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The effects of computer-administered instructions providing domain or strategy knowledge on the comprehension of familiar and unfamiliar expository text.

Barbara A. Greene
University of Massachusetts Amherst

THE EFFECTS OF COMPUTER-ADMINISTERED INSTRUCTIONS PROVIDING DOMAIN OR STRATEGY KNOWLEDGE ON THE COMPREHENSION OF FAMILIAR AND UNFAMILIAR EXPOSITORY TEXT

A Dissertation

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BARBARA A. GREENE

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By

BARBARA A. GREENE

Approved as to style and content by:

James M. Royer, Chairperson of Committee

Howard Gadlin, Member

Ronald K. Hambleton, Member

Jerome L. Myers, Member

Melinda Novak, Acting Department Chair
Psychology Department

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ABSTRACT

THE EFFECTS OF COMPUTER-ADMINISTERED INSTRUCTIONS
PROVIDING DOMAIN OR STRATEGY KNOWLEDGE
ON THE COMPREHENSION OF
FAMILIAR AND UNFAMILIAR EXPOSITORY TEXT

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BARBARA A. GREENE, B.A., BOSTON UNIVERSITY
M.S., UNIVERSITY OF MASSACHUSETTS
Ph.D., UNIVERSITY OF MASSACHUSETTS
Directed by: Professor James Michael Royer

The purpose of the study was to examine the effects of computer-administered instructions on the comprehension of familiar and unfamiliar college-level material. The instructions addressed two majors issues: a) the effects of domain-specific knowledge and b) the effects of strategy knowledge (i.e., knowledge about methods for active, purposeful reading).

There were 157 university students who were recruited from psychology classes to participate in the study. There were two instructional conditions and two control conditions for the familiar and unfamiliar domain. The first instructional condition presented background information and information on concepts that were central to the topic. The second instructional condition instructed subjects on when and how to generate questions, summarize, and reread

portions of the text. The third condition was a control condition in which subjects only read the text before taking the comprehension tests. The fourth condition was a control condition in which subjects were given the domain instructions and the tests without reading the text.

The results were examined in terms of performance on each of three comprehension tests. On the sentence verification test, only a main effect for content familiarity was found. Subjects in the unfamiliar content condition performed better than subjects in the familiar content condition. On the summary test, there was a significant interaction of instruction with content familiarity. Contrary to what was expected, the advantage of the strategy condition over the control was not significant for the familiar content condition. For the unfamiliar content condition both the domain and strategy conditions showed a significant advantage over the control condition, but there was no difference between the domain and strategy. For the inference task, no effects of instructions were found for either condition of content familiarity.

The findings provide support for the conclusion that strategy knowledge can be useful for comprehension even in the absence of domain knowledge. The evidence for the efficacy of the domain instructions used in the present study was weak, possibly due to methodological problems.

The findings also support the use of multiple measures of comprehension in studies that examine the effects of comprehension instructions.

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CHAPTER I

INTRODUCTION

Reading researchers and educators are generally agreed that understanding text depends to some extent on a reader's or listener's relevant background knowledge. Numerous empirical investigations have supported the relationship between prior knowledge and text comprehension (e.g., Anderson & Acker, 1984; Anderson, Reynolds, Schallert, & Goetz, 1977; Davey & Kapinus, 1985; Chiesi, Spilich, & Voss, 1979; Freebody & Anderson, 1983; Langer, 1984; Lipson, 1982; Pearson, Hansen, & Gordon, 1979; Recht & Leslie, 1988; Royer, Lynch, Hambleton, & Bulgarelli, 1984). The finding that successful comprehension of text requires relevant prior knowledge seems to pose a special problem for understanding expository text since people generally read expository text in order to build knowledge structures in new domains (Miller, 1985). The problem is that reading expository text very often requires some familiarity with the concepts in an unfamiliar domain.

The educational implications of this near-paradox are very real. An important part of academics from junior high school through college is learning in new domains with the aid of expository text. That it is difficult to comprehend expository text in unfamiliar domains is acknowledged by most people concerned with text comprehension. Text publishers and teachers generally acknowledge this situation

by providing prereading activities and instruction. Unfortunately, the optimal methods for activating and teaching the necessary background knowledge have not yet been identified by publishers and teachers (e.g., Barr & Sadow, 1989, Beck, Omanson, & McKeown, 1982; Langer, 1984; and Wilson & Anderson, 1986). This is probably the case, at least in part, because the specific nature of knowledge that facilitates comprehension has not been closely examined by reading researchers (e.g., Davey and Kapinus, 1985; Recht and Leslie, 1988; Wilson & Anderson, 1986). Only recently have some researchers begun to explore specific effects of knowledge on comprehension (e.g., Alvermann, Smith, Readence, 1985; McKeown, Beck, Omanson, & Pople, 1985; Miller, 1985; Stahl, Jacobson, Davis, & Davis, 1989). A major goal of the present study was to build on these findings in order to further clarify how prior knowledge facilitates text comprehension.

So far the discussion has focused on the importance of conceptual knowledge that is specific to a domain. There is also evidence that strategic knowledge can facilitate reading comprehension (e.g., Armbruster & Brown, 1984; Cunningham, 1988; Haller, Child, & Walberg, 1988; Jacobs & Paris, 1987; Palinscar, Brown, & Martin 1984; Paris, Cross, & Lipson, 1984; Walczck & Hall, in press). Strategic knowledge about reading comprehension is knowledge about the reading process that is goal directed and intentionally

applied to the reading situation (e.g., Alexander & Judith, 1988). It is knowledge about what strategies should aid comprehension, why they should be helpful, how they should be used, and when they should be used (e.g., Brown, Armbruster, & Baker, 1986). In their recent review, Alexander & Judith (1988) argued that more research was needed that explores the nature of the interaction between domain-specific and strategic knowledge. Therefore, a second goal of the present study was to explore this interaction by examining the effects of both background knowledge and strategy instructions on comprehension performance.

The remainder of this proposal is organized as follows. The introduction will proceed with a presentation of the theoretical background on both the relationship between prior knowledge and text and the probable importance of strategic knowledge. Specifically, schema theory (e.g., Anderson & Pearson, 1984 and Schallert, 1982) and van Dijk and Kintsch's evolving theory of text comprehension (e.g., Kintsch and van Dijk, 1978; and van Dijk & Kintsch, 1983) will be addressed, though, with greater emphasis on the van Dijk and Kintsch (1983) model. Additionally, the procedural component of ACT* (Anderson, 1983) will briefly be reviewed as a theoretical basis for the importance of comprehension strategies. A review of the research that has supported the relationship between prior knowledge and text comprehension

will follow. Studies that have examined prior knowledge effects using different instructional interventions will be described here. Next, the role of strategic knowledge will be discussed along with the body of research that supports that role. The following topic will be concerned with the instructional implications that can be culled from the research on the effects of prior conceptual knowledge and strategic knowledge. Next, the efficacy of using computer-based comprehension instructions to examine the theoretical and practical issues associated with text comprehension and prior knowledge will be discussed. The chapter will conclude with an overview of the present study. Following the introduction there will be a Method section that will explain the experiment in detail. The results will be presented in the following chapter. The final chapter will be concerned with a discussion of the findings and possible interpretations.

Theoretical Background

Schema Theory and Text Comprehension

One rather influential theory of how existing knowledge affects the interpretation and storage of new information is known as schema theory (Anderson & Pearson, 1984; Schallert, 1982). Schemata are abstract knowledge structures that represent one's knowledge and beliefs about the world. The structures are hierarchically ordered configurations of domain-specific variables (Schallert, 1982). Some variables

are necessary for a given schema while others are optional. For example, a restaurant schema necessarily involves a variable for people ordering food, but a variable for ordering dessert is optional. This example demonstrates another characteristic of schemata and that is that a schema will generally contain subschemata. Categories of food that are ordered in a restaurant are subschemata within the larger restaurant schema.

Schallert (1982) argued that comprehension is an interaction between the reader's activated schemata and the incoming message. As words are processed by a reader, the variable slots in the activated schema are filled. In this sense, comprehension involves both bottom-up and top-down processing. The activated schema is what allows for top-down, that is knowledge-driven processing to occur.

There are several ways in which schemata seem to affect text comprehension. Schema effects have been found when readers need to make inferences in order to make sense out of the target message (Pearson, Hansen, Gordon, 1979; Schallert, 1982). In other words, readers have been found to fill in information plausible to a schema when that information is crucial to the comprehensibility of the text. Anderson and Pearson (1984) noted that, in addition to the effects on inferences, the data on schema effects generally suggest that schemata affect retrieval processes and reconstruction of a text. Anderson and Pearson (1984) also

argued that the data were suggestive of a selective attention effect of schema on incoming information. A more recent study by Kardash, Royer, and Greene (1988) provided evidence showing that schemata affect the retrieval but not encoding of textual information.

The van Dijk and Kintsch Model of Discourse Comprehension

van Dijk and Kintsch (1983) argued that the concept of schema is applied too generally for it to be truly useful for a theory of comprehension. Their model supports a multilevel comprehension structure in memory that utilizes different knowledge structures at each level. van Dijk and Kintsch argued that the effects of knowledge structures on text comprehension should be specified in terms of the types of knowledge that are involved at the different levels of comprehension processing.

The three major levels of text representation in the van Dijk and Kintsch model are: a) a verbatim surface structure; b) a textbase that represents propositions and relations among propositions and has a micro- and macro-level; c) and a situation model. The construction of a verbatim structure of discourse involves parsing processes that rely on psycholinguistic knowledge. The model only presupposes the parsing of text into a verbatim structure; it does not specify how parsing processes might operate on units of text.

The construction of the textbase involves constructing and connecting propositions, which are micro-level processes, and constructing macropropositions, which define the global or macrostructure of the text. These multiple processes can involve numerous types of knowledge. For example, the following knowledge sources could be used for constructing propositions: a) syntactic category; b) semantic function: c) word meanings; and d) relevant domain knowledge. The process of connecting propositions in order to establish local coherence involves knowledge concerning argument repetitions, conditional and functional connections between propositions, and sentence topicality.

In addition to establishing connections between every proposition in a textbase, comprehension, according to the van Dijk and Kintsch model, also involves inferring macropropositions that are based on sequences of interrelated propositions. The macrostructure defines the higher level conceptual organization of a text. van Dijk and Kintsch noted (1983, p. 227) that there is a greater probability that macropropositions rather than micropropositions will be represented and retained in memory. This is consistent with the 1978 version of the model since in that model propositions that are held over in working memory have a greater likelihood of being stored in memory. Macropropositions, by virtue of their macro-

relevance, are held over in working memory to facilitate the processing of new incoming propositions.

The construction of the macrostructure will involve both prior knowledge and textual clues that signal the organizational structure of the text. This level of text comprehension is most closely analogous to filling in the variable slots of an activated schema. Propositions that are not related to other propositions or are not related to the overall organization of the text will be dropped at the macrostructure level.

Evidence Supporting Relevancy of the Distinction Between Micro-and Macro-level Comprehension Processes

The distinction between micro and macro-level processes was first made by Kintsch and van Dijk in the earlier version of their comprehension model (Kintsch and van Dijk, 1978) and there have been several studies that have explored the usefulness of the distinction. For example, Graesser, Hoffman, & Clark (1980) looked at reading time differences between fast and slow college readers with microstructure variables (average time spent on single words, syntactic predictability, and number of propositions in a sentence) and macrostructure variables (number of new argument nouns, passage familiarity, and narrative versus expository text). They found that most of the differences in reading speed between the two groups of college readers were accounted for by the microstructure variables. That is, the slow readers

were slower at processing single words and slower when the number of propositions in the text increased and when the syntax became more complex. The groups did not differ as a function of the manipulations of the macrostructure variables. Furthermore, for both groups the bulk of the variability in reading time was accounted for by the macrostructure variables.

Vipond (1980) conducted a series of studies that involved predicting comprehension scores using micro- and macro- level variables. He found that micro-level variables were better predictors of comprehension performance for less skilled college readers, while the macro-level variables were the better predictors for the skilled readers. He also found that both types of variables contributed unique amounts of variance for comprehension performance for both skilled and less skilled readers. Across his three studies, Vipond found consistent evidence that both micro- and macro-level processes are involved in comprehension.

Evidence Demonstrating Importance of Macro-level Comprehension Processes

Van Dijk and Kintsch (1983) described several experiments from Kintsch's lab that seem to provide support for the notion of macrostructure. In one experiment (Walker & Kintsch, 1981, cited in van Dijk & Kintsch, 1983) subjects read a short passage and were asked to write a completion sentence when they were done. The idea was that the

completion would reflect what the subject considered to be most relevant about the passage. The passages were either normal (e.g., about boys seeing a goat while mountain climbing), elaborated (e.g., part about seeing a goat described in more detail), or surprising/interesting (e.g, saw a bus while mountain climbing). The hypothesis was that information that was either elaborated or surprising would be included in the macrostructure. The prediction was that the target information (what was seen) would be included in the completions of elaborated and surprising passage conditions. This is exactly what they found.

Two experiments that involved priming macropropositions were conducted by Guindon and Kintsch (1984). In the first study, a word from a macroproposition that was explicitly stated in the text was used to prime a second word from the same proposition. Recognition latencies were obtained and compared to latencies obtained when a microproposition had been primed. They hypothesized that there should be a larger priming effect for macroproposition than for microproposition because the model predicts that macropropositions form stronger, more available memory units. Primed macrowords were recognized on average 176 msec faster than primed microwords. This finding supported the saliency of explicit macropropositions over micropropositions.

In a second experiment the macroproposition was not explicitly stated in the text (Guindon & Kintsch, 1984). The amount of time it took subjects to respond "no" to an implicit macroword was measured and it was found that there was an average of 340 msec increase in reaction time for macrowords compared to unrelated distractors and 218 increase compared to related distractors. There was a 63% false alarm to implicit macrowords compared to 8% for the unrelated distractors and 27% for the related distractors. This finding demonstrated that subjects generate macropropositions on their own.

Implications of Evidence Supporting the Role of Micro- and Macro-level Processes

The evidence reviewed does seem to support the importance of both micro-and macro-levels of comprehension processes. Furthermore, the evidence suggests some instructional implications related to these two levels of processes. The first implication concerns the finding that college readers who differ with respect to either speed or comprehension performance are differentiated on the basis of micro-level text variables (Graesser et al., 1980; Vipond, 1980). This finding demonstrates that lower-level processes, that is lexical processes and processes involved in constructing and connecting propositions, are not functioning as efficiently as they can even within a college population. This suggests that, for some readers, lower

level processes do not develop to the point of automaticity without intervention.

A second implication, and one more relevant to the current thesis concerning prior knowledge and text comprehension, is that domain-relevant prior knowledge will be more important for constructing the macrostructure of a textbase than for the microstructure. Since macropropositions are more likely to be stored in memory and since the macrostructure defines the higher-order structure of a text, it seems possible that readers who are lacking in prior knowledge will also be lacking in both the quantity and quality of their memory representations for the higher-order meaning of a text. In fact, a study conducted by Spilich, Vesonder, Chiesi, & Voss, (1979) provided support for this possibility.

Spilich et al. (1979) examined free recall performance following an aural presentation of an account of a baseball game. Their subjects were either high or low with respect to their knowledge of baseball. The macrostructure of their text was defined in terms of the goal structure of the game. They found that high knowledge (HK) subjects recalled more information overall from the text than low knowledge (LK) subjects. Furthermore, the HK tended to recall more information that was relevant to the goal structure than did LK subjects. The protocols from LK subjects tended to be less elaborate and less coherent in terms of the sequencing

of events recalled than those from the HK subjects. These findings suggested that the HK subjects were able to use their knowledge of baseball's goal structure to construct a coherent macrostructure that they then used when recalling information about the text.

The Notion of a Situation Model and Supportive Evidence

The evidence reviewed so far suggests that comprehension processes involve constructing both a micro-level structure and a macro-level structure, and that the macrostructure will be more affected by prior knowledge than the microstructure. According to van Dijk and Kintsch (1983), though, in addition to the construction of a locally and globally coherent textbase, comprehension involves the simultaneous activation, updating, and utilization of a situation model in episodic memory. The situation model is a mental model that represents the situation (including the events, actions, and persons) a text is about. Inferences that are not essential for a coherent textbase are thought to be part of the situational representation. van Dijk and Kintsch argued that this situational representation is necessary in order to explain the following phenomena: a) we are able to interpret what a text refers to in some possible world; b) we learn from text; c) people can use the information from a text for problem solving; d) we interpret coreferences or anaphora in a text; e) there can be individual differences in the interpretation of a text.

The major assumption about the situation model is that it represents the integration of the information in a text with the reader's knowledge system. If this is the case, then it should be a crucial cognitive representation for the reader who is attempting to learn from expository text. Kintsch has been involved in at least two investigations that support this view (e.g., Kintsch, 1986; Perrig & Kintsch, 1985).

Perrig and Kintsch (1985) provided some evidence that a situational representation is necessary, in addition to a textbase, in order for subjects to learn from text. Their subjects read either a route or spatial layout version of a text that described a town. Their subjects then had to recall the text, verify inferences, and draw a map of the town. Subjects in the route condition were expected to perform better than subjects in the spatial condition on the recall task, while subjects in spatial layout condition were expected to perform better than subjects in the route condition on the map drawing task. The first prediction was supported in that the subjects in the route condition did have significantly better recall protocols, but there were no differences between the two groups of subjects on the map drawing task. All subjects performed poorly on both the map drawing and inference tasks. Neither group of subjects seemed to learn enough about the town to apply the information to those two tasks even though they clearly had

developed a textbase that was adequate enough for a recall task.

In a second experiment, Perrig and Kintsch (1985) used simpler text in the hope that subjects would learn about the town and utilize their situation models to verify inference statements. They also looked at differences between males and females in how they would represent textual information in a situation model. The findings of interest were concerned with verification performance on inference statements that were stated in forms either congruent or incongruent with a subject's text version (e.g., a route inference would be congruent with a route text version, while a spatial inference would be incongruent with a route text version). Females who received either a route or spatial description of the town were more accurate verifying inferences that were congruent with the text version they read. So, females who read spatial versions of the text were more accurate verifying spatial inferences than verifying route inferences. The males, though, tended to be most accurate verifying spatial inferences regardless of the form in which they read the text. The females seemed to base their situational representation on the text, in that if the text was conducive to a propositional representation than they chose a propositional representation, but if the text lent itself to a spatial understanding of the information than the representation was more spatial in

nature. The males chose a spatial representation in both cases. These findings provide support for the notion of a situation model as a cognitive representation that is constructed and utilized during learning. The findings also demonstrate that a situation model can be either propositional or spatial in nature.

