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THE EFFECT OF INTEREST ON COMPREHENSION AND RECALL OF PRIMARY AND SECONDARY TASKS

by

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A dissertation submitted to the Graduate Faculty in Educational Psychology in partial fulfillment of the requirements for the degree of Doctor of Philosophy, The City University of New York.

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Abstract

THE EFFECT OF INTEREST ON COMPREHENSION AND RECALL OF PRIMARY AND SECONDARY TASKS

by

Janice A. Walters

Adviser: Dr. Sigmund Tobias

The study investigated the effect of interest on comprehension and recall of primary and secondary tasks. Subjects (n-81) were randomly assigned to one of six conditions: case-illustrated (high interest) primary and secondary tasks; case-illustrated primary with an expository (low interest) secondary task; case-illustrated primary only; expository primary with a case-illustrated secondary task; expository primary and secondary tasks; and expository primary only. Subjects read the primary task passage on computer while listening to secondary task text, rated their interest in each text, completed two free recall and two multiple choice posttests, and answered questions related to the cognitive processes used while learning primary and secondary tasks.

The hypothesis of greater comprehension and recall under high compared to low interest conditions was not supported. However, the study found a significant multivariate interaction for primary x secondary task with significant univariate effects for primary and secondary task multiple choice posttests. Subjects who read expository passages answered significantly more primary task questions correctly when they heard case-illustrated, compared to expository or no secondary task texts.

Further, when participants read case-illustrated passages, they answered significantly fewer questions correctly when they heard case-illustrated, compared to expository or no secondary task texts. As predicted, those who read expository text answered significantly more secondary task questions correctly when they heard case-illustrated, compared to expository or no secondary task texts. Subjects who read case-illustrated passages answered an equal number of questions correctly, irrespective of secondary task condition.

The findings of the study suggest that importance may override interest in directing mature students' attention. Subjects appear to have been strategic in approaching the primary task when told they would be required to answer questions related to its content. They directed their attention toward important, less interesting information, while using cues from the case-illustrated secondary task text to make expository passages more interesting. However, those who read case-illustrated text were not as strategic. They appear to have directed their attention toward case descriptive paragraphs included in this text, resulting in their decreased comprehension and recall of important, less interesting information.

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Shaun
Kylie
Tania
and
Damien
with all my love and gratitude for their support and faith in me during the many years that led to its completion.

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I would like to thank the State University of New York Health Science Center at Brooklyn for allowing me to conduct this study. In addition, I want to thank Glen Frick for writing the computer program and the students from the various health related professions for their participation.

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The Effect of Interest on Comprehension and Recall of Primary and Secondary Tasks

Introduction

Researchers who have investigated the effects of various interventions on student learning, have usually found the cognitive processes used by students while learning to be somewhat variable and inconsistent (Paris, 1988; Tobias, 1988, 1989). This inconsistency in cognitive processing may be explained in many ways. One possible explanation that has received little attention, is the degree to which students are energized by the learning task. The findings of variable and ineffective cognitive processing in these studies may be attributable to the student's lack of motivation or interest in the given topic.

Intrinsic motivation and interest have often been referred to synonymously. Deci (1992) proposed that interest is an affect that occurs during an interaction between a person and an activity. Therefore, concern is with the needs and desires that are either intrinsic to the self, or have become integrated with the self (Deci & Ryan, 1991), and with the match between those needs and the affordances of various activities.

Schiefele (1991) refuted this proposal in his suggestion that intrinsic motivation and interest cannot be viewed as synonymous concepts because intrinsic motivation does not capture all of the essential aspects of interest. These aspects are: interest's content specificity, directive force, explanatory ability, inclusion of valences attached to a topic

or activity, subject-matter specificity, and the fact that it is not a personality trait.

Recently, researchers have shown renewed curiosity about "interest" as an explanatory construct. Studies have focused on both the influence of interest on learning and development, and the origin and transformation of interests (Hidi, 1990; Hidi, Baird, & Hildyard, 1982; Krapp, 1989; Renninger, 1984, 1989 a,b, 1990; Renninger & Leckrone, 1991; Renninger & Wozniak, 1985; Schiefele, Winteler, & Krapp, 1988). These studies have found that interest influences students' selection of and persistence while processing certain types of information in preference to other types (Hidi, 1990).

In exploring the role of affect in cognition, Mishkin and Appenzeller (1987) looked at the anatomical structures involved in memory. They concluded that emotion, controlled by the hypothalamus contributes to the integration of sensory information in the amygdala by serving as a filter that limits attention to stimuli that has emotional significance. This selective attention to emotional stimuli affects learning and schema construction. This finding suggests a possible link between emotion, attention and cognition.

Research that has explored the effect of interest on learning has investigated several mediating variables in order to better understand students' cognitive processing of interesting information. One such variable is attention. Studies that have investigated the effect of interest on students' allocation of attention (Anderson, 1982; Anderson, Mason, & Shirey, 1984; Shirey & Reynolds, 1988) have demonstrated a variable relationship between interest and learning. However, this research has failed to establish a causal link between interest, attention, and learning.

Schiefele (1990) investigated the relationship between interest and students' level of text processing and comprehension. The findings of this research were that interest exerted a substantial influence on those processes that contribute to the representation of the meaning of text, independent of both prior knowledge and intelligence. These findings suggest a causal link between interest, attention and differential levels of comprehension.

Medical educators have attempted to provide students with experiences during which patient problems become the stimuli for the integration of basic science and clinical information. The philosophy behind this approach was that learning should be fun, and that basic science concepts would be better understood, remembered and subsequently applied if learned in a clinically relevant manner (Berkson, 1993). Therefore, providing students with clinical information would cause them to be more interested in learning basic science information.

The purpose of this study is to further investigate the effect of interest on learning; specifically, to further explore the existence of a causal relationship between interest, attention, and learning. The study plans to investigate whether providing medical students with an expository text that includes case history information will result in their greater and "deeper" comprehension and recall of this text compared to students who are assigned an expository text that does not include case history information. The assumption being that including case history information within text will result in greater interest by students than expository text without this information. This assumption will be tested during a pilot study. Literature that links intrinsic motivation and interest will

be presented, together with current research on interest and attention, and medical education.

Literature Review

Intrinsic Motivation and Interest

According to self-determination theory, interest is closely linked to intrinsic motivation. Interest is conceptualized as the core affect of the self, the affect that relates one's self to activities that provide the type of novelty, challenge, or aesthetic appeal that is desired at that time. Deci and Ryan (1991) proposed that interest will be primarily linked to intrinsically motivated activities to the extent that their regulation has been integrated with one's intrinsic self. Deci and Ryan (1985) ascribed to interest "an important directive role in intrinsically motivated behavior in that people naturally approach activities that interest them" (p.34). When intrinsically motivated, an individual experiences interest and enjoyment, which results in feelings of competence and self-determination. This motivational state results in concentration and engagement; it occurs spontaneously, and individuals become wholly absorbed in it (Deci & Ryan, 1991).

Recently, Schiefele (1991) proposed that intrinsic motivation and interest cannot be viewed as synonymous concepts. He suggested that intrinsic motivation does not capture all of the essential aspects of interest. These aspects are: its content-specificity, its directive force, its role in explaining subjective theories, its inclusion of valences attached to a topic or activity, and the fact that it is not a personality trait. Schiefele (1992) suggested that interest comprises feeling-related and value-related valences. He defined feeling-related valences as feelings that are associated with a topic or an object,

and value-related valences as the attribution of personal significance to an object.

Izard (1977) suggested that when the locus of causality for behavior is perceived by an individual to be internal, a state of 'flow' will follow. He defined this state as one in which an individual experiences a holistic sensation of task involvement with an activity. Izard further proposed that the antithesis of interest and flow is pressure and tension. According to him, when an individual experiences self-pressure, feelings of anxiety, and working with great urgency, extrinsic motivation is usually involved.

Csikszentmihalyi (1975) suggested that the flow state is a prototype of interest. He proposed that intrinsically motivated activities are those characterized by enjoyment, with the experience of pleasure being the reward. According to him, the goal of intrinsically motivated behaviors is their inherent experiential aspects. Csikszentmihalyi used the term "autotelic" to refer to this goal suggesting that, when intrinsically motivated, an individual experiences feelings of pleasure from engagement in the task itself, and that this true enjoyment accompanies the experience of flow. In this state, a loss of ego and experienced unity with one's surroundings occurs, the distinction between person and activity becomes unclear, and action and experience move smoothly from one moment to the next.

Csikszentmihalyi (1975) suggested that flow states emerge under conditions of optimal challenge. According to him, engagement in an optimally challenging activity, with respect to an individual's capacities, results in maximal possibility for task involvement and flow. However, engagement in activities below an individual's state of optimal challenge (i.e., too easy) will cause boredom; whereas activities that greatly

exceed an individual's current capacities, will generate anxiety and disrupt flow. Both Deci and Ryan (1991) and Csikszentmihalyi (1975) have proposed that intrinsic motivation/interest will be more likely to occur during optimally challenging tasks.

Csikszentmihalyi and Csikszentmihalyi (1990) reported that when individuals are in a flow state, time seems to pass quickly, their attention is sharply focused, and the individual becomes lost in the activity. Although the person so engaged is unconscious of self, there is, nevertheless, a feeling of control over the current activity. Csikszentmihalyi and Csikszentmihalyi suggested that flow can occur to different degrees during any activity. However, an individual must perceive the level of task difficulty, together with his/her ability to complete the task, as higher than average for flow to occur. Other researchers have also referred to the 'flow' state in relation to interest. Rathunde (1989) referred to flow as a state of deep interest. Schiefele (1992) concluded that readers who display high levels of topic interest are prone to experience flow during the reading process.

Interest

Early researchers have referred to the role of interest in learning (Arnold, 1906; Baldwin, 1897, 1906, 1907; Berlyne, 1949; Claparede, 1909; Kerschensteiner, 1926; Lunk, 1926, 1927; Rubinstein, 1935/1958; Thorndike, 1935). Herbart (1806/1965, 1841/1965) proposed that interest is closely related to learning because it allows for the correct and complete recognition of an object, leads to meaningful learning, promotes long-term storage of knowledge, and provides motivation for further learning. He further proposed that the development of unspecialized, multi-faceted interest should be one of

the primary goals of education.

Dewey (1913, 1933, 1938) argued that interest is an important aspect of learning. He postulated three basic characteristics of interest: it is an active, "propulsive" state, it is based on real objects, and it has high personal meaning. According to Dewey (1913), there are qualitative differences between the results of interest-based learning and learning only based on effort. He proposed that effort-based learning is mechanical and results in trained knowledge and habits that lack any mental purpose or worth. Alternatively, learning based on interest is characterized by a sense of pleasure arising out of and accompanying the activity. According to him, this sense of pleasure results from the satisfaction of psychological needs.

Dewey (1913) also addressed the distinction between interest-oriented learning (intrinsic motivation) and learning that neglects a student's interests and is based on coercion (extrinsic motivation). He proposed that external attempts to make something interesting lead to only temporary effort and do not result in identification with the material. James (1890) also addressed the concept of interest in his proposal that the experiential component of a person's interest is the uniquely recognizable awareness that an individual has come to associate with a particular physiological activity. For example, engagement in an activity that is interesting results in pleasurable feelings, strengthening the likelihood that an individual will repeat an activity that they find interesting.

Following these early references to the role of interest in learning, research typically focused on a single aspect of interest, that is, attention (Eysenck, 1982); curiosity (Berlyne, 1960); emotion (Izard, 1977); attitude (Evans, 1971); value orientation

(Allport, Vernon & Lindzay, 1960); motivation consisting of achievement motivation (Atkinson & Raynor, 1974; Heckhausen, 1980) and intrinsic motivation (Day, 1981; Deci, 1975; Deci & Ryan, 1985); and flow (Csikszentmihalyi, 1975, Csikszentmihalyi & Csikszentmihalyi, 1988, 1990; Larson, 1988). More recently, several theorists have attempted to define interest as a construct. Deci (1992) proposed that interest is an affect that occurs during an interaction between a person and an activity. Therefore, concern is with the needs and desires that are either intrinsic to the self, or have become integrated with the self (Deci & Ryan, 1991), and with the match between those needs and the affordances of various activities. Interest will only be experienced when the needs and desires of an individual mesh with an activity. Deci (1992) further suggested, that the degree of interest in the activity will determine the quality of the motivated behavior. Therefore, Deci views interest as an important determinant of motivational orientation.

Deci (1992) also addressed the role of social context in the development of interest. He proposed that novel, challenging, aesthetically pleasing activities or objects encountered in a context that allows for the satisfaction of basic psychological needs, will result in the development of interest. He also proposed that interest has a dispositional component, that is, when interest is experienced in relation to particular activities, an enduring desire to interact with those activities will develop.

Preference also explains what interests people. According to Deci (1992), preferences are a result of one's innate capacities, environmental affordance, and interpersonal contexts. He argued that people tend to have stronger preferences for activities at which they are more competent, or have greater potential. This has been confirmed by research

studies that have shown a correlation between perceived competence, and both interest and intrinsic motivation (Ryan & Grolnick, 1986). According to Deci (1992), preference will be influenced both by available activities and the social context. He suggested that those social contexts that provide autonomy, support, optimal challenge, informational feedback, and within which one feels securely related to significant others, will be more likely to promote the experience of interest, the development of enduring interests, and the integration of regulations into the self.

Hidi (1990) has also addressed the role of interest in learning. She proposed that interest is an especially important affective factor that strongly influences how people select and persist in processing certain types of information in preference to others. According to her, processing interesting information has unique aspects not present while processing uninteresting information. She also addressed the development of interest, suggesting that it may derive from an individual's peculiar sensitivity to stimuli, either through inheritance or early environmental exposure to adults whose interests were similar.

