and seizure episodes suggests that they have had natural breathing problems.**
 - d. **smothering should be severely punished.**
9. **In which way can society reasonably help to prevent the intentional smothering of children?**
 - a. **Stop the manufacturing of all plastic bags.**
 - b. **Prevent those who are suspected of abuse from buying plastic bags.**
 - c. **Inform people both young and old of how to take proper care of children.**
 - d. **Make all parents go through a mandatory and intensive parent screening test before the birth of their first child.**

10. Now that you have read this text, which of the following recommendations seems most reasonable
 - a. young children must be observed closely for possible signs of intentional injuries.
 - b. fathers must remain at home more often.
 - c. parents must be prosecuted without exception.
 - d. all mothers must attend weekly counseling sessions on abuse.
11. A possible emotional consequence of smothering for the child might be the fear of
 - a. enclosed areas.
 - b. heights.
 - c. speed.
 - d. snakes.
12. If you were interviewing a parent who brought a child to the hospital after an episode of apnea, what would you consider a good question to ask?
 - a. 'You really did that on purpose, didn't you?'
 - b. 'Are you impatient with your child?'
 - c. 'Does anyone else in your family suffer from breathing problems?'
 - d. 'Do you have plastic bags in your home?'

Note

After performing an item analysis of the multiple choice test in this appendix the following items were retained for final analysis: 2, 3, 5, 6, 7, 9, 10, 12.

EMOTIONAL ABUSE AND NEGLECT¹⁵

Emotional abuse and neglect of children may take many forms from a lack of care for their physical needs, through a failure to provide consistent love and nurture, to overt hostility and rejection. Harmful effects upon developing children are many and tend to vary with age. In infancy neglect of physical care is likely to produce the most negative effects and delays in all aspects of growth.

Emotional abuse refers to repeated verbal harassment of a child by criticism, threat and ridicule, and the withdrawal of love; by verbal and non-verbal means rejection and withdrawal are substituted. Neglect includes both a lack of physical caretaking and supervision and a lack of cognitive stimulation such as talking, playing, and exploring. Although direct observation of parenting may raise suspicions about the presence of emotional abuse and neglect, the diagnosis is usually suggested by its effects on the child: "The severe adverse effects on the behaviour and emotional development of a child caused by persistent or severe emotional ill-treatment of rejection." All abuse includes some emotional harm. There is also often physical or sexual abuse. Without signs of physical or sexual maltreatment it is still possible to recognize groups of features that demand further investigation. Research tell us that we are still unable to link causes of maltreatment to particular delays and disorders. In addition, the symptoms and signs to be described below do not always mean that there is abuse and neglect. But stopping the abuse and replacing it with sensitive care - often in an another home - is usually followed by a rapid and dramatic improvement in various aspects of the infant's development.

Neglect of the physical and emotional needs of an infant is likely to result in various signs and symptoms that should be fairly easily noted.

15. "ABC of child abuse: Emotional abuse and neglect" by D.H. Skuse, 1989, *British Medical Journal*, 298, 1692-1693. Copyright 1989 by British Medical Journal. Used by permission.

The aspects of physical development that are affected are those that demand the closest attention from caregivers. Babies are dependent creatures: they need to be fed regularly, to be kept in a reasonably dry and warm environment, and to have their bowel and bladder functions taken care of. If they are always cold and wet they will contract infections repeatedly; if they do not have their diapers changed regularly they will develop diaper rash, which if neglected may cause scarring; if they are not fed well they will fail to thrive. Failure to thrive is usually defined as an exceptionally poor rate of growth in which weight (and often length) increasingly fall below the norm. There are many reasons why this may happen. Recent population surveys show that it is seldom linked with abuse or deliberate neglect, even in non-organic cases. In families in which abuse is suspected other evidence to support those suspicions should be sought.

When there has been serious neglect, social and psychomotor skills are also likely to be affected. If there has been no encouragement to acquire skills such as sitting, crawling, and walking, the infant may show developmental delay. Infants are naturally sociable: they enjoy interacting with others, adults or children. A severely neglected infant will not have learned the joy of accepting and returning a smile and so may not try to arouse another's attention. Although we are still not certain that infants can be depressed, increasing evidence suggests that the infants of some depressed (and possibly neglectful) mothers do show characteristic social responses, such as withdrawal, "looking away" behaviour, and emotional flattening. Infants who are not given the chance to interact with others may stimulate themselves. For example, they may repeatedly bang their heads or rock.

Selective attachments to important adults in an infant's life begin to be established around 6 to 8 months of age. A neglected or abused infant may show an unusual pattern of attachment. Usually the experience of consistent and sensitive parenting leads a child to feel safe and secure with the primary caregiver, even in the presence of a stranger. In an unfamiliar setting, such as a clinic, despite the child's wish to want to stay close to her parents, she will still go ahead and explore. Infants who have been abused or neglected, however, lack this sense of security. They

do not have sufficient confidence to explore their surroundings and seem ill at ease, whining, and unhappy and cling to their caregiver, who responds with irritation. The opposite behaviour may also exist in that the infant shows few signs of attachment and may either roam around the room in a completely non-directed fashion or may creep quietly into a corner and will fearfully observe what goes on in the environment (frozen watchfulness). However, it is possible too that the infant who is not abused nor neglected will not want to stray from his parents or he may only want to watch what is going on but not participate.

Multiple-Choice: Emotional Abuse & Neglect

1. Emotional abuse refers to
 - a. hitting, slapping, and some criticism and ridicule.
 - b. criticism and ridicule, and may include hitting and slapping.
 - c. rejection, criticism, and ridicule only.
 - d. rejection, hitting, slapping, and pinching only.
2. Neglect includes a lack of
 - a. cognitive or mental stimulation.
 - b. physical care.
 - c. a lack of cognitive and linguistic stimulation.
 - d. a lack of cognitive stimulation and physical care.
3. We know for a fact that specific patterns of maltreatment
 - a. all cause specific disorders and delays in growth.
 - b. may cause disorders and delays in growth.
 - c. do not cause specific disorders and delays in growth.
 - d. may either cause disorders or delays in growth.
4. A failure to thrive means that the child
 - a. is growing at a rate that is proper for his age.
 - b. is like some children who seem to take a little longer to grow to their full potential.
 - c. is not growing at a rate that is proper for his age.
 - d. the child is normally small.

5. The statement "you clumsy girl" is an example of
 - a. neglect.
 - b. emotional abuse.
 - c. ordinary conversation with a child.
 - d. emotional abuse and neglect.
6. The message that the author of this text is trying to convey is that
 - a. neglect of infants will always lead to emotional, cognitive, and physical consequences for the neglected person.
 - b. neglect of infants is sometimes normal if the parent(s) is pressed with other matters that are more urgent.
 - c. neglect of others is sometimes normal and the parent(s) should not feel guilty about it.
 - d. consistent neglect of infants will probably lead to emotional, cognitive, and physical consequences for the neglected person.
7. A child who has been consistently neglected will have
 - a. less interactions with their parents than a child who has been physically and emotionally abused.
 - b. more interactions than a child who has been physically and emotionally abused.
 - c. as many interactions as a child who has been physically and emotionally abused.
 - d. more interactions with their parents than they would have had with strangers.

8. An infant who has been consistently neglected and emotionally abused may very likely
 - a. make friends with other neglected and abused children.
 - b. be insensitive to other children's needs.
 - c. have a close relationship with his/her parents.
 - d. enjoy being by themselves.
9. Someone who has been severely neglected during infancy will
 - a. lead a normal life when away from those who neglected him/her.
 - b. be able to overcome any emotional or physical problems on their own.
 - c. require extensive psychological help and may be able to function well.
 - d. will certainly be neglectful of others.
10. Setting up a program which is intended to foster positive relationships between an infant and his parents should include
 - a. having the parent buy the infant toys and letting the infant play with them.
 - b. having the parent buy the infant toys so that the baby will be able to play with other babies.
 - c. having the parent buy the infant toys so that they may both play with them together.
 - d. having the parent buy the infant toys so that the parent may watch another adult play with the infant.

11. The consistent and severe neglect of an infant is due to
 - a. an increasing number of mothers working outside the home.
 - b. an increasing number of infants placed in day cares.
 - c. the caregiver's lack of knowledge and inability to take care of the child.
 - d. the infant's unreasonable demands which he makes of the parents.
12. When a baby cries, you should
 - a. pick it up at once and comfort it.
 - b. check to see if the baby is hurt or hungry, but do not hold the baby for a long time.
 - c. let it cry until it falls asleep.
 - d. tell the baby to "be quiet".