Kintsch (1986) looked at whether or not children's recall of word problems in arithmetic would reflect their activated situation model. He noted that one type of situation model is a problem model used to solve math problems. He hypothesized that once a solution had been attempted the recall of the original problem would reflect the problem model. He examined recall of easy and hard problems before and after a solution was attempted. He found no differences between recall of the easy and hard problems before a solution had been attempted, but after the subjects had attempted to solve the problems they were better at recalling the easier problems. The errors they made on those easy problems tended to reflect either simplifications necessary to the solution or a problematic solution plan. The situation model used to solve the word problems seemed to dominate recall which supported Kintsch's hypothesis and further supports the idea that a situation model is used to apply information learned from a text.

The Theoretical Basis for the Notion of Strategic Comprehension

In addition to the focus on the use of multiple knowledge sources at different levels of comprehension processing, the model also emphasizes the dynamic, strategic nature of comprehension processing. An important assumption of the van Dijk and Kintsch (1983) model is that successful language users are able to strategically apply different kinds of information (i.e., the many knowledge sources discussed above) in order to effectively construct a memory representation. Van Dijk and Kintsch stated that strategies are a type of procedural knowledge used to comprehend text. They further explained that strategies are flexible, operate at several different levels at the same time, use incomplete information, and combine bottom-up and top-down processing. These ideas about comprehension strategies are consistent with Anderson's ACT* theory of cognition (Anderson, 1983).

According to Anderson's ACT* the cognitive system has separate components for declarative and procedural knowledge. Declarative knowledge is conceptual and factual knowledge while procedural knowledge is skill-related knowledge applied to both motor and cognitive skills. Declarative knowledge is translated into behavior through productions. Productions are acquired through repeated pairings of declarative information with actions. In the initial stages of skill learning, factual, domain-specific

knowledge is acquired and applied "interpretively" to the task. Skills then become proceduralized through repeated practice.

Whereas van Dijk and Kintsch argued for the strategic nature of comprehension processing, they did not in fact discuss the nature of strategies in concrete terms. They did explain that strategies are parts of sets that are hierarchically ordered. The lower sets are concerned with micro-level processes, that is those processes involved in constructing and connecting propositions. The top sets are concerned with macro-level processes which are the processes involved in the global/thematic understanding of a text. They also explained that strategies are person-specific and will vary as a function of the context. The important point for the present thesis is that successful comprehension depends not only on the comprehender's available knowledge but also on the comprehender's strategic application of relevant prior knowledge.

Evidence for Effects of Prior Knowledge on Reading Comprehension

The van Dijk and Kintsch (1983) model provides a theoretical framework for understanding how prior knowledge might affect comprehension processing. The next step is to see whether the evidence supports prior knowledge effects on comprehension and then whether the effects can be viewed within the van Dijk and Kintsch framework. There is a

substantial body of literature demonstrating the relationship between prior knowledge and comprehension that will be summarized in terms of the following: a) positive effects of prior knowledge on comprehension performance; b) effects of prior knowledge on the interpretation of text; prior knowledge and differences between good and poor readers; and d) effects of prior knowledge instructions on comprehension performance.

Positive Effects of Prior Knowledge on Comprehension Performance

A number of investigators have found an increase in recall of text as a function of the reader's subject matter knowledge (Chiesi, Spilich, & Voss, 1979; Davey and Kapinus, 1985; Freebody & Anderson, 1983; Lipson, 1983; Recht & Leslie, 1988; Spilich et al., 1979). For example, both Chiesi et al. and Spilich et al. presented aural descriptions of baseball scenarios to adult subjects and found that subjects who were very knowledgeable about baseball recalled more information and more important information than subjects who were not as knowledgeable. Chiesi et al. additionally provided evidence that the high-knowledge subjects had a more coherent text representation than the low-knowledge subjects.

Recht and Leslie (1988) also looked at the effects of baseball knowledge on the recall of printed text materials about baseball. They found that high-knowledge seventh and

eighth grade students performed better on a recall task in terms of both quantity and quality of idea units recalled than their low-baseball-knowledge peers. Lipson (1983) also examined the recall performance of grade school children. She had fourth and sixth grade subjects who were Jewish and Catholic read passages about a Bar Mitzvah, a first Communion, and a neutral topic. Subjects recalled more information from the passage that was about the ceremony familiar to their religion. Lipson's subjects also took less time to read the familiar passage and generated more inferences concerning the familiar topic.

Other researchers chose to examine prior knowledge effects with measures of comprehension other than, or in addition to recall tasks (e.g., Freebody & Anderson, Pearson et al., 1979; Stahl & Jacobson, 1986; and Royer et al., 1984). For example, Pearson et al. (1979) examined domain-knowledge effects found with grade school children using wh questions (i.e., who, what, where, and when questions) instead of recall as the measure of comprehension. They found that second grade subjects who were knowledgeable about spiders performed better than less-knowledgeable subjects on a reading comprehension test based on a passage about spiders.

Royer et al. (1984) used a sentence verification task to measure comprehension. Their subjects were college students who varied in terms of their knowledge of

psychology as determined by either amount of exposure to psychology courses (experiment one) or whether or not subjects had completed a particular psychology class. They found that comprehension performance based on psychology passages did vary as a function of variation in knowledge of psychology.

While the research reviewed thus far has concentrated on the effects of structured background knowledge, there are researchers who have additionally looked at vocabulary knowledge (e.g., Freebody & Anderson, 1983; Stahl & Jacobson, 1986; and Stahl et al., 1989). For example, Freebody and Anderson (1983) examined the effects of both vocabulary difficulty and topic familiarity on the reading comprehension performance of sixth grade subjects. Comprehension was measured with recall, summarization, and sentence verification tasks. Subjects performed better on all three measures of comprehension when tested on the familiar passage than when tested on the unfamiliar passage. The vocabulary difficulty manipulation only affected performance on the sentence verification test. An important additional finding was that the knowledge sources did not interact in a compensatory manner. That is, easy vocabulary did not compensate for an unfamiliar passage and a familiar topic did not compensate for very difficult vocabulary.

Stahl and Jacobson (1986) conducted a modified-replication of the Freebody and Anderson (1983) study.

Stahl and Jacobson also manipulated vocabulary and prior knowledge about the topic, but the prior knowledge manipulation was accomplished with a preteaching condition. Prior to reading a passage, the sixth grade subjects received an expository lesson that was either relevant or irrelevant to the material presented in the passage. Comprehension performance was measured with a multiple-choice test and a sentence verification test. The Stahl and Jacobson findings were in fact very similar to the Freebody and Anderson findings. Relevant preteaching resulted in better performance on both comprehension tests when compared with irrelevant preteaching. The easy vocabulary condition resulted in increased performance on only the sentence verification test when compared with the difficult vocabulary condition. Furthermore, there was no interaction between vocabulary difficulty and preteaching.

The Stahl and Jacobson (1986) findings concerning the differential effects of vocabulary and topic knowledge were further explored in a series of studies reported by Stahl et al. (1989). The Stahl et al. findings strongly suggested that vocabulary knowledge affects literal comprehension. That is, vocabulary knowledge seems to affect the construction of local propositions. Their findings additionally suggested that structured knowledge about the topic affects the reader's global understanding of the text. Stahl et al. argued for viewing their findings within the

framework of Kintsch and van Dijk's distinction between micro- and macro-processes involved in comprehension (i.e., Kintsch & van Dijk, 1978). In other words, Stahl et al. argued that vocabulary knowledge seems to affect microprocesses while structured-domain knowledge seems to affect macroprocesses.

The Effects of Prior Knowledge on the Interpretation of Text

The different knowledge readers and listeners bring to a text can also differentially influence the interpretation of the text (e.g., Anderson et al., 1977; Lipson, 1983). This is an effect of prior knowledge that is not decidedly positive (e.g., Alvermann et al., 1985; Lipson, 1982). For example, Anderson et al. (1977) found different interpretations of ambiguous passages demonstrated by college students with different interests. The subjects were women studying music education and men taking weight-lifting classes who were also knowledgeable about wrestling. One of the passages was about either a card game or a music rehearsal, while the second passage was about either a plan to escape from prison or a wrestler's attempt to break from a hold. For both passages, the first interpretation was rated as dominant by persons not biased toward either interpretation. After reading each of the passages, subjects engaged in a free recall task. After reading both passages, subjects completed a ten item multiple-choice test for each passage. For each multiple choice item there were

two correct answers corresponding to the two interpretations.

Anderson et al. (1977) found that subjects who were knowledgeable about music were more likely than the other group to answer multiple-choice questions correctly about the card/music passage in terms of a music rehearsal, while the subjects knowledgeable about wrestling were more likely to answer multiple-choice questions correctly about the prison/wrestling passage in terms of a wrestling match. The recall protocols also revealed the same pattern of biases in interpretations. The music majors were more likely to recall idea units related to music following the card/music passage and the males knowledgeable about wrestling were more likely to recall ideas about wrestling following the prison/wrestling passage.

Lipson (1983) also provided evidence that prior knowledge exerts influence over the interpretation of text, but in her study the text was not intended to have multiple interpretations. As described above, Lipson's subjects were Jewish and Catholic children who read accounts of a Bar Mitzvah and a First Communion. The Jewish children were expected to be unfamiliar with the First Communion ritual and the Catholic children were expected to be unfamiliar with the Bar Mitzvah ceremony. Both groups of subjects had the most trouble accurately recalling the symbolic actions described in the account of the unfamiliar ritual.

Moreover, the Catholic subjects tended to recall aspects of the Bar Mitzvah account in terms of Catholic symbolism. Thus, Lipson's findings suggested that prior religious knowledge can bias the interpretation of unfamiliar text.

While the findings of Anderson et al. (1977) demonstrate that prior knowledge can bias an interpretation in the face of ambiguous text, the findings of Lipson (1983) are suggestive of an interference effect whereby prior knowledge actually inhibits the comprehension of unfamiliar text. Other investigations have revealed further evidence that incompatible prior knowledge can interfere with learning from text. For example, Lipson (1982) examined the performance of third grade subjects on an inferencing task that followed each of eight expository passages. Lipson assessed her subjects' prior knowledge on each topic in a preliminary session. She found that subjects who had accurate prior knowledge on a topic performed well on the inference test following that passage. More interesting, though, was the finding that subjects who had reported inaccurate prior knowledge performed more poorly on the inference test than subjects who claimed they knew nothing or little about the topic.

Lipson (1982) argued that her findings showed that prior knowledge can exert more influence than information provided in text. The subjects' inaccurate prior knowledge seemed to interfere with constructing an adequate

interpretation of the text. Alvermann et al. (1985) reached a similar conclusion following a study with sixth grade students. They found that subjects did not alter their knowledge in the face of incompatible text. The evidence from both studies suggests that children do not routinely update their knowledge about a topic as a result of reading about that topic.

Prior Knowledge and Differences Between Good and Poor Readers

Several studies have shown that reading ability differences can be explained in terms of prior knowledge (e.g., Anderson & Acker, 1984; Lipson, 1982; and Recht & Leslie, 1988). Lipson (1982) included reading ability as a factor in her study. While she found a large effect for prior knowledge on her postreading inference test, she did not find an ability effect. Anderson and Acker (1984) found that good and poor readers performed similarly on a recall task following unfamiliar text. They concluded that the differences between good and poor readers were attenuated in the absence of prior knowledge differences. Finally, Recht and Leslie (1988) also examined the effects of differences in reading ability in addition to prior knowledge differences on recall performance. They found that subjects who were high in regards to their knowledge of baseball and low in terms of their reading ability performed better on

the recall task than high ability subjects with little knowledge of baseball.

These findings demonstrate the potential for confusing reading ability differences with differences in prior knowledge. Johnston has argued (e.g., Johnston, 1984) that standardized tests of reading comprehension do not separate out ability problems from prior knowledge problems. For the purposes of instruction it is clearly important that the two sources for potential failure are differentiated since the interventions for each source would be very different. The evidence also suggests that not only should teachers attempt to activate and/or teach the relevant background knowledge, but they should also attempt to assess the knowledge that readers bring to a text in order to expose insufficient and/or inaccurate knowledge as potential sources for comprehension failure.

The Effects of Prior Knowledge Instructions on Comprehension Performance

As mentioned earlier, while most educators are aware of the need to provide some prereading instruction to bolster the prior knowledge available to readers, there is not a wealth of information available concerning the optimal content and methods for such instruction. There have, though, been some investigations that have explored methods for prior knowledge instruction. For example, Langer (1984)

examined the effects on comprehension performance of an instructional procedure called PReP.

PReP requires that teachers identify concepts that are centrally important to a text (Langer, 1984). Students engage in three group activities for each identified concept. First, students generate all the associations they can think of for a given concept. Next, students discuss how each association is related to the target concept. Finally, students reformulate their ideas concerning the concept based on their discussion. The idea is that the discussion should lead students from an unstructured understanding of the concept to a well-structured understanding.

Langer (1984) examined the effects of PReP with sixth grade subjects who were either low, average, or high in terms of reading achievement. She found that for the average readers there was a clear positive effect for PReP when compared to a motivation inducing prereading exercise and a control condition. There was some evidence for positive effects of PReP with high achieving readers. The low achieving group was not consistently affected by either the PReP or the motivation intervention. Langer (1984) argued that the low achieving readers probably needed more concrete prior knowledge instruction.

Beck and her colleagues have conducted several studies that have shed light on the question of how instruction can

increase the positive effects of prior knowledge on comprehension (e.g., Beck, Omanson, & McKeown, 1982; Omanson, Beck, Voss, & McKeown, 1984; and McKeown et al., 1985). Beck et al. (1982) and Omanson et al. (1984) argued that commercial reading programs often focus on teaching background knowledge that is not central for understanding the text selection while central concepts are not taught. In both studies, a commercial reading program was modified such that emphasis was placed on introducing background knowledge that was highly relevant for understanding the text. Additionally, the modification included directing readers to find the most important content while reading. Both studies found that the modified version of the reading lesson resulted in better comprehension of texts than the original version of the reading lesson.

The Omanson et al. (1984) study differed from the Beck et al. (1982) study in that Omanson et al. discussed their plan for modifying the reading lesson in terms of the Kintsch and van Dijk (1978) model of comprehension. More specifically, Omanson et al. argued that their lesson plan encouraged both the holding over of important propositions in memory and the repeated reinstatements of central propositions. According to the model, these tactics should facilitate the construction of both a coherent microstructure and a macrostructure that adequately represents the main ideas presented in the text. The

Omanson et al. (1984) findings did provide support for positive effects of their revised lesson plan on micro- and macro- comprehension processes.

McKeown et al. (1985) were interested in the type of vocabulary instruction that would facilitate comprehension since some evidence showed that traditional vocabulary instruction that focused on definitions and limited encounters with words did not facilitate comprehension. They found that vocabulary instruction that involved both elaborations beyond traditional definitions and multiple experiences with the new words resulted in increased comprehension performance when compared to traditional vocabulary instruction. The elaborated instructions included different tasks that involved, in addition to learning the definitions, using the words in their appropriate contexts and exploring different relationships among and between words.

The Stahl et al. (1989) study produced findings that may help to explain the limited effects of traditional vocabulary instruction. As noted previously, Stahl et al. found that manipulating vocabulary difficulty only affected local text processing. It is possible that some comprehension measures tap into only global text processes involved in comprehension and therefore are insensitive to rudimentary gains in vocabulary knowledge.

Stahl et al. also found that prior knowledge instructions that focused on content central to the passage had positive effects on comprehension whereas instructions that focused on tangentially related information did not facilitate comprehension performance. This finding is consistent with those of both Beck et al. (1982) and Omanson et al. (1984). The evidence strongly suggests that prereading reading instruction should focus on centrally important concepts as opposed to tangentially relevant material in order to be most beneficial for comprehension.

The Role of Strategic Knowledge in Comprehension Processing

Evidence that Strategic Knowledge is Important for Successful Comprehension

The evidence supporting prior knowledge effects on text comprehension suggests at least three plausible reasons why strategic knowledge may be necessary in addition to conceptual knowledge. The first reason is that comprehenders will need to know how to apply what they already know to the new information from text. As van Dijk and Kintsch argued, existing knowledge structures must be strategically applied to the comprehension context. Compelling evidence that strategic application is required was provided by Alvermann et al. (1985) and Lipson (1982). In both those studies, the data supported the conclusion that subjects relied on their prior knowledge when tested on materials they had read even though their prior knowledge

was inaccurate and contradictory to the information presented in the text. In other words, they failed to integrate information from the text with their existing knowledge.

Bransford, Stein, and Vye (1982) reported evidence suggesting that readers sometimes possess relevant knowledge but fail to activate that knowledge. They found that fifth grade students who were unsuccessful academically did not elaborate on implicit text whereas their academically successful peers tended to fill in the implied information. When the text was made explicit, the unsuccessful learners had no problem understanding the information. Bransford et al. argued that the unsuccessful students had the necessary knowledge for understanding the text, but failed to activate it while reading.

In addition to needing knowledge of how to strategically activate and utilize prior knowledge, readers also need to know about monitoring their comprehension in order to assess whether or not they have successfully comprehended a text. The Alvermann et al. (1985) and Lipson (1982) findings indirectly suggest that young readers do not monitor comprehension while reading since their subjects did not seem to notice that the text was contradictory to what they already knew about the topic. Brown and her colleagues (e.g., Armbruster & Brown, 1984; Brown, Armbruster, & Baker, 1986) have argued that there is ample evidence showing that

younger and less-skilled readers are less likely to monitor comprehension than older and more skilled readers. Furthermore, Alexander and Judy (1988) reviewed evidence that readers who are knowledgeable in a domain are more likely to monitor and reflect on their comprehension performance in that domain than less-knowledgeable readers.

There is also evidence that college students are not always very good at assessing their comprehension of text even when domain knowledge is not an issue (Schommer & Surber, 1986; Walczck & Hall, in press). For example, Schommer and Surber (1986) found that college students who were told to read a text in order to report on the comprehensibility of the text rated their comprehension as being high even though they performed poorly on a multiple-choice test of comprehension. The subjects who were told to read the text in order to later teach the material to other students did not demonstrate the discrepancy between comprehension rating and performance. These findings suggest that comprehension monitoring is affected by the goals of comprehension. Therefore, it seems that reading skill, domain knowledge, and task goals are all factors related to whether or not readers will engage in comprehension monitoring

A third reason why comprehenders will need strategic knowledge is that they will need to contend with situations in which they lack relevant prior knowledge. Garner (1987)

argued that this is especially problematic for students in junior high and high school who often encounter expository text in new domains. This is also a problem at the college level where students additionally find that the prereading support provided by teachers in junior and senior high is no longer available. Garner (1987) suggested that summarizing and rereading are two basic strategies useful for situations where readers have limited prior knowledge. The evidence supporting the positive effects of these strategies and others will next be summarized.