Types of Interest

Investigators of interest have often assumed that interest is a phenonoma that emerges from an individual's interaction with the environment. Research has divided interest according to two dimensions: individual and situational. Individual interest can be content and/or topic specific as well as one's preference for particular object domains. Situational interest focuses on those environmental factors found in the learning situation or material. The person-environment components of interest have been assigned differing significance.

One body of research has emphasized variations in individual or personal interest, including their origins and their effects, with special emphasis being given to the effect of interest on some category of cognitive performance (i.e., learning). Another group, has concentrated more on the specific characteristics of a learning environment that captures the interest of many individuals (i.e., interestingness of text).

Both individual and situational interest have been shown to have an important role in learning and can interact to influence each other's development. Hidi and Anderson (1992) proposed that situational interest, which can only result from an interaction between the individual and the environment, may influence individual interest by its contribution to the development of long-lasting personal interest. Alternatively, an individual with a well-developed personal interest, may have stronger reactions to certain relevant and potentially interest-evoking situations, than a person without such interest.

Individual Interest. Schiefele (1991) defined individual interest as the relatively long-term orientation of an individual toward a type of object, activity, or area of knowledge. According to him, interest is a domain-specific or topic-specific motivational characteristic of personality. He distinguished between two components of interest: feeling-related and value-related valences. Feeling-related valences occur when a topic or object is associated with feelings that precede, accompany, or follow an activity that involves a topic or object of interest; specifically, relating a topic to feelings of enjoyment and involvement. Value-related valences occur when personal significance is ascribed to a topic; specifically, when a topic has particular value to the individual. Topic interest, according to Schiefele (1992) is comprised of both feeling-related and value-

related valences, and these valences must be intrinsic to the individual.

Schiefele (1991) proposed that personal significance (value-related valences) may be ascribed to an object for a wide variety of reasons, including its contribution to one's personality development, competence, or understanding of important problems. He referred to a second form of individual interest; actualized individual interest. In this state the person wants to learn about a topic for its own sake, and adopts a task-or-learning orientation as opposed to an ego-or-performance orientation toward the topic (Nolan, 1988). This distinction has often been made between intrinsic and extrinsic motivation (Deci & Ryan, 1985).

Renninger (1992) discussed individual interest in terms of the stored knowledge and value with which individuals' re-engage classes of tasks, objects, ideas, and events in their environment. According to Renninger, these components can be described as individual, because the individual constructs and reconstructs the possibilities of any activity. She cited Mead (1934), in her suggestion that they are also social, because of the influence of others on what the individual represents to him/herself as possibilities for action. Therefore, the assumption is that interest is reflected in the individual's perception of possibilities for action; representation of these possibilities to the self; and the setting, resolving, and resetting of challenges (Fink, 1991; Renninger, 1990; Renninger & Leckrone, 1991). Renninger (1992) suggested that because individuals' differ in their interests, its effect will be differential; however, research has often found that when interested, both children and adults pay more attention, persist for longer periods of time, and acquire more knowledge, than they do during uninteresting activities

(Asher, 1979, 1980; Estes & Vaughan, 1973; Fransson, 1977; Nenniger, 1987; Prenzel, 1988; Renninger, 1990).

Situational Interest. Berlyne (1960,1971,1974) was one of the early researchers to consider environmentally-based causes of interest. In examining the influence of stimulus characteristics on perceptual processing of, and response to visual and auditory patterns, he concluded that interest was a function of collative variables. These variables are the structural or formal properties of stimulus patterns, such as variations along the lines of familiar-novel; simple-complex; expected-surprising; clear-ambiguous; and stable-variable (Berlyne, 1974, p.5) whose common, underlying characteristic is their ability to create conflict and uncertainty. Hidi (1990) has also proposed that situational interest is elicited by certain aspects of a situation, such as novelty or intensity, and that these aspects contribute to the interestingness of the situation.

Research on situational interest has often focused on text-based interest, that is, interest elicited by text through ideas, topics, and themes (Hidi & Baird, 1988). According to Hidi (1990), two factors contribute to text-based interest: Berlyne's collative variables, and content bound factors such as human activity, intensity, and life themes. Schank (1979) proposed that certain kinds of topics are inherently interesting to the reader (e.g., death, danger, chaos, destruction, disease, injury, power, money, sex, and romance). He further suggested that these topics can be made more or less interesting depending on two conditions: unexpected events and personal relatedness. Anderson, Shirey, Wilson and Fielding (1984) suggested that character identification and novelty contribute to text-based interest. Kintsch (1980) distinguished between emotional

and cognitive interest. He proposed that emotional interest is aroused when events have a direct emotional impact, such as elicited by sex and violence; and when the text provides the reader with a vicarious experience. Cognitive interest is aroused in the reader, when reading a text that contains an element of surprise.

Research that has focused on both individual and situational interest has investigated several variables in order to gain a better understanding of interest's effect on cognitive processing. These variables include childrens' play and problem solving activities, childrens' temperament, text comprehension and attention. Further, the relationship between interest and prior knowledge has also been investigated. The findings of this research will be presented below.

Childrens' play with objects

In a series of studies, Renninger (1990,1992) and Renninger & Leckrone (1991) focused on the effect of individual interest on childrens' activities. Renninger (1990) investigated the effect of interest on childrens' actions during play. High and low interest objects were identified, and individual children's actions with each of 16 discrete play objects present during free play were coded to identify the range and quality of each child's actions. Five types of play emerged: investigative, functional, operational, transformational, and facilitative. Specific actions for each child within each type of play with each play object were coded across six 40-minute tapes.

The study found that when children played with an object that held high interest for them, they had more types of play available to them, were more likely to spend longer amounts of time, and to repeat particular sequences of action, than when they played

with an object that had low interest value. Further, children used more varied actions during play with a high interest than with a low interest object, even though those action sequences were not necessarily the same for individual children who selected the same object of interest. Renninger (1990) further demonstrated that during play with low interest objects, children were unlikely to repeat their prior action within play types or if they did repeat those actions, they were unlikely to incorporate changes into their action sequences.

The study also found a relationship between gender and childrens' play activities related to interest. Girls were more likely than boys, to reengage in investigative play and to shift actions with their identified object of interest during this play. They were also more likely than boys, to select those objects that offered possibilities for investigative activity. During functional play, boys were more likely than girls, to engage more varied actions with high interest objects. They also selected those objects that provided them with more possibilities for functional activity. Girls were more likely than boys to have more different types of actions in operational play with their identified objects of interest, and their objects of interest were also more likely than the boys' objects to provide more possibilities for exploring relations during operational play. During transformational play, girls were more likely than boys, to repeatedly engage in activities with high interest objects, and to choose those objects that provided them with greater possibilities for repeated engagement. Boys were more likely than girls to shift actions in transformational play with their identified objects of interest. Boys' objects of interest were more likely than girls' objects, to offer the possibility for different actions

in transformational play.

Renninger (1990) concluded that children appear to see more possibilities for action when playing with an identified object of interest, than they do during play with a noninterest object. She further proposed, that particular play objects do represent possibilities for action to children. In this study, continued re-engagement with objects of interest allowed children to repeat particular patterns of action and to incorporate systematic variations into these actions. Renninger suggested that these variations in actions among children were an indication that children respond not only to the challenge that the play object presents, but that they also set challenges that build on their prior actions. The finding of a relationship between interest and optimally challenging engagement in task activity confirms the relationship between interest and optimal challenge proposed by Deci and Ryan (1985) and Csikszentmihalyi (1975).

Renninger (1990) further concluded that children appear to coordinate their types of play in pursuit of a goal. In this study, even when the goal was unrealistic, they stayed on task and reorganized their goals, while exploring alternative possibilities for action. Renninger proposed that the longer time children spent playing with a high interest than with a low interest object, may have been an indication of their greater engagement, need for extra time to explore and employ actions with that object, and the fact that they were less distracted during play with a high interest object. In contrast, when children played with a low interest object, they did not repeat actions, an indication that they did not represent as many possibilities for action to themselves; nor did they invest in exploration while playing with low interest objects. An alternative explanation for these findings may

be that when playing with high interest objects, children allocate their attention to them. This focused attention may cause childrens' cognitive representation of interesting objects to be more meaningful, resulting in their resisting distraction from less interesting objects and their engaging in more varied activities with those objects that interested them.

Problem solving

Renninger (1992) investigated the relationship between value/interest, task difficulty, gender and mathematics performance. Students' engaged in a mathematics word problem solving task that required them to complete 12 word problems at a mastery level (i.e., independently), and at an instructional level (i.e., with support). At each level, the context in which the problem was presented varied. Three problems contained three interesting contexts (i.e., MTV and basketball) and three noninteresting contexts. All problems had the same structure, but the numbers were varied. The number of steps involved in a problem solution were controlled across problems. Dependent variables were student accuracy and type of error made.

The study found that students were more accurate in completing mastery, than instructional problems. Difficulties experienced by students were found to occur on instructional problems. Errors made were related to setting up the problem, with children either setting up the problem too generally or only partially setting it up. The study also found significant value/interest and gender differences. Boys were more likely to have fewer set-up problems or to set the problem up only partially on interesting problems; whereas girls were more likely to have fewer set-up difficulties with noninteresting problems. The study further found that children were most able to respond accurately to

mastery problems, although interest and gender influenced the way they approached these problems.

Renninger concluded that both interest and gender influenced students' willingness to try to work at, or to persevere in solving mathematical word problems. When the problem was of low interest, boys made more errors with set-up than girls. However, girls made more errors with set-up for interesting problems, than did boys. Renninger concluded that interest assisted boys' understanding of these problems, whereas interest appeared to act as a distractor to girls' problem solving. The study also found that gender differences disappeared when students did not experience difficulty with problem set-up, therefore these differences appeared to be linked to problem set-up, that is, task difficulty.

Renninger (1992) proposed that gender may cause task expectations to be represented differently. She suggested that the finding of gender differences based on problem set-up were a reflection of the specific challenges that students set for themselves in solving these problems. She further suggested that the challenges set by students, influenced the repertoire of strategies and questions they brought to their work on the problems, making them different problems, especially when the context of the problem is of interest to the student.

Temperament

Renninger and Leckrone (1991) investigated the effect of interest on young childrens' temperament. The study contrasted interest, noninterest and attraction. Interest was defined as high knowledge, high value; noninterest as knowledge, but little value; and

attraction as low knowledge, high value. Videotaped behaviors by 10 children during free play were coded and rated for temperament, according to the dimensions of emotionality, sociability and reactivity. Ratings of emotionality were based on the child's distractibility from play, tempo of play, attention to the flow of play, contributions to play, and immersion in play. Reactivity was rated according to the child's distractibility from play, rhythm of play, attention to flow of play, return to flow of play, and immersion in play.

The study found that ratings for each of the dimensions were highest during play with an object of interest, next during play with a noninterest object, and lowest during play with an attraction object. Childrens' emotionality, sociability, and reactivity were not found to differ as a function of interest or gender. However, when the task required persistence, both value and gender distinguished between the childrens' engagements. Specifically, children were found to be more likely to have higher levels of emotionality on tasks that involved their identified objects of interest. They were also more likely to have higher levels of reactivity, that is, to reorganize actions in play, when engaged with identified objects of interest. Gender differences were found for the emotionality dimension, with girls being more likely than boys to have higher levels of emotionality for interesting objects.

Renninger (1992) suggested that interest may serve a particular cognitive function in the process of childrens' representation of possibilities for action to themselves. She proposed that children are more likely to have greater attention and memory for interesting objects, than for those identified as either noninterests or attractions. They are also likely to be more systematic in their actions, and to employ a wider range of play

types during play with interest than with noninterest objects. She further proposed that objects of interest influence childrens' social engagement and persistence during play.

Comprehension

Research studies that have investigated the effect of motivational orientations on student comprehension have demonstrated a relationship between intrinsic motivation and deeper processing of text. Benware and Deci (1984) found that intrinsically motivated students exhibited greater conceptual comprehension of text content - measured by definitions, multiple-choice questions, and explanations - than did extrinsically motivated students. A study by Lepper (1988) concluded that high school and college students who demonstrated a willingness to engage in an activity for its own sake, developed comparably more differentiated and original knowledge structures than did students with an externally motivated orientation. Entwistle and Ramsden (1983) found that intrinsically motivated students made greater attempts than did other students, to relate new information to prior knowledge, similar topics, concrete examples or personal experience. Alternatively, extrinsically motivated students were found to approach text in a superficial and mechanical manner, repeatedly reading the text and memorizing certain passages.

Research has also investigated the effect of interest on students' text processing. Schiefele (1992) proposed that when the reader is stimulated by topic interest, actualized interest (i.e., topic-specific, intrinsic motivation) will result. He further suggested that this actualized interest will exert an influence on cognitive (elaborative processes) and emotional variables (level of activation). According to Schiefele, emotional and cognitive

variables interact with one another, with students' emotional states influencing their willingness to use learning strategies, invest effort, and to draw inferences. He suggested, that while level of cognitive investment may contribute to the quality of the emotional experience, the effect of interest depends on it's impact on the quality of the mediating emotional and cognitive processes.

Several research studies have investigated the effect of interest on students' level of text processing and comprehension. Fransson (1977) demonstrated that students who were more interested in a topic, exhibited deeper processing of a related text than did less interested students. Analysis of free recall data, revealed that students whose interest was high made more connections between different parts of text, and between their prior knowledge and the text. Interviews with students revealed that high interest resulted in more independent thinking about text content than did low interest. Schiefele and Krapp (1988) and Schiefele, Winteler, and Krapp (1988) found that university students who were highly interested in their majors, failed to produce any more associations with subject related terms than did less interested students. However, the study found that the associations made by the highly interested students were more adequate in a technical sense, than were those made by students whose interest was low. Schiefele et. al. explained these differences in the cognitive structure of stimulus concepts, as being due to the fact that interest is less important when superficial knowledge is required, but of great importance when deeper comprehension of text content is required.