APPENDIX F

APPENDIX F**Example Test of Metacomprehension**

Student ID: _____

Date: _____

Class: _____

Time Taken: _____

Instructions:

Please read the following text passage carefully. We do not expect that it will take you longer than 5 minutes to read the passage. Record the time it takes you to read this passage.

Leukemia¹⁶) is a characteristic of cancer in which there is an increased number of malignant cells in the bone marrow. The bone marrow is a soft, fatty substance which fills the cavity of the bones of the

16. *Physically handicapped children: A medical atlas for teachers, 2nd edition: Cancer in childhood* (pp. 53-54) by M.P. Link, M.D., 1982, Needham Heights, Massachusetts: Allyn & Bacon. Copyright 1982 by Allyn & Bacon. Used by permission of the publisher.

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skeleton and is the place where normal blood cells are produced. Leukemia interferes with the production of the normal components of blood by the bone marrow. Children with leukemia present symptoms related to the deficiencies of normal brain cells - i.e., anemia, excessive bleeding, and infection. Leukemia may be suspected from the abnormal blood counts, but a bone marrow test is performed to make the diagnosis. The abnormal cells which fill the bone marrow in leukemia are immature blood cells referred to as "blasts". The blast cells may also leave the marrow, circulate in the bloodstream, and spread to other organs - especially the lymph nodes, liver, and spleen. The leukemic cells may also spread to the central nervous system such as the brain, spinal cord, and cerebrospinal fluid.

The principles of the treatment of leukemia in childhood are similar to those applied in treating malignant solid tumors. Leukemia is found throughout in the bone marrow, bloodstream, and many organs of the body at the time of diagnosis. Today, treatment thus depends primarily on surgery which attempts to eliminate all detectable leukemia cells from the body.

Instructions	
If you noticed something wrong or which did not make sense to you in the passage you just read, circle the word "YES" below. Then, read and follow the instructions below.	If you did not notice anything wrong or which did not make sense to you in the passage you just read, circle the word "NO" below. Then, read and follow the instructions below.
YES	NO
1. Go back to the text passage and, using your RED pencil, underline the part(s) that was(were) giving you trouble or did not seem to make sense to you. 2. Once you have completed the above, write down how you would change what you underlined so that it does make sense. Make your change(s) directly on the text passage. Use your BLACK pencil. 3. Once you have made your revisions, go on to the next page and follow the instructions there.	1. Read the passage which begins on the next page and follow the instructions there.

Instructions: Please, read the following text passage carefully. We do not expect that it will take you longer than 5 minutes to read the passage. Record the time it takes you to read this passage.

Hemophilia¹⁷) is an inherited disorder of blood coagulation in which a protein required for blood clotting is abnormal and, therefore, does not function properly.

Hemophilia is the same as a genetic pattern known as "sex-linked recessive inheritance". The term "sex-linked" refers to the fact that the defective gene is located on the X chromosome, which functions in determining an individual's personality. The term "recessive" refers to the fact that the trait (hemophilia) is expressed only when the defective form of the gene alone is present. Females, who have two X chromosomes, must therefore carry the defective form of the gene on one chromosome in order to have hemophilia. If only one of their chromosomes bears the defective gene, they will be carriers of the

17. *Physically handicapped children: A medical atlas for teachers, 2nd edition: Hemophilia* (pp. 325-326) by F.R. Berberich, M.D., 1982, Needham Heights, Massachusetts: Allyn & Bacon. Copyright 1982 by Allyn Bacon. Used by permission of the publisher.

defective gene and may pass it on to their offspring, but only rarely will they have bleeding difficulties themselves. Males, on the other hand, have only one X chromosome (their second sex chromosome is a Y). Therefore, they require only a single dose of the defective gene to have hemophilia. Each male offspring born of a carrier mother and normal father has a 50 percent chance of having hemophilia. Each daughter, however, has a 50 percent chance of being a carrier. Sons born to a normal, noncarrier mother and a hemophiliac father will be normal. But all daughters of such parents will be carriers.

Instructions	
If you noticed something wrong or which did not make sense to you in the passage you just read, circle the word "YES" below. Then, read and follow the instructions below.	If you did not notice anything wrong or which did not make sense to you in the passage you just read, circle the word "NO" below. Then, read and follow the instructions below.
YES	NO
1. Go back to the text passage and, using your RED pencil, underline the part(s) that was(were) giving you trouble or did not seem to make sense to you. 2. Once you have completed the above, write down how you would change what you underlined so that it does make sense. Make your change(s) directly on the text passage. Use your BLACK pencil. 3. Once you have made your revisions, go on to the next page and follow the instructions there.	1. STOP and hand in your booklet.

Thank you for completing this exercise. Make sure that you have written your identification number where indicated.

APPENDIX G

APPENDIX G

SICKLE CELL ANEMIA¹⁸

Sickle cell anemia was first described at the turn of the century by Herrick. He observed the crescent-shaped red blood cells, from which the disease derives its name, in the blood of an anemic Black West Indian student.

In the United States, sickle cell disease has been identified with the Black population, and it is unique to this group. It is widely distributed and crosses both racial and continental lines. The disease, cause of an inherited genetic defect, is most common in the areas of the world where malaria is common. It has been found that normal people carrying the sickle gene are relatively resistant to being infected by the malaria parasite. The distribution of sickle cell disease illustrates the principle of Darwinian selection, since a child carrying the sickle gene in areas with malaria has a good chance of survival. In the areas of the West Coast of South America, thought to be the ancestral homeland of most American Blacks, about 30 percent of the populace has the sickle cell gene. About 10 percent of the American Blacks carry the sickle cell gene. These people are physically normal, and, under usual circumstances have no symptoms of sickle cell disease. However, approximately 1 in 1000 Black newborn infants will have sickle cell anemia, having inherited two defective sickle cell genes. Sickle-cell anemia may limit a person's life.

18. *Physically handicapped children: A medical atlas for teachers, 2nd edition:* Sickle Cell Anemia (p. 469) by F.R. Berberich, M.D., 1982, Needham Heights, Massachusetts: Allyn & Bacon. Copyright 1982 by Allyn Bacon. Used by permission of the publisher.

APPENDIX H

APPENDIX H

Instructions to Raters of Texts Used for Metacomprehension Tasks

Instructions to Raters

Here are four (4) passages. Please read them carefully. If you noticed anything that does not make sense to you or is inconsistent, please underline the questionable section(s) and rewrite the section(s) so that it(they) do(es) make sense. Then, classify the questionable or anomalous section(s) into one of the categories described below. Repeat this process for all four passages.

Definition of the Categories

1. Inconsistent information, where ideas in one sentence in the text conflict with those of another (also in the text). In other words, there is a contradiction in the text. For example, 'Because of the adequacy of certain early vaccines for measles, some individuals

may still be susceptible to the disease.' Instead, the sentence should read: 'Because of the *inadequacy* of certain early vaccines for measles, some individuals may still be susceptible to the disease.'

2. Prior Knowledge Inconsistency, where the information in the text is inconsistent with the reader's prior knowledge of the topic. For example, 'Epidemics of hepatitis A occur most frequently in day-care centres that accept children over 2 years old.' Rather, the sentence should read: 'Epidemics of hepatitis A occur most frequently in day-care centres that accept children *under* 2 years old.'
3. Inappropriate relationship, where the relationship expressed between concept is inaccurate. For example, 'The causes of hepatitis A are fever, diarrhea, or generally a sick feeling feeling.' Rather, the sentence should read: 'The *symptoms* of hepatitis A are fever, diarrhea, or generally sick feeling.'

APPENDIX I

APPENDIX I

Free-Written Recall Coding Scheme

The following is a description of the method used to segment expert texts.

The basic unit of analysis used to segment text was the "idea unit". An idea unit is defined as a distinct and meaningful piece of information which can then be evaluated in some way. Idea units were identified according to a set of rules which involved taking individual sentences and segmenting them into concepts and relationships. If they contained relatively contrasting examples, types, characteristics, causes, and elaborations each of these was considered a new idea unit. Otherwise, they were treated as conveying the same idea. To some extent, syntactical markers such as punctuation and subject-predicate combinations were also used to aid in the identification of these units.