Effects of Strategy Training on Reading Comprehension Performance

A number of researchers have examined the effects of training comprehension strategies on comprehension performance (Cunningham, 1988; Hasselhorn & Korkel, 1986; Palinscar & Brown, 1984; Paris et al., 1984). For example, Palinscar and Brown (1984) developed a peer tutoring program for training comprehension strategies. The program focused on teaching students to use four strategies: self-questioning while reading, summarizing, paraphrasing, and predicting upcoming information. The effectiveness of the program was evaluated with middle school students serving as subjects. Subjects in the intervention condition played the role of both tutor and learner and were engaged instruction every day for 20 days. They showed significant gains in

comprehension performance relative to students who were not involved in the intervention.

Paris et al. (1984) also developed a strategy training program that involved students in the process of instruction. Instead of peer tutoring, though, they emphasized group processes. The focus of their program which they called Informed Strategies for Learning (ISL) was on getting students thinking about reading tasks and goals, and teaching them how, why, and when strategies help the reading process. Their subjects were students in the third and fifth grades.

Paris et al. (1984) evaluated their program after 14 weeks wherein subjects in the intervention condition received ISL instruction in addition to their regular classroom reading instruction. They found that the subjects who received ISL instruction performed better on a cloze task, an error detection task, and a knowledge of strategies test than subjects who did not receive the ISL training. There were no differences on a standardized test of reading comprehension.

An important aspect of the ISL program is that it teaches students not only how to use strategies but also why and when they should use strategies. Brown et al. (1986) argued that informing students about why strategies are effective was essential for transfer to other comprehension tasks. Cunningham (1988) provided some empirical data

demonstrating that strategy instruction is most effective when it includes information on why and when strategies should be employed.

Instead of looking at comprehension strategies, Cunningham (1988) examined strategies for applying knowledge of phonemic processes to the decoding process. More specifically, she looked at instruction in phonemic segmentation and blending with kindergarten and first grade subjects. She compared instruction that focused only on how to segment and blend with instruction that included why and when in addition to the procedural information. She argued that the conceptual framework provided by the why and when information would facilitate transfer to novel decoding situations. After 10 weeks of training, her hypothesis was supported when the group that received both conceptual and procedural instruction showed greater gains on the Metropolitan Achievement Test than the group that received only procedural training.

Instead of looking only at the effects of strategy training, Hasselhorn and Korkel (1986) addressed the question of whether strategy training would be more beneficial than traditional reading instruction. The traditional instruction included an emphasis on activating the readers' prior knowledge and activities related to literal comprehension. The strategy training included such techniques as underlining important ideas, stopping after

each paragraph to assess comprehension, and summarizing. The trainer modeled strategy use, then subjects had to verbalize their use of the strategies with different texts. The subjects were 40 sixth grade students. Half of the subjects were classified as knowledge experts in the domain targeted on the comprehension test while the other half were classified as novices.

Hasselhorn and Korkel (1986) found differential effects of the training interventions on novices and experts. The experts showed greater comprehension gains following traditional comprehension instructions while the novices demonstrated greater gains after receiving strategy instruction. It seems that the traditional instructions encouraged the activation and use of prior knowledge which was exactly what the experts needed. The novices, since they had little prior knowledge, did not benefit much from the traditional instruction. Instead, the novices seemed to need and benefit from general strategy training. These findings are very important because they are some of the very few that shed light on the interaction between domain-specific and strategic knowledge.

Effects of Specific Strategies on Comprehension Performance

While the above investigations focused on general strategy training, other researchers have examined specific strategies (Andre & Anderson, 1978-1979; Garner, Hare, Alexander, Haynes, Winograd, 1984; Hare & Borchardt, 1984;

Walczck & Hall, in press). The evidence favoring three strategies will be discussed in this section. First, effects of answering questions about the text while reading will be discussed. Then, evidence for positive effects for rereading text will be presented. Finally, evidence supporting summarizing as a strategy will also be presented.

Reading researchers have for sometime acknowledged the positive effects of answering questions about a text while reading. In a review of the literature conducted by Anderson and Biddle (1975; as described by Andre & Anderson, 1978-1979) it was found that experimenter-generated questions were most effective when they followed the targeted material, were open-ended as opposed to multiple-choice, and focused on abstract concepts rather than details. Walczck and Hall (in press) compared the effects of experimenter-generated questions with the effects of providing concrete examples on the comprehension monitoring performance of college students. They expected the questions to be more effective because the questions should induce self-testing and monitoring. A question followed each paragraph. They found a stronger relationship between a measure of comprehension and a self-assessment measure for the group who encountered the questions than was found for the group encountering examples. This finding suggested that the question group had more effectively monitored their comprehension of the text than the example group.

In two experiments with high school subjects, Andre and Anderson (1978-1979) looked at the effects of reader-generated questions. They compared high and low ability groups instructed to either reread a text or generate questions while reading. The criterion task consisted of 24 items (for three passages) that assessed comprehension of both main ideas and details. In the first experiment they found that both ability groups performed better with the question-generation instructions. An ability by treatment interaction showed that the low ability group were more affected than the high ability readers by the instructional manipulation as they showed greater gains from pretest to posttest.

In the second experiment, Andre and Anderson compared conditions whereby subjects were either trained to generate good questions, simply instructed to generate questions (same as in experiment one), or instructed to reread the entire text. Again, they found an advantage for question generation over rereading. Furthermore, they found that the low ability readers benefited more than the skilled readers from the training. They argued that the skilled students were probably already somewhat skilled at generating questions prior to training.

Palinscar and Brown (1984) also included generating questions in their battery of four activities for strategy training. They argued that training students to generate

questions about a text encourages students to focus on the main ideas and to monitor whether or not they have understood the material. The subjects in their training study were instructed to ask questions about the text that a teacher or test would ask. As students attempted to generate questions, they would be prompted by the adult tutor whenever they had difficulty. The tutor would help the student to formulate a question that was both clearly stated and focused on important content. Palinscar and Brown found that the question-generation training resulted in improvements in question generation over time and that the skills transferred to new tasks where question generation was required.

Another strategy that has been the focus of training is strategic rereading of critical portions of a text. For example, Garner et al. (1984) examined the effects of training subjects to strategically reread portions of a text. Garner et al.'s subjects were upper-elementary and middle school students who were competent decoders but unsuccessful comprehenders. The training focused on <u>why</u> rereading can be helpful, <u>when</u> rereading should be done, and <u>where</u> in the text a reader should backtrack. Following the training, subjects read expository passages and answered both text-based and inferential questions. They expected that training would affect performance on only the text-based questions and that expectation was confirmed by the

results. They additionally found that the training group performed better than the control group on text-based questions when they had strategically reread relevant parts of the text. Furthermore, the trained group engaged in strategic rereading more than did the control group.

As mentioned earlier, Garner (1987) has argued that rereading and summarizing are the optimal strategies for readers encountering text in an unfamiliar domain. She noted that there is evidence for both the need for and effectiveness of training in both strategies. For example, in one study she found that students in the ninth and eleventh grades were able to differentiate between good and poor summaries even when they failed to generate a sufficient summary (Garner, 1985). This study demonstrates that knowledge about summaries is not always applied to the reading context.

Hare and Borchadt (1984) examined the effects of instruction in summarizing on both the products and process of summarizing. Their programed involved training five strategies for summarization: a) using topic sentences; b) collapsing lists; c) collapsing paragraphs; d) deleting irrelevant details; and e) revising summary. The trained group demonstrated a more effective application of the rules than did the control group. Furthermore, they found that the trained students were more likely than the untrained

subjects to include all or most of the main ideas in their summaries.

Summary of Instructional Implications of Evidence Supporting the Roles of Prior Knowledge and Strategic Knowledge

The evidence reviewed in the previous two sections suggests a number of implications for reading comprehension instruction. The evidence showing effects of prior knowledge on comprehension performance have implications for prereading instructional activities, while the evidence showing benefits of strategy training suggests that instructions can help readers become more successful comprehenders. These implications will be summarized in this section.

There are several important implications for prereading instruction that can be culled from studies demonstrating effects of prior knowledge and prior knowledge instruction on comprehension performance. First, it is clear that prereading instruction should focus on background information that is central to the content of a reading selection (Beck et al., 1982; Omanson et al. 1984; Stahl & Jacobson, 1986; and Stahl et al., 1989). Relevant prior knowledge should be activated and/or relevant information should be provided before readers encounter the text. Teachers should also attempt to identify and address misconceptions concerning the topic (Alvermann et al., 1985;

Lipson, 1982; 1983). The instruction should also encourage students to connect their existing knowledge with the information from the text since the work of Alvermann et al. (1985) and Lipson (1982; 1983) also suggests that it can be difficult for readers to integrate new information with existing knowledge. Both vocabulary and topic information should be included in prereading instruction (Freebody & Anderson, 1983; Stahl & Jacobson, 1986; and Stahl et al., 1989). Finally, vocabulary instruction should go beyond definitions and synonyms in order for it to affect macro-level processes (McKeown et al., 1985).

While the importance of domain knowledge for successful comprehension is well supported, there is also evidence showing that strategic knowledge can facilitate comprehension (Cunningham, 1988; Palinscar & Brown, 1984; Paris et al., 1984). Furthermore, it seems that strategy training is especially effective for situations where readers have insufficient prior knowledge (Garner, 1987; Hasselhorn & Korkel, 1986). Evidence favors the strategies of generating questions, summarizing, and rereading as effective for improving comprehension monitoring and repairing comprehension failures (Andre & Anderson, 1978-1979; Garner, Hare, Alexander, Haynes, Winograd, 1984; Hare & Borchardt, 1984; Walczck & Hall, in press). Finally, it seems that strategy instruction should include the reasoning

behind utilizing strategies in different situations (the why and when information).

Rationale for Using Computer-Based Comprehension Instructions

General Advantages of Applying Computer Technology to Reading Instruction

There are a number of advantages to using computer-based instructions (CBI) for reading instruction afforded by computer technology. One important advantage is that there are at least four reasons why CBI can result in a significant increase in time spent on reading tasks (e.g., Bunderson & Inouye, 1987; Rude, 1986). First of all, computers can provide significant amounts of information very quickly so that the delivery of instruction tends to be more efficient than the delivery of typical classroom instruction (Bunderson & Inouye, 1987). Secondly, the nature of the instruction can vary such that instruction can be tailored to different, specific aspects of reading. For example, CBI programs can be primarily drill and practice of skills without direct instruction. CBI can also take the form of tutorials that present instructional frames followed by questions, feedback, and branching that can be used for combining the teaching and drilling of reading skills (Kinzer, 1986). Additionally, simulations can be used to engage children in comprehension and critical thinking exercises (e.g., Kinzer, 1986; Strickland, Feeley, & Wepner.

1987). Thirdly, CBI is generally used as a supplement to classroom instruction (e.g., Bunderson & Inouye, 1987; Rude, 1986) so any amount of time spent with CBI reading programs is additional time on reading tasks. Fourthly, many educators have noted that children seem to find working with CBI programs engaging which increases their motivation to work with the programs (e.g., Daniel & Reinking, 1987; Kamil, 1987; Reinking, 1987).

Probably the most utilized application of computer technology to reading instruction is the game format for drill and practice. One common and seemingly valid complaint against the phonics approach to reading instruction (i.e., the approach that emphasizes learning print-to-sound correspondences) is that it engages children in boring drill and practice exercises that foster a negative attitude toward reading. Research has shown, though, that the low ability readers who need the practice need plenty of practice trials in order to meet even modest goals (e.g., Frederiksen et al., 1985a and 1985b). CBI is ideal for the administration of numerous practice trials and practice trials can be incorporated into game formats that mask the repetitive nature of the task while encouraging the development of both speed and accuracy. Both Frederiksen et al. (1985a; 1985b) and Roth and Beck (1987) found this to be a useful strategy for increasing motivation. Kamil (1987)

pointed out that game formats can be useful for increasing both attention to the task and motivation.

Another significant advantage to using computer technology is that computer-controlled displays can be interactive. Programs can be developed such that the computer responds to the reader's questions and requests for information (Reinking, 1987). Programs can monitor a number of reader characteristics such as reading time, responses to questions, and requests for assistance and then use this information to adjust the on-line presentation of instruction (Daniel & Reinking, 1987). For example, adaptive programs are being researched that adjust readability and passage structure based on the reader's responses and reading time measures (Daniel & Reinking, 1987).

Computers can also be used to present instructional materials such that they vary with varying stages of learning (e.g., Reiser, 1987). For example, in the early stages of learning when declarative information must still be learned, the program can provide this information along with instruction in how to apply the information. Gradually, the guiding manipulations can be removed as the learner's knowledge become compiled into procedures. An alternative to computer-controlled manipulations is for guiding manipulations to be presented only when a learner requests help (Reinking, 1988). These types of applications

seem especially useful for instruction in when and how to use strategies while reading.

Another very important advantage to using CBI for reading instruction is that instruction can be individualized for both rate and content (e.g., Bunderson & Inouye, 1987; Kamil, 1987). CBI programs can be developed such that they target the component skills that individual readers have problems executing efficiently. Two prominent reader researchers (Perfetti, 1983b; Lesgold 1983) have argued that CBI is ideal for remediating the lower-level skills that must be executed very quickly and learned to the point of automaticity. Additionally, progress through modules that focus on component skills can be monitored for each student (Bunderson & Inouye, 1987).

Evidence in Favor of Using CBI for Research in Comprehension Instruction

Langer (1986) argued that too much emphasis has been placed on how CBI can be applied to lower-level processes to the exclusion of higher-level processes. She suggested that more research should focus on using CBI for comprehension instruction. Langer advocated examining computer-based instructional interventions that include prior knowledge instructions prior to reading the text and strategy instructions during reading. The present study was designed partially in response to the surprising dearth of research

in this area. The most closely related research will be described in the remainder of this section.

Gay (1986) looked at the effects of prior knowledge differences and learner- versus program-controlled computer-based video instruction. The subjects were college students who were classified as either high-knowledge or low-knowledge in terms of their knowledge of the content. Gay found that the low-knowledge subjects spent less time working with the material and performed more poorly when the instruction was under their control than when the instruction was preprogrammed. The high-knowledge subjects performed as successfully when instruction was under their control as when the instruction was preprogrammed. It seemed that the high-knowledge subjects were much better than the low-knowledge subjects at effectively organizing the instruction.

The issue of who benefits from learner-controlled versus program-controlled instruction is very important since CBI programs can easily be adapted either way to suit the learner's needs and characteristics. While the idea of learner-controlled instruction had been well received by educators, the research tended to be consistent with Gay's finding (1986), in that generally only high knowledge and/or high ability students have been found to benefit from learner-controlled instruction (Garhart & Hanafin, 1986; Jonasson, 1986). Garhart and Hanafin (1986) hypothesized

that most students do not benefit from learner-controlled instruction because they fail to accurately assess their understanding of the material they are reading.

Garhart and Hanafin (1986) tested their hypothesis by having college students assess their comprehension of material and then comparing those assessments with comprehension performance on both factual and inferential test items. In order to control for prior knowledge differences, they used fictional expository text (i.e., they made-up the content). They did not find correlations between the self-assessment measures and the two measures of comprehension. Garhart and Hanafin argued that their finding suggested a possible mismatch between the learner's criteria for comprehension and the intentions of the lesson. Clearly, the subjects did not monitor their comprehension of the material in terms of the goals of the lesson.

It is important to note that the study by Walczck and Hall (in press) demonstrated one possible way to address the Garhart and Hanafin (1986) finding that students fail to monitor comprehension. Walczck and Hall found that embedding questions following each paragraph resulted in a strong relationship between self-assessment and comprehension performance suggesting that students were successfully monitoring their comprehension of the material. While Walczck and Hall used conventional paper and pencil materials, clearly CBI would be ideal for using embedded

questions to encourage comprehension monitoring. With CBI it is possible to make a subject's progress through a text contingent on answering the embedded questions following each paragraph, thus increasing the likelihood that each subject will monitor his or her comprehension while attempting to respond to the questions.

In agreement with this point, Schloss, Sindelar, Cartwright, and Schloss (1986) argued that the effects of embedded questions can be increased with CBI because subjects can in fact be forced to respond. In their study, Schloss et al. compared the effects of questions with the effects of highlights in a CBI setting. The questions and highlights focused on both factual and higher cognitive material. By higher cognitive they meant material not directly stated in the text but requiring some cognitive manipulation of the text material.

The subjects in the Schloss et al. (1986) study were college and graduate students. Schloss et al. found that students in the question conditions performed better on factual and higher cognitive questions when compared to subjects in the highlight conditions. This effect of questions was specific to the material targeted on-line, that is there were no differences between the question and highlight conditions when the material tested was not targeted on-line. This finding demonstrates the importance

of targeting central concepts when trying to enhance comprehension with embedded questions.

Reinking (1988) looked at the comprehension performance of fifth and sixth grade good and poor readers as a function of assistance provided with computer-presented text. There were two computer-based assistance conditions that were compared with two control conditions: a) an off-line reading condition; and b) an on-line, no-assistance condition. The two assistance conditions were: a) reader-controlled requests for type and amount of assistance; and b) all-options for assistance provided. For both conditions, assistance came <u>following</u> passage presentation. The type of assistance offered included easier text, main idea identification, vocabulary definitions, and background information on passage content.

Reinking (1988) found that performance was better on the comprehension tests in both the computer-based assistance conditions than in the two control conditions. The two control conditions did not differ in terms of comprehension performance from one another and, unlike in Gay's (1986) study, Reinking did not find a difference between the reader-control condition and the all-options-provided condition. The good readers performed consistently better than the poor readers and there was no interaction of ability with treatment. Reinking did not explore the nature of the positive effects of the individual types of

assistance nor did he offer a theoretical rationale for including the specific types of assistance he chose to include in his comprehension program.

There are several conclusions that can be drawn from the CBI studies just reviewed. First of all, the research overall supports the use of CBI to examine instructional factors that can affect comprehension of text. Secondly, the issue of reader versus program control over CBI for reading comprehension is not yet resolved as Reinking's (1988) finding showed, but the bulk of the evidence does favor using program control with text that is expected to be unfamiliar to readers (Gay, 1986, Garhart & Hanafin, 1986; Jonasson, 1986). Thirdly, there is evidence from the Schloss et al. (1986) study that one effective CBI technique for enhancing comprehension is to use embedded questions that target centrally important concepts from a text. Finally, there is an obvious need for more theoretically-guided CBI research into specific instructional interventions that will facilitate comprehension.