In two studies, Schiefele (1990) investigated the impact of topic interest on various levels of comprehension. He further investigated, whether interest affects comprehension

independently of prior knowledge and intelligence. Students were divided into high and low interest groups based on their level of interest in the experimental text. Prior knowledge, verbal and general intelligence, short-term memory capacity, comprehension of text, and indications of text processing were measured. The study required that students' prior knowledge was limited and that there was a large variance in topic interest.

In study I, 53 computer science students rated an abstract of a text about 'Emotion' according to their level of interest, using two four-point rating scales: one that measured feeling-related and the other value-related reactions to the text. Topic interest was a measure of intrinsic feeling-related and value-related valences. Feeling-related valences were subjects' expectation of experiencing certain feelings while reading text. Response choices included: bored, stimulated, interested, indifferent, involved, and engaged. Value-related valences were determined by students' responses on a scale that required them to rate topic value according to the dimensions of meaningful, unimportant, useful, and worthless. Four response categories were included in all scales: not at all, somewhat, quite, and completely. Students' scores on both categories were combined to determine high and low interest groups. Prior knowledge was determined by a word association test and by five open-ended questions related to the text.

The comprehension test comprised three types of questions: six simple, three complex, and three deeper comprehension. Simple questions required recall of concrete details (facts, definitions) stated explicitedly in text; complex questions required the grouping of facts or relations between facts, stated explicitedly in text; and deeper

comprehension required that students' recombine or compare various aspects of text and apply text information to a novel situation. Students were required to read the complete text, making notes in the margins, and underlining portions of the text. Following this reading, their level of activation, flow experience, and elaborations were measured, and the comprehension test administered.

In this study, Schiefele (1990) found a significant difference between student comprehension of complex and deeper comprehension questions, and simple questions. However, an analysis of the length of answers given for all three question types failed to find a significant difference between high and low interest subjects. Schiefele concluded that the significant difference between question types was a qualitative one. There were no intelligence, short-term memory, or prior knowledge differences between high and low interest groups. No correlation between prior knowledge and comprehension was found.

To better determine the nature of the difference in students' comprehension, Schiefele conducted a second study. In this study, comprehension was measured according to the text processing theory of van Dijk and Kintsch (1983), who distinguished between the cognitive representation of a text and the representation of the situation the text describes (situational model). vanDijk and Kintsch described two other forms of text-bound representation: verbatim and propositional. Propositional representation consisted of both a microstructure, containing the meaning of the text; and a macrostructure, representing the gist of the text. Verbatim representation is more closely bound to text than is propositional representation, and contains the representation of the texts' superficial

structure.

Schiefele (1990) hypothesized that students with high topic interest would build more propositional and situational text representations than would low interest students. Low interest was expected to result in mainly verbatim comprehension of text. Forty-one social science students read a text on 'Communication'. The procedures for this study were the same as for Study I. Comprehension was measured by a recognition test that comprised 30 sentences that were administered to subjects in random order. These sentences included six of each of the following types: original, paraphrased, meaning changed, and correctness changed. Students in this study were required to decide whether a sentence had been presented verbatim in the original text. If the student indicated that the sentence was not found in the text, he or she was asked to indicate whether the sentence was true or false. Individual scores were determined for the extent of verbatim, propositional, and situational representations of text. The strength of individual text representations was a measure of the discriminability of two response distributions: strength of verbatim representations (difference between the number of 'yes' answers for the original and paraphrased sentences); and strength of propositional representation (difference between 'yes' answers for paraphrased and meaning changed sentences). Situational representation was determined by the difference between 'yes' answers for the meaning changed sentences and correctness changed sentences.

This study found a significant interaction between interest and text representation. Students whose interest was low, tended to have more pronounced verbatim and less pronounced propositional and situational text representations, than did students with high

interest. A significant difference was found only for verbatim representation, but the effect of interest on propositional representation failed to reach significance. Interest was found to exert an influence on the verification of correct sentences, but not incorrect ones. Low interest resulted in students' judging more correct sentences to be false, than did high interest. Students whose interest was low rejected, on average, 21% of all paraphrased sentences as being true; whereas those whose interest was high did so only for .08% of paraphrased sentences. Students whose topic interest was high, exhibited a less pronounced verbatim representation than did those whose interest was low. The effect of situational representation revealed that low interest caused students to reject significantly more correct sentences in the additional verification task, than did high interest.

Analysis of control variables revealed that in study I, there were no significant differences between students with high and low interest for general intelligence, verbal intelligence, STM capacity, and prior knowledge. Schiefele (1990) concluded that the difference in comprehension between high and low interest groups was not attributable to these factors. In study II, prior knowledge was found to be significantly correlated with interest, but it did not influence the indicators of comprehension. Controlling for prior knowledge and intelligence did not reduce the correlation between interest and the representational components of text. Therefore, in this study as in Study I, the effects of prior knowledge and intelligence were found to be independent of the effect of interest.

Schiefele (1990) also investigated the effect of the affective variables, activation and flow; and cognitive variables, elaborations and learning techniques. In both studies,

significant correlations were found among interest and activation, flow and elaboration. In terms of flow, it was found that for students whose interest was high, time went by much faster, they were much more caught up in the text, and experienced a greater alertness and deeper concentration than did those whose interest was low. In addition, those with high interest more frequently reported the occurrence of mental images and personal thoughts about the text, as well as trying harder to paraphrase the text.

The findings of these studies indicated that the effect of interest on comprehension is more pronounced at deeper levels of understanding. High interest caused students to process text in a more meaning-oriented manner, whereas students whose interest was low were more likely to engage in verbatim processing of text. Schiefele (1990) concluded that interest affects text processing independently of intelligence and prior knowledge. He suggested that high levels of topic interest contributed to an increased level of activation and the experience of flow, caused students to engage in more pronounced elaborative processing, and to make more use of learning techniques. In these studies, interest was found to exert a substantial influence on those processes that contribute to the representation of the meaning of a text.

In another study, Schiefele (1991) investigated the effects of topic interest and cognitive characteristics on different indicators of free recall of expository texts. Subjects (n=81) were tested for their prior knowledge of text content and their level of intelligence. Following this they rated the text according to their degree of interest in the topic. Process variables for the study were activation, attention, elaboration, note-taking, and underlining. Following their reading, subjects were asked to write down the text

content as completely as possible. Dependent variables were recall of idea units, main ideas and coherence of recall. Idea units represented a meaningful information complex that corresponded usually to a main sentence. All free recall ideas were rated as being complete, incomplete, wrong, or new (correct information not stated explicitly in the text). Main ideas were rated in recall protocols as being either complete, incomplete, or wrong. Coherence of recall was determined by computing students' recall of the sequence of idea units, or main ideas from the original text. Individual scores of coherence were a measure of the number of coherent transitions in each recall protocol weighted by the overall number of idea units, or main ideas.

The results of this study found that topic interest was significantly related to the number of reproduced complete idea units, new idea units (elaborations) and complete main ideas. Interest was also found to exert a significant influence on the coherence of recall. These effects were independent of intelligence and prior knowledge. The study also found that topic interest was significantly related to activation, attention, elaboration, and note-taking. However, only the combined variable activation/attention mediated parts of the interest effect on recall.

Schiefele (1991) concluded that interest exerts a strong influence on the correctness of recall. Interest was found to have a stronger effect on the recall of main ideas than on recall of idea units. Further, subjects with higher levels of interest tended to recall ideas that were not included in the text, but represented inferences or stemmed from the subjects' prior knowledge. Topic interest was also found to be significantly related to the coherence of recalled information.

Renninger (1992) reported the findings of a study that investigated the effects of interest on students' reading. Text consisted of four expository passages that were either at a mastery, that is, a task that could be completed independently, or instructional level, that is, a task that could be completed with assistance. At each level, text comprised one passage that contained an identified interest and another that contained an identified noninterest. Each passage consisted of three paragraphs, each containing three to five points on an aspect of the topic that was not common knowledge, despite familiarity. Third grade students were required to read the first passage, answer two buffer questions, and then write down as much of the passage as they could recall. Dependent variables were number of points remembered, sentences written, paragraphs represented, presence and completeness of overall gist, paragraph gists' recalled, order of recall, and types of errors made.

The study found individual differences in students' topics of interest. However, when a passage interested them, they were more likely to recall more points, information from more paragraphs, and more topic sentences; write more sentences; provide more detailed information about the topics read; have no errors on their written recall; and provide topic-relevant information. Renninger (1992) concluded that these findings indicated that interesting information was more easily accessed, or perhaps more efficiently chunked for subsequent recall, than was noninterest information. The study also found that students were more likely to be inaccurate and to demonstrate depressed recall, following their reading of a noninterest topic, than they were when they read interesting information.

The study failed to find a relationship between task difficulty and recall. It appeared that those students whose recall was accurate, were no more likely to be accurate on the mastery than on the instructional level task. However, task difficulty was found to affect the way students 'approached the material. Following their reading of the more difficult instructional level passages, students were more likely to represent all three paragraphs in their recall, to recall passages in mixed chunks, or to include more editorial comments than they did when they read the mastery level passages. The study found gender differences for task difficulty. Girls were more likely than boys to be distracted by interesting mastery level text at the mastery level. This text was found to increase the recall of information for boys more than it did for girls.

Renninger (1992) proposed that interest provided a scaffold for girls while reading instructional level text, whereas it hindered or distracted boys reading text at this level. The findings of this study appear to indicate, that for boys, an optimal reading task includes an interesting context but at a mastery level. Alternatively, girls' optimal reading task appears to be one with an interesting context at the instructional level. She suggested that interest may enable the student to adjust the level of a passage, allowing it to be easier to read even when it is at an instructional level and contains a neutral context. Renninger (1992) further proposed that the finding of this study supported the proposition by Paris and Cross (1988) that a context of interest could support a wider zone of proximal development than one of noninterest, between the task that a student could complete independently (mastery level) and the task that the student could complete with assistance (instructional level).

The study further found greater accuracy and detailed recall for interesting, than uninteresting passages. Student errors primarily involved misreading and lack of recall on uninteresting passages. Renninger (1992) concluded that interest, not difficulty level or gender, enabled students to be more accurate. According to them, interest may have rendered the passage more or less difficult for students in a way that the actual structure of the passage did not. They further suggested, that student effectiveness in chunking information as a function of interest leads to differing zones of proximal development, despite structurally similar passages. Another explanation for the finding of more effective chunking by students in this study, may be that reading interesting text focused students' attention resulting in their processing information in a more meaningful manner. This finding of deeper processing of information based on interest, confirms that of other studies (McLaren & Hidi, 1991; Saks, 1989; Schiefele, 1990; Wade, Schraw, Buxton, & Hayes, 1991).

The results of these studies provide some support for the proposal that interest affects comprehension via cognitive mediating variables. One cognitive variable that may act as a mediator between interest and comprehension is attention. In addressing the role of affect in cognition, Mishkin and Appenzeller (1987) proposed that the numerous interconnections between the amygdala and other limbic and cortical areas of the brain play a key role in integrating experience. According to them, the amygdala not only enables sensory events to develop emotional associations, but may also enable emotions to shape perceptions and affect the storage and utilization (construction and reconstruction) of experience. Therefore, according to Mishkin and Appenzeller (1987)

emotion influences sensory processing and subsequent perception in the cortex by serving as a filter; filtering can occur by limiting attention to those stimuli that have emotional significance. They proposed that selective attention to specific external and internal events or thoughts may have a profound effect on the type or quality of a person's learning or schema constructions. The fact that interest is an emotional variable that has been shown to facilitate student comprehension and learning (Hidi, Renninger, & Krapp, 1992), suggests that there may be a causal link between interest, attention and different levels of comprehension.

Prior Knowledge

Research that has investigated the relationship between prior knowledge and comprehension (Alexander, Pate, Kulikowich, Farrell, & Wright, 1989; Garner & Gillingham, 1991; Hasselhorn & Korkel, 1986; Stahl, Hare, Sinatra, & Gregory, 1991) has demonstrated that high knowledge positively affects student comprehension. However, the relationship between interest and prior knowledge has been a more problematic one to establish. Some researchers have attempted to distinguish between the effects of interest and prior knowledge (Asher, 1980; Tobias, 1992), while others have incorporated prior knowledge into their definition of interest. For example, Renninger (1992) defined interest as comprising value and knowledge. Tobias (1992) has proposed that research studies that investigate the effect of interest on student learning need to differentiate between the effects of interest and those of prior knowledge. Therefore, studies need to examine whether interest has an impact on learning, independent of the effects of prior knowledge (Asher, 1980; Tobias, 1992).

In defining prior knowledge, Alexander, Kulikowich, and Schulze (1992) differentiated between domain and topic knowledge. They defined domain knowledge as familiarity with general information in an area, even though it may not be specifically referred to in a particular passage; topic knowledge refers to prior familiarity with content closely related to material covered in a particular text passage, or segment of instructional material. Studies that have investigated the relationship between interest and prior knowledge have often divided knowledge according to these dimensions.