Application of Method

The following examples illustrate the application of the method described above.

RULE I: As a general rule, statements representing examples such as the following are treated as new ideas. For example, 'Animals or plants may trigger an attack.' There are two idea units here because 'animals' and 'plants' are different examples of allergens. Similarly, in the sentence, 'Asthmatics can have an attack because of over-exertion, allergies, excitement' is segmented into three (3) idea units: (a) Asthmatics can have an attack because of over-exertion; (b) Asthmatics can have an attack because of allergies; and (c) Asthmatics can have an attack because of excitement. However, the sentence 'Parents may be beating, hitting, kicking their children out of frustration or anger.' is treated as 1 idea unit. The verbs "beating, hitting, kicking" are similar enough that they do not warrant segmenting.

RULE II: As a general rule, statements which introduce other statements (Meyer's signaling statements) such as the following are segmented into different idea units. For example, "Asthmatics can have an attack for a variety of reasons such as over-exertion, allergies, excitement" are segmented into four (4) idea units.

- a. Asthmatics can have an attack for a variety of reasons
- b. such as over-exertion
- c. such as allergies
- d. such as excitement

RULE III: As a general rule, statements representing alternative types such as the following are treated as new ideas. For example, 'Glucose or insulin injections must be taken.' There are 2 idea units here: 'Glucose injections must be taken', 'Insulin injections must be taken'. These types of injections are taken for very different medical reason and have different reactions.

RULE IV: As a general rule, statements representing symptoms such as the following are treated as new ideas. For example, 'Symptoms of juvenile diabetes is drinking alot, frequent urination, and weight loss.' There are 3 idea units here: 'Symptom of juvenile diabetes is drinking a lot', 'Symptom of juvenile diabetes is frequent urination', and 'Symptom of juvenile diabetes is weight loss'. Each of these 3 symptoms impacts a different part of the body and lead to different consequences. **However,** had the student written 'Symptom of juvenile diabetes is that the patient gets thirsty, he drinks a lot', this statement would be treated as 1 idea unit because the latter part of this statement serves to clarify the former part without the introduction of a new idea.

RULE V: As a general rule, when a piece of information is identical to some information already expressed earlier or later, it is not considered in the analysis. For example, 'It is a genetic disorder passed on by the parents'. There is only 1 idea unit here because 'genetic disorder' and 'passed on by the parents' convey the same idea.

RULE VI: As a general rule, statements representing explanations such as the following are treated as conveying new ideas. For example, 'Death occurs often before teen years but now because of special treatments victims can live into adult life.' There are 2 idea units here: 'Death occurs often before teen years', 'But now because of special treatments victims can live into adult life.' Similarly, the sentence "In juvenile diabetes mellitus glucose cannot be used normally because the body cannot make a hormone known as insulin" is segmented into 2 idea units: 'In juvenile diabetes mellitus glucose cannot be used normally' and 'the body cannot make a hormone known as insulin.' However, the statement 'It's not a rare sickness, common to both humans and animals' is treated as 1 idea unit.

RULE VII: As a general rule, statements representing conditions such as the following are treated as conveying 1 idea. For example, 'If injections are not taken, then the patient could have a reaction' contains 1 idea.

RULE VIII: As a general rule, statements containing qualifiers such as the following are not treated as conveying new ideas. For example, 'It is a genetic disease.' There is only 1 idea here because the word "genetic" modifies the word "disease". Similarly, "It is a disease found mainly in children." However, both of these examples illustrate the case of single modifiers. There are cases where more than one modifier is used to describe a concept and these modifiers convey different ideas. For example, had the author written "Cystic fibrosis is a fatal genetic disease found mainly in children." This sentence can be segmented into three (3) idea units here: 'Cystic fibrosis is fatal (or a fatal disease); 'Cystic fibrosis is genetic (or a genetic disease); and 'Cystic fibrosis is found mainly in children'.

APPENDIX J

APPENDIX J

Instructions to Raters Identifying Key and Non-Key Ideas

Identification of Key and Non-Key Ideas

INSTRUCTION TO RATER: Using the segmented master version of the text passage (a segmented version is provided as well for your reference), rate each idea unit in terms of its importance. In other words, rate the idea units in terms of their centrality or "keyness" in the text. The ratings can be written next to the idea unit being considered.

The following 5 point scale will be used to rate the centrality of the ideas.

The two extremes of the scale are outlined below.

A rating of '1' is assigned to idea units which are least central or key or which are lowest in importance.

A rating of '5' is assigned to idea units which are most central or which

are highest in importance.

To facilitate this rating process, you may consider asking yourself the following questions, "If the author took this idea away, would one of the central ideas be missing from the text?" Another way to think of this is if the idea was not present in the text, would your understanding of the idea be severely limited? If your answer is that a very central idea would be missing from the text or that your understanding of the text would be severely limited, then rate this idea unit as a '5'.

Note: For each of the rating levels, there may be several idea units at each level.

APPENDIX K

APPENDIX K

Master Segmentation and Idea Quality Identification Template for Diabetes Text

The following is a segmentation of the expert text on Diabetes into idea units. Beside each idea unit is either the letter 'K' (key idea) or 'NK' (nonkey). Information contained by the square bracket [] has been included by the primary investigator. This was to facilitate reading of the idea.

Master Template: Diabetes Mellitus

1. Diabetes mellitus is a disorder of carbohydrate, (K)
2. protein, (K)
3. and fat metabolism, (K)
4. which may become apparent any time between early infancy and old age. (K)

5. The body's main energy source, a sugar known as glucose, (NK)
6. [glucose] cannot be used normally in juvenile diabetes mellitus (K)
7. because the body cannot make a hormone known as insulin. (K)
8. In juvenile diabetes mellitus, the pancreas is unable to make insulin. (K)
9. It follows that the use of glucose as an energy source will be disturbed. (NK)
10. When there is no insulin, the glucose cannot move into the cells as fast. (NK)
11. Moreover, the resulting shortage of glucose in the cells indirectly stimulates the liver to produce even more glucose. (NK)
12. The amount of glucose present in the blood thus rises, (NK)
13. and the amount of glucose passing through the kidney in the blood also is increased. (NK)
14. The function of the kidney is to make urine out of blood. (NK)

15. Normally, the kidney completely extracts the glucose from the blood, (NK)
16. so that no glucose appears in the urine. (NK)
17. When the amount of glucose delivered to the kidney reaches a certain level, however, the kidney suddenly finds itself unable to extract the excess glucose, (NK)
18. and glucose begins to appear in the urine. (NK)
19. As this happens, the amount of urine increases, (NK)
20. because the glucose carries water with it. (NK)
21. Thus, one of the first signs of diabetes is polyuria (the production of large amounts of urine). (K)
22. Since glucose in the blood cannot enter the cells, the body acts as if no food were being ingested, (NK)
23. and fat is broken down for energy, (NK)
24. just as in starvation. (NK)

25. The patient now experiences polyphagia (the eating of excessive amounts of food) (K)
26. and weight loss. (K)
27. Tiredness and weakness also develop. (K)
28. If nothing is done, the diabetic will soon develop diabetic coma (K)
29. (technically known as ketoacidosis) note: error in text: ketoacidosis leads to coma, they are not the same (NK)
30. and, if untreated, may die. (K)
31. If an individual is going to develop diabetes, there is nothing that will forestall its development. (K)
32. Nothing that the individual did or ate caused the diabetes to appear. (NK)
33. Likewise, it is not true that eating sweets will bring on diabetes. (NK)
34. In addition, some people do not develop diabetes until they are adults. This is known as adult-onset diabetes. (NK)

35. The development of juvenile diabetes mellitus is strongly influenced by heredity, (K)
36. but the degree to which it is an inherited trait is not yet known. (NK)
37. Diabetes is much more prevalent in children whose close relatives have the disease. (K)
38. A child is more likely to develop diabetes if both parents have (NK)
39. is more likely to develop diabetes if a parent has the disease than if an aunt or an uncle has diabetes, (NK)
40. and is more likely to develop diabetes if an identical twin has the disease than if a brother or sister had diabetes. (NK)
41. This fact and other evidence makes scientists think that some other factors, perhaps viral, are needed - in addition to heredity - to produce juvenile diabetes mellitus. (NK)
42. Since diabetes appears any time between a few months and several

decades after birth, (K)