Present Research

Overview of Study

The purpose of the present study was to use computer-based instructional interventions to explore the effects of domain and strategy knowledge on the comprehension of expository passages that were either familiar or unfamiliar to subjects. Instructional manipulations were used because

they provide both a way of exploring the effects of knowledge and potential for practical applications. There were two instructional conditions and two control condition for both the familiar and unfamiliar passage.

The first instructional condition (called the domain condition) involved presenting relevant background information along with definitions and explanations of the important vocabulary terms. This condition was devised based on the literature suggesting that well-structured, relevant domain information is beneficial for aiding comprehension.

The second condition (called the strategy condition) involves instructions on why and how strategies should be used while reading. Subjects were instructed on-line to generate main idea questions following designated paragraphs, to summarize following other paragraphs, and to reread previous segments of text whenever they were unable to generate questions and/or to summarize. These particular strategies were chosen because the effectiveness of each is well supported in the literature and the combination of the three was expected to constitute a robust instructional intervention.

The third condition was a typical control in that subjects did not encounter any instructions before reading the passage and taking the tests. The fourth condition was a control for the domain condition (called the domain-

control condition). The assumption underlying the domain condition is that the domain instructions will affect comprehending the text and not simply performance on the tests. A condition in which subjects receive the domain instructions without reading the text should allow for a test of this assumption. Such a condition was included for that purpose.

Comprehension was assessed using three different verification tasks selected to measure the three levels of the comprehension process identified in the van Dijk and Kintsch (1983) model. Microstructure comprehension was measured with a sentence verification task, macrostructure comprehension was assessed using a task in which subjects verified summary statements, and the reader's situational representation was evaluated in terms of performance on an inference verification task. The decision to include multiple tests of comprehension based on the van Dijk and Kintsch framework was made in an attempt to detect any differential effects of the instructional manipulations on comprehension performance.

Computer-administered instructional programs were used for two reasons. First, the computer-based environment should encourage subjects to engage in the instructional activities. In other words, program control over the session provides a type of manipulation check. Secondly, it is hoped that the current programs can be expanded on for

future studies with the result being programs with more elaborate branching and more embedded text features.

Predictions

There are five predictions concerning the effects of content familiarity and the different instructions. It should be noted that predictions were made only when they were logical and well-supported extensions of the literature. As a result of this restriction, predictions were not made for the entire set of eight conditions. The five predictions are summarized in Table 1 (see page 57).

The first prediction is that all subjects in the domain condition (i.e, those reading either familiar or unfamiliar text) should perform better on all three comprehension tests than subjects in the domain-control condition. This prediction is based on the assumption that the domain instructions will facilitate the comprehension process and will not facilitate performance on the tests in the absence of the text.

A second prediction is that there should be a main effect for topic familiarity. Subjects should perform better overall on the familiar passage.

The third prediction is that, for subjects reading unfamiliar text, mean performance on both the microstructure and macrostructure tests should be ordered such that subjects in the domain condition perform best, then subjects in the strategy condition, and lastly subjects in the

control condition. The assumption here is that domain knowledge should be critical for constructing the textbase at both the micro- and macrostructure levels. Additionally, strategy instructions in the absence of domain knowledge should be insufficient for macrostructure comprehension since without structured domain knowledge subjects will most likely be unable to identify and synthesize the most important ideas in an unfamiliar domain.

However, the fourth prediction is that there should be positive effects on the macrostructure test of the strategy instructions for subjects in the familiar content condition. The strategy instructions should facilitate the process of constructing a macrostructure since the instructions encourage subjects to focus on the most important content, to summarize, and to update their summary. So, the strategy instructions actually encourage subjects to construct a macrostructure which should be beneficial when reading in familiar domain.

The fifth prediction is that positive effects of domain instructions should be found on the inference test for subjects in the familiar content condition. It should be the case that conceptual instructions in a familiar domain activate relevant knowledge that will facilitate the process of drawing inferences. Therefore, with familiar text, subjects in the domain instructional condition should

outperform subjects in either the strategy or control conditions.

Table 1

Predictions Concerning the Effects of the Different Instructions and Content Familiarity on Comprehension Performance

1)	Subjects in the domain condition will perform better than subjects in the domain-control condition on all tests.
2)	Subjects should perform better overall on the familiar passage.
3)	Mean performance for subjects reading unfamiliar text should vary on both the microstructure and macrostructure tests such that the domain condition subjects perform best, then subjects in the strategy conditions, and lastly subjects in the control condition.
4)	For subjects in the familiar content condition, positive effects for the strategy instructions should be found on the macrostructure test.
5)	Subjects reading familiar text in the domain instructional condition should perform better on the inference verification test than subjects in than in the control or strategy conditions.

CHAPTER II

METHOD

Subjects

A total of 195 students at the University of Massachusetts participated in the study. Thirty-eight of those students were invovled in pilot testing of the materials. Volunteers were recruited from classes in the Department of Psychology with the stipulations that selected subjects must be beyond their freshmen year and have taken at least two classes in psychology. Subjects received one experimental credit for their participation.

As part of the experiment, subjects were screened for their familiarity in the two domains. Subjects who had been assigned to the unfamiliar content condition and who demonstrated familiarity with targeted concepts in economics were excluded from the analyses. Additionally, subjects who had been assigned to the familiar content condition and who demonstrated a lack of familiarity with targeted concepts in psychology were also excluded from the analyses. As a result of this screening process, 146 subjects were included in the analyses. There were 75 subjects assigned to the unfamiliar content condition and 71 assigned to the familiar content condition.

Materials

Overview of Materials Development

All of the materials for both domains were developed by the experimenter and reviewed by an expert in each domain. A faculty member in the department of psychology volunteered to review the psychology materials. A doctoral student in economics was hired to review the economics materials.

The materials were piloted in two ways. First, 30 subjects participated in a pilot study that was designed to test whether the domain instructions were affecting performance on the tests in the absence of the text passage. Evidence for such a biasing effect was found for both conditions of content familiarity on the sentence verification test. An examination of performance on individual items by instruction type revealed information concerning which items seemed to causing the effect. These items were revised.

The next concern for piloting was the amount of time required for subjects in the instructional conditions to complete the entire experiment. Since the experiment was to take place in one session, it was deemed necessary to keep the time down to one hour or less. There were eight subjects who were timed going through each of the eight experimental conditions. The subjects assigned to the domain and strategy conditions were averaging one and one-half hours for completing the experiment. As a result of

this information, both the text and the tests were shortened.

Passages

The passages were taken from textbook chapters that are representative of upper-division college material. The psychology material was taken from a book entitled Child psychology: A contemporary viewpoint (Hetherington and Parke, 1979) that has been used in 300-level classes on developmental psychology at San Francisco State University. The chosen topic was classical and operant conditioning. This topic was chosen to represent the familiar material because the basic concepts of behavioral theories are commonly encountered in lower-division psychology classes. For example, at the University of Massachusetts, psychology majors encounter concepts on behaviorism in their introductory class, their research methods class, and then again if they take classes in educational psychology and/or learning theory. Furthermore, many students have had some exposure to the basic concepts in high school.

The unfamiliar material was chosen from a textbook on macroeconomics (Sherman and Evans, 1984). At the University of Massachusetts, classes on macroeconomics are taught at the 300 level. The chosen topic was theories of the business cycle. Economics was chosen for the unfamiliar domain because its content is clearly distinct from psychology. The specific topic was chosen because there are

basic concepts in economics that are needed before a reader would be able to comprehend a passage about different views on the business cycle at any deep level (i.e., beyond the microstructure level). Furthermore, most of the concepts necessary for understanding the topic are specific to the field of economics and not commonly familiar to college students outside of that major.

Both passages contained 16 paragraphs and were excerpted from longer chapters. They were equated in terms of word count and readability. The psychology passage was 1051 words and the economics passage was 1052 words. Readability analyses were performed on the two passages and the results showed that the passages were comparable in terms of approximate grade level and the Flesch index of readability. The Flesch index is based on the average number of words per sentence and the average number of syllables per words. The lower the index the greater is the complexity of the text material. The approximate grade level for the psychology passage was 15 and the Flesch index was 37. For the economics passage, the approximate grade level was 16 and the Flesch index was 34. These indices of readability support the assertion that both passages are at the upper-division college level and that the passages are not very different in terms of readability. The psychology passage can be found in Appendix A and the economics passage in Appendix B.

Concept Familiarity Screening Tests

Two concept familiarity screening tests were constructed based on a subset of six of the central concepts from each passage. Importance was defined in terms of the concepts that represented the ideas most central for understanding the material. The experimenter selected the concepts for both the psychology and economics passages, but the domain experts reviewed the selections. The tests asked subjects to rate their familiarity with each of the concepts based on a 5 point scale. A rating of 1 indicated a high degree of familiarity, while a rating of 5 indicated a low degree of familiarity. The psychology screening form can be found in Appendix A, while the economics screening form can be found in Appendix B.

Microstructure Comprehension Tests

A version of the Sentence Verification Technique (SVT) called the Meaning Identification Task (MIT) was used to measure microstructure comprehension. The SVT was developed by Royer, Hastings, and Hook (1979) as a measure of reading and listening comprehension. The reliability and validity of the Sentence Verification Technique have been supported by 10 years of research (e.g., Rasool & Royer, 1986; Royer & Hambleton, 1983; Royer et al., 1979; Royer, Kulhavy, Lee & Peterson, 1986; Royer et al., 1984). A study conducted by Royer et al. (1984) showed that the SVT was sensitive to manipulations of such text characteristics as propositional

density, argument overlap, and coherence. This findings suggests that the SVT is a valid measure of microstructure comprehension.

Tests based on the SVT have an equal number of four item types. The item types are based on passage sentences: originals are replicas of a passage sentence; paraphrases have many different words but the same meaning as a passage sentence; meaning changes contain most of the same words but a different meaning from a passage sentence; and distractors are different in wording and meaning from a passage sentence but are similar in theme, syntax, and vocabulary level to a passage sentence. A complete description of the SVT can be found in Royer, Greene, and Sinatra (1987).

The MIT is a modification of the SVT introduced by Marchant, Royer, and Greene (1988). MIT tests have only two items: paraphrases and meaning changes based on paraphrases. Both types of test sentences are different from passage sentences in wording, but only paraphrases have the same meaning. Marchant et al. (1988) found that the MIT was more reliable and valid than the original version of the SVT when the two were compared based on the same passages. A 14 item MIT test was constructed for both passages. The psychology MIT test can be found in Appendix A and the economics test in Appendix B.

MIT tests are constructed by first writing paraphrase sentences for targeted passage sentences, and then writing

meaning change sentences from half of the paraphrases. Meaning change test items are developed by changing one or two words in half of the paraphrase sentences so as to alter the meanings of those sentences. The MIT tests for both passages were based on 14 passage sentences. Sentences for each passage were chosen such that seven of the sentences were rated by experts to be highly important to the passage topic, while the other seven were rated to be of low importance to the passage topic. All of the passage sentences had been rated in terms of importance prior to the selection process.

Summary Statement Verification Task

As a measure of macrostructure comprehension, a summary statement verification task was developed. This task required subjects to verify a series of accurate and inaccurate summary statements. Williams has used tasks involving summaries to measure macrostructure comprehension in two studies (Williams, 1984; Williams, Taylor, & deCani, 1984). In one study she and her colleagues instructed subjects to generate summaries after reading (Williams et al.,1984), while in another study she had subjects decide whether target summary sentences were either accurate or inaccurate based on what they had read in the text (Williams, 1984). It is this second task that was adopted for use in the present experiment.

The accurate summary statements were macropropositions from the text in that they represented generalized and integrated ideas based on material presented in paragraphs and sometimes across paragraphs. Thus the statements summarized the major points of the text. The inaccurate summary statements were meaning change versions of accurate summaries statements not used. The meanings were changed such that they were plausible yet still contradictory with the text. There were 7 accurate and 7 inaccurate statements. The psychology summary test can be found in Appendix A and the test for economics in Appendix B.

Inference verification task

In order to assess whether or not subjects understood the texts well enough to apply the information, subjects additionally completed an inference verification task similar to that used by Perrig and Kintsch (1985). The accurate inferences were statements consistent with the material presented in the text, but not actually stated in the text. Whereas differentiating between accurate and inaccurate macro-statements requires that subjects effectively synthesize the information from the text, differentiating between accurate and inaccurate inferences requires that subjects actually apply the information to novel circumstances. The accurate inferences reflected correct applications of the textual information, while the inaccurate inferences reflected applications of the

information based on misunderstandings of the material. There were 7 accurate and 7 inaccurate inferences. The psychology inference test can be found in Appendix A and the economics inference test in Appendix B.

Instructional Conditions

Domain Instructions

The emphasis in this condition was on providing background knowledge and teaching the important concepts in terms of their relationship to the domain. The instructional goal of this condition was for subjects to develop a structured knowledge base that will include both background information about the domain that is specific to the text and knowledge about the concepts that are central to the text. That satisfaction of this goal will facilitate comprehension is consistent with the studies by Langer (1984), Omanson et al. (1984) and Stahl et al. (1989) that were described in the introduction.

This condition began with a statement concerning the importance of having some background knowledge before reading a text. That statement was followed by an explanation of the type of information that would be provided by the computer program. The instruction began with an expository presentation of background knowledge that was relevant to the passage content. So, for example, background on the dilemma posed by business cycles was presented for the economics passage. Next, the critical

terms were presented along with their definitions and a statement that described how the term is related to the background information provided earlier. The six terms that were used in the screening tests, along with an additional nine terms were included because these 15 terms had been identified as being critical for understanding the material. Each term was defined and explained in a separate frame with subjects controlling the speed at which they reviewed each frame.

After each term was presented, subjects completed a matching test in which they had to match each term with its definition. In this task, each term was presented in a separate frame along with four definitions. The subjects had to choose the definition that matched the term. If they were correct, the program moved to the next definition. If they were incorrect, the program displayed the instructional frame for that term, and then sent them to the next matching item when they indicated (by pressing a button) they were ready. After they cycled through all the matching frames once, they cycled back through the list. A message that said "Got this one right! Page down for next item." was displayed for each item they got correct, while they had to repeat the matching task for each item they got incorrect.

Once subjects demonstrated mastery of the vocabulary terms, they were instructed to complete the three comprehension tests. The materials used for the domain

instructions appear in the appendices. See Appendix A for the psychology materials and Appendix B for the economics material.

Strategy Instructions

The instructions in this condition focused on why and how strategies should be employed during reading. The goals of instruction were for students to understand why and when they should use strategies and how the specific strategies of generating questions, summarizing, and rereading are applied to a reading context. The importance of the goals for this condition is supported by the work of Garner et al. (1984), Hare and Borchardt (1984), and Andre and Anderson (1978-1979) which was described in the introduction.

The instruction began with an explanation of why and when strategies are useful for aiding text comprehension. The actual instructions for the strategy condition are presented in Appendix C. Each element of the intervention was discussed beginning with the activity of generating questions. Subjects were told that they should type in a question whenever they were prompted to do so following a paragraph. Subjects were instructed to generate questions that focus on the central ideas as opposed to details. An example paragraph with a good and poor example of a question were presented. Subjects were instructed to type in their question before proceeding to the next paragraph. They were

also instructed to go back and reread the text when they are unable to generate a question.

After subjects saw the example paragraph and a good and poor example question, they were told that they would receive prompts following every third paragraph to summarize the main ideas presented in the text and update previous summaries based on the last two paragraphs. The previously used example paragraph was presented, followed by a consecutive paragraph, and then an example summary. Subjects were instructed to type in their summaries in one to two sentences. So, following each paragraph subjects typed in either a question or a summary. Again, subjects were told to reread whenever they were unable to summarize.

Control Instructions

Subjects in this control condition were instructed to read the text carefully and complete the three comprehension tests.

Domain Control Instructions

The same instructions were presented in this condition that were presented in the Domain instructional condition. The only difference between the two conditions was that in this control condition subjects did not encounter the text. Instead, after they went through the instructional manipulation they began the comprehension tests.

Performance Indices for Use as Covariates: Grade Point Average and Verbal SAT score

In order to have available information on subjects that was expected to be correlated with performance on the comprehension test, an attempt was made to obtain subjects' Grade Point Averages (GPAs) and SAT scores. Previous research with the SVT has shown relatively high correlations of SVT scores with both verbal SAT scores and GPAs (see, for example, Royer, Marchant, Sinatra, and Lovejoy, 1990). The other two measures of comprehension were also expected to correlate highly with verbal SAT scores and/or GPA. Therefore, use of these indices as covariates in an analysis of variance design was expected to reduce the error variance in the design.

Apparatus and Software

Three computers were used to accommodate running three subjects simultaneously. A Leading Edge computer with a 30 megabyte hard disk drive was used along with a Leading Edge monochrome monitor. A Zenith computer with a 20 megabyte hard disk drive was employed and used with a Zenith monochrome monitor. Additionally, a Toshiba 3100/20 laptop was used with its monochrome monitor. The programs for presenting the instructions, texts, and comprehension tests were developed using HyperPAD (Brightbill-Roberts, 1989) software.

Design

The conditions and levels are depicted in Table 2 (see page 74). This is a 4 (type of instructions) by 2 (topic familiarity) by 3 (type of comprehension test) design with repeated measures on comprehension test. Instructions are crossed with topic familiarity.

Procedure

Three experimenters were involved in running subjects. The author trained two undergraduate assistants to help with data collection. All of the experimenters followed a script that was developed to keep the process uniform across experimenters.

When subjects arrived for the experiment they were randomly assigned to one of the eight between-subjects conditions. Random assignment was accomplished in the following manner. For each of the eight conditions, 20 pieces of paper were coded with the condition and subject numbers from 1 through 20. The 160 pieces of paper were mixed together and then placed in bowl. Each day one of the experimenters would take out 10 pieces and list them on a log sheet. Subjects were assigned to the condition and number that was next on the list when they arrived, and that information was recorded on their concept familiarity screening form. Conditions and number were checked off the list after they were assigned.

Subjects were seated in front of one of the three computers and given both a consent form and the concept familiarity screening tests to fill out. The consent included a general consent-to-participate section and a section for consenting to allow the experimenter to obtain their GPAs and SAT scores from the University's Office of the Registrar. Subjects had the option of participating in the experiment while not consenting to the release of information on their GPAs or SAT scores. After subjects signed the consent form, they filled out the screening tests for both domains and listed the classes they had taken in both psychology and economics.

After subjects filled out the forms, they were given general information about the experiment and specific information about their condition. They were told that the goal of the experiment was to test computer-based instructions that would accompany a passage. They were also told that three different comprehension tests would follow the passage and that they should be sure to read the instructions for each test. Subjects were then given information to orient them to the computer program specific to their condition. All conditions that included the text allowed for rereading portions of the text and subjects were made aware of this feature. Finally, subjects were told to complete the session at their own pace.