Some research studies have reported little relationship between interest and prior knowledge (Baldwin, Peleg-Brukner, & McClintock, 1985; Schiefele, 1990). A study by Baldwin, Peleg-Bruckner, and McClintock (1985) investigated the effects of prior knowledge and topic interest on reading comprehension. The study assessed whether a causal or correlational relationship existed between reading comprehension and topic interest, and whether the impact of interest on comprehension differed according to gender. In this study, subjects were 41 seventh- and eighth-grade students whose mean score on the California Achievement Test was at the 89th percentile. Three sets of materials were used: an interest inventory, a 100-word prior knowledge test, and ten 300-word passages with accompanying multiple choice comprehension tests. Interest was measured by an interest inventory that required subjects to rate the degree to which they were interested in ten topics selected from the Britannica Junior Encyclopedia (1977). Prior knowledge was assessed by a multiple choice pretest based on information presented in the Britannica Junior for each of the chosen topics. Ten test items were chosen for each topic and each test question was selected to be passage independent and

factual. The ten 300-word passages were taken from the same entries in the encyclopedia as the pretest questions, but from different sub-headings within the entries. The 10-multiple choice comprehension tests were passage dependent measures composed of both textually explicit and textually implicit questions. The comprehension tests also contained a question that assessed subjects' postreading interest in the passage, according to a scale that ranged from 1 to 10.

Both interest ratings and prior knowledge test scores were converted to z-scores to determine each subject's level of interest and prior knowledge per topic. Subjects then read and were tested on their own interest/prior knowledge combinations of four passages that corresponded to the four experimental conditions: high interest/high prior knowledge, high interest/low prior knowledge, low interest/high prior knowledge and low interest/low prior knowledge. Following their reading of each passage, subjects completed a matching comprehension test. This was followed by three comprehension tests without the corresponding passages, to assess passage dependency.

The study found that comprehension was significantly better for passages for which students had high prior knowledge, than for passages where their prior knowledge was low. Comprehension was also significantly better for passages for which topic interest was high, than for those for which it was low. A significant sex x prior knowledge x topic interest interaction revealed that boys' comprehension was significantly higher for passages that held high topic interest and for which they had high prior knowledge than for those where both topic interest and prior knowledge was low. For girls, comprehension was significantly higher on passages for which they had high prior

knowledge, than it was for those where prior knowledge was low. However, there was no difference between high and low topic interest passages.

The study found a .67 correlation between subjects' prereading interest ratings and postreading interest ratings of passages. However, a pearson correlation between topic interest and prior knowledge computed for each subject for all 10 topics, found a minimal relationship between interest and prior knowledge (r=.74 to -.49; Mean=.09).

In another study, Saks (1989) investigated the effects of knowledge and interest on students' allocation of attention. The study hypothesized that students who read topics that held high interest for them would demonstrate greater comprehension of these passages, compared to those who read passages with low interest topics. Further, it was hypothesized that students whose prior knowledge was high would demonstrate greater comprehension of these passages compared to those whose prior knowledge was low. The study further hypothesized that students who read high interest topics, would allocate greater attention to their reading determined by slower response times to a secondary task probe than would students who read topics that were of low interest; and that students with greater prior knowledge, would allocate less attention to reading resulting in faster response times to secondary task probe than those with low prior knowledge. Materials for this study were the same as those used by Baldwin et. al. (1985). Fifty-five 7th and 8th grade students were assigned to one of four conditions based on their interest and prior knowledge of a topic. Interest was determined by student ratings of a story title and a one sentence summary of the story to be read. High and low interest and domain knowledge were determined by comparison to a group of peers.

During Session I, students completed an interest inventory to determine their level of interest in the topic. A pretest was administered to determine students' level of prior knowledge. One week later, students were required to read text about a topic. This was followed by a multiple choice posttest, a post-interest rating scale, and a cognitive processes questionnaire. Attention was measured by secondary task probe.

This study found a significant, but low median correlation between interest and prior knowledge ($r=.18$; $p<.05$). However, the study failed to find a relationship between prior domain knowledge and a posttest that measured students' comprehension of the text passage. Students demonstrated significantly higher posttest scores for high, compared to low interest passages. Students whose prior knowledge of text topics was high, demonstrated significantly faster response times to the secondary task probe than did those students with low prior knowledge. No differences in reaction time to secondary task probe were found related to interest. Further, Saks reported that during the structured interview, students who were highly interested in text topics reported very active involvement with the material, with greater use of visual imagery and increased personal knowledge compared to less interested subjects. In both the Baldwin et. al. (1985) and the Saks (1989) study, prior domain knowledge was found to have little relationship to the topic knowledge needed for comprehension of the passage students were assigned to read.

Entin and Klare (1985) found that readability, prior domain knowledge (determined by asking for definitions of vocabulary assumed to be understood by the reader and not defined in the text), and interest affected students' reading comprehension (measured by

cloze procedure) of six passages. However, the effects of interest were found to be nonsignificant once prior knowledge was used as a covariate. In a series of analyses, general main effects were found for each of these variables. Entin and Klare explained the failure of this study to demonstrate a relationship between interest and prior knowledge as due to the measures of prior knowledge used. They concluded that prior knowledge was confounded with interest (i.e., subjects rated their prior knowledge of the interesting topics as high relative to their prior knowledge of the uninteresting topics).

In the studies by Schiefele (1990) cited earlier, a significant correlation was found between interest and prior knowledge, however, when the effects of knowledge were partialled out correlations between interest and type of comprehension remained unaffected. Therefore, in this study and those cited above, the effects of interest on student comprehension were found to be independent of those of prior knowledge.

Other studies have reported substantial prior knowledge and interest relationships. Morris, Tweedy, and Gruneberg (1985) found a correlation of .72 between students' self-rated knowledge about several soccer teams and their self-rated interest in soccer (attitudes toward those teams). In this study, both positive (support for a specific team) and negative interest (dislike for a team) were found to have similar effects on students' recall of soccer scores. Morris et. al. proposed that emotional involvement may have contributed to the enhanced performance attributed to interest. Schneider and Bjorklund (1992) reanalyzed a series of studies, using large samples of German school children. In each of three studies, a significant relationship was found between knowledge and interest in soccer for second and fourth grade children. Further, correlations between interest and

knowledge tended to increase with age. In another study, Tobias (1992) examined the effects of interest on the acquisition and use of math checking techniques. In this study, a significant correlation of .53 was found between self-reported interest and prior knowledge.

Alexander, Kulikowich, and Schulze (1993) investigated the relationship between both domain and topic knowledge and interest. Subjects read two different passages about physics: one more technical than the other. A domain knowledge-interest correlation of .28 ($p < .01$) was found. On the second passage, both domain and topic knowledge were strongly associated with interest (.13 and .62, respectively; $p < .01$). When students were divided into three categories based on their domain knowledge, the interest-domain knowledge relationship was found to be highest on both passages for students who knew the most about the domain. No significant correlations were found for intermediate or least knowledgeable students.

Kintsch (1980) proposed an inverted-U relationship between prior knowledge and interest. He proposed that interest tends to be low with little or no relevant background knowledge, increases as more is known about the topic, but diminishes as the reader reaches the point where nothing new can be learned. According to Kintsch, moderate levels of topic knowledge can be expected to generate more interest than either high or low levels. Hidi and McLaren (1990) provided support for Kintsch's (1980) proposal in their finding of low interest ratings for topics about which subjects' knowledge was high or low, and high interest ratings for topics about which they had moderate knowledge. Garner and Gillingham (1991) also found that students with high and low levels of topic

knowledge seemed to rate text passages as less interesting than they did for those for which they had moderate levels of knowledge.

Tobias (1993) refuted the inverted-U hypothesis by proposing that experts in any field would be more likely to have both the highest interest and knowledge about that topic. He cites (Roe, 1946) in his suggestion that expertise results from intense devotion to the subject often to the exclusion of other activities; further proposing that the dedication and persistence with which those with expertise in a domain pursue activities related to that domain, would not support the prediction of an inverted-U shaped interest-knowledge relationship. Tobias further proposed, that when students' know nothing or everything about a particular text passage they will have little interest in reading that passage; however, knowledgeable students may be highly interested in reading other (less familiar) passages about the same topic.

The results of research to date, indicate that there is uncertainty about the degree to which interests' effect on learning can be attributed to prior knowledge. Tobias (1993) suggested that while a strong interest-prior knowledge relationship appears to exist, interest does appear to have independent effects on learning. Interest has been shown to cause the learner to process information at deeper levels of comprehension (Schiefele, 1990), to use more imagery (Saks, 1989), and to arouse a more personal and extensive network of relevant associations (Tobias, 1993).

Attention

Several researchers have suggested that attention is allocated within a limited capacity system. Eysenck (1982) stated, "the original notion of attention has been replaced by a

conceptualization in which attention is regarded as a limited power supply. The basic idea is that attention represents a general purpose limited capacity that can be flexibly allocated in many different ways in response to task demands" (p.28). Hasher and Zacks (1979) wrote, "consistent with a capacity view of attention, we think of attention as a nonspecific resource for cognitive processing. This resource is necessary for the carrying out of mental operations, but its supply is limited" (p. 363). Norman (1976) proposed, "the limit on attentional capacity appears to be a general limit on resources ... the completion of a mental activity requires two types of input to the corresponding structure: an information input specific to that structure, and a non-specific input that may be variously labeled 'effort,' 'capacity,' or 'attention.' To explain man's limited ability to carry out multiple activities at the same time, a capacity theory assumes that the total amount of attention that can be deployed at any time is limited." (p.71). Csiksentmihalyi (1988) also proposed that psychic energy (i.e., attention) is allocated within a limited capacity attention model, suggesting that reason, percepts, feelings, and motives all compete within a limited capacity system resulting in their contributing differentially to the focusing of attention.

Dual-task paradigm

Research based on the limited capacity model of attention has focused on differences in task structure - primarily related to stages of processing - that impact on dual-task performance efficiency. This dual-task paradigm has often been used to investigate students' differential allocation of attention. Paulhan (1887) was the first to call attention to dual-task performance by stating, "the most favorable condition for doubling the mind

is it's simultaneous application of two easy and heterogeneous operations" (p.684). Wickens (1984) referred to the degree to which two tasks can be performed as well concurrently as each can be performed in isolation, as time-sharing. Examples of effective time-sharing activities are walking while talking, and reading while listening to music. Examples of inefficient time-sharing are talking while reading, and problem solving while listening (Wickens, 1984).

Wickens proposed that two intervening variables account for time-sharing efficiency: processing resources and structure. According to Wickens (1984), tasks are assumed to demand resources for their performance, and these resources are limited in their availability. Therefore, when the joint resource demand of two tasks exceeds the available supply, time-sharing efficiency drops. He suggested that this will be more likely to occur as the difficulty of either component task increases. For example, conversation with one's passenger in a car will normally be disrupted if the demands of the concurrent driving task are increased by poor visibility or heavy traffic. Alternatively, driving performance may degrade as the conversation becomes extremely interesting.

Structural interference will occur when two tasks compete for common processing mechanisms or structures (i.e., stages of processing, modalities of input, and/or requirements for manual response). For example, listening to music will be more disrupted by the simultaneous requirement to understand a conversation, which also demands the auditory channel, than by reading a paper, which involves visual input (Wickens, 1984). Knowles (1963) proposed that according to a limited capacity resource model, as a primary task demands more resources (becomes more difficult) fewer are

available for a concurrent secondary task, and the latter will deteriorate. In this manner, primary task workload is inversely reflected in secondary task performance.

According to the limited capacity model of attention, an individual's performance will decline when he/she is required to shift from performing two tasks sequentially to performing them simultaneously (Schneider, Dumais, & Shiffrin, 1984). Schneider et. al. divided attention according to automatic and control processing mechanisms. They defined automatic processing as a fast, parallel, fairly effortless process that is not limited by short-term memory (STM) capacity, is not under direct subject control, and is responsible for the performance of well-developed, skilled behaviors; whereas, controlled processing is a slow, generally serial, effortful, capacity-limited, and subject-regulated processing mode that must be used to deal with novel or inconsistent information. Schneider et. al. proposed that combining tasks that primarily compete for control processing, will cause processing capacity to be exceeded and performance to be reduced. However, combining tasks that can be processed automatically will not reduce performance because automatic processing can occur in parallel.

Investigators have often made assumptions of capacity usage in performing a primary task (to be learned or remembered), by inferring residual capacity from the secondary task "probes" (Eysenck & Eysenck, 1979; Underwood, 1976). For example, longer reaction times to probe stimuli are presumed to reflect greater capacity demands (less automation, deeper processing) of the primary task. In two experiments, Martin (1977) used a dual-task paradigm to investigate the possibility that processing capacity has both structural and general limits. Subjects were required to perform two tasks concurrently:

primary importance was attached to a listening task, and secondary importance to a reading task. The listening task required subjects to monitor for phonemic (stop consonants), syntactic (adjectives), or semantic targets (words referring to time) embedded in sentences. Subjects were required to press a button as soon as any target was detected. The secondary task required subjects to read aloud from a printed passage as fast as possible, without impairing performance on the primary task. Passages were either random word passages, with neither syntactic nor semantic constraints; syntactic passages, containing only syntactic constraints; or normal prose, containing both syntactic and semantic constraints.

Martin proposed a multiple capacity model of attention. She hypothesized that if subjects' obeyed the instructions to maintain their maximum level of performance on the primary task while concurrently carrying out the secondary task, the primary task would utilize both general capacity and capacity specific to the primary task. She further hypothesized, that the mean level of performance of a secondary task when combined with a primary task, would be proportional to its mean level of performance in isolation. The study predicted several possible outcomes. According to the task-specific model, performance on primary and secondary tasks combined should be as good as that found for either in isolation. The general capacity model predicted that task performance would be very poor. The level-specific capacity hypothesis, or a combination of it and the general capacity hypothesis predicted a pattern of interactions between the primary and secondary tasks, with pairs of tasks requiring the same level of linguistic processing suffering most. The single-channel hypothesis, predicted that most impairment would be

expected between tasks that require the higher levels of processing (semantic).