43. and since there are many forms diabetes can take (K)
44. (juvenile diabetes, (NK)
45. adult-onset diabetes, (NK)
46. obesity-associated diabetes, etc.), (NK)
47. it is not possible to predict who will or will not develop diabetes
(K)
48. or what type of diabetes he will have. (K)
49. Given that the diabetic needs insulin (K)
50. to allow the cells to utilize glucose for energy, (NK)
51. too much insulin may be harmful. (K)
52. When an excessive dose of insulin is given, the amount of the sugar
in the blood falls drastically. (K)
53. Certain organs in the body, and particularly the brain, cannot
utilize fatty acids (NK)

- 54. and thus have an absolute requirement for glucose as their sole energy source. (NK)
- 55. If not enough glucose reaches the brain, then certain symptoms appear: (NK)
- 56. headache, (K)
- 57. dizziness, (K)
- 58. irritability or other changes in personality, (K)
- 59. blurred vision, (K)
- 60. nausea, vomiting, (K)
- 61. profuse sweating, (K)
- 62. fast heart rate, (K)
- 63. cold hands and feet, (K)
- 64. and eventually, convulsions, (K)
- 65. coma, (K)
- 66. and death. (K)

- 67. These are the symptoms of an insulin reaction, or a hypoglycemia episode (low blood sugar). (K)
- 68. An insulin reaction is more likely to occur at the time of peak action for the insulin. (NK)
- 69. If a diabetic receives too much NPH (longer lasting) insulin at 7:30 A.M., for example, an insulin reaction would be likely to occur some 8 hours later, or at 3:30 P.M. (NK)
- 70. The symptoms of insulin reaction [are rapid in onset] (K)
- 71. unlike those of ketoacidosis (too little insulin) (K)
- 72. Thus, they must be recognized and treated promptly if serious problems are to be avoided. (K)
- 73. Normally, the administration of concentrated sugar in some form will terminate the insulin reaction in a matter of 2 to 3 minutes. (K)
- 74. Sweetened fruit juices (such as orange juice), nondietetic carbonated beverages, or fruit-flavored hard candies (such as Life-Savers) are the best sources of rapid sugar. (NK)

- 75. Medical aid must be sought immediately to avoid further problems,
if the diabetic does not respond promptly to sugar, (K)
- 76. [Medical aid must be sought immediately to avoid further problem,
if the diabetic] vomits what is given. (K)

APPENDIX L

APPENDIX L

Master Segmentation and Idea Quality Identification Template for Cystic Fibrosis Text

The following is a segmentation of the expert text on Cystic Fibrosis into idea units. Beside each idea unit is either the letter 'K' (key idea) or 'NK' (nonkey). Information contained by the square bracket [] has been included by the primary investigator. This was to facilitate reading of the idea.

Master Template: Cystic Fibrosis

1. It is a disease of childhood, (K)
2. hereditary, (K)
3. usually fatal (K)
4. most common (K)

5. Not described until 1936. (NK)
6. One of the most popular alternate names for cystic fibrosis is mucoviscidosis. (NK)
7. This (mucoviscidosis) is a descriptive term which means the widespread presence of abnormally thick, viscid mucus. (K)
8. This name came into use once it was apparent that various aspects of the disease could be attributed to an abnormal mucus secreted, (K)
9. not only in the pancreas (NK)
10. and the lungs (NK)
11. but in other organs as well. (NK)
12. Various investigators were able to show that the walls of the stomach [secretes abnormal mucus], (NK)
13. the intestine [secretes abnormal mucus], (NK)
14. the salivary glands [secrete abnormal mucus], (NK)

15. and the liver [secretes abnormal mucus]. (NK)
16. Children with cystic fibrosis have an abnormal concentration of salt in their sweat. (K)
17. This was discovered in 1952. (NK)
18. This peculiarity of the sweat glands was the first evidence that non-mucous secreting glands were also involved in this disorder. (NK)
19. Cystic fibrosis is now considered to involve all the secreting glands of the body, except those that secrete into the bloodstream. (K)
20. Cystic fibrosis is considered to be a genetic disorder. (K)
21. [Cystic Fibrosis is considered to be] simple recessive. To be affected the child must inherit two cystic fibrosis genes, one from each parent. (K)
22. Persons who have only one cystic fibrosis gene and one normal gene are carriers of the disorder, (NK)
23. but there are no significant abnormalities associated with being a

carrier. (NK)

24. The discovery of an abnormal protein isolated from the blood of children with cystic fibrosis [may become the basis for carrier identification] (NK)
25. and from carriers of this gene may become the basis for carrier identification. (NK)
26. A child with cystic fibrosis may come to a doctor's attention in a variety of ways. (NK)
27. The disease may be evident at birth (K)
28. in those children whose predominant abnormality is of the intestinal tract. (K)
29. A lack of the normal pancreatic juice during fetal life can result in a grossly thickened material replacing the normal stool that babies pass in the first day or two of life. (K)
30. Inability of the child to pass this material causes obstruction of the intestine, (NK)

31. and surgery is required to relieve it. (NK)
32. Intestinal involvement is often not severe enough to manifest itself at birth, (NK)
33. but it will be evident later, (K)
34. when the child's stool shows the effect of insufficient pancreatic juice. (K)
35. Pancreatic juice supplies enzymes that break down ingested proteins, (NK)
36. carbohydrates, (NK)
37. and fats. (NK)
38. Fortunately, other organs of the intestinal tract also supply enzymes that break down proteins (NK)
39. and carbohydrates, (NK)
40. as well as some fats. (NK)
41. A child with cystic fibrosis with significant involvement of the pancreas will have stools that are frequent, (NK)

- 42. bulky, (NK)
- 43. greasy, and (NK)
- 44. very foul in odor, (NK)
- 45. due to the excretion of undigested fats. (NK)
- 46. The child may lose calories in his stool, (NK)
- 47. so that either he will have a voracious appetite to make up for the calorie loss, (K)
- 48. or he will fail to gain weight adequately. (K)
- 49. Involvement of the lungs results in an increased frequency [of respirator infections] (K)
- 50. and more prolonged course of respiratory infections. (K)
- 51. The child who develops a cold is subsequently apt to have a persistent cough for several months (NK)
- 52. or to develop an episode of pneumonia (secondary to this cold) (NK)

- 53. or bronchitis secondary to this cold. (NK)
- 54. Once infection is firmly lodged in the chest, one can expect cough to become chronic and to be present most of the time. (K)
- 55. Cystic fibrosis should be considered, therefore, in children with chronic cough (NK)
- 56. in children with frequent episodes of bronchitis (NK)
- 57. in children with pneumonia. (NK)
- 58. (Since) plugs of mucus in the bronchial tubes can partly obstruct the flow of air, particularly on expiration, (NK)
- 59. wheezing may occur secondary to this type of obstruction. (NK)
- 60. Consequently, some children are initially diagnosed as asthmatic, before the correct diagnosis of cystic fibrosis is considered. (NK)
- 61. The high salt content of sweat can cause problems in the summertime, particularly for the active child who perspires freely. (K)

- 62. If enough salt is lost in the sweat, the child may become acutely ill (NK)
- 63. and require hospitalization (NK)
- 64. in order to receive the needed rapid, intravenous replacement of the salt lost. (K)
- 65. There are at least two things which the teacher of a cystic fibrosis child might bear in mind that can help improve the quality of the child's experience at school: (NK)
- 66. It is most important that the child cough out the mucus and not keep it in the lungs. (K)
- 67. The child may cough frequently. (NK)
- 68. The lung disease is not communicable. (NK)
- 69. Do not embarrass the child when she is coughing by looking at her or stopping the normal class routine. (K)
- 70. The child with cystic fibrosis will have an increased appetite (K)

71. and may well take seconds and thirds during times when the class is eating. (K)
72. This should be encouraged. (K)
73. In fact, you may even consider encouraging the rest of the children to eat less fat by providing them with fresh fruits and vegetables. (NK)

APPENDIX M

APPENDIX M

Master Segmentation and Idea Quality Identification Template for Asthma Text

The following is a segmentation of the expert text on Asthma into idea units. Beside each idea unit is either the letter 'K' (key idea) or 'NK' (nonkey). Information contained by the square bracket [] has been included by the primary investigator. This was to facilitate reading of the idea.