Subjects' progress through the instructional programs was monitored by the experimenters. An experimenter checked on each subject at least once during the experiment. This was done both as a manipulation check (i.e., to make sure that subjects were at least trying to do what they were supposed to do) and as a means of making sure that subjects understood how to interact with the HyperPad programs.

After all the data were collected, a list of students who consented to having their GPA and SAT scores released was sent to the University's Office of the Registrar along with copies of the consent forms. Of the 146 subjects who met the criteria for inclusion in the study, GPA and SAT information was obtained for 122 subjects.

Table 2

Conditions and Levels

Content Type	Instructional Condition (Type of Comprehension Test)
1) Unfamiliar	
	1) Domain --background information, vocabulary terms, explanations of relationship between terms and background information (MIT) (Summary) (Inference)
	2) Strategy-- when and how to generate questions, summarize and reread portions of the text. (MIT) (Summary) (Inference)
	3) Control--No instruction, just text and tests (MIT) (Summary) (Inference)
	4) Domain Control--Domain instructions without text (MIT) (Summary) (Inference)
2) Familiar	
	1) Domain --background information, vocabulary terms, explanations of relationship between terms and background information (MIT) (Summary) (Inference)
	2) Strategy-- when and how to generate questions, summarize and reread portions of the text. (MIT) (Summary) (Inference)
	3) Control--No instruction, just text and tests (MIT) (Summary) (Inference)
	4) Domain Control--Domain instructions without text (MIT) (Summary) (Inference)

CHAPTER III

RESULTS

The responses to the three verification tests were scored and a proportion correct score was computed for each subject. The responses to the concept familiarity tests were also tallied and a mean familiarity score obtained for each subject in both domains. The scores ranged from 1 to 5 with a score of 5 indicating lack of familiarity and a score of 1 indicating highly familiar. These scores were used to select subjects for inclusion in the analyses. A score of 3 or greater was necessary on the economics test for subjects assigned to the unfamiliar content condition. Three subjects did not meet that criterion and were omitted from the analyses. A score of 3 or less on the psychology test was the requirement for subjects in the familiar content condition. There were eight subjects who did not meet the requirement of familiarity with psychology concepts. Therefore, the results are based on 75 subjects in the unfamiliar content condition and 71 in the familiar content condition.

The results are presented in six sections. In the first section, the correlations of GPA and verbal SAT with the three dependent measures are presented. In the following section, the analysis of the complete design is summarized. The third section is concerned with the comparisons between the domain instructional condition and

the domain-control. In the following three sections the data for each of three comprehension tests are examined for the two conditions of content familiarity and the three instructional conditions (i.e., excluding the domain-control). Each of these sections will begin with a summary of an analysis of variance (ANOVA). In order to ensure that the family-wise error rate would not exceed 5%, an alpha of .017 will be used for each of the three separate ANOVAs. Whenever justified by the ANOVA for a given comprehension test, contrasts that address the planned comparisons will be summarized. In accordance with the suggestions of Myers and Well (in press), whenever multiple contrasts are computed on a single source of variance, the Bonferroni *t* procedure will be used to control for Type 1 error.

Correlations of GPA and Verbal SAT (VSAT) with the Three Tests of Comprehension

Before proceeding with an analysis of covariance, the correlations of the designated covariates with the three comprehension tests were examined. This was done because the covariates were not available for 24 subjects and the expected increase in power (i.e., through an increase in the precision of estimation) was potentially jeopardized by a loss in number of subjects. The decision was made to proceed with analysis of covariance only if the covariates satisfied the assumption that they would exhibit high linear relationships with the three dependent measures. The

observed correlations did not support this assumption. The correlations are displayed in Table 3 (see page 83). As can be seen from the table, only one correlation coefficient, that for performance on the inference test with verbal SAT, exceeded .20. The next highest correlation was found for performance on the inference test correlated with GPA. The other four values were below .10 and three of these values were actually negative. Therefore, the decision was made not to conduct analyses of covariance.

The Analysis of the Complete Design

A multivariate analysis of variance was conducted in order to look at differences on the three tests as a function of instructions and content familiarity. Significant main effects were found for both instructions and content familiarity [instructions, $F(3,138) = 9.40$, $p < .001$, MSe = .02; content, $F(1,138) = 15.10$, $p < .001$, MSe = .02. The interaction of instructions and content was not significant. The main effect for the comprehension tests factor was significant, as were the three interactions involving the effects of the tests [tests, $F(2,276) = 5.59$, $p < .005$, MSe = .02; instructions by tests, $F(6,276) = 4.04$, $p < .002$, MSe = .02; content by tests, $F(2,276) = 16.73$, $p < .001$, MSe = .02; instructions by content by tests, $F(2,276) = 6.36$, $p < .001$, MSe = .02;]. The finding of a significant three-way interaction of test with instructions and content familiarity means that the effects of instruction and

content familiarity will more clearly be understood in terms of performance on the individual tests. The means, cell counts, and 95% confidence intervals for the MIT, summary, and inference tests are displayed in Tables 4, 5, and 6, respectively (see pages 83, 84, & 85).

Domain versus Domain-Control

In order to assess whether subjects in the domain condition performed better on the comprehension tests than subjects in the domain-control condition, the differences between the means for the two conditions were examined for each of the three tests in the two conditions of text familiarity. Differences were found with four of the six comparisons, but *t*-tests based on the Bonferroni procedure (with $K=6$, $p. < .01$) established that only two of the differences were statistically significant. These findings do not support the prediction that subjects in the domain condition would outperform subjects in the domain-control on all tests.

The six comparisons of means for the domain and domain-control conditions are summarized in Table 7 (see page 86). Looking first at the unfamiliar condition, it can be seen that on both the MIT and summary tests, subjects in the domain condition performed better than subjects in the domain-control condition. However, the difference in means of 10 percentage points on the summary test did not reach

statistical significance. On the inference test the means differed by only one percentage point.

In the familiar text condition, it was on the summary tests that subjects in the domain condition performed better than subjects in the domain-control. The means were identical on the MIT test and the difference of seven percentage points on the Inference test was not significant.

Performance on the MIT Test as a Function of Content Familiarity and Instructions

A two-way ANOVA was employed to examine the effects of content familiarity and instructions on the MIT test. The only effect that reached significance was the main effect for content, $F(1,103) = 6.01$, $p = .016$, $MSe = .014$. As can be seen from Figure 1 (p. 87), the direction of the main effect is counter to what was hypothesized. The expectation was that subjects in the familiar content condition would perform better than subjects in the unfamiliar content condition, but the present finding shows a significant advantage for subjects in the unfamiliar content condition. The means for the two content familiarity conditions are shown in Table 4 (p. 83).

It can also be seen that the prediction concerning instructional effects is not supported. For both content conditions, neither the domain nor the strategy condition subjects performed better than the control condition subjects on the MIT test.

Since the MIT tests were composed of items that had been rated as either of high or low importance relative to the passage topic, performance on the different types of items was also examined. The means based on the high importance items are depicted in Figure 2 and the means for the low importance items are shown in Figure 3 (p. 88). While the functions in Figure 3 (p. 88) are very similar to those found with the overall MIT tests in Figure 1, a somewhat different pattern emerges when performance on high importance items is examined. The functions in Figure 2 show that subjects in the strategy condition have some advantage over subjects in either the control condition or domain condition, though, no effect for instruction was found.

Performance on the Summary Test as a Function of Content Familiarity and Instructions

A two-way ANOVA was also used to look at the effects of content familiarity and instructions on the summary test. A main effect for instruction was found, $F(1,103) = 5.39$, $p < .01$, $MSe = .019$. Additionally, a significant interaction of instruction with content was found, $F(1,103) = 4.85$, $p = .01$, $MSe = .019$. In order to get a clearer sense of these effects, the means are graphed in Figure 4 (see p. 89).

Looking at the graph, it appears that the main effect for instruction might be explained by a positive effect of the strategy instructions relative to the control

instructions. In fact, two contrasts comparing the means of the domain and strategy conditions with the control supported this interpretation. Using the Bonferroni t procedure (with K=3), the difference between the domain and the control was not significant, but the difference between the strategy and the control was significant, $t(59) = 3.12$, $p < .01$.

The interpretation of the main effect is tempered by the significant interaction of instruction with content. Looking first at the function for the familiar content condition, it can be seen that the domain condition mean is actually slightly lower than the control mean. The strategy condition mean is higher than the control mean, but the actual difference is only six percentage points (see Table 5 for the means, p. 84). A contrast on these means did not reveal a statistical difference.

Looking again at Figure 4, a different pattern of instructional effects can be seen for the unfamiliar content condition. Both the domain and strategy means are well above the mean for the control condition. Contrasts comparing these means were computed and evaluated using the on the Bonferroni t procedure (with K=3). The contrasts demonstrated significant differences between the domain and the control, $t(36) = 3.73$, $p < .01$, and between the strategy and the control, $t(36) = 3.14$, $p < .01$.

In addition to these effects of instruction relative to the control, the domain mean is above that of the strategy condition. This pattern is consistent with the prediction concerning the order of means for this condition. However, advantage of the domain over the strategy condition amounts to only four percentage points (see Table 5 for the means, p. 84).

Performance on the Inference Test as a Function of Content Familiarity and Instructions

In order to examine the effects of content familiarity and instructions on the inference test, a two-way ANOVA was computed. The only significant effect found was a main effect for content, $F(1,103) = 43.51$, $p < .001$, $MSe = .016$. The means for this test are depicted in Figure 5 (see p. 90). As can be seen from the graph, subjects in the familiar content condition performed much better than subjects in the unfamiliar condition. The difference in the average performance between the two content conditions was 16 percentage points (see Table 6 for the means, p. 85). As can also be seen from Figure 5, the domain and strategy instructional conditions are not showing an advantage over the control condition for subjects in either condition of content familiarity. This finding contradicts the prediction that for the familiar content condition subjects in the domain instructional condition would perform better than subjects in either the strategy or control conditions.

Table 3

Correlations of MIT, Summary (SUM) and Inference (INF) Tests with GPA and Verbal SAT

Test	GPA	VSAT
MIT	-.0742	-.0852
SUM	-.0262	.0937
INF	.1453	.2134

NOTE. n = 122

Table 4

Means and 95% Confidence Intervals for Performance on the MIT Tests

Content Type Instruction	Mean	n	95 % Confidence Interval
Unfamiliar Content			
Domain	.65	19	.59 to .71
Strategy	.68	20	.63 to .73
Control	.66	19	.61 to .72
Domain-Control	.48	17	.42 to .54
Familiar Content			
Domain	.60	19	.54 to .65
Strategy	.63	18	.57 to .70
Control	.59	14	.53 to .65
Domain-Control	.60	20	.56 to .65

Table 5

Means and 95% Confidence Intervals for Performance on the Summary Tests

Content Type Instruction	Mean	n	95 % Confidence Interval
Unfamiliar Content			
Domain	.73	19	.66 to .79
Strategy	.69	20	.63 to .75
Control	.56	19	.49 to .62
Domain-Control	.63	17	.53 to .72
Familiar Content			
Domain	.68	19	.60 to .76
Strategy	.77	18	.72 to .82
Control	.71	14	.63 to .79
Domain-Control	.51	20	.46 to .57

Table 6

Means and 95% Confidence Intervals for Performance on the Inference Tests

Content Type Instruction	Mean	n	95 % Confidence Interval
Unfamiliar Content			
Domain	.59	19	.52 to .66
Strategy	.55	20	.51 to .60
Control	.57	19	.50 to .64
Domain-Control	.58	17	.51 to .65
Familiar Content			
Domain	.76	19	.70 to .82
Strategy	.68	18	.62 to .74
Control	.75	14	.68 to .82
Domain-Control	.69	20	.62 to .75

Table 7

Means, t values, and degrees of freedom for Differences between Domain and Domain-Control

Test	Means		t value	df
Unfamiliar Content	Domain,	Control		
MIT	.65,	.48	3.95**	34
Summary	.73,	.63	1.86	34
Inference	.59,	.58	< 1.00	
Familiar Content	Domain,	Control		
MIT	.60,	.60	< 1.00	
Summary	.68,	.51	3.69**	37
Inference	.76,	.69	1.79	37

**p < .01. using Bonferroni procedure for K=6.

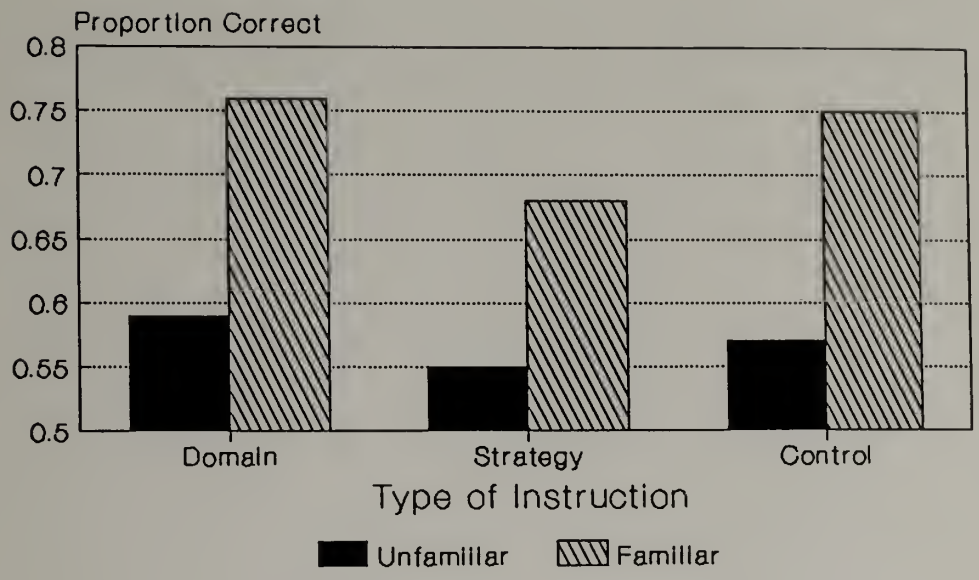

Figure 1. MIT Performance as a Function of Instruction Type and Content Type

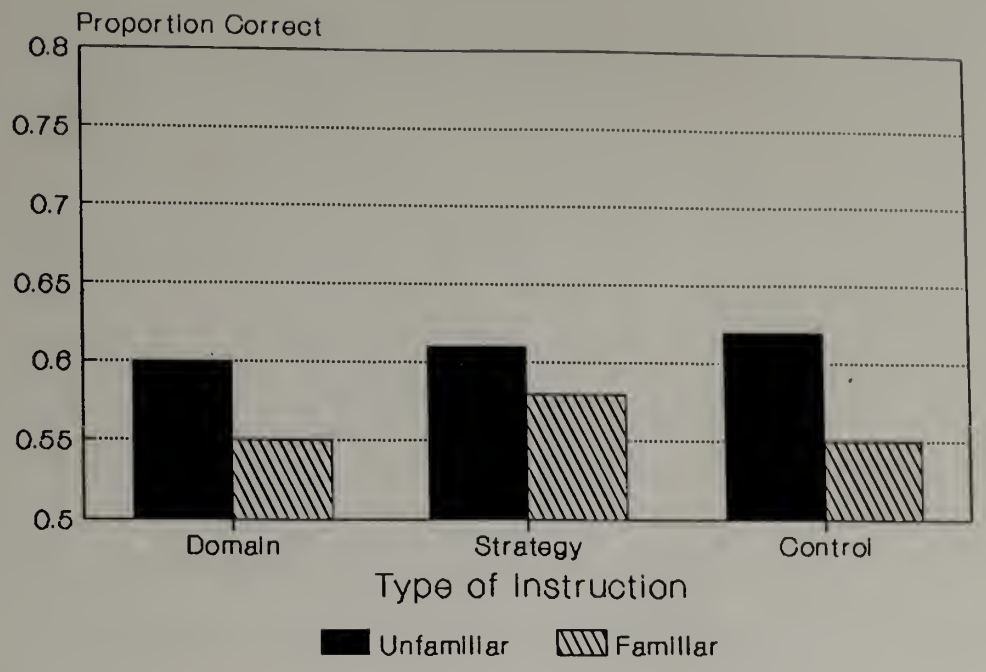

Figure 2. Performance on Low Importance MIT items as a Function of Instructions and Content

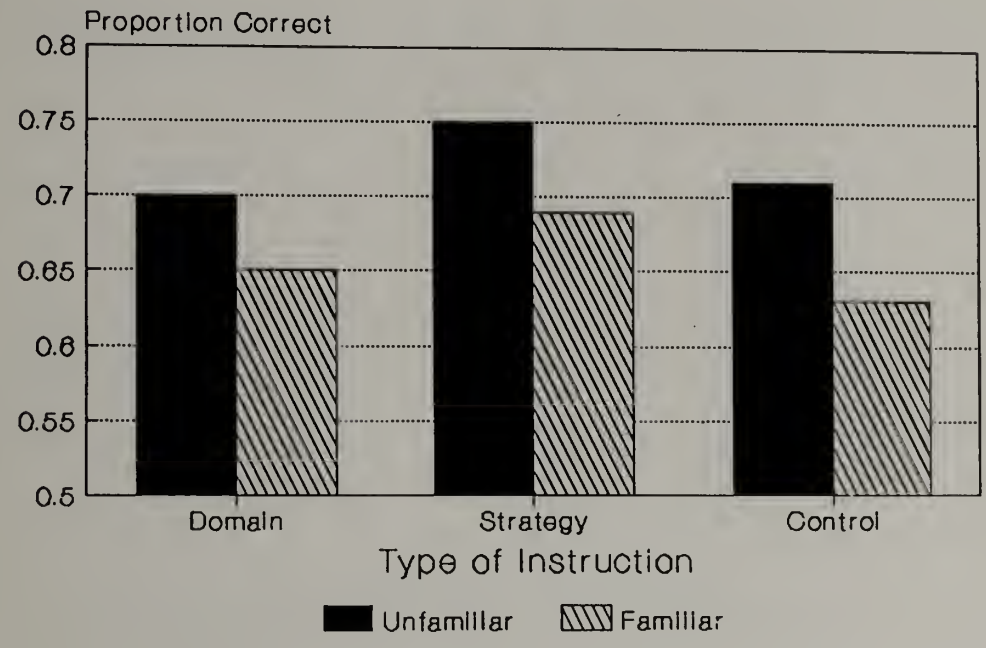

Figure 3. Performance on High Importance MIT items as a Function of Instructions and Content