In experiment one, subjects were 27 right-handed male university students (mean age 21 years). An auditory monitoring task consisted of six groups of 13 sentences for each of three target types. Each group contained six sentences, each of which contained one target, and seven filler sentences. The reading task consisted of three types of passages. Subjects were divided into three groups, each of which were tested with one type of target only. Subjects were placed in a soundproof chamber where they listened through headphones to a tape recorder that played the groups of sentences. They were instructed to press the response key if they heard a target in the sentences, and told that doing so was of primary importance. They simultaneously read one of the passages as fast as they could, without missing any target embedded in the auditory sentences. Written instructions explained the task and an incentive pay-off scheme. A baseline condition was established by having subjects read a normal passage as fast as they could, while listening to reversed female speech.

In this study, reading rate was measured by both gross and fine-grain measures. Overall reading rate was obtained by counting the number of words read in a fixed period from the beginning of the second to the end of the twelfth sentence in a group. Fine-grain time analysis was achieved by transferring the recordings of subjects' reading to a four-channel tape recorder with a beep every two seconds on the third channel. Subjects' reading was marked off in two second intervals and the number of syllables occurring in each interval counted. Occurrence of target words and responses was also noted. If there was no response within the interval in which the target occurred, or in the

next two intervals, the target was said to be missed. The number of syllables read in different types of intervals were tabulated separately for detected and for missed targets. Intervals examined were ones containing targets plus the two before and the two after, and the ones containing responses plus the one after. Scores from all other intervals were averaged, except those in which a false positive occurred.

This study found that for the primary task, subjects were able to maintain the same level of detection of adjectives and time reference words while concurrently reading. However, performance on stop consonants was significantly impaired by the presence of a secondary task, despite the fact that subjects were instructed and paid extra to concentrate on detecting the targets. The study analyzed secondary task performance in terms of overall reading rate in words per second, number of syllables read in different 2-second intervals, and nature of errors made. A significant difference in reading rate among passage types was found. Syntactic passages were read significantly faster than random words, whereas normal passages were read significantly faster than syntactic passages. A significant difference was also found among passage types with both syntactic and normal passages being read significantly faster than random word passages.

Comparison between reading with and without a secondary task, revealed that there was a significant decrease in reading rate when subjects were required to detect targets. A significant interaction was found between the type of passage read and the presence or absence of concurrent target detection. This difference reflected the significant advantage in the reading rate of normal over syntactic passages when reading alone, but not when concurrently monitoring.

The study found a decrement in students' overall performance. A fine-grain time analysis of reading rate for every 2-second interval, found that a significant fluctuation occurred in performance near a target, but the magnitude of this fluctuation was much too small to account for the substantial decrement in overall performance. Reading rate was found to increase in the interval following a response. Martin suggested, that this finding was consistent with subjects continuing to process the written words, but withholding their reading aloud in periods between a target and a response in the primary task. Subjects' errors while reading were found to be less than 5% of the words read, with the most frequent error being omission of a word, followed by commission, substitution, and then transposition.

In a second experiment, Martin further investigated the interference found between primary and secondary tasks, related to stop consonants. The study investigated the effect of rate of presentation upon the detection of stop consonant targets compared with that of semantic targets. Sixteen subjects monitored sentences containing stop consonants and time reference word targets, recorded at two different speeds. Subjects were divided into two groups: one half were required to detect stop consonant targets, and the other half, time reference targets. Each subject listened to three groups of sentences at the fast rate, and three groups at the slow rate. Sentences were heard in both ears through headphones, and subjects were required to respond to a target by pressing a button. The study found a significant difference between fast and slow rates of presentation. Mean percentage of stop consonant targets correctly detected was 85.6% for slow presentation, and 74.1% for fast presentation. For time reference targets, mean percentage of targets correct was

81.3% for slow, and 75% for fast presentation.

Martin (1977) concluded that the ability to read and listen concurrently is limited by the availability of both general and task-specific processing capacity. The model proposed by Martin predicted that when two tasks - neither of which can be performed perfectly in isolation - are carried out concurrently, the levels of performance of different forms of the secondary task are proportional to their levels of performance in isolation. In this study, 85% of the variance in observed values were captured by this model. Fine-grain analysis revealed only a small drop in reading performance when a target occurred in the listening task, compensated for by an increase in reading rate immediately after the response to that target. Martin concluded that the substantial overall decrement in reading performance was due to the listening process itself, and not to the occurrence of actual detections or responses. In this study, one task could be performed at its original level, while a second one could be concurrently performed at a reduced level.

Other research has investigated the effects of divided attention on primary and secondary task performance. Baker and Madell (1965) investigated academic achieving and underachieving college students' susceptibility to distraction. Twenty-four male freshman college students were divided into achievers and underachievers based on discrepancies between their class GPA and SAT performance. Ability was measured by students' SAT scores for which the mean percentile rank was similar for both groups. However, a significant difference existed between groups for GPA mean percentile rank scores.

Students were required to read two forms of Part II of the Cooperative English Test

and to answer relevant questions based on text content. The distractor task was an extraneous auditory stimulation consisting of segments of the recording "An evening with Mike Nichols and Elaine May." Both achievers and underachievers performed the experimental task under two conditions: one quiet reading, and the other in which students heard the humorous conversations while reading. These conditions were separated by a 10-minute rest period.

The study found no significant differences in average percentile scores between achievers and underachievers in the quiet reading condition. However, significant impairment in performance was found for both achievers and underachievers from the quiet to distraction conditions. Further, a significant interaction was found between subjects and conditions. The distractive stimuli did have a differential effect on subjects, with underachievers suffering greater impairment as a result of distraction than did achievers. A performance decrement of 25% was found for achievers and 51% for underachievers. Therefore, it appears that processing two tasks concurrently is more likely to adversely affect the performance of poorer students, than it is good students.

In another study, Tobias (1973) used a dual-task paradigm to investigate the effects of distraction on students' performance. In this study, students learned the content of an instructional program while simultaneously memorizing nonsense syllables. Students were randomly assigned to the instructional program under either distracted or neutral conditions; and to either a constructed response mode with feedback, or a reading condition. Students who were in the distraction condition, were required to memorize and recall 35 consonant-vowel-consonant (CVC) syllables while working on a text describing

the diagnosis of myocardial infarction. The study found that distraction did not affect student achievement, however, it did increase the time students' spent on the program. Students who were in the constructed response condition attained higher achievement on posttest. In this study, processing primary and secondary tasks did not adversely affect student achievement. Students' recalled 85% of the trigrams correctly while on the program, and 81% following posttest. Tobias (1973) concluded that students were able to process both the primary and secondary task without impaired comprehension of either task.

The majority of research that has used a dual-task paradigm, has focused on the differential allocation of attention to primary and secondary tasks to investigate models of attention allocation. Measures of attention commonly used in this research have been reading rate and secondary task response time. Studies have been inconclusive about the degree to which processing two simultaneous tasks interferes with student learning. It appears that when tasks that require controlled processing, that is, conscious, effortful processing of information are performed concurrently, interference is more likely than for tasks that can be performed under automatic processing, that is, without conscious effort. Further, when one task can be performed using automatic processes and the other demands controlled processing, more attention will be available for the more demanding task, resulting in less interference. The structure of the tasks can also influence the degree to which they can be performed simultaneously, without interference. When students are required to process information using the same sensory modality (i.e., two auditory tasks), interference is more likely than when the tasks require two different

sensory modalities (i.e., reading and listening). Further, the achievement of poor compared to good students is more likely to be affected when students are required to attend to two tasks.

Tobias (1973) proposed that interest/motivation may contribute to the degree to which performance is impaired by primary and secondary task performance. Students in the Tobias (1973) study may have been more interested in the text than the distractor task, resulting in more focused attention to text content and little interference by the distractor task. Further, the increased reading time by students in the experimental condition may be an indication that students moved back and forth between the two tasks (i.e., serial processing) resulting in little interference by either. The secondary task comedy text used by Baker and Madell (1965) may have held higher interest value for students than did the primary text, resulting in increased attention being allocated to this task. Another major difference between the Baker and Madell and Tobias studies, was that Baker and Madell required students to simultaneously read and listen, whereas Tobias presented both tasks as reading tasks. According to a structural interpretation, more interference would be expected in the Tobias study. One possible explanation for the finding of no interference by either task in this study, may be the extra time students took to process the primary text. This additional time may have minimized the degree to which the secondary task could interfere with their comprehension because they were able to move freely back and forth between tasks.

Susceptibility to Distraction

Several research studies have investigated the effects of studying while listening to

background music. These studies have found both significant improvement and significant impairment of students' performance under conditions of distraction.

Some researchers have suggested that the effect of music on studying depends on the type of music (rock vs. easy-listening) or listener preference (Burton, 1986; Etaugh & Michaels, 1975; Fogelson, 1973; Hilliard & Tolin, 1979). Wolfe (1982) suggested that the facilitative effects of music found in college age students may be due to these students' increased exposure to music, and their greater ability to adapt to repetitive auditory stimulation. Mehrabian, (1976) proposed that music can produce overarousal, depending on its information-load characteristics (e.g., loudness, variety, complexity, and tonal range). According to him, this overarousal causes an overstimulation of attentional processes and interferes with concentration. It has also been proposed that students' study habits can mediate the effect of music on learning. Etaugh & Ptasnik (1982) found that subjects who seldom study to background music demonstrated greater comprehension when learning in silence. Alternatively, those who frequently studied with music performed better in the presence of music.

Fogelson (1973) investigated the effect of music as a distractor on eighth grade students' reading test performance. In this study, 14 eighth grade students were divided according to their Stanford Binet IQ scores into groups of bright/no music; bright/with music; nonbright/no music; and nonbright/with music. Students completed a 55-minute reading test, comprised of 80 questions taken from the Iowa Tests of Basic Skills, Test R, Form 4. Students who were assigned to the music conditions completed the test while listening to popular music.

The study found that bright students who did not listen to music, outperformed those bright students who did listen to music. Further, students assigned to the nonbright without music condition outperformed those nonbright students who did listen to music. Combined means of students with and without music revealed that music acted as a distractor to students while taking the reading test. Fogelson (1973) concluded that listening to music during test-taking adversely affected the reading test performance of students, that student ability interacted significantly with reading performance, and playing music during test-taking had a greater effect on nonbright students than it did on bright students.

Another line of research has investigated vigilance performance by subjects while listening to music. These studies have reported significant improvement under variable as opposed to constant background stimulation such as music (Davenport, 1972; Tarriere &Wisner, 1962; Ware, Kowal, & Baker, 1964; Wokoun, 1963). Corhan and Gounard (1976) investigated the effects of different types of music on visual vigilance and concluded that "vigilance performance is best when background stimulation is discontinuous and contains elements of uncertainty, as in rock music, which is more diversified, vigorous, and changeable than easy-listening music."

Other research has challenged this conclusion, suggesting that familiarity is more important in determining students' performance on vigilance tasks than are the properties of discontinuity, rigor, and uncertainty (Wolfe & Weiner, 1972). A study by Fontaine and Schwalm (1979) investigated the effects of familiarity of music on vigilance performance. In this study, 35 college students were randomly assigned to either familiar

rock; unfamiliar rock; familiar easy-listening; unfamiliar easy-listening; or no music conditions.

Subjects participated in a vigilance task that lasted for 55 minutes. Music was played during the last 45 minutes of this session. The first 10 minutes were used for subjects to practice the task and to obtain baseline EKG levels for each subject. The vigilance task included the presentation of 1100 stimuli (400-msec. flashes of a 380-ml light bulb) of which approximately 110 were signals (flashes or 600 msec; total of 990 at 400 msec.). Subjects were instructed to press a response button each time they detected a signal. Stimuli, signals, and subjects' responses were all automatically recorded by an Esterline Angus Model 8920A Operations Recorder. Independent measures were type and familiarity of music, and dependent measures were heart rate, in beats per minute, and percent detections (hits).

The study found a significant main effect for familiarity of music, however no main effect for type of music on subjects' level of arousal was found. Subjects who listened to familiar music displayed significantly higher levels of arousal than those who listened to non-familiar music. Further, those subjects who listened to non-familiar music displayed significantly higher levels of arousal than subjects who did not listen to music at all. A significant main effect for familiarity, but not type of music on over-all percent detections was found. Over-all percent detections were significantly higher for subjects who listened to familiar music than they were for subjects who listened to unfamiliar music. Further, over time the percentage of detections decreased for subjects who listened to unfamiliar or no music, but did not decrease for those who listened to familiar

music. Fontaine and Schwalm (1979) concluded that familiar music significantly increased arousal and over-all percent detections on a vigilance task, as well as mitigating the vigilance decrement. It appears that familiar music is less likely to divert student attention and more likely to cause them to resist distraction by the music, resulting in increased performance on the vigilance task.

Hilliard and Tolin (1979) assessed the effect of variation in familiarity of background music on reading comprehension scores using an experimental manipulation of familiarity. The study investigated the effect of test difficulty, familiarity with music and music selection. Sixty-four subjects were randomly assigned to eight groups and instructed to listen to music for 15 minutes and told that further instructions would be given at the end of that period. They listened through headphones to one of two tape recorded 3-min. selections. At the end of this period, subjects were given 12 minutes to complete a section of the Sequential Tests of Educational Progress that included an easy and difficult reading comprehension test, each consisting of 12 multiple-choice questions. During the test, each subject repeatedly heard, through headphones, one of the two music selections. In the familiar music condition, subjects' heard the selection that had been presented earlier, while in the unfamiliar condition they heard the other section.

This study found no significant differences between music familiarity and task difficulty. However, those subjects who completed a comprehension test while listening to familiar background music, had significantly higher comprehension scores, compared to subjects who completed a comprehension test while listening to unfamiliar music.