Master Template: Asthma

1. Asthma is found in children (K)
2. is a common disease (K)
3. is chronic (K)
4. is frequently encountered in the classroom. (K)

5. Asthma may be best described as a labored, wheezing breathing (K)
6. caused by interference with the normal flow of air in and out of the lungs. (K)
7. The discussion in this passage will be limited to allergic asthma and thus will not consider other nonallergic causes of wheezing. (K)
8. The basic causes of asthma are little understood. (NK)
9. Our knowledge of them is expanding rapidly, however. (NK)
10. The individual with "allergy" was at one time felt to have a deficiency in antibodies. (NK)
11. which allowed substances to react against the individual's own tissues (NK)
12. such as pollens, (NK)
13. house dust, (NK)

14. animal danders, (NK)
15. molds, (NK)
16. and foods. (NK)
17. Our present belief is just the opposite. (NK)
18. The allergic individual has an over-abundance of antibodies to certain substances (K)
19. and these antibodies react in heightened response whenever the allergy- producing substances (allergen or antigen) are inhaled (K)
20. or ingested into the body. (K)
21. The union of the antigen and antibody leads to an explosive reaction (NK)
22. and release of chemicals from the mast cells of the body (NK)
23. (histamine) (NK)
24. (serotonin) (NK)
25. (bradykinin,) (NK)

26. (SRS-A). (NK)
27. These chemicals, in turn, produce the symptoms we call allergy.
(NK)
28. The allergic reaction can take place in various parts of the body
such as, (NK)
29. the nose, (NK)
30. the lungs, (NK)
31. the eyes, (NK)
32. the skin (NK)
33. [An allergic reaction that occurs in the lungs is called] asthma.
(NK)
34. [An allergic reaction that occurs in the nose is called] allergic
rhinitis (or hayfever) (NK)
35. [An allergic reaction that occurs in the eyes is called] allergic
conjunctivitis. (NK)

36. [An allergic reaction that occurs on the skin is called] eczema.
(NK)
37. [Another an allergic reaction occurs on the skin is called] hives.
(NK)
38. One of the most serious reactions occurs in the lungs. (NK)
39. It is still not clear why the allergic individual reacts so explosively to substances that, in a nonallergic individual, are inoffensive and tolerated. (NK)
40. Two basic factors are at work when asthma occurs. (NK)
41. First, there is a constitutional predisposition on the part of the individual to form antibodies, (K)
42. and second, she must have contact with the offending substances (allergens) to which she will react. (K)
43. The substances to which a predisposed person may become allergic and against which she will make antibodies can be divided broadly into ingestants (K)

- 44. and inhalants. (K)
- 45. In this section we will talk about ingestants only. (NK)
- 46. Younger children are more prone to have asthma from ingestants.
(K)
- 47. Some of the most common offenders in early childhood are (NK)
- 48. milk, (NK)
- 49. eggs, (NK)
- 50. nuts, (NK)
- 51. chocolate, (NK)
- 52. wheat, (NK)
- 53. and citrus fruits. (NK)
- 54. As a child grows older, she generally tends to develop greater
tolerance for foods, (NK)
- 55. but some people continue to have severe reactions to a variety of
specific foods. (NK)

- 56. Another large class of ingestants is drugs. (NK)
- 57. A reaction to drugs is highly variable from one individual to another. (K)
- 58. It can be very mild in some (itching or hives) and overwhelming in others (asthma or shock). (NK)
- 59. The degree of allergic reaction or the intensity of asthma seems unrelated to the amount of drug ingested. (K)
- 60. One penicillin tablet can be as dangerous as 20 to the allergic individual. (NK)
- 61. Asthma usually starts as isolated episodes of wheezing (K)
- 62. which are relatively mild and of short duration. (NK)
- 63. The initial attacks are most often precipitated by respiratory infections. (K)
- 64. With time, as allergic exposure and difficulties continue attacks become more frequent and can occur under almost any circumstances, (K)

- 65. any season of the year, (NK)
- 66. day or night, (NK)
- 67. indoors or outdoors. (NK)
- 68. All too often the causative factors are unknown to the individual.
(NK)
- 69. Since the interval between exposure to allergens and the onset of
an attack is quite variable and may, at time, be many hours, the
precipitating factors go unrecognized. (NK)
- 70. Later, attacks are less frequently precipitated by infection, (K)
- 71. there often will still be a clear running nose before the onset of
wheezing. (NK)
- 72. Rather than being a cold, this may represent nasal allergy, (NK)
- 73. and, after a time varying from minutes to hours, it is followed by
the onset of a characteristic dry, hacking, nonproductive cough. (K)
- 74. The cough is so typical that the parents and child both realize that
wheezing will soon commence. (K)

75. If the attack is at all severe, the child's activity will diminish considerably. (K)
76. He will sit with his shoulders hunched forward, (NK)
77. laboring hard to breathe. (NK)
78. His whole chest moves with each respiratory effort, (NK)
79. his nostrils may flare, (NK)
80. and the noise of his breathing is easily audible. (NK)
81. He may appear quite anxious and apprehensive. (NK)
82. If the attack is very severe, there may be blueness of his fingertips and lips. (NK)
83. Not all asthmatic attacks will be so marked, (NK)
84. and some are mild enough to require little treatment. (NK)
85. With many children, especially early in the course of the disease, the episodes will terminate abruptly (NK)
86. and the child will be free of any wheeze until the next acute attack

occurs. (NK)

87. In other cases, especially as the duration of the disease is prolonged, the wheeze will not end abruptly but will gradually decrease in severity (K)
88. and will persist in mild form between acute exacerbations. (K)
89. Thus, some children with rather marked asthma can be heard to wheeze all through the day in a very mild, almost inaudible way.
90. Wheezing will become quite audible only in responses to running, (NK)
91. laughing, (NK)
92. cold weather, (NK)
93. and irritants. (NK)

APPENDIX N

APPENDIX N

Master Segmentation and Idea Quality Identification Template for Non-Accidental Injury Text

The following is a segmentation of the expert text on Non-Accidental Injury into idea units. Beside each idea unit is either the letter 'K' (key idea) or 'NK' (nonkey). Information contained by the square bracket [] has been included by the primary investigator. This was to facilitate reading of the idea.

Master Template: Non-Accidental Injury

1. The diagnosis of physical abuse (non-accidental injury) is a difficult intellectual [exercise] (Nk)
2. and emotional exercise. (NK)
3. It is one of the most difficult subjects in clinical work, (NK)

4. needing time, (NK)
5. experience, (NK)
6. emotional energy.(NK)
7. The biggest barrier to diagnosis is the existence of emotional blocks in the minds of professionals. (K)
8. These can be so powerful that they prevent the diagnosis even being considered in quite obvious cases. (K)
9. All those working with children should be warned that their overwhelming impulse on confronting their first case will be to want to cover it up. (K)
10. The most important step in diagnosing non-accidental injury is to force yourself to think of it in the first place. (NK)
11. Non-accidental injury is one of the most important diagnoses in clinical pediatrics as it can so vitally influence a child's future life. (NK)
12. At worst it is a matter of life and death for the child, (K)

13. and short of death there may still be possible brain damage or handicap. (K)
14. Though high risk cases are currently in a minority, (NK)
15. the diagnosis remains crucially important in every case. (NK)
16. This is because non-accidental injury is often a marker for emotional abuse and deprivation (K)
17. that can cause progressive and possibly permanent damage to a child's developing personality. (K)
18. This principle is especially relevant in children of school age. (NK)
19. In such children the risk of death may be extremely small,
20. yet non-accidental injury in older children is almost inevitably associated with longstanding disturbance of the parent-child relationship. (K)
21. Non-accidental injury is not a full diagnosis, (NK)
22. it is merely a symptom of disordered parenting. (NK)

23. The aim of intervention is to diagnose (K)
24. and cure (if possible) the disordered parenting. (K)
25. Simply to aim at preventing death is a lowly ambition. (NK)
26. In some cases the occurrence of physical abuse may provide an opportunity for intervention. (NK)
27. There are no hard and fast rules and no easy answers for diagnosis. (NK)
28. The following list constitutes seven classic "pointers" to the diagnosis. (NK)
29. None of them is diagnostic, neither does the absence of them exclude the diagnosis of non-accidental injury. (K)
30. 1. There is a delay in seeking medical help (or no medical help is sought). (K)
31. 2. The story of the "accident" is vague, is lacking in detail, and may vary with each telling and from person to person. (K)