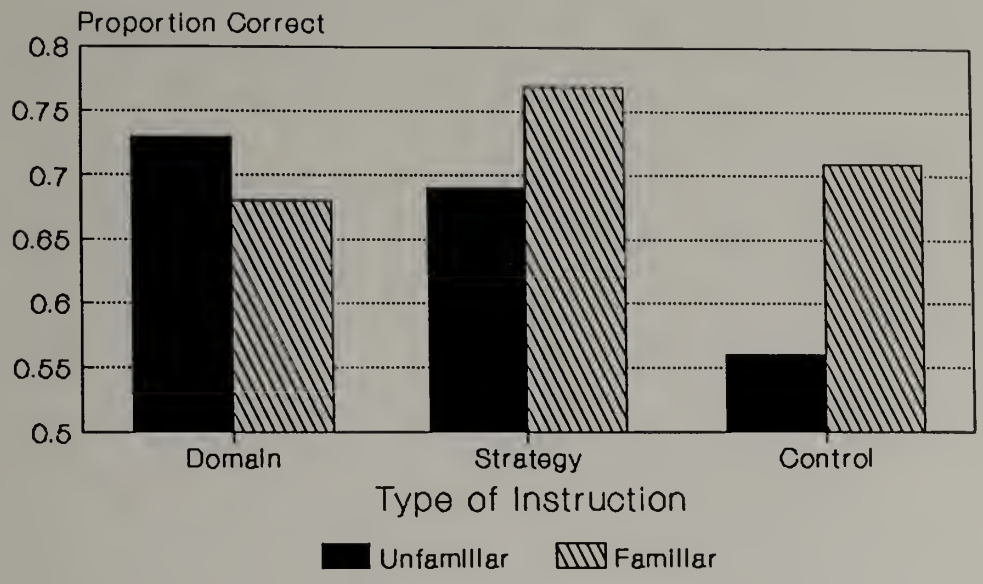

Figure 4. Summary Performance as a Function of Instruction Type and Content Type

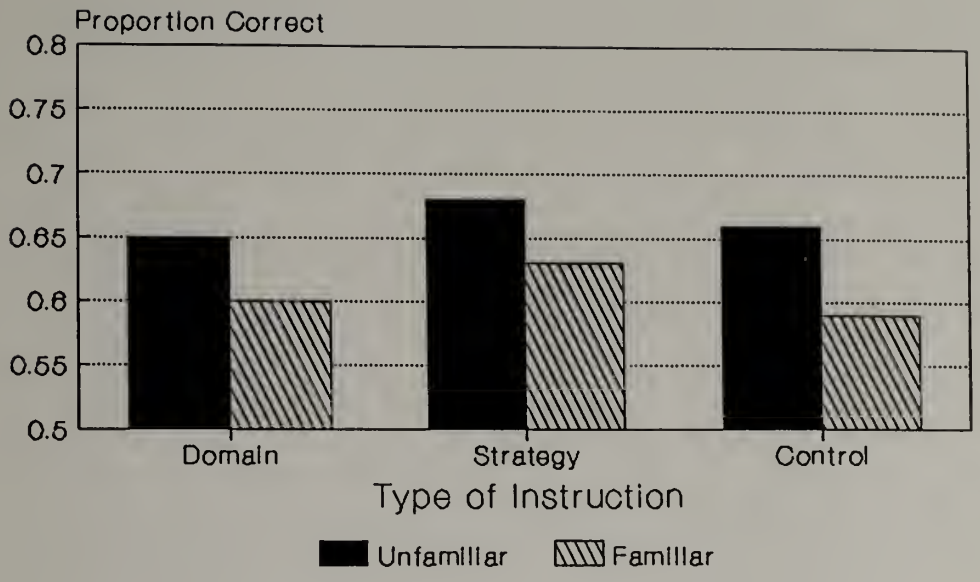

Figure 5. Inference Performance as a Function of Instruction Type and Content Type

CHAPTER IV

DISCUSSION

The most important result was the finding concerning the effects of instructions on performance on the summary verification test with unfamiliar text. Subjects who received strategy instructions performed better than subjects in the control condition and as well as subjects who received instructions providing domain-specific knowledge. This finding is in contradiction to the prediction that domain-specific knowledge would be more important for macrostructure comprehension. It suggests, instead, that strategy usage may compensate to a significant extent for the lack of domain knowledge.

In fact, none of the predictions concerning the superiority of the domain instructional condition were supported. Instead, the results suggest that both instructional conditions were irrelevant for both microstructure comprehension and situation model comprehension with either familiar or unfamiliar text. The only significant effects for instructions were found on the macrostructure test based on unfamiliar reading material, and the domain instructions were found to be only as good as the strategy instructions. Possible explanations for these outcomes will be discussed in this chapter.

The first section of this chapter will include a discussion of the findings concerning the effects of

instructions in terms of both the present predictions and the literature in this area. In the next section the effects of content familiarity will be reviewed and discussed. In the third section several methodological issues concerning the domain instructional condition will be discussed. The following section will be concerned with a discussion of the utility of the van Dijk and Kintsch model. A discussion of directions for future research follows. This chapter will close with some final conclusions.

The Effects of Instructions

The literature on the importance of prior knowledge for successful comprehension lead to several hypotheses concerning the effects of instructions that provide domain knowledge. For the unfamiliar text condition, the domain knowledge instructions were expected to be superior to either the strategy or control instructions for both microstructure and macrostructure comprehension. At the microstructure level, the processes of constructing and connecting propositions should require at least vocabulary knowledge and possibly more structured domain knowledge. As was argued in the introduction, relevant domain knowledge should be even more critical for inferring the higher-order meaning of a text. The study by Spilich et al. (1979) was shown to provide evidence for the importance of prior knowledge for macrostructure-level comprehension. These arguments in favor of the importance of domain knowledge

suggested that strategy usage should not be sufficient to compensate for the lack of domain knowledge.

The pattern of results observed on the MIT test suggests that neither type of intervention affected microstructure comprehension. While this finding is quite understandable given familiar content, it is more difficult to interpret in the unfamiliar content condition for the reasons described in the previous paragraph. Additionally, other researchers have found effects of domain knowledge manipulations on children's performance on sentence verification tasks (e.g., Freebody and Anderson, 1983; Stahl and Jacobsen, 1986).

However, one possible explanation for the present finding is that micro-level processes in skilled, college-age readers are so efficient that even in the absence of considerable domain knowledge these highly-skilled readers are able to construct a microstructure. Furthermore, if it is the case that micro-level processes are already very efficient, then it makes sense that the strategies instructions are irrelevant. This interpretation is consistent with the evidence summarized by Snow and Lohman (1984). Snow and Lohman examined the results from many instructional intevention studies. They found that high-ability subjects did not benefit from the instructional interventions that attempted to redirect the strategies used by subjects. Therefore, instructional effects on the MIT

test might be found when younger, less-skilled readers are targeted by the intervention.

A different pattern than what was found on the MIT test was observed on the summary verification test. The pattern on the summary test suggests that either type of intervention facilitated macrostructure comprehension. As mentioned above, this finding provides evidence that strategy usage may indeed compensate for the lack of domain knowledge.

While the observed effect of strategy instructions is contrary to what was predicted, it is not quite an anomalous finding. The present finding is consistent with the Hasselhorn and Korkel (1986) finding that strategy instructions were beneficial for low-knowledge subjects. Hasselhorn and Korkel found positive effects using an error detection task as the comprehension measure.

The present finding also provides support for Garner's argument (1987) that strategies should be useful for low-knowledge readers. Garner's work has provided much of the support for the strategies of summarization and strategic rereading (e.g., Garner, 1985 and Garner et al., 1984). While Garner has not directly manipulated knowledge, she has used expository text and found positive effects for children's comprehension performance. She has also hypothesized (Garner, 1987) that these strategies would be

beneficial for children reading in new domains and the current result provides some support for this hypothesis.

Further elucidation of the relationship between preexisting knowledge and the benefits of strategy instructions was provided, again, by Hasselhorn and Korkel (1986). They also found that high-knowledge subjects did not show positive effects following strategy training. For the present study, positive effects of strategy instructions were expected on the macrostructure (summary) task for high-knowledge subjects (i.e., subjects reading familiar text). This prediction was made despite knowledge of the Hasselhorn and Korkel finding because the strategy instructions encourage subjects to engage in activities that focus on the higher-order meaning of the text. The finding, though, was a non-significant advantage observed for subjects who received the strategy instructions.

One of the current predictions concerning the effects of the domain-relevant instructions was, in fact, consistent with the findings of Hasselhorn and Korkel (1986). Hasselhorn and Korkel (1986) additionally found that instructions that emphasized activating prior knowledge were more beneficial for high-knowledge subjects than were strategy instructions. For the present study, an advantage for the instructions that provided domain-specific knowledge was predicted for high-knowledge subjects (i.e., those reading familiar text) on the inference test. The

expectation was that the instructions would activate subjects' knowledge about the topic that they could then use for judging inferences, but no effect of instruction was found.

It is important to note that the prediction concerning the difference between performance in the domain condition and performance in the domain-control condition was not supported. The expectation was that the subjects who received the instruction with the text would perform better than subjects who received the instruction without thee text. The results were that only two out of four observed differences were significant, while the other two observed differences were in the right direction (see Table 7, p. 86). In the two cases where no differences were observed, the functions for instructional effects was essentially flat.

In retrospect, it seems that the difference between the domain and domain-control found with the MIT test in the unfamiliar condition is the best test of whether the domain-relevant instructions exerted a direct effect on comprehension performance. The MIT is the only test based on actual propositions in the text, so it should be the least susceptible to domain-relevant instructions. In a very familiar domain, though, subjects will most likely have enough prior knowledge to differentiate between probable and improbable propositions, even in the absence of the text.

Therefore, the present findings provide some evidence that the domain-relevant instructions do not directly facilitate test performance.

The Effects of Content Familiarity

The prediction that subjects would perform better with familiar text was supported only on the inference test where a significant main effect of content familiarity was found. On the summary test, there was no main effect of content familiarity, but from Figure 4 (see p. 89) it can be seen that in the control and strategy instructional conditions, subjects in the familiar content condition perform better than subjects in the unfamiliar condition. For subjects in the domain instructional condition, there was a slight advantage (5 percentage points) for subjects in the unfamiliar content condition.

On the MIT test, though, subjects reading unfamiliar text in all three instructional conditions actually performed better than subjects reading familiar text, and the difference was statistically significant. There are several possible explanations for this unexpected finding. First of all, it might have been the case that subjects who encountered familiar material were not very motivated to read the text carefully. They may have relied more heavily on their prior knowledge than on the text itself. With the MIT test, which requires subjects to verify actual propositions from the text, this strategy did not work well,

thus psychology students reading psychology material performed more poorly than their peers who read unfamiliar material from an economics text.

A related explanation is that subjects in the unfamiliar text condition may have worked harder than their peers in the familiar content condition. When subjects found out they were in the condition with economics material, they very often expressed concern, citing how little they knew about economics. It seems possible that subjects anticipated that comprehending a text in an unfamiliar content domain would be a difficult task. They may, then, have approached the task more diligently in response to the anticipated difficulty.

A final explanation, and one that is perhaps more parsimonious, is that the familiar MIT test may have been more difficult than the unfamiliar MIT test. While the experimenter followed the same procedures for test development in both domains, it is still possible that the two tests were not in fact equally difficult. The familiar MIT test may have been more difficult because the experimenter, like her subjects, had considerably more knowledge about psychology that she had about economics. Only an expert in both domains would be able to assess whether the two MIT tests were at the same level of difficulty.

Methodological Considerations

Possible Problems with the Comprehension Tests

There are several reasons to suspect that there may have been problems with the tests. First, the absence of instructional effects on all tests except the summary test in the unfamiliar content condition suggests the possibility that the tests may have been insensitive to instructional effects. Secondly, that the tests were virtually uncorrelated with GPA and VSAT suggests that the tests may have been unreliable. While low correlations could be explained on the basis of restriction of range, near-zero correlations indicate unreliability of the measures.

There are two plausible explanations for the tests being unreliable and insensitive to instructional effects. One explanation is that subjects may not have understood the different requirements of the tests. Occasionally subjects would ask about how they should respond to test items. This happened most often with the MIT. It is very possible that other subjects also did not understand the task requirements, but opted not to ask. Subjects may not have read the instructions that preceded each test, or they may have read them without fully understanding them. Even though the instructions for each of the three tests seemed straightforward, a check on subjects' understanding of the test requirements should have been included.

The second explanation has to do with the length of the three tests. Each of the three tests contained only 14 items. This length was chosen primarily to keep the experimental session to an hour. In retrospect, it seems that the reliability of the tests probably suffered as a result of using only 14 items.

Possible Problems With the Domain Instructional Condition

Given that there are many prior investigations that have demonstrated the relevancy of domain knowledge for successful comprehension, it seems important that the current domain knowledge manipulation is critically evaluated in light of the findings. One possible reason for the failure of these instructions to consistently affect comprehension performance will be presented. The explanation has to do with presenting the new knowledge during the same session as the reading comprehension segment. It is possible that there was not enough time for subjects in the unfamiliar domain condition to build up a structured knowledge base that would greatly facilitate the comprehension process.

It seems that a stronger test of the domain-knowledge instructions might involve at least two experimental sessions. This would allow for separating the learning segment of the study from the reading comprehension segment. The first session would be devoted to learning the new material. Then, in a subsequent session subjects would read

the material and take the tests. Subjects could also be enticed to study the material before they returned for the reading comprehension segment. The point is that it might be necessary for subjects to have more time to develop a structured knowledge base in a new domain.

Additionally, it would be prudent to have a more probing test of the subjects newly acquired knowledge in the unfamiliar domain than the one used in the present study. The definition matching test was designed primarily as an assurance that subjects had attended to the instructional material. For this purpose it seemed to work well as subjects were forced to review instructional frames when they got items wrong. It is possible, though, that subjects developed only a superficial understanding of concepts since the current manipulation was not a sufficient device for assessing whether or not subjects developed a structured knowledge base from the instructions. A more probing test might involve asking subjects to summarize what they learned about the topic after they finished the matching test.

The Utility of the van Dijk and Kintsch Model

The van Dijk and Kintsch (1983) model of comprehension was employed for two reasons. First, the model proposes that multiple knowledge sources will be utilized at the different levels of comprehension, therefore it provided a framework for conceptualizing how different types of instructional interventions might affect comprehension.

Secondly, the three levels of comprehension proposed by the model acted as a guideline for developing the different types of comprehension tests. For these purposes the model was very useful.

One question that naturally emerges is whether or not it is actually necessary to distinguish between levels of comprehension. For example, for the present study it could be said that the predictions were simply about how different instructions might affect performance on different types of comprehension tests. In other words, no reference to different levels of comprehension need be given. The problem with this approach is that there is no longer a rationale for using multiple measures of comprehension. A possible way out of that bind might be to say that measures commonly used by reading researchers were employed, but the question of why researchers define comprehension differently is left unanswered. The levels approach to conceptualizing comprehension processes allows for studying different views or forms of comprehension within a coherent (if not correct) framework.

Another reason why the van Dijk and Kintsch (1983) model is useful is that it allows for exploring the possibility that memory for a text may be different from learning from a text. It might be the case that a reader can build a memory representation of a text without that representation getting integrated with the reader's other

relevant memory structures. That reader will not likely demonstrate learning from the text in the sense that he/she will not be able to apply the information to novel situations.

The levels approach to understanding comprehension proposed within the van Dijk and Kintsch framework provides a mechanism for understanding the distinction between memory for a text (the textbase) and learning from the text (the situation model). This type of distinction is useful for educational researchers who are interested in instructional interventions. In general, the van Dijk and Kintsch (1983) model seems quite useful for the study of the effects of instructions on comprehension.

Directions for Future Research

Further Explorations of Instructions that will Facilitate the Process of Making Inferences

As noted in the section on methodological considerations, there are several reasons to believe that a stronger test of the effects of instructions that provide domain-knowledge is needed. An additional reason is that the present study did not provide any information concerning how instructions might facilitate the process or drawing inferences from text. The question that really needs further investigation is: What type of instructions will be most beneficial for making inferences from a text in a new domain?

While it seems likely that instructions providing domain knowledge will be necessary, it also seems possible that instructions such as those used in the present investigation, even in a stronger formulation, will not be sufficient. It might be the case that in addition to instructions that provide background knowledge and concept teaching, instructions that provide other domain-related information are also necessary. Additionally, it might be the case that an instructional condition that combines domain and strategy instructions will be beneficial. A future study should examine these possibilities.

Further Studies Exploring Strategy Instructions

There are two studies concerning the effects of strategy instructions that seem to follow naturally from the present study. One follow-up study would examine how the products of the strategy condition relate to comprehension performance. This study would involve scoring the questions and summaries generated by subjects in the strategy conditions. It is possible that success at utilizing strategies, as measured by scores on the products, will predict performance on the comprehension tests.

A second study would examine how computer-based strategy instructions might be used to foster a sense of the importance of using strategies for reading comprehension. The point here would be to develop an instructional intervention that would lead to subjects using strategies

without overt prompts. As with the present instructions, subjects could first be instructed on how, why, and when to use strategies. After they were prompted to use the strategies for some time, usage could become voluntary. The research question would be, under what circumstances would subjects continue to use the strategies.

Final Conclusions

The present study examined the effects of computer-based instructions providing either domain-specific or strategy knowledge. The findings provided support for the conclusion that strategy knowledge can be useful for comprehension even in the absence of domain knowledge. The evidence for the efficacy of the domain instructions used in the present study was weak, possibly due to some methodological factors that were discussed. The findings also support the use of multiple measures of comprehension in studies that examine the effects of comprehension instructions since significant effects were observed for only one of three tests.

APPENDICES

Appendix A

PSYCHOLOGY MATERIAL

Classical Conditioning

The first and most famous demonstrations of the kind of learning termed classical conditioning was carried out by Ivan Pavlov over 60 years ago. A harnessed dog heard a bell ring just as food was placed in his mouth. The dog, of course, salivated. What was significant was the fact that after a series of occasions in which the bell and food were presented together, the dog began to salivate whenever he heard the bell. The presentation of the food was unnecessary; the bell had become an effective elicitor of the salivary reaction.

With this example in mind, let us examine the characteristic features of this type of learning. The food in our example is termed the unconditioned stimulus, which is a reliable elicitor of a particular response. The presentation of food always evokes salivation, which is termed the unconditioned response. The stimulus that is paired with the unconditioned stimulus (the bell in this case) is labeled the conditioned stimulus. The most important property of this stimulus, the bell, is its inability to evoke salivation reactions prior to being systematically paired with the unconditioned stimulus. The unconditioned stimulus and the conditioned stimulus generally occur together, or the conditioned stimulus is sometimes presented just prior to the presentation of the unconditioned stimulus. To complete this procedure we have a conditioned response, which in this case is a salivary response that is now evoked by the conditioned stimulus alone. The conditioned response often will differ from the unconditioned response in terms of the strength of the response.