In another study, the effects of studying with music vs. studying in silence were

investigated in conjunction with the effects of post-study relaxation vs. activity, that is, reading unrelated material (Etaugh & Ptasnik, 1982). The study predicted that subjects who seldom study to music would perform best after studying in silence, while those who frequently study to music would perform best after studying to music. It was further predicted that post-study relaxation would lead to better performance than would post-study activity.

Forty college students were randomly assigned to either a music-relaxation; music-activity; silence-relaxation; or silence-activity condition. Subjects in the music condition were asked to bring to the session a record album to which they would choose to listen to music while studying. Subjects studied for 10 minutes from a passage taken from a Law School Admissions Test preparation booklet. This was followed by a 10 minute post-study interval during which subjects either lay on the floor, closed their eyes, and concentrated on relaxing each part of their body, or read an unrelated article from Newsweek. Subjects then answered five multiple-choice questions based on the passage they had read, and responded to a question that asked them how frequently they studied while listening to music.

The study found significant main effects for both study condition and post-study condition. Subjects in the post-study relaxation condition did better than those subjects who were in the activity condition. Subjects who were in the silence condition outperformed those subjects who listened to music; however, this difference held only for those subjects who reported that they seldom studied to music. Subjects who reported that they seldom studied to music performed significantly better in the silent condition

than they did when they listened to music. Alternatively, subjects who reported studying frequently to music, performed better while listening to music than they did during silence. However, this difference did not reach significance.

Kiger (1989) investigated the effects of music information-load on adolescents' reading comprehension while controlling for prior background music/study habits. The study hypothesized that reading comprehension would be best when material was learned in silence, moderate when learned with low information-load background music, and lowest in the presence of high information-load music.

Subjects were randomly selected from a 10th grade class (N=133) and assigned to either silence; low information-load; or high information-load conditions. Subjects' reading ability was matched according to the California Testing Basic Skills Test. The reading passage was a 1450-word passage on Japanese history, scored at the 10th grade reading level. Ten minute selections of music via audiocassette tape consisted of either low information-load that was a highly repetitive, synthesizer piece with a narrow tonal range, or high information-load, a rhythmically varied, highly dynamic piece. Comprehension was measured by a 20-item true-false and multiple-choice test based on the passage. Subjects were also asked if they never, occasionally, or always studied with background music. Subjects in each condition read the passage for 10 minutes, followed by a 5-minute period in which they read materials they had brought to the experiment. Subjects then completed the comprehension test.

The study found that subjects who were in the low information-load condition demonstrated significantly higher reading comprehension scores than did subjects who

were in the silent or high information-load conditions. Kiger (1989) proposed two explanations for these findings. The first explanation is based on Broadbent's (1958) selection filter model of attention that contends that information is actively blocked early in processing when it might interfere with higher-order processing. According to Kiger, students in the high information-load condition had to contend with many stimuli competing for attention at one time resulting in interference and compromised performance. Alternatively, consolant rhythms and melody of the low information-load condition diverted less attention and allowed for greater comprehension of the reading task. A second explanation, involved the arousal affects of music. Kiger proposed that unfamiliar, high information-load music may produce tension and anxiety in the listener seriously impairing students' performance on complex tasks requiring concentration. Further, students who experienced silence while reading may have experienced subthreshold arousal that impaired their performance. Kiger concluded that slow, soft, and repetitive (low information-load) music lowers arousal and facilitates performance. Thus, optimal conditions for learning would be pairing low-load music with complex, valued tasks and high-load music with simple, routine jobs. It appears that the high information-load music with its' varied, high dynamic characteristics may have been of greater interest to students than the low information-load music. Thus, students' attention may have been diverted to music causing them to resist distraction by the reading comprehension task and impairing their performance on this task.

Interest, Attention and Learning. Several early theorists have proposed that attention is spontaneously allocated to interesting information. William James (1890) was the first

to suggest that human beings control the stimuli they process, and therefore create vastly different informational systems. According to him, reality depends on which aspects of the environment the individual chooses to attend to, through their senses. James (1890/1950, p.402) viewed interest as directing attention, stating "my experience is what I agree to attend to." Dewey (1913) stated, "attention flies to that which is of interest." Berlyne (1960) proposed that spontaneous attention is attracted by certain physical properties of the environment, such as novelty, complexity, or significance. Izard (1977) who viewed interest-excitement to be the basis of intrinsically motivated behavior, proposed that interest is involved whenever an individual orients toward an object. He suggested that interest plays an important role in the amplification and direction of attention, that it can activate many types of investigative or manipulative behaviors, as well as being instrumental in the regulation of a variety of experiences and behaviors.

James (1890/1950) divided interest into two types: selective and momentary. Momentary interest is impulsive or habitual; selective interest is willed or effortful, and allows an individual to hold an object in mind until it becomes clear and distinct. This distinction between selective and momentary interest is synonymous with the distinction made between selective and non-selective attention. The selective model of attention (controlled processing) assumes that attention will be allocated in a conscious, effortful manner; whereas according to the non-selective model (automatic processing), attention allocation is unconscious and effortless.

Psychic energy has often been linked to attention (Csikszentmihalyi, 1975, 1978; Hoffman, Nelson, & Houck, 1983; Kahneman, 1973). Csikszentmihalyi (1988) proposed

that interest must explain why an individual's psychic energy (attention) is attracted to a domain. He defined interest in terms of an individual's acute curiosity about a particular aspect of a domain, suggesting that some individuals may be born with an unusual sensitivity to some domain of experience; a sensitivity that allows them to become very responsive to ranges of stimulations that other people cannot perceive. Csikszentmihalyi (1988) suggested a relationship between psychic energy (attention) and creativity. According to him, creativity comprises four components: interest, perseverance, dissatisfaction, and social context. Perseverance entails the expenditure of a great deal of psychic energy because an individual must invest an inordinate amount of attention in the task at hand. He cites Roe (1946), in his proposition that creative persons are those individuals who devote more hours to thinking about their ideas. He further suggested that it is intrinsic motivation that keeps some individuals concentrating on a domain, while others waver in their interest and dilute the focus of their psychic energy. He cites Amabile (1983) in support of his proposal that creative people are those who enjoy what they are doing for its own sake, finding in the process of discovery itself rewards as powerful as those other people have to seek outside their work. Csikszentmihalyi (1985) suggested that those individuals for whom processing information is rewarding, will do more of it. According to him, dissatisfaction stems from an individual's cognitive and emotional needs. He proposed that creative persons maintain unusual flexibility in dealing with ideas and materials, are dissatisfied with their state of knowledge, and motivated to search for alternatives, while being able to delay closure. He also addressed the role of social context in creativity, in his suggestion that

the consensus of a critical segment of society defines what is or is not creative. Further, he proposed that for creative ideas to be realized, they must be supported by the social milieu.

Csikszentmihalyi (1988) argued that psychic energy (attention) is the common denominator in creating a synthesis between affect, motivation, and cognition. He explained the role of attention in cognitive processing, in his suggestion that feelings, desires, and thoughts must be represented as information in consciousness in order to make a difference to a person's subjective experience or behavior. He further proposed, that because feelings, desires, and thoughts complete for space within a limited capacity system, it is attention that causes information to be actualized. This relationship between emotion, attention, and cognition was also proposed by Mishkin and Appenzellar (1987). Csikszentmihalyi (1988) further suggested that because the primary goal of consciousness is internal organization, information that conflicts with prior goals established by affects, motives, or thoughts will disrupt this organization. He defined this disorder in consciousness as 'psychic entropy', and suggested that it reduces an individual's predictability and ability to do work. This state results in negative affects like sadness, loneliness, anger, or despair; lack of motivation such as withdrawal, disinterest, listlessness, or alienation; and lack of cognitive efficiency such as confusion, lack of concentration, and distractibility. Alternatively, he suggested that when information is congruent with previously established goals, a state of 'psychic negentropy' will exist. This state is defined by joy, happiness, satisfaction, clarity or sense of achievement.

Deci (1992) also proposed that interest organizes attention and activity. He suggested

that when an individual experiences freedom to do, attention is directed toward activities or objects of interest and the energy necessary for action is readily available. Hidi (1990) further proposed that interest is an energetic feature of the organism that effects learning via it's influence on attention. According to Hidi, this process is controlled by two factors. These factors were referred to by Iran-Nejad and Chissom, (1988) and by Iran-Nejad and Cecil (1992), as active and dynamic control. Active control refers to the allocation of conscious, selective attention; whereas dynamic control is associated with the affective responses of anxiety or excitement. Hidi (1990) suggested that learning that results from interest may be under dynamic control, and may elicit spontaneous rather than conscious, selective allocation of attention. Hidi (1990) has questioned the assumption often made, that interest results in increased attention. She referred to Kahnemann's (1973) in her suggestion that interest causes spontaneous rather than conscious selective allocation of attention and therefore, might result in learning that requires less cognitive capacity and less cognitive effort.

The Selective Attention Model. Research studies (Anderson, 1982; Reynolds & Anderson, 1982; and Reynolds, Standiford, & Anderson, 1979) that have investigated the effect of importance on student attention have predicted that attentional factors would result in longer reading and secondary task reaction times. This prediction was based on the selective attention model that proposed that three steps are involved in the selective allocation of attention: text elements are processed at some minimal level and graded for importance; extra attention is devoted to elements in proportion to their importance; because of extra attention, or a process supported by the extra attention, important text

elements are learned better than other elements. According to the selective attention model (Anderson, 1982) questions inserted in text will cause students to focus their attention on those segments containing information from the questioned category. Alternatively, nonselective attention will result in a nonspecific heightening of vigilance by a student.

Recently, a number of studies have assumed that attentional factors play an important role in interests' effect on learning (Hidi, 1990). Anderson (1982) and Anderson, Mason, & Shirey (1984) predicted that attentional factors would result in longer reading and secondary task reaction times for interesting text segments. This prediction was based on the selective attention model that was extended by Anderson and colleagues to explain the facilitative effect of interesting information on learning. They proposed that interesting information resulted in increased learning because of extra attention paid to it. The assumption was that the same processes were required for both interesting and important information. Later research (Hidi & Baird, 1983, 1986) has challenged this assumption by showing independent effects of interest and importance. Research that has used the selective attention model, and reading and secondary tasks reaction times as measures of attention will be reported below.

Importance and Attention. Research (Johnson, 1970; Newman, 1939) that has focused on the role of importance in learning text elements, has often found that important text elements are better learned and recalled than are less important elements. Text elements can attain importance because of their relationship to instructions or objectives stated prior to reading (Ausubel, 1960; Rothkopf & Kaplan, 1972), their relevance to a reader's

perspective or point of view (Anderson & Pichert, 1978; Pichert & Anderson, 1977), cues inserted into the text by the author (Rothkopf, 1966; Reynolds, Standiford, & Anderson, 1979), the structure of the text in which they occur (Kintsch & van Dijk, 1978; vanDijk & Kintsch, 1983), their representation of conceptual or relational links between text elements and ideas (Frase, 1969), or their interest to the reader (Asher, 1980).

Reynolds, Standiford, and Anderson (1979) investigated the effect of inserted questions on student attention. Independent groups of students read an oceanography text presented on computer, which recorded reading times for small segments of the text. Three types of questions were inserted into text: those that could be answered with a technical term, a proper name, or a number. Students moved from one text segment to the next by pressing a key, which caused the segment on the screen to be erased and the next one to appear. Attention was measured by the time it took a student to read each segment, determined by key presses.

The study found that students who were required to answer inserted questions, performed better than control students on posttest items requiring information from the same category as earlier questions, even when the specific content differed. Further, students in the questioned group were found to spend significantly more time than controls, reading text segments that discussed the type of information addressed by the questions. Reynolds et. al. (1979) concluded that the finding of increased reading time by students supported the selective attention hypothesis, that is, students' devoted more attention to further processing information that they identified as relevant to the inserted

questions.

Reynolds and Anderson (1982) hypothesized that inserting questions in text would facilitate student learning due to a change in their allocation of attention. They used the selective attention model to determine whether readers would selectively allocate their attention to those text segments containing information from a questioned category, or whether they would nonselectively increase their attention to most aspects of the text. This study used three measures of attention. The first was the amount of time spent reading text segments. Student reaction time to a secondary task was the second measure; students were instructed to read a primary task, but to depress a key as quickly as they could at the sound of a computer generated tone (secondary task). The third measure, volume of attention was determined by combining reading and reaction times. The study assumed a direct relationship between the amount of attention and the amount of learning, therefore the rate at which the text could be read was controlled for some students. The study hypothesized that restricting the duration of processing would either affect student learning, or that students would compensate by increasing the length of time they took to respond to a secondary task probe.

Students read the passage, which consisted of 48 PLATO-length pages divided into twelve 4-page zones. Four short answer questions per zone comprised 2 of each type, those that could be answered using a technical term, or those that could be answered using a proper name. Half of the questions were used both in the text and posttest, the remaining 24 questions were used only on the posttest. Students were assigned to technical term, proper name, or no question groups. Reading rate was either self or

machine directed. Dependent variables were reading time, secondary task reaction time, and proportion of new and repeated posttest items answered correctly after reading each 4-page zone. Following their reading of each zone, the question groups received a question to which the answer was in the immediately preceding zone. Student answers, reading time for each segment, and secondary task reaction time were recorded by computer. A 5-minute interpolated task, containing the first 40-items from the Wide Range Vocabulary test was also administered. Simple reaction time was a measure of the average time taken to respond to a block of five tone sounds, presented when the student was not reading. The posttest contained 48 questions (24 repeated items and 24 new items).

This study found that inserting questions in text caused readers to selectively attend to information relevant to questions, resulting in increased learning. Student secondary task reaction times were found to be significantly delayed when they read segments containing information relevant to the questions. Further, students who were in the self-paced group demonstrated significantly longer reading times for those text segments that contained information relevant to inserted questions.