32. (Innocent accidents tend to have vivid accounts that ring true.)
(NK)
33. 3. The account of the accident is not compatible with the injury
observed. (K)
34. 4. The parents' affect is abnormal. (K)
35. Normal parents are full of creative anxiety for the child. (NK)
36. Abusing parents tend to be more preoccupied with their own
problems - (NK)
37. for example, how they can return home as soon as possible. (NK)
38. 5. The parents' behaviour gives cause for concern - (K)
39. for example, they soon become hostile, (NK)
40. they rebut accusations that have not been made, (NK)
41. and they leave before the consultant arrives. (NK)
42. 6. The child's appearance and his interaction with his parents is
abnormal. (K)

- 43. He may look sad, withdrawn, or frightened. (NK)
- 44. There may be visible evidence of a failure to thrive. (NK)
- 45. Full blown frozen watchfulness is a late stage (NK)
- 46. and results from repetitive physical and emotional abuse over a period of time. (NK)
- 47. The absence of frozen watchfulness does not exclude the diagnosis of non-accidental injury. (NK)
- 48. 7. The child may say something. (K)
- 49. Always make a point of interviewing the child in a safe place in private. (NK)
- 50. This is one of the virtues of admission to hospital. (NK)
- 51. Interviewing the child as an outpatient may fail to let the child open up (NK)
- 52. as he is expecting to be returned to the custody of the abusing parent in the future. (NK)

- 53. 8. Some forms of injury are by their nature virtually diagnostic of non-accidental injury. (NK)
- 54. These include finger tip bruising, especially when it is multiple; (K)
- 55. cigarette burns; (K)
- 56. lash marks; (K)
- 57. retinal and subdural hemorrhages, (K)
- 58. which can occur after a shaking injury without other evidence of bruising or fracture. (NK)
- 59. When physicians diagnose cases of child abuse, they should first approach the parents as they would in other clinical cases, (K)
- 60. introduce themselves, shake hands, and proceed logically through the history, examination, provisional diagnosis, and decision making. (NK)
- 61. Secondly, they should not jump to conclusions one way or the other. (K)

- 62. They should try to proceed slowly and deliberately, keeping their mind open as long as possible. (K)
- 63. They should take a provisional social history to form a picture of the family background and how likely it would be for abuse to occur there. (K)
- 64. While the physicians have the responsibility to make the correct diagnostic, the importance of the inter-professional team-work cannot be overemphasized. (K)
- 65. First, the complexity of many child abuse cases may mean that a whole range of different agencies are involved in dealing with a child abuse case; (NK)
- 66. second, the emotional stress experienced by workers in child abuse is minimized if professionals have the opportunity to share their difficulties and find support from colleagues. (NK)
- 67. Professional team work is increasingly accepted as the most appropriate method of working in the area. (NK)

APPENDIX O

APPENDIX O

Master Segmentation and Idea Quality Identification Template for Suffocation Text

The following is a segmentation of the expert text on Suffocation into idea units. Beside each idea unit is either the letter 'K' (key idea) or 'NK' (nonkey). Information contained by the square bracket [] has been included by the primary investigator. This was to facilitate reading of the idea.

Master Template: Suffocation Text

1. Asphyxia is uncommon (K)
2. serious (K)
3. form of child abuse. (K)
4. The most common form is smothering (K)

5. and the abuser is usually the child's mother (K)
6. who uses her hand, a pad of rolled up clothing, or a pillow (NK)
7. to cause mechanical obstruction to the child's airways (NK)
8. Less commonly she presses the child's face against her chest, (NK)
9. encloses the child's head in a plastic bag (NK)
10. or strangles by pressure on the child's neck (NK)
11. Smothering happens to young children under the age of 3 years (K)
12. most being infants under the age of 1 year (K)
13. They may appear to doctors either as sudden unexplained deaths ("cot deaths"), (K)
14. moribund "near miss cot deaths" (K)
15. or repetitively as cyanotic (K)
16. or floppy children (K)
17. whom the mother claims to have had an episode at home (NK)

18. which is presumed by doctors to have been an apneic attack (the child temporarily stops breathing) (K)
19. or a seizure (K)
20. (If a mother describes a young baby as having stopped breathing or having seemed unconscious for a short time, a doctor will probably consider that the baby has had an apnea attack (K)
21. whereas in an older child, he or she is more likely to consider the same description to have been a seizure.) (K)
22. Between 2 and 10 % of babies currently labelled as dying from sudden death syndrome have probably been smothered by their mothers (NK)
23. Many of these have had previous recurrent episodes of apnea (K)
24. or seizures (K)
25. that may have been investigated thoroughly in a conventional radiological, (NK)
26. biochemical (NK)

27. or electrophysiological way (NK)
28. without proper consideration being given to child abuse as a possible cause. (NK)
29. Warning features that the sudden infant death syndrome may have been caused by a mother smothering her child are: (NK)
30. Previous episodes of unexplained apnea, or "near miss cot death", (K)
31. seizures (K)
32. an infant aged over 6 months (K)
33. Previous unexplained disorders affecting that child (K)
34. other unexplained deaths of children in the same family. (K)
35. For some children the smothering is associated with other forms of child abuse, (NK)
36. particularly physical abuse (K)
37. Some mothers smother their child when they are feeling violent hatred towards their baby (NK)

- 38. others do it in a repetitive symstematic way, (NK)
- 39. taking their child regularly to the doctor each time that they may have smothered their child for long enough to make him or her unconscious (NK)
- 40. Smothering is violent; (K)
- 41. a young child who cannot breathe struggles and tries to get air. (NK)
- 42. The smothering needs considerable force, even when a child is young: (NK)
- 43. the child has to be laid down on his back or against something firm for the mother to press hard on his face, (NK)
- 44. alternatively the child is clutched closely into her chest (NK)
- 45. Despite the obvious violence entailed, the signs may be very few (K)
- 46. In general, someone who is asphyxiated tends to develop multiple spots on the face, particularly on the eyelids, (K)

- 47. as a result of raised blood pressure (NK)
- 48. of lack of oxygen (NK)
- 49. and retention of carbon dioxide (NK)
- 50. There may be swelling of the face too (K)
- 51. Hand pressure on the face may leave thumbmarks or fingerprints around the nose or mouth (K)
- 52. or abrasions inside the mouth with bruising of the gums (K)
- 53. but more often smothering is done with a pillow or with clothing, and no external pressure marks are visible (K)
- 54. and quite often neither spots (NK)
- 55. nor swelling in the face are apparent (NK)
- 56. All forms of asphyxiation may be associated with some bleeding from the nose or mouth, but not always. (NK)
- 57. Thus a smothered infant may show no signs at all to the most qualified doctors (K)

58. Although generally the smothering has to persist for a minute to cause seizures (NK)
59. longer to cause brain damage (NK)
60. and perhaps two minutes (depending upon other circumstances) to cause death- (NK)
61. damage may be more sudden and catastrophic if the child, as a result of the sudden assault, has a cardiac arrest (NK)
62. or vomits and chokes (NK)
63. Commonly reported by mothers of young babies are unexplained episodes of apnea (interrupted breathing) (NK)
64. or a seizure (K)
65. Sometimes an anxious mother perceives illness that is not there (NK)
66. or overinterprets the periodic breathing and normal movements of a healthy baby. (NK)

- 67. Therefore, in all such cases it is worth trying to get a description of the episodes from another relative (K)
- 68. This is particularly important if the mother is suspected of causing the episodes (NK)
- 69. True apnea, in which the breathing stops for 20 seconds (NK)
- 70. and is followed by relatively slow heart activity, (NK)
- 71. blueish skin colour (NK)
- 72. or paleness, (NK)
- 73. is frightening and often unexplained (NK)
- 74. It is more likely in small preterm babies (NK)
- 75. and usually starts in the neonatal period. (NK)
- 76. In early life both respiratory viral infection [can be associated with spells of apnea in previously well infants] (NK)
- 77. and whooping cough can be associated with spells of apnea in previously well infant (NK)

- 78. the apnea may come before the cough or other respiratory signs by a few days (NK)
- 79. Whenever apnea starts unexpectedly in a previously well baby it must be investigated thoroughly (K)
- 80. As well, home life must be investigated. (NK)

APPENDIX P

APPENDIX P

Master Segmentation and Idea Quality Identification Template for Emotional Abuse and Neglect Text

The following is a segmentation of the expert text on Emotional Abuse and Neglect into idea units. Beside each idea unit is either the letter 'K' (key idea) or 'NK' (nonkey). Information contained by the square bracket [] has been included by the primary investigator. This was to facilitate reading of the idea.