Operant conditioning

Unlike classical conditioning, operant conditioning requires that the organism first make a response and then experience some consequence for his behavior. The frequency of the response that is followed by a reinforcing or rewarding outcome is increased. Let us consider an example of operant conditioning with children, for this type of learning is extremely important in understanding the development of infant and child behavior. A group of psychologists demonstrated that vocalizing in 3-month old infants could be modified by the use of operant conditioning. First, an adult leaned over the baby's crib and recorded the frequency of the infant's vocalizations. To determine whether positive feedback would increase vocalizing, the later adult began to smile, say "tsk," and touch the infant immediately after a vocalization. The frequency of vocalizing was found to increase following the adults reactions. In short, through operant conditioning the infant's vocalizations had been modified.

While with classical conditioning the response to be conditioned is readily and reliably elicited by the unconditioned stimulus, the operant conditioning method can be used to increase the frequency of behaviors that are often not emitted by the child. This process is termed shaping, and the following example of a child who seldom attended to his teacher's actions will illustrate this process. This pupil spent most of his day either looking at classmates, gazing out the window, or staring blankly at his desk. The school year might have been over before the child ever looked at the teacher, so it would have been highly inefficient to wait for the desired response to spontaneously occur. The solution is to reinforce or reward (by approval, candy, etc) for approximations of the final response that is desired. For example, whenever the child looked to the front of the class, the "experimenter" dispensed a candy, even though the child did not look directly at the teacher. By gradually, reinforcing the child for closer and closer approximations of the final response, the child eventually begins to look at his teacher.

An important aspect of operant conditioning is the schedule of reinforcement, or the pattern with which reinforcement is delivered. There are a variety of schedules of reinforcement. Under ratio schedules, the reinforcement is delivered only after the child has made a certain number of responses. Under interval schedules, reinforcement is delivered only after a certain time interval since the last reinforcement has elapsed. Ratio and interval schedules can be either fixed or variable. A fixed schedule is one where every fifth or tenth response is reinforced or reinforcement comes at a set interval (for example, thirty second) after the last reinforcement. In every day life, mealtimes, the presence of father, or opportunities for interaction among school-age siblings usually occur on a fixed-interval schedule. That is, they occur with predictable regularity at the same times of the day. Fixed- ratio schedules are less common in naturalistic settings. Perhaps the most usual reinforcement patterns are variable-ratio schedules, the reinforcement comes after differing numbers of responses.

<u>How early can Children be Conditioned</u>

For the past forty years there has been considerable controversy over the issue of how early children can be conditioned, and the controversy is not over yet. Some investigators have attempted to demonstrate classical conditioning in the unborn fetus. There appears to be evidence that a limited set of responses can be classically conditioned in newborns. Generally, the responses which have been successfully conditioned do not involve motor behavior such as sucking or movement, but involve behavior such as heart rate. It appears that the infant's autonomic nervous

system which controls heart rate and respiration may be more conditionable in the early days of life than complex motor behavior.

Less controversy surround the modifiability of the infant's behavior by operant conditioning. Sameroff (1968) has demonstrated that the sucking response of the newborn can be modified by the presentation or withholding of milk. The infants were able to adjust their style of sucking depending on the component that was followed by milk. This study clearly indicates that operant conditioning involving very subtle and complex discriminations is possible in the first few days of life.

However, this study and other successful demonstrations of operant conditioning with young infants have involved existing organized patterns of behavior such as sucking or head turning, a component of rooting- feeding behavior, which are of considerable biological importance to the infant's survival. Some responses are apparently more modifiable than others. Newborn infants, like members of any species, have certain response systems that are biologically prepared to operate efficiently very early in life. For the human newborn infant, these prepared responses, to use Seligman's (1970) terms, are associated with feeding and through evolution have been selected as a result of their importance for survival.

Concept Familiarity Screening Test

For each set of concepts please indicate the degree to which you are familiar with each concept. Indicate your familiarity based on a five point scale with 1 indicating highly familiar and 5 indicating not familiar. Please be honest. You are not expected to be familiar with all these terms.

Psychology Concepts

SCALE:

1	2	3	4	5
Highly Familiar		Moderately Familiar		Not Familiar

1) positive reinforcement

1 2 3 4 5

2) schedule of reinforcement

1 2 3 4 5

3) classical conditioning

1 2 3 4 5

4) stimulus

1 2 3 4 5

5) emitted response

1 2 3 4 5

6) autonomic nervous system

1 2 3 4 5

LIST BELOW THE PSYCHOLOGY CLASSES YOU HAVE TAKEN:

Psychology Concepts
Definitions and Explanations

learning
Definition-
a change in behavior or a change in knowledge about the world that is caused by experience
Explanation-
Many psychologists focus on the study of human learning, behaviorists focus on learning as changes in observable behaviors.

conditioning
Definition-
an approach to learning that is concerned with the modification of observable behaviors
Explanation-
Behavioral psychologists often use the terms conditioning and learning interchangeably.

experimentation
Definition-
process undertaken to discover something new or to demonstrate that events that have already occurred will occur again under specific conditions
Explanation-
Psychologists study human learning through experimentation.

stimulus
Definition-
any environmental event
Explanation-
With respect to behavior, a stimulus can either be neutral or bring about a response.

response
Definition-
another word for a behavior
Explanation-
Psychologists often measure a specific response for research purposes.

classical conditioning
Definition-
a process whereby a neutral stimulus, when repeated paired with a stimulus that normally brings about a response, comes to elicit a very similar response by itself
Explanation-
Classical conditioning is a type of learning studied by behaviorists that involves learning an association between two distinct stimuli.

operant conditioning (also called instrumental conditioning)
Definition-
learning that is explained by the way positive and negative consequences of behavior affect future behavior
Explanation-
Operant conditioning is one form of learning that focuses on the modification of observable behaviors.

reflexes
Definition-
an involuntary response of the body to an external stimulus
Explanation-
In classical conditioning experiments, reflexes are modified in that they occur in the presence of previously neutral stimuli, though they are often less intense in terms of the strength of the response.

autonomic nervous system
Definition-
the division of the peripheral nervous system that regulates the body's internal environment and is generally involuntary
Explanation-
Autonomic nervous system responses are often the focus of classical conditioning experiments.

elicited response
Definition-
a behavior that reliably follows a specific stimulus
Explanation-
The behaviors that are the focus of classical conditioning are elicited responses.

emitted response
Definition-
a behavior that is made independently of a specific stimulus
Explanation-
The behaviors that are the focus of operant conditioning are emitted responses.

feedback
Definition-
responses to performance that are meant to reward desired performance or to correct undesired performance (errors)
Explanation-
Feedback on performance is often used as a form of positive reinforcement and is generally considered an important component of learning.

positive reinforcement
Definition-
presentation of a reward that increases the tendency to repeat the response that lead to the reward
Explanation-
Operant conditioning experiments have shown that behavior can be modified through varying the delivery of reinforcement.

contingent
Definition-
depending on something; conditional
Explanation-
In operant conditioning, reinforcement is delivered only under prescribed conditions.

schedule of reinforcement
Definition-
the basis on which a person or animal is rewarded for a behavior
Explanation-
In an operant conditioning experiment, the schedule of reinforcement will often be varied in order to observe how different schedules affect learning.

Background for Psychology Passage

The study of learning is central to the study of psychology. There are many different types of learning that psychologists study. For example, some psychologists study imprinting which is an instinctual form of learning that all animals exhibit given the necessary environmental conditions. Other psychologists study habituation which is learning that involves a decrease in responding to a stimulus that has been repeatedly encountered. While these two examples demonstrate a focus on simple forms of learning, psychologists also study the learning of concepts and problem solving skills which are examples of complex human learning.

There are two perspectives on how psychologists should study learning. Some psychologists believe that observable behaviors should be the focus for the study of learning. These psychologists, called behaviorists, study overt behavior in order to discover the general principles that govern learning. Other psychologists believe that internal or mental events involved in human learning are as important as behavioral changes. These psychologists, called cognitive psychologists, are concerned with studying the mental processes that underlie changes in behavior. Despite their perspectives on learning, all psychologists use experimental methods to study learning. Experiments involve comparisons between two or more conditions that are identical except for the factors (variables) under study. So, experimental methods involve collecting data in settings where researchers control the presence, absence, or intensity of factors that may affect the behavior of interest.

The behaviorists often use experimental methods to study two types of learning called classical conditioning and operant conditioning. Classical conditioning is a process whereby a neutral stimulus is repeatedly paired with a stimulus that naturally brings about a reflexive response so that the previously neutral stimulus comes to bring about that response when presented by itself. So, classical conditioning is the learning of an association between two stimulus events that occur at the same time or very close together. To study this type of learning, psychologists, vary the type, timing, and intensity of the stimulus events to see how the variations affect the response.

Operant conditioning is learning the consequences of behavior and adjusting behavior according to those learned consequences. To study operant learning, psychologists vary the type, timing, and intensity of consequences (e.g., rewards and punishment) that follow targeted behaviors and see how the manipulations affect the future execution of the targeted behaviors.

MEANING IDENTIFICATION TEST

Instructions for First Comprehension Test

There are 14 test sentences. Read each one and DECIDE WHETHER OR NOT THE MEANING OF THE TEST SENTENCE IS CONSISTENT WITH THE MEANING OF A SENTENCE YOU ACTUALLY READ. If the test sentence is consistent, type "Y" for "yes" next to the sentence. If the test sentence is inconsistent type "N" for "no" next to the sentence.

Type Y or N

1. The amount of vocal expression was shown to decrease after the adult stopped responding.

2. Let us review a case of instrumental conditioning involving children, as this category of learning is essential for understanding how behaviors develop in the infant and child.

3. The word for this procedure is shaping, and the next example of a child who rarely pays attention to his mother's requests will demonstrate this procedure.

4. Generally, the response that has been conditioned will be different from the unconditioned response in terms of the intensity of the response.

5. What was important was the finding that following a number of incidents in which the bell and food were simultaneously presented, the dog started salivating as soon as he heard the bell.

6. The recurrence of the behavior that precedes a reinforcement or reward is increased.

7. The event that always follows the unconditioned stimulus (the presentation of the bell in this example) is called the conditioned stimulus.

8. Keeping this illustration in mind, let us consider the typical aspects of this category of experiment.

9. As we observed in the study reported earlier on the vocalizations of babies, babies can be classically conditioned at 3 months if the

unconditioned stimulus and the conditioned stimulus are presented at the same time.

10. Responses seem to vary in terms of whether they are easily conditioned.

11. For example, the reward is given not after each response, but following every third or fifth response.

12. Very young babies, like mammals of other species, have specific patterns for responding that are biologically ready to function competently soon after birth.

13. There has been considerable debate over the last forty years concerning the question of how soon babies can be conditioned, and the debate still continues.

14. Schedules based on a fixed-ratio are often used in experimental situations.

SUMMARY VERIFICATION TEST

Instructions for the Second Comprehension Test

There are 14 summary statements. Read each one and DECIDE WHETHER OR NOT THE MEANING OF THE SUMMARY STATEMENT IS CONSISTENT WITH THE INFORMATION YOU JUST READ. If the test statement is consistent, type "Y" for "yes" next to the sentence. If the test statement is inconsistent type "N" for "no" next to the sentence.

Type Y or N

1. The evidence showing operant conditioning of infants is clearer than the evidence showing classical conditioning of infants.

2. Pavlov's experiment showed that a dog could learn to associate a bell with food, if the bell and food were paired repeatedly.

3. Classical conditioning requires the subject to make a response that will then be shaped with reinforcement.

4. The procedure of shaping involves reinforcing every occurrence of the desired behavior in order to increase the frequency of that behavior.

5. In classical conditioning, the unconditioned response always follows the conditioned stimulus.

6. Many of our day-to-day experiences happen on a fixed-interval schedule.

7. Infants have been found to increase their vocalizations when adults provide positive reinforcement.

8. Shaping is a procedure that can be used to bring about desired behaviors that are not yet occurring at all.

9. There is considerable evidence that many responses by newborns can be conditioned through classical conditioning.

10. There are a number of different schedules of reinforcement that are utilized to bring about classical conditioning.

11. The different schedules of reinforcement involve plans for giving reinforcement that vary depending on either a specified number of responses required or a specified amount of time between deliveries of reinforcement.

12. The most successful conditioning of newborns has involved motor behavior.

13. Sameroff (1968) showed that infants could change different aspects their grasping behavior in order to get milk.

14. Conditioning works best with infant when the focus is on behaviors that the infant is biologically prepared to perform.

INFERENCE VERIFICATION TEST

Instructions for Third Comprehension Test

There are 14 inference statements. Read each one and DECIDE WHETHER OR NOT THE MEANING OF THE INFERENCE STATEMENT IS CONSISTENT WITH INFORMATION YOU JUST LEARNED. If the test statement is consistent, type "Y" for "yes" next to the sentence. If the test statement is inconsistent type "N" for "no" next to the item.

Type Y or N

1. In order to decide whether or not a particular procedure is reinforcing, the behavior of interest must be measured before and after the reinforcement is provided.

2. Conditioning is a category of learning that applies more to learning in children than adult learning.

3. Reinforcement in the real world generally does not follow schedules.

4. Evidence of infant conditioning is evidence that infants are able to change their behaviors in order to bring about desired consequences.

5. The sound of the bell was reinforcing to Pavlov's dogs.

6. Shaping is probably a good technique for teaching children not to fight with each other.

7. Babies find adult responses to their actions reinforcing.

8. When salivation is a conditioned response there is probably less saliva generated than when salivation is an unconditioned response.

9. Older children are easier to condition than infants because they are better able to recognize positive consequences that follow their behaviors.

10. Just as it doesn't make sense to condition a rat to peck, it doesn't make sense to condition a young infant to walk.

11. Operant conditioning can be used to induce desirable behavior in children.

12. Newborn humans are not easily conditioned since they are virtually dependent on adults for their survival.

13. Children would behave better if parents were more careful to follow ratio rather than interval schedules.

14. After a period of time in which the bell has no longer been paired with food, salivation to the bell alone is likely to decrease.

Appendix B

ECONOMICS MATERIAL

Theories of the Business Cycle

Until the Great Depression of the 1930s, the majority of neoclassical economists did not try to explain, but rather tried to explain away, the business cycle. In the first place, it was argued that the amount of unemployment was exaggerated, that there were only partial and brief fluctuations of production. In the second place, each economic contraction was said to be the last; especially in the twenties, economic contractions were said to be gone forever. Again, in the 1960s there were many economists who declared that the business cycle had disappeared. More recently, high unemployment has forced even neoclassical economists to produce a large number of new books and articles on the business cycle.

Neoclassical Theories of Unemployment

The latest reincarnation of the theory that most unemployment is "frictional" that is, just movement between jobs, is the search theory. In this view, many workers voluntarily quit their jobs for other jobs with higher pay. In the search theory, the problem causing unemployment is not lack of demand, but a lack of information on just what jobs are available. When there are sudden economic changes, such as recession, perfect information becomes more difficult to obtain, so this explains sudden surges in voluntary unemployment. If all workers had perfect information as to wages and job locations, this theory claims that there would be perfect adaptation to changes, so there would be no search unemployment.

As long as most economists accepted Say's law, there were only a few logically possible explanations for the fluctuations of aggregate output. One such explanation is that "external" or noneconomic forces may limit supply or bring sudden demands. For example, sunspots may cause bad weather, and bad weather leads to bad harvests; unions may go on strike; governments may foolishly interfere with production activities; wars may stop the flow of raw materials or bring sudden demands for military production; etcetera ad infinitum. Thus, Dusenberry declares: "Major depressions have been produced by a variety of different types of "shocks," not by a regular cycle-producing mechanism." Certainly, such shocks as wars and bad weather do affect the economy, but their happenings do not always coincide with the major swings in the economy, some of which occur with no apparent outside shock at that time.

One theory concentrates on the reaction of the economy to accidental or external shocks. It is observed that enterprises tend to react to changes in the economic situation by going much farther than necessary in the new direction--for example, a small rise in demand may cause an excessive increase in supply. Then, to compensate for the excessive movement in one direction, they react excessively

in the opposite direction, always swinging beyond the point of "equilibrium" in a sort of "cobweb" pattern woven about that point. This cobweb theory, when applied to the dynamic development of the whole economy, sees it swinging like a pendulum past "equilibrium," always reacting to new random shocks to maintain the length of the swing.

Another theory that emphasizes one kind of "external" shock is Schumpeter's theory of the impact of technological innovations on the economy. According to this theory, economic expansion begins when an invention is used as an innovation in industry by some one bold entrepreneur, who is then followed by others owing to imitation or competition. The boom is brought to an end when the impetus of this innovation expires. * While it is certainly true that the uneven development of technology combines with entrepreneurial psychology to influence the course of economic events, innovation itself may be determined by economic conditions though it may then intensify the course of events.

Another type of theory reaffirms Say's law to the extent that aggregate demand cannot be deficient for very long. It is argued that it is never rational to hoard money because if it is not used for consumption, it is always most profitable to lend it at interest for further investment. Yet there may be temporary panics with hoarding of money and withholding of credit caused by irrational pessimism. The defect of these theories lies in the fact that no one has ever demonstrated cycles of optimism and pessimism in business people independent of the economic cycle. Only after economic conditions have objectively worsened are there irrationally large reactions by business people, which intensify the economic downturn. Similarly, irrational reactions may intensify an economic expansion after conditions have objectively improved.

Closely related to the preceding explanation is the notion that the main fault of the system lies in a banking structure that irrationally brings any industrial expansion to an end. One theory is that the boom is brought about by the expansion of bank credit, but that the bankers cannot or will not continue to expand credit indefinitely at the necessary rate. Certainly,speculative expansion followed by excessive restriction of credit may magnify any disturbance, but banks have generally continued to increase credit rapidly until after profit expectations begin to fall. What must be explained is why these profit expectations change. The monetarists hold a similar theory except that they focus on government intervention as the crux of the problem. To the extent that the monetarists believe that the private economy always stays at full employment equilibrium until disturbed by incorrect government monetary policies, they are hard-core followers of Say's law and the classical analysis.

The Opposing Views of John Maynard Keynes

John Maynard Keynes' main contribution was the demolition of Say's law within a sophisticated theoretical structure acceptable to mainstream economics. Keynes demonstrated the possibility that an economy could suffer from a recurring problem of serious involuntary unemployment. Furthermore, severe unemployment could have endogenous causes, meaning that it is the result of economic behavior on the part of people within the normal operation of the capitalist economy. Keynes focused attention on the fact that all income derives from either consumers' purchases or purchases for investment purposes. The occasional disequilibrium leading to unemployment could be caused by either a very unstable pattern of investment, unstable patterns of consumption , or both. The instability was due to the extreme sensitivity of these patterns to changes in market expectations. Expectations, in turn, could be very volatile and prone to sudden reversals, so a small change in the underlying economic conditions could lead to a large decline.