Reynolds and Anderson (1982) concluded that these students were utilizing a greater proportion of cognitive capacity while processing question-relevant information. While they concluded that attention does lie on the causal path between questions and learning, the relationship of attention to learning was not clear. When the effect of attention (reading and reaction times) was removed, the variance in student performance on new posttest items due to inserted questions went from a significant, to a small and

nonsignificant amount. For repeated questions, the variance attributed to questions fell to a smaller, but still significant amount. Therefore, learning could not be attributed to the mediating effects of attention. Reynolds and Anderson (1982) concluded that rehearsal was partially responsible for students' learning of the information required by repeated items. This study failed to find a causal link between interest, attention, and learning.

Britton, Glynn, Muth, and Penland (1985) investigated the effect of placing instructional objectives in text on student attention. They hypothesized that learning would be increased due to the increased cognitive capacity (attention) allocated to processing text segments relevant to the objectives, and/or because of increases in the time spent attending to these segments. Attention was measured by secondary task technique, that is, the time taken to release a telegraph key following occasional random clicks. The assumption underlying this measure of attention was that if more cognitive capacity is allocated to processing a text segment, less capacity will be available for responding to the secondary task click, resulting in longer reaction times.

Seventy-two undergraduate students read two texts with the expectation that they would be tested on the content. Twenty-four subjects were randomly assigned to a specific objective condition, a general objective condition, and a no-objective condition. Student performance was measured by reading and reaction time, and free recall. Each student was required to read a practice passage, respond to clicks, and complete a short-answer test on the passage. Students were instructed that reading the information was the primary task, and that they would be tested from time to time on the information they were reading. They were also instructed to respond to a click by lifting their finger off

the key when they heard it, the secondary task.

The study found that instructional objectives increased the recall of objective-relevant content in text. Further, instructional objectives were also found to increase the amount of time students' spent reading the objective-relevant content, as well as the amount of cognitive capacity (attention) they devoted to this content. However, attention which was measured by secondary task response time, was not found to be significantly correlated with recall or reading time. Therefore, a causal link between attention and learning was not established. Britton et. al. (1985) concluded that attention may exert an indirect causal influence, mediated by processes other than those reflected by student reading time.

Studies that have investigated the relationship between importance and attention have established that reading important text elements does result in increased learning by students. However, this research has failed to establish a causal link between importance, attention, and learning. It appears that the measures of attention used in these studies, reading and secondary task reaction times, are not a clear index of attention.

Importance, Interest and Attention. Research that has focused on the role of importance on student attention and learning was challenged by the proposition that childrens' recall of expositions does not show a simple abstractive process, in which important information is selectively recalled and unimportant information is ignored or forgotten (Baird & Hidi, 1984; Hidi & Baird, 1983,1984,1986; Hidi, Baird, & Hildyard, 1982). In a series of studies, Hidi and colleagues found that interestingness of ideas also played a part in determining what children remembered. In a qualitative analysis of recall

protocols, Hidi and Baird (1983,1986) identified several patterns for highly recalled text segments. They found that text segments that contained traditional story elements - including goal-directed activities and human interest factors - were well recalled, even when they were not important to the main points of the text. They further demonstrated that surprise or novel information was highly recalled, particularly when this information had a high imagery value; lists of objects, properties, countries, and quantified information were also well recalled. Wittrock (1986) also addressed the independent effects of interest/motivation on attention, in his proposal that adjunct questions can only facilitate learning when an individual lacks motivation. He stated, "attention can be controlled by the learner as well as by external sources, which can be superfluous when readers are properly attentive and motivated" (p.153).

A number of studies have investigated the degree to which both importance and interest affect student learning. Wade and Adams (1990) examined how interest and importance interact to affect the learning of good and poor readers. Four categories of information were examined: seductive details, main ideas, important factual details, and boring trivia. Forty-eight college students read a text written about Horatio Nelson, that had been previously rated for interest and importance. They completed a written free-recall test, either immediately after or one week following the reading task.

The study found interest to be a better predictor of good and poor readers recall than structural importance. In this study, good readers remembered significantly more than poor readers, however no difference was found in the patterns of recall between these readers. Both good and poor readers demonstrated significantly better recall for seductive

details and main ideas, than they did for uninteresting information. However, details that supported main ideas that had been rated as important but uninteresting, were found to be the least memorable information.

Wade and Schraw (1990) investigated the selective attention strategies used by college students while reading text. They hypothesized that mature readers would allocate extra attention to important but uninteresting parts of a text, and the least attention to unimportant parts (seductive details and boring trivia). The study investigated the relationship between attention allocation and recall of main ideas, seductive details, important factual details, and boring trivia. Students read a text written about Horatio Nelson that had been previously rated for importance and interest. Text sentences were classified according to high interest/low importance and low interest/high importance. The text was presented on computer, which recorded the amount of time each student spent reading an individual sentence before calling up the next sentence. Following this reading, students' completed a written free-recall test.

The study found the greatest recall for seductive details, followed by main ideas, with important factual details being the least well recalled information. While students' spent twice as much time reading important, factual details as they did main ideas or boring trivia, this information was found to be the least memorable. Wade and Schraw concluded that readers may realize that they need to devote extra time to important factual details because they are so difficult to process and remember. Thus, mature readers may allocate their cognitive resources in a strategic manner.

In this study, mature readers also appeared to be strategic in their allocation of time

spent on main ideas and boring trivia, that is, they spent relatively little time on these two types of information. Wade and Schraw proposed that students may be aware that main ideas are more memorable and thus require a minimal amount of attention. They further suggested that information that is uninteresting and unimportant, may be allocated little attention because it does not need to be learned. They suggested that the mature reader first discriminates between important and unimportant information, allocating extra attention only to important information that requires it, thus being highly efficient and strategic. However, readers in this study were found to be far from strategic when it came to seductive details. These details, which were unimportant were found to be the most memorable kind of information; readers spent over 50% more time reading them than they did main ideas. The finding that interest and importance exerted differential effects on students' allocation of attention could be attributed to different motivational orientations elicited by these two types of information. Specifically, interest may have caused students to be intrinsically motivated, whereas importance may have resulted in extrinsic motivation. Further, these differing motivational orientations may elicit different energy sources resulting in more intensive processing of interesting than important information.

In an early study, Garner, Gillingham and White (1989) identified the effect of seductive detail on readers' learning of text. Seductive details are referred to as interesting, but unimportant information presented in text that create situational interest. In this study, children and adults read a three-paragraph text on the topic of differences among insects. Information in the text had been rated for importance and interest. One

half of each age group of readers, read the text with interesting detail while the other half read the text without interesting detail. The study found that recall of important information in text differed by condition for both children and adults. Whereas adults who read the text without the interesting detail recalled an average of 93% of the ideas rated as most important, adults given interesting detail recalled an average of only 43%. Readers who read the interesting detail text, recalled a combination of important and interesting information.

Garner, Alexander, Gillingham, Kulikowich, and Brown (1991) investigated in two experiments the effect of interest on students' learning from text. In experiment one, 48 students were randomly assigned to one of four text conditions. Text written about Stephen Hawking was prepared with either interesting detail presented as an aside in generally interesting text (A); interesting detail presented as an aside in a paragraph in generally uninteresting text(B); interesting detail embedded in a paragraph in generally interesting text(C); and interesting detail embedded in a paragraph in generally uninteresting text(D). Seductive detail appeared in all four text versions. In forms A and B, it was presented as a separate paragraph, whereas in forms C and D it was embedded in a paragraph. All text versions were rated for interest and importance prior to the experiment. Subjects were asked to read one of the text forms and to try to remember the important information in the text. Following their reading they completed three recall measures that asked them to recall really important information, provide a title for the text, and to complete short answer responses to five questions. The study found that interesting detail was highly memorable, and important generalizations were not. Ideas

rated as high interest/low importance and as moderate interest/moderate importance were frequently recalled, whereas ideas rated as low interest/high importance were less frequently recalled. Interest was found to be a better predictor of recall than importance regardless of whether or not interesting ideas support important ideas in text.

In a second study, 228 undergraduate students were assigned to one of the same four conditions. Subjects were given a 25-item multiple choice pretest to determine their knowledge about physics prior to their reading of text. The study confirmed the findings of experiment one. A significant group by interestingness interaction found that subjects with high knowledge consistently answered more questions correctly, than did the low knowledge group. However, this difference lessened when subjects read interesting text. High knowledge subjects gave more responses to questions when they read uninteresting compared to interesting text. However, low knowledge subjects gave more responses when they read interesting than noninteresting text. Garner, et. al. (1991) suggested that the results of these studies provide evidence for the effect of seductive details on learning. They concluded that interesting detail is highly memorable to readers while important generalizations are less memorable.

McLaren and Hidi (1991) also investigated the relationship of importance and interest on students' attention. They examined those factors that affect reading times of expository text sentences. In this study, 42 college students read parallel expository texts: one containing interesting, and the other less interesting material. Interesting, but unimportant anecdotes (seductive details) were included in both texts. A sentence-by-sentence rating of interestingness and textual importance was done by a peer group of

students using a 4-point scale (1=not at all interesting/important; 4=very interesting/important).

Data were collected in two sessions. During the first session, students were required to read one of the texts, presented on computer screen, one sentence at a time. Reading times were recorded by computer. Following this reading, students studied a printed version of the text for several minutes. One week later, each student was given a selective recall task in which they were required to write down the information they found to be most memorable from their previous reading. They were also required to compose a title for the text they had read. The Sentence Verification Technique (Royer, Hastings, & Hook, 1979) was administered to test student comprehension and ability to use information learned during their reading. This technique involved the development of three additional sentences for every original sentence; including a paraphrase (same meaning/different structure), modified (different meaning/similar structure), and distractor (different meaning and structure) sentence. Students were then presented with one of the four types of sentences (randomly chosen) for each sentence they had originally read. These 31 sentences were presented in the same manner as the original text, and response times recorded by computer. Students were required to classify information in the sentences as old or new, and to report whether they thought they had read them the previous week. The study analyzed the extent to which text characteristics predicted sentence reading times. Sentence length, measured by number of letters, was found to be a highly significant predictor of reading time. Topic transitional sentences (topic switches and seductive details) took students 35% longer to read, a significant

difference. Neither interest nor importance were found to be significant predictors of reading time.

McLaren and Hidi concluded that the relationship between attention, interest, and importance was confounded by sharp transitions in the text. They proposed that the finding that topical transitions affected reading time, indicates that reading time is not a good measure of attention, due to interest. They further proposed that a content analysis is required to interpret reading time. Session two data were analyzed to explore the effect of manipulating text interestingness, and the effect of seductive details in more or less interesting texts. Inter-text average response time was not affected by these factors. Response time appeared to depend on sentence length and to a lesser degree on transition to a new topic. The Royer technique was used to attain student accuracy in identifying old and new sentences. The number of hits (correct identification of old or similar material) and the number of rejections (correct identification of new and different material) were added to attain an accuracy score. No differences were found between texts in terms of accuracy.

The study further analyzed the relationship between sentence interest, comprehension, and use. Sentences were divided by interest ratings, and the top and bottom quarter sentences were assigned to high and low interest categories. Students demonstrated higher average response times (session two reading and decision times) for most interesting, compared to less interesting sentences. Students were more than 20% slower, on average, while responding to more interesting sentences in both texts, a significant difference. More interesting sentences appeared to cause students to become more involved and to

try harder to be accurate. However, their accuracy did not improve significantly as a result of this additional processing time.

Qualitative analysis of reading data revealed differences between texts. Students who read the high interest text recalled significantly more higher level scientific physics information than students who read the low interest text (45% vs. 15%). Further, 20 - 25% of subjects recalled seductive details as the most memorable ideas, that is, the most interesting/important ideas.

Students who read the interesting text were found to produce more integrated and better focused titles than did those who read the less interesting text. Those who read the less interesting text tended to vary widely in their focus and to focus on simple statements. Thus, it appears that interest may have focused students' attention and influenced the level at which they processed text. While the study failed to support differences in reading, response times, and accuracy due to interest; the finding that interest resulted in greater integration and focus by students, supports previous research (Schiefele, 1992) that concluded that interest produced qualitative differences in student learning. Further, interest appears to have directed students' attention resulting in a more meaningful integration of text.

In two studies, Wade, Schraw, Buxton, and Hayes (1991) investigated the interactive effects of interest and importance on mature readers' selective attention strategies. Study one investigated readers' selective attention strategies and recall of information that varied in interest and importance. Prior to reading a main passage of text, 43 college student participants were presented with a 250-word practice passage, on computer, one

sentence at a time. While reading the main passage, subjects' reading times were recorded to determine the amount of attention devoted to each passage. Following this reading, students' completed a five minute interpolated task and answered a written free recall test.

The study demonstrated greater recall for more interesting, unimportant information. A two-way interaction between importance and interest indicated that students' recalled information of high interest, low importance; high interest, high importance; low interest, low importance; and low interest, high importance in descending order. Students also tended to devote more time to both important and uninteresting information. More study time was devoted to low interest, highly important information, followed by information of low interest, low importance. The least amount of time was allotted to high importance, high interest information. Therefore, readers in this study appeared to require less attention when processing high interest information.

Students were found to be more likely to recall interesting than uninteresting information, with seductive details being the more readily remembered, and important factual details the least likely to be remembered. Readers spent the most time on important, but uninteresting parts of the text, an indication that skilled readers devote more time to important, difficult to remember information. However, little time was devoted to important, interesting material. Wade et. al (1991) concluded that mature readers appear to be highly efficient and strategic in their ability to discriminate between important and unimportant information. However, when reading seductive details, these readers were neither efficient nor strategic, and devoted a great deal of time to reading

these passages.