Master Template: Emotional Abuse/Neglect

1. Emotional abuse and neglect of children may take many forms (NK)
2. from a lack of care for their physical needs, (K)
3. through a failure to provide consistent love and nurture, (K)

4. to overt hostility and rejection. (K)
5. Harmful effects upon developing children are many (K)
6. and tend to vary with age. (K)
7. In infancy neglect of physical care is likely to produce the most negative effects and delays in all aspects of growth. (K)
8. Emotional abuse refers to repeated verbal harassment of a child (K)
9. by criticism, and ridicule (K)
10. threat (K)
11. and the withdrawal of love; (K)
12. by verbal and non-verbal means rejection and withdrawal are substituted. (NK)
13. Neglect includes both a lack of physical caretaking and supervision (K)
14. Neglect includes and a lack of cognitive stimulation (K)
15. such as talking, playing, and exploring. (NK)

16. Although direct observation of parenting may raise suspicions about the presence of emotional abuse and neglect, (NK)
17. the diagnosis is usually suggested by its effects on the child: "The severe adverse effects on the behaviour and emotional development of a child caused by persistent or severe emotional ill-treatment of rejection." (K)
18. All abuse includes some emotional harm (K)
19. There is also often physical (K)
20. or sexual abuse. (K)
21. It is still possible to recognize groups of features that demand further investigation without signs of physical (NK)
22. or sexual maltreatment. (NK)
23. Research tell us that we are still unable to link causes of maltreatment to particular delays and disorders. (NK)
24. In addition, the symptoms and signs to be described below do not always mean that there is abuse and neglect. (NK)

25. But stopping the abuse and replacing it with sensitive care - often in an another home - is usually followed by a rapid and dramatic improvement in various aspects of the infant's development. (NK)
26. Neglect of the physical and emotional needs of an infant is likely to result in various signs and symptoms that should be fairly easily noted. (NK)
27. The aspects of physical development that are affected are those that demand the closest attention from caregivers. (K)
28. Babies are dependent creatures: (NK)
29. they need to be fed regularly, (NK)
30. to be kept in a reasonably dry and warm environment, (NK)
31. and to have their bowel and bladder functions taken care of. (NK)
32. If they are always cold and wet they will contract infections repeatedly; (NK)
33. if they do not have their diapers changed regularly they will develop diaper rash, (NK)

34. which if neglected may cause scarring; (NK)
35. if they are not fed well they will fail to thrive. (NK)
36. Failure to thrive is usually defined as an exceptionally poor rate of growth in which weight (and often length) increasingly fall below the norm. (NK)
37. There are many reasons why this may happen. (NK)
38. Recent population surveys show that it is seldom linked with abuse or deliberate neglect, even in non-organic cases. (NK)
39. In families in which abuse is suspected other evidence to support those suspicions should be sought. (NK)
40. When there has been serious neglect, [skills are likely to be affected] (K)
41. social [skills] are also likely to be affected. (K)
42. and psychomotor skills are also likely to be affected. (K)
43. If there has been no encouragement to acquire skills such as sitting, crawling, and walking, the infant may show developmental delay.

(NK)

- 44. Infants are naturally sociable: they enjoy interacting with others, adults or children. (NK)
- 45. A severely neglected infant will not have learned the joy of accepting and returning a smile and so may not try to arouse another's attention. (NK)
- 46. Although we are still not certain that infants can be depressed, (NK)
- 47. increasing evidence suggests that the infants of some depressed (NK)
- 48. (and possibly neglectful) mothers do show characteristic social responses, (NK)
- 49. such as withdrawal, "looking away" behaviour, and emotional flattening. (NK)
- 50. Infants who are not given the chance to interact with others may stimulate themselves. (NK)

51. For example, they may repeatedly bang their heads or rock. (NK)
52. Selective attachments to important adults in an infant's life begin to be established around 6 to 8 months of age. (NK)
53. A neglected or abused infant may show an unusual pattern of attachment. (K)
54. Usually the experience of consistent and sensitive parenting leads a child to feel safe and secure with the primary caregiver, even in the presence of a stranger. (NK)
55. In an unfamiliar setting, such as a clinic, despite the child's wish to want to stay close to her parents, she will still go ahead and explore. (NK)
56. Infants who have been abused or neglected, however, lack this sense of security. (NK)
57. They do not have sufficient confidence to explore their surroundings (NK)
58. and seem ill at ease, whining, and unhappy (NK)

59. and cling to their caregiver, (NK)
60. who responds with irritation [to the child' s clinging] (NK)
61. The opposite behaviour may also exist in that the infant shows few signs of attachment (K)
62. and may either roam around the room in a completely non-directed fashion (NK)
63. or may creep quietly into a corner (NK)
64. and will fearfully observe what goes on in the environment (frozen watchfulness). (NK)
65. However, it is possible too that the infant who is not abused nor neglected will not want to stray from his parents (NK)
66. or he may only want to watch what is going on but not participate. (NK)