Concept Familiarity Screening Test

For each set of concepts please indicate the degree to which you are familiar with each concept. Indicate your familiarity based on a five point scale with 1 indicating highly familiar and 5 indicating not familiar. Please be honest. You are not expected to be familiar with all these terms.

Economics Concepts

SCALE:

1	2	3	4	5
Highly Familiar		Moderately Familiar		Not Familiar

1) business cycles

1 2 3 4 5

2) frictional unemployment

1 2 3 4 5

3) Say's law

1 2 3 4 5

4) Classical theories

1 2 3 4 5

5) Keynesian theories

1 2 3 4 5

6) monetarists

1 2 3 4 5

LIST BELOW THE ECONOMICS CLASSES YOU HAVE TAKEN:

Economics Concepts
Definitions and Explanations

business cycles
Definition-
long and short periods of economic expansion followed by periods long and short of recession or depression
Explanation-
Economists who believe that a free market system should be left to regulate itself must be careful to explain business cycles as being caused by factors external to the system.

free market system or pure capitalism
Definition-
economic system with free, competitive markets and very little government planning or control
Explanation-
The economists who support pure capitalism do not like to admit to the possibility that business cycles are a natural occurrence in free market systems because the down side of business cycles brings large-scale, involuntary unemployment.

Say's law
Definition-
an economic notion about the free market system that states that any supply of goods will result in enough income to bring about an equal level of demand
Explanation-
Say's law was used as the main argument for the inherent stability in a free market economy.

investment
Definition-
the purchase of capital assets such as machinery and equipment, or construction of new additions for business expansion
Explanation-
Investment is something businesses engage in when they plan on expanding.

consumption
Definition-
total purchase, by all U.S. households, of consumer goods and services
Explanation-
Consumption must include all of the goods produced in order for demand to equal supply.

involuntary unemployment
Definition-
when people are out of work for reasons other than that they chose to leave jobs and/or look for other jobs
Explanation-
The existence of involuntary unemployment on any large scale is inconsistent with Say's law and therefore a problem for the supporters of pure capitalism.

frictional unemployment
Definition-
temporary and usually small-scale unemployment that is due to seasonal factors that affect demand for labor and mobility between jobs
Explanation-
While frictional unemployment is seen as involuntary, it is not associated with cyclical changes in the economy.

aggregate supply
Definition-
total output that business produces and plans to sell
Explanation-
The supporters of Say's law explain business cycles by focusing on problems associated with aggregate supply because Say's law showed that aggregate demand was generally a constant function of supply.

aggregate demand
Definition-
total amount of money for goods and services that consumers and other business people plan to buy from the business sector
Explanation-
If aggregate demand is not a function of aggregate supply, that is, if Say's law is not universally true, then it is possible that changes in aggregate demand may affect business cycles.

equilibrium
Definition-
economic condition that occurs when planned aggregate demand is equal to planned aggregate supply at the current prices
Explanation-
Say's law asserts that equilibrium is a natural state in free market systems that is created by the interaction of aggregate supply and aggregate demand.

Classical theories
Definition-
the original economic theories in support the free market system that often relied on the arguments of Say's law
Explanation-
The classical theories of economics proposed that Say's law demonstrated that business cycles were not possible.

Neoclassical theories
Definition-
Modern economic theories in support of the free market system that have adopted some of the classical notions including Say's law
Explanation-
The neoclassical theories of economics assume that Say's law is valid and therefore they assert that only external factors can cause business cycles.

Keynesian theories
Definition-
theories about economics that build from John M. Keynes' demonstration of the fallacy of Say's law
Explanation-
Keynesian theories of economics build upon the assumption that Say's law is invalid and assert business cycles are caused by factors internal to the natural workings of free market systems.

monetarists
Definition-
group of economists who believe that natural fluctuations in the money supply affect the economy only in the short run and that government intervention will only make worse any short-term effects.
Explanation-
The monetarists tend to hold views very consistent with the neoclassical theories, in that they strongly oppose government intervention, but they focus on the importance of money supply.

economic contraction
Definition-
periods where production has shrunk and the unemployment rate has risen; also known as periods of recession or depression depending on the severity
Explanation-
Economic contraction are the down side of business cycles and are characterized by involuntary unemployment.

Background for Economics Passage

The topic is concerned with different theories that explain the occurrence of business cycles within capitalist economies. Business cycles are periods of economic growth that are followed by recessions or depressions. The reason that economists are compelled to address the issue of economic cycles is that the recessions or depressions that tend to follow periods of expansion are characterized by high unemployment. High unemployment means that one or more segment of society will experience hardship and perhaps considerable suffering. The explanation for unemployment varies depending on the theoretical bias of the economist who is attempting such an explanation. Even amongst the supporters of capitalism there is considerable variability in terms of how business cycles will be explained.

The major thesis of the original supporters of capitalism was that severe unemployment was inconsistent with the workings of the free market system. This thesis was expressed as "Say's law." Say's law states that the aggregate supply (that is, all goods supplied to markets) creates the necessary demand with the result being that the supply and demand are nearly always in balance. In other words, the income needed to buy the goods that are produced is sufficiently created through the act of production. This means that the free market system should always be able to support full employment.

If it is true that the economic system will always support full employment, then the explanation for unemployment must be external to the economic system. In fact, the early supporters of capitalism, who believed in Say's law, proposed economic theories that tended to dispute the cyclical nature of economic downturns and explain unemployment in terms of factors external to the economic system. Similar arguments are made by 20th century economists whose pro-capitalism theories build from the assumption that Say's law is correct. While the modern theories are more likely to acknowledge the fact of business cycles, they focus on external causes to explain cycles.

The dilemma that these theories attempt to avoid concerns the possibility that business cycles are a natural aspect of free market systems. If business cycles are caused by internal factors related to the workings of the free market system, then perhaps capitalism naturally brings about periods of severe unemployment. In fact, this is exactly what a very influential economist named John Maynard Keynes proposed with his economic theory. While Keynes was a strong supporter of capitalism, he thought that the negative side of free market systems, cyclical unemployment, needed to be tempered through limited government intervention.

MEANING IDENTIFICATION TEST

Instructions for First Comprehension Test

There are 14 test sentences. Read each one and DECIDE WHETHER OR NOT THE MEANING OF THE TEST SENTENCE IS CONSISTENT WITH THE MEANING OF A SENTENCE YOU ACTUALLY READ. If the test sentence is consistent, type "Y" for "yes" next to the sentence. If the test sentence is inconsistent type "N" for "no" next to the sentence.

Type Y or N

1. Lately, low unemployment has influenced neoclassical economists to publish many new books and articles about the end of business cycle phenomena.

2. When this cobweb theory is used to explain the dynamic progress of the entire economy, it shows the economy swaying like a pendulum past "equilibrium," continually responding to unexpected shocks in order to keep the length of the sway constant.

3. During the 1960s there were again a number of economists who argued that economic cycles had vanished.

4. This theory maintains that if workers knew all about where jobs were and how much they paid, there would still be problems dealing with job changes and, therefore, unemployment due to job searching.

5. Several theories focus on the economy's response to shocks that are either accidental or external.

6. Another theory that focuses on a type of "external" shock is the theory proposed by Schumpeter concerning the effects of advances in technology on the economy.

7. One such reason is that factors that are external to the economic system might restrict supply or suddenly increase demand.

8. The question that needs to be answered is why the projections concerning profit expectations are never accurate.

9. The flaw in these theories concerns the fact that it has shown that business people go through cycles of optimism and pessimism that are unrelated to the business cycle.

10. Of course, growth based on speculation that is followed by continuous credit may increase any disruption, but banks usually start to limit credit at rapid rates after profit expectations have decreased.

11. To the degree that Schumpeter thinks that the free market economy remains at equilibrium with full employment until disrupted by the government's mistaken monetary policies, he is a supporter of Say's Law and the classical perspective.

12. In a similar manner, irrational responses might increase an economic upswing once the economic situation has clearly gotten better.

13. Mitchell additionally outlined reasonable methods, that were consistent with free market economics, for resolving these problems.

14. It is definitely the case that the psychology of enterprise is linked with the irregular progress of technology to affect economic outcomes, but it is also possible that innovation is affected by economic situations while also magnifying those situations.

SUMMARY VERIFICATION TEST

Instructions for the Second Comprehension Test

There are 14 summary statements. Read each one and DECIDE WHETHER OR NOT THE MEANING OF THE SUMMARY STATEMENT IS CONSISTENT WITH THE INFORMATION YOU JUST READ. If the test statement is consistent, type "Y" for "yes" next to the sentence. If the test statement is inconsistent type "N" for "no" next to the sentence.

Type Y or N

1. The concept of frictional unemployment refers to unemployment that varies as a function of business cycles.

2. The economists who support Say's law have traditionally tried to show that unemployment is not a serious economic problem.

3. The search theory of unemployment addresses the problems of involuntary unemployment.

4. One theory proposes that businesses react to shocks they often make a correction in the wrong direction (e.g., they increase supply when demand is actually lower) because they miscalculate the effect of the shock.

5. Monetarists believe that economic contractions results when the monetary system is regulated.

6. Neoclassical theorists often point to external shocks as causing economic downturns, even though the occurrences of downturns have not always coincided with the occurrences of external shocks.

7. Keynes' theory concentrates on the effects of marketing and technological innovations.

8. The experience of the Great Depression influenced neoclassical theorists to address the issue of business cycles.

9. The problem with the theory that states it is the optimism or pessimism of business people that creates economic cycles is that business people tend to remain confident even after there has been objective signs of an economic downturn.

10. Keynes' demonstrated the problems found with Schumpeter's theory of business cycles.

11. One of Keynes' contributions was showing that aggregate demand could be more or less than aggregate supply at full employment.

12. The neoclassical theorist have identified many possible sources for external shocks that can upset the economy.

13. Some economic theorists have argued that the banking system is often responsible for economic downturns.

14. Keynes argued that patterns of consumption and investment tended to be stable despite changing profit expectations.

INFERENCE VERIFICATION TEST

Instructions for Third Comprehension Test

There are 14 inference statements. Read each one and DECIDE WHETHER OR NOT THE MEANING OF THE INFERENCE STATEMENT IS CONSISTENT WITH INFORMATION YOU JUST LEARNED. If the test statement is consistent, type "Y" for "yes" next to the sentence. If the test statement is inconsistent type "N" for "no" next to the item.

Type Y or N

1. Frictional unemployment increases when aggregate demand falls below the level of aggregate supply.

2. President Reagan's economic policies were inconsistent with Say's law.

3. The economists who explain increases in unemployment in terms of an increase in frictional and/or search unemployment are unlikely to propose economic intervention by the government.

4. President Carter's deregulation of the airlines was consistent with Keynesian theories of economics.

5. Support for the neoclassical theories would be present if the economy fluctuated every time the U.S. was involved in a war.

6. Keynes would argue that an explanation for the increase in homeless people in the U. S. is provided by the search theory of unemployment.

7. A Keynesian theorist would probably blame the economic downturn experienced in Massachusetts in 1989 on the governor's preoccupation with his presidential candidacy.

8. Nixon's call to freeze wages and prices in order to combat inflation was more consistent with Keynesian ideas than with neoclassical ideas.

9. A neoclassical theorist might argue that the bottom fell out of the "Massachusetts Miracle" when the high-technology industries in the state lost their innovative edge.

10. The monetarist are most concerned with the government's response to external shocks.

11. The notion of supply-side economics is consistent with Keynesian theories.

12. Johnson's war against poverty during the 1960s was more consistent with Keynesian economic theory than with neoclassical theory.

13. Banks are likely to stop extending credit as soon as they suspect that the economy is about to slow down.

14. Both neoclassical and Keynesian economists agree that the reactions to economic changes by the business community and consumers have significant effects on the economy.

Appendix C

STRATEGY INSTRUCTIONS

You are going to learn how to use three strategies that have been found to be beneficial for helping people understand what they read. Researchers have found that utilizing strategies while reading encourages readers to actively monitor their understanding of the material. We have all had the experience of finishing a paragraph or even a full page of text and then realizing that we don't remember what we just read. Sometimes, though, we do remember what we read but we only have a superficial understanding of what it meant. This is a common problem that comes back to haunt students around exam time. Some researchers say that this problem arises when we do not actively monitor our comprehension while we read. The strategies you will learn to use today are methods for active monitoring. Each of the three strategies will be explained, then you will go through an example that will show you how each of the strategies should be applied.

The first strategy involves generating questions about the central ideas presented in each paragraph. The purpose of this strategy is make sure you are able to identify the main ideas presented in each paragraph. Therefore, it is important that you focus your questions on central ideas and not on irrelevant details. Central ideas are the ideas that you expect will either be expanded on or somehow related to material presented later in the chapter. Irrelevant details are ideas that you expect will not come up in later paragraphs.

After each paragraph you will be prompted to generate a question. You should type in your question in the box provided for that purpose. You do not have to type in the answer, but the idea is that you will know the answer to your own question. It is important that you type in a question before you move on.

The second strategy involves summarizing the chapter and updating the summary on a regular basis. The process of summarizing involves integrating information across paragraphs and deciding what information is important enough to be included in a summary. Therefore, summarizing requires that the reader have a solid grasp of what the material means. When a reader has trouble summarizing, this indicates that the reader is having comprehension problems. Therefore, the purpose of this strategy is to continually monitor comprehension through the process of summarizing.

You will be prompted to summarize following every other paragraph. You should type in your summary in the box provided on that page. You should try to keep your summary to two sentences or several short phrases. So, instead of summarizing the entire chapter each time, you should update your summary based on the material presented in the last two paragraphs. So, you might want to hold over a general summary statement and also summarize the last two paragraphs. Or, you may decide to revise your previous

summary based on the new information from the last two paragraphs.

The third strategy involves what is called strategic rereading. Research has shown that simply reading a chapter twice does not ensure that you will understand the chapter better. Instead, it seems that rereading text is more beneficial when the reader is able to identify where comprehension broke down and then reread that portion of the text. Therefore, rereading is a strategy that compliments the two strategies described above, since those strategies will reveal when comprehension has not occurred and indicate where in the chapter the reader should return.

Whenever you find that you cannot generate a question about a paragraph, you should go back and reread that paragraph. If you are having trouble with a particular paragraph because you think it contradicts a point made in an earlier paragraph, then you should go back and reread that earlier paragraph. Whenever you have trouble summarizing, you should first go back and reread the last two paragraphs. If the problem is not resolved in these paragraphs, you should go back to your last summary to see if you can now integrate the new material with that summary. You probably won't have to go back further, since the process of summarizing should have revealed any earlier comprehension problems.

Now let's go through an example, starting with the strategy of generating questions. The example will be based on two paragraphs about different views on measuring intelligence. You will read the first paragraph, then examples of good and bad questions will be presented. Then you will have a chance to generate your own question for the second paragraph.

*First Example Paragraph

The view of intelligence as a map of the mind extends back at least to Franz Gall, perhaps the most famous of phrenologists. Gall implemented the model of a map in a literal way. He investigated the bumps on an individual's head, looking (an feeling) for the hills and valleys in each specific region of the head that he believed would reveal the nature of that person's abilities. For him, the measure of intelligence resided in the pattern of cranial bumps found on a person's head.

*Sternberg, R. J. (1988). The triarchic mind: A new theory of human intelligence (p.38). New York: Penguin.

Here's an example of a good question about that paragraph:

1) Why did Gall examine the cranial bumps on people's heads?

Here's an example of a bad question about that paragraph:

2) Who was the most famous phrenologist?

The first question is better than the second because it is getting at the most important point in the paragraph--which has to do with the fact that Gall examined cranial bumps because he thought such an exam would provide information about people's intellectual abilities. The second question focuses on a detail that is not very important. For generating questions, it is better to concentrate on the most important points. Now that you have an idea about how to generate questions, why don't you try one on your own based on the second example paragraph.

*Second Example Paragraph

During the first half of the twentieth century the model of intelligence as something to be mapped dominated theory and research. However, the model of the map became more abstract than it had been for Gall. The psychologist studying intelligence was both an explorer and a cartographer, seeking to chart the innermost regions of the mind. Instead of visual inspection and touching, though, the indispensible tool for the psychologist appeared to be a statistical procedure called factor analysis. This tool is a means of separating intelligence into a number of hypothetical factors or abilities that are believed to for the basis of individual differences in test performance. The major debate among these theorists of intelligence centered on the issue of the "true" factorial structure, or map, of intelligence.

*Sternberg, R. J. (1988). <u>The triarchic mind: A new theory of human intelligence</u> (p.38). New York: Penguin.

Type in your question in the box that appears below.

Remember to reread the paragraph if you have trouble generating a question.

If your question had to do with factor analysis as the tool that was used by psychologists to study intelligence, then you were right on target. If your question was about another point, go back to the paragraph and see if you focused on a nonessential detail. Sometimes there will be more than one important point in a paragraph. Try and focus your questions on the points that seem most important given what you have read of the chapter so far. Determining importance should get easier as you read more of the chapter. Whenever you are unable to generate a question, you should go back and reread the last paragraph.

Now let's look at the strategy of summarizing. Here are two important rules for summarizing: 1) the most central information should be retained and synthesized into two sentences or several short phrases; and 2) nonessential details should be omitted. Remember that central ideas are the ideas that you expect will continue to be important in subsequent paragraphs.

Go back and review those last two paragraphs and return here to type in your summary in the box below.

Here is an example of a good summary for those two paragraphs:

> Intelligence has been viewed as a map of the mind. Some people have studied the map with external exams of people's heads, while others have relied on the statistical procedure of factor analysis.

How does your summary compare to this example?

Notice that important information from the two paragraphs has been collapsed into a two sentence summary. Also notice that details have been left out. These are the two most important points about summarizing.

Let's briefly review that strategies you will use while reading the chapter. First, after each paragraph you will generate a question that addresses the central idea presented in the previous paragraph. A prompt will appear on the page following the paragraph and you will type in your question in the box provided. A prompt to reread the paragraph if you have trouble generating a question will appear at the bottom of the page. Secondly, after two consecutive paragraphs you will summarize and/or revise your previous summary. A prompt to summarize will appear following the question page and you will type in your summary in two sentences or several short phrases. Finally, you will reread portions of the chapter whenever you have trouble either generating a question or summarizing.

If you are clear about the strategies, then you are ready to begin reading otherwise you can review the instructions. Remember that after you have finished reading you will take three comprehension tests. You will not be able to return to the text once you have started the tests.

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