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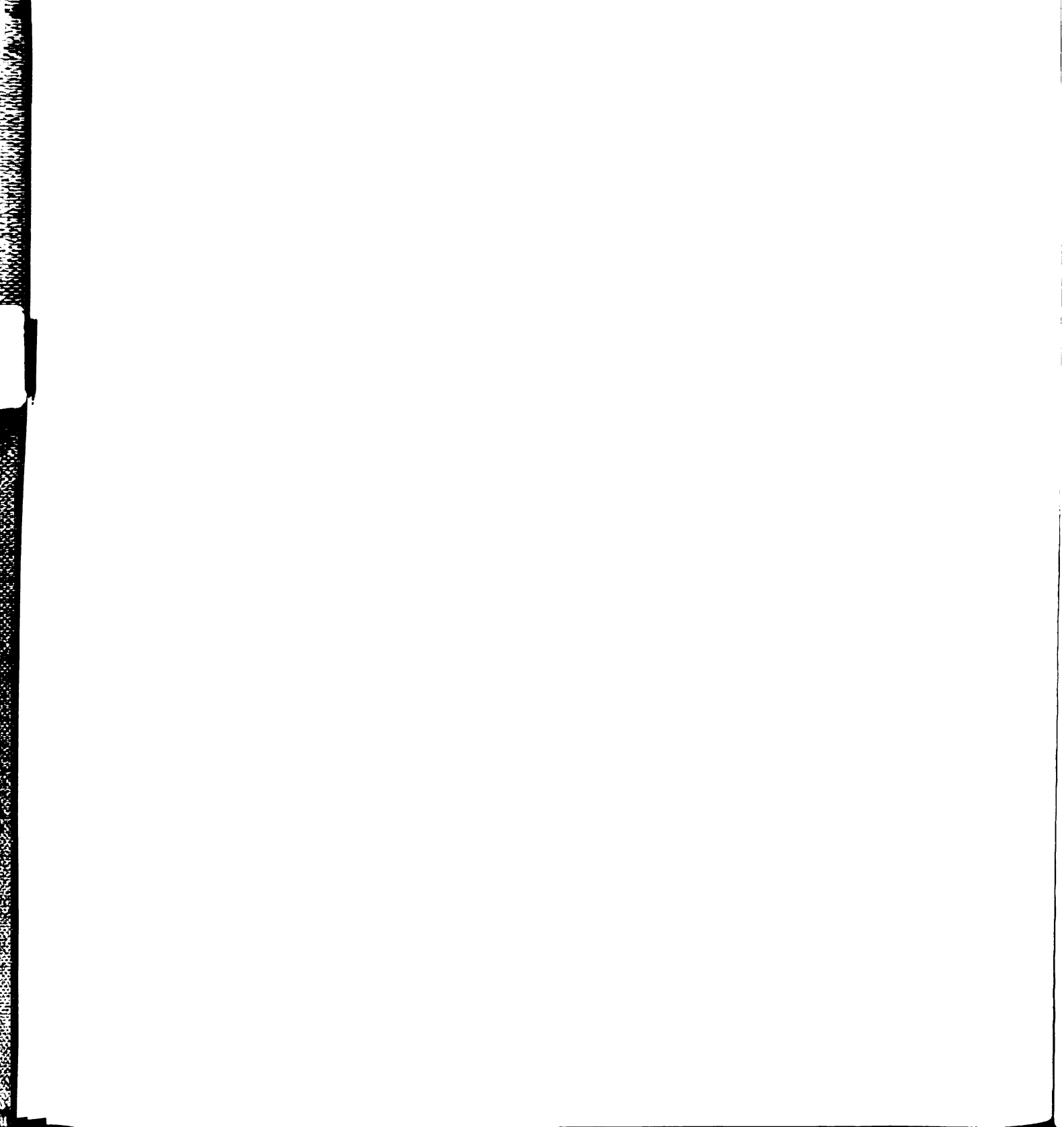
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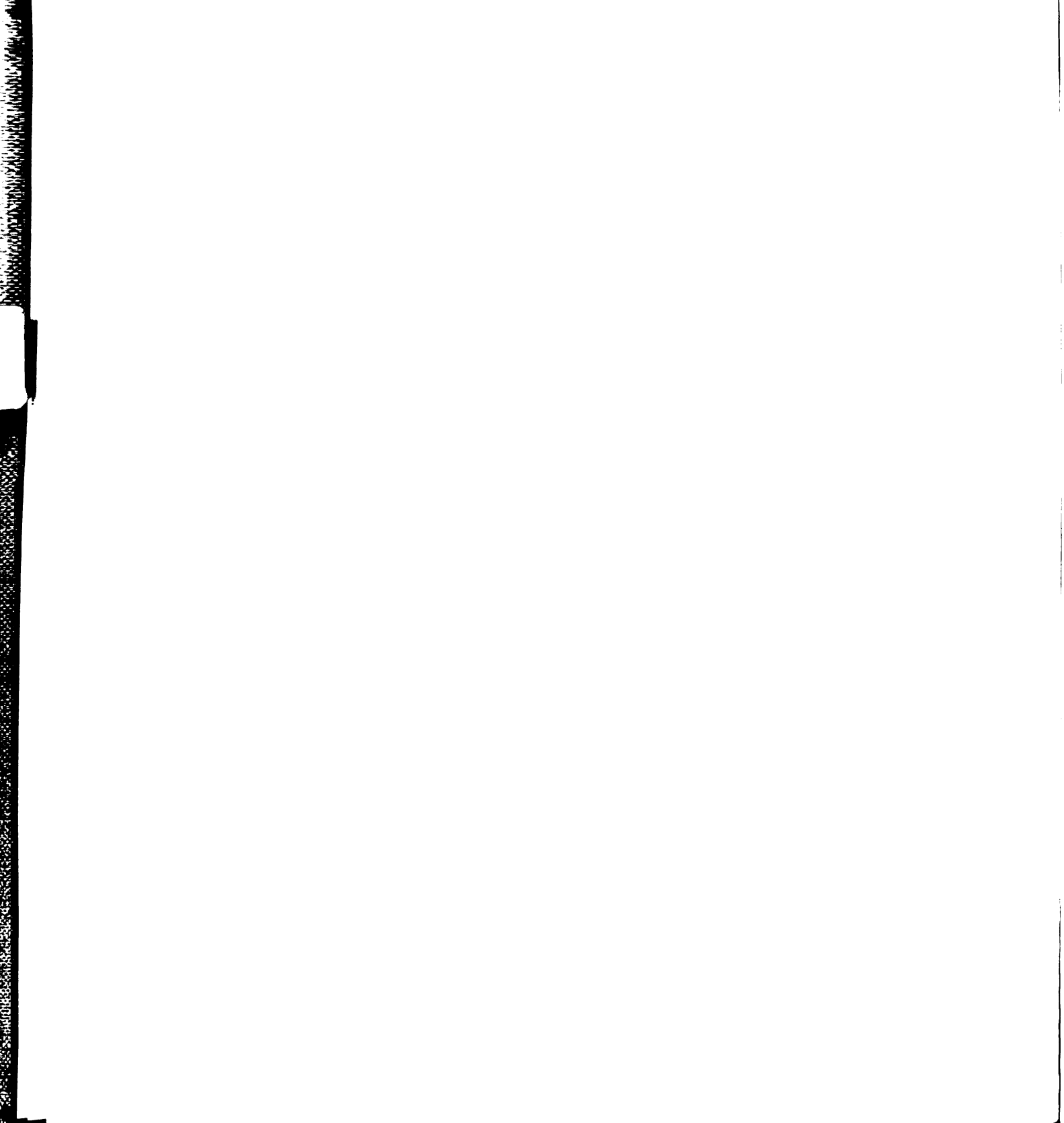
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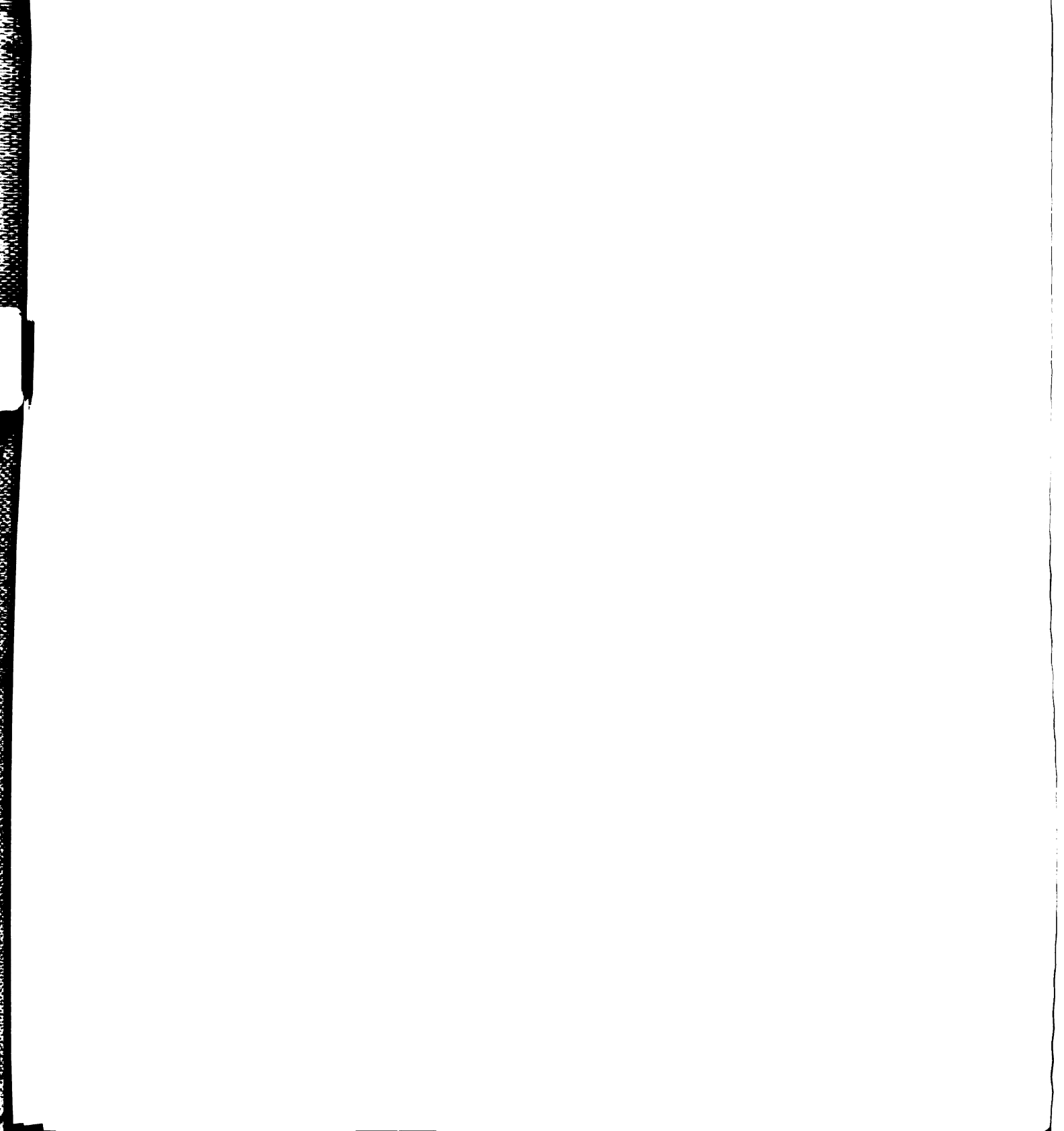
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