In a second study Wade et. al (1991) attempted to understand the relationship between selective attention and recall, for interesting and important information. Twenty-two college students were first tested to ascertain whether their recall performance was similar to that of students in the first study. Students were presented with text in manuscript form and required to recall the information read. The study found that with the exception of seductive details, readers used the criterion of importance and difficulty to guide their decisions about the allocation of time and effort. Students judged factual details to be both important and difficult to learn and reported spending a good deal of time on this information. This time was spent in conscious, effortful, and goal-directed actions. However, little time was spent on main ideas that were easy to remember, due to interest and prior knowledge. Students also spent little time on boring trivia, an indication that they did not think this information was important to know. Attention to seductive details appeared to be less conscious. Sentences that had emotional interest to these readers resulted in them processing information quickly and easily, although students were found to linger over the information.

Wade et. al. (1991) concluded that background experience and knowledge, as well as personal relatedness, influenced readers' interest in a topic. These factors also influenced student comprehension, visualization, integration, and recall of information in a text segment. Further, the ease with which information was processed appeared to influence student interest in that information. Readers devoted extra time and effort to information they considered to be both important and difficult to remember. Students'

judged main ideas to be important but highly memorable, and boring trivia to be unimportant information, not worth additional time and effort. The study found that skilled readers, who were usually strategic were seduced by highly interesting but unimportant information. They devoted 50% more time to this kind of information than to main ideas or boring trivia. Further, they were not generally aware of spending more time on seductive details. While the most time was spent reading important factual details, these were the least well remembered. However, compared to important factual details, readers spent less time on seductive details, but these were by far the most memorable type of information. Relatively little time was spent on main ideas, which were also fairly well recalled.

Wade et. al. (1991) concluded that there are two different kinds of attention: concentrated effort, and attention devoted to interesting information, whether important or not. They proposed that concentrated effort, which entails the use of effective study strategies is required to learn important, difficult, uninteresting text material, such as important factual details. However, when attention is devoted to interesting information, actions taken require little effort and are less conscious. In this study, reading interesting information caused the reader to linger over text, picturing scenes that come to mind, while relating information to background knowledge and experience. Thus, interest appeared to facilitate students' use of prior knowledge. Seductive details, however, tended to direct the readers' attention away from important, hard to learn material.

Interest and Attention. Several research studies have investigated the effect of interest on student allocation of attention. In two studies, Anderson (1982) required fourth grade

students to read on a computer screen, sentences previously rated for interest, and to rate each sentence according to it's interest to them. The length of time taken to read each sentence was a measure of the duration of attention. Students were also required to press a key on the computer keyset, as soon as they heard a computer generated tone (secondary task). The time between the onset of the tone and key pressing measured depth of attention.

These studies found that interesting information was better learned by students than was uninteresting information. Interest was found to be positively related to student attention, measured by both duration and depth; that is, those students who were interested in text displayed both longer reading and secondary task response times than did students who were uninterested. The studies found that student recall of text elements was positively related to their allocation of attention. However, when the effects of attention were statistically removed from the analysis, the association between interest and recall remained unaffected. Therefore, in these studies attention was not shown to be a mediating variable between student interest and learning.

Anderson, Mason, and Shirey (1984) predicted longer reading and secondary task reaction times for interesting text, due to attention. Third and fourth grade children were required to read a series of unrelated sentences that had been previously rated for interest by an equivalent group of subjects. Attention was measured by reading and reaction times. Reading time was the amount of time subjects' spent reading sentences presented individually on a computer screen before pressing the space bar to call up the next sentence. Reaction times were obtained by recording the amount of time subjects took

to respond to a tone that sounded periodically in the earphones they were wearing. Following their reading, subjects were given a cued recall test on the materials read. The study found that third and fourth grade children recalled significantly more information from sentences rated for interest, than they did for less interesting sentences. However, attention was not found to be a mediating variable between interest and learning.

Some studies that have investigated the causal relationship between interest, attention, and learning have demonstrated decreased reading times by students for interesting information. Kintsch, Kozminsky, Streby, McKoon, and Keenan (1975) compared reading times and memory performance on science and history passages. The study found that history passages took significantly less time to read, than did science passages. The assumption of this study was that history was the more interesting topic. Graesser and Riha (1984) also found decreased reading times with both higher sentence interestingness and higher passage interestingness.

Shirey and Reynolds (1988) investigated the effect of interest on attention and learning. Twenty-five college students read 72 sentences previously rated for interest, on computer terminals. A 13-segment practice passage was used to attain a baseline reading rate for students. Measures of attention were: sentence reading time and secondary task reaction time, that is, the time taken for students to respond to a computer generated tone by pressing a key on the computer keyset. Learning was measured by the percentage of sentences recalled on a cued recall test. Students read the first 24 sentences of text during which their reaction time to the secondary task was recorded. Following their reading, students completed an oral recall test. The first two content words of each sentence (noun

and its modifier) were given to cue their recall. Following this, students completed the remaining sentences while again responding to the secondary task. A recall test, comprising 72 sentences was then administered. Students then rated the interest level of each sentence. Sentence recall was a measure of the number of words reproduced for each sentence, including verbatim and synonymous words and phrases. The total number of words recalled were averaged to provide a measure of proportional sentence recall.

Dependent variables in this study were sentence recall, learning, reading time per sentence, and secondary task reaction time. A connectivity rating was also attained for each sentence, and this was a measure of the semantic connectivity between the subject noun phrase cue in the recall test, and the remainder of the sentence. Other variables were a Fry readability rating, number of content words, block presentation, and interest.

The relationship between interest and learning was tested by regression analysis. Interest was found to be a highly significant predictor of subject recall, with high interest sentences being better recalled than low interest sentences. A regression analysis using reading time as the dependent variable and connectivity rating, readability, number of content words, presentation order, and interest as independent variables, revealed that students' spent less time on more difficult sentences. Longer reading times were associated with sentences in the later block orders. Sentences with high connectivity ratings were read faster. Further, a significant negative relationship was found between interest and reading time, with more interesting sentences being read faster than less interesting ones. A regression analysis that used the same independent variables and secondary task reaction time as a dependent variable, found significant effects of interest

on student secondary task reaction times. Faster reaction times were associated with more interesting sentences.

In this study, adult readers were found to allocate fewer cognitive resources to information they rated as interesting, but they recalled this information much better. This finding refutes that of Anderson et al. (1984), of greater allocation of attention, and increased learning by young readers exposed to interesting information. The study did not support the hypothesis that learning occurs as a result of increased attention. The authors concluded that two forms of learning take place in the mature reader: task-relevant learning that becomes effective when a strategy involving attention as a mediating factor is engaged, and internally driven learning that occurs without extra effort on the part of the learner.

Shirey (1992) has attempted to explain the contradictory findings of these studies. He proposed that mature skilled readers are more effective and efficient in their allocation of attention, than are younger readers. He further suggested that mature readers can successfully allocate cognitive resources to information that is relevant to task related or external criteria, such as objectives and adjunct questions. However, they do not allocate extra attention to information made important by criteria internal to the reader, that is, interest. Shirey (1992) proposed that to understand the effects of interest on attention and learning, external factors, such as task demands and text characteristics; and internal factors such as interest, cultural relevance, and background knowledge must be considered, together with the developmental level of the reader. He suggested that the readers' ability to determine the parameters of the reading task, that is, which

information is interesting or important, and to evaluate the effectiveness of these strategies is also important. Shirey further proposed that mature readers appear to have an externally driven learning - that is learning related to the text and the task - that can be explained by the selective attention model; and an internally driven learning that occurs without extra effort or input from interest on the part of the reader, learning perhaps supported by a more elaborate schematic understanding.

Research studies that have investigated the link between importance, attention, and learning; and interest, attention, and learning, have failed to establish a causal link between attention and learning. In fact, conflicting evidence has been found for the selective attention model that suggests increased reading and reaction times for important/interesting information. It appears that reading and reaction times have not been adequate measures of student attention in these studies, therefore a clearer index of attention is required to establish a link between interest, attention, and learning.

Medical Education

Integrating Basic and Clinical Science

The role of basic science in medical school curricula has been questioned (Flexner, 1925). Colleges of Medicine have developed their curricula based on two approaches to the teaching of basic science. One has been to present basic science topics prior to clinical instruction, so that students will develop a strong foundation in the sciences before encountering patient problems (traditional curriculum). Another, has been to develop clinically integrated curricula within which instruction is directed by the presentation of clinically meaningful problems that allow students to integrate basic and

clinical science information (problem-based learning curriculum).

The efficacy of these approaches to teaching medical students has been explored by several research studies. Balla (1980) found evidence to support the proposal that students' experience difficulty in applying basic science when taught in the traditional curriculum. In another study, Patel, Groen, and Scott (1988) found that when basic science information was presented outside of the clinical context in which it was to be used, students' failed to establish the necessary link between basic and clinical science domains.

Several studies have explored the reasoning processes used by physicians and students in applying basic science information to clinical problems. These studies (Patel & Groen, 1986; Patel, Evans, & Chawla, 1987; Patel, Groen & Scott, 1988) concluded that both expert physicians and medical students made very little accurate use of basic science concepts when reasoning about medical problems. Based on this finding, these authors suggested that reasoning using basic science concepts occurs independently of reasoning about clinical concepts.

Patel, Evans and Groen (1989) suggested that basic science and clinical knowledge may not share common domains, but may be connected only at various discrete points. They further asserted that it is important to identify where and how these two independent domains interact during the learning of new material. In an investigation of the relationship between comprehension and problem solving, Patel, Groen and Scott (1988) presented medical students with basic science material that was immediately followed by a clinical case. Subjects (N=24) were first, second, and fourth year medical

students. Following their reading of a clinical and three related basic science texts, students' recalled in writing the texts and further explained the clinical problem in terms of the basic science information. Students' responses were coded for propositions and relations among propositions. The study found that subjects' recall of basic science texts was poor. First year students' found the texts too technical, second year students' recalled selectively only information they had recently encountered, and fourth year students did not focus on the basic science information. The study further found recall of the clinical text to be a function of clinical experience. However, no correlation between the basic science texts and experience was found. First year students' explained the clinical problem in terms of common-sense inferences from experiential knowledge, whereas, second year students made extensive use of basic science knowledge though their inferences were frequently incorrect and inconsistent. Fourth year students made more use of basic science explanations, however, these explanations were frequently inconsistent.

In a subsequent study, Patel, Evans & Chawla (1987) asked subjects (N=24) to recall and explain cases when basic science information was provided following presentation of the clinical problem. This resulted in more effective use of basic science by both second and fourth year students. However, first year students were not able to use basic science information any more effectively when it was given following the clinical problem, than they were when it was presented before the clinical problem. Thus, it appears that for these medical students, the effective use of clinical information was dependent on their having a knowledge of the basic science topics presented to them.

Balla, Biggs, Gibson, and Chang (1990) investigated the relationship between anatomical concepts held by medical students and their clinical application in a traditional curriculum. Data for this study was collected during two lectures. During the first lecture, students were required to make an anatomical diagnosis of a clinical case presented on video. During lecture two, students' answered an anatomy question on the concept related to the clinical case. Students were asked to write down their diagnosis, and explain how they came to their conclusion within eight minutes. They were then given 10 minutes to explain the basic science mechanisms underlying their clinical diagnosis. The study found no significant relationship between students' knowledge of anatomy and their ability to make the correct diagnosis. The authors concluded that the learning of basic science and clinical information takes place more or less independently, especially when taught in a traditional curriculum. It appears that students who are taught in a traditional curriculum, need instruction on the relationship between basic and clinical science information if they are to be expected to create links between these two domains.

Patel, Evans and Groen (1989) have suggested that an instructional approach that teaches basic science thoroughly and then proceeds to build the connections to the clinical domain, may be more likely to result in students' integrating basic and clinical science. They further suggested, that teaching basic science by using a clinically integrated approach may result in students' acquiring two initially incomplete and ill-formed knowledge domains. This could in turn result in students' reasoning with clinical information being supported by explanations based on superficial scientific theory and not a knowledge of basic science topics.

The findings of the above research indicate that students may experience difficulty identifying the connections between clinical and basic science information independently of instructional objectives. It has been suggested that students should be provided with a link between clinical and basic science information during early knowledge acquisition (Bordage & Lemieux, 1991). Therefore, when presenting basic science information to students within a clinical context, it may be important for instructors to direct students' attention to those relationships that link clinical signs and symptoms and basic science mechanisms.

Curriculum Approaches

In response to the suggestion that traditional curricula with two years of basic science lectures followed by two years of clinical science, were dehumanizing, demotivating, inefficient, and ineffective, some medical schools have focused on methods of integrating clinical and basic science when instructing medical students. The philosophical approach behind the presentation of basic science information within a clinical context was that learning should be fun, students learn better when they are actively involved and interested in their learning, basic science concepts would be better understood, remembered, and subsequently applied if learned in a clinically relevant manner, and that problem solving and self-directed learning should be promoted in future physicians (Berkson, 1993).

One instructional approach that has often been used is problem-based learning. The major goal of this approach was to make basic science information more interesting than it was in the lecture-driven traditional curriculum by providing students with clinical

cases that would result in a learning experience that was fun (Berkson, 1993). This method of instruction resulted in lectures being deemphasized and students' exploring and discussing simulated patient problems in small groups under the supervision of a tutor (Schmidt, 1993). The assumption underlying this approach was that students will understand the clinical relevance of the information they are expected to learn (Barrows & Tamblyn, 1980). Small groups of students analyzed and explained patient-related events in terms of underlying basic science principles, mechanisms or processes. The tutor directed students' attention to those mechanisms that explained the patient's signs and symptoms. The tools used to identify and learn these mechanisms were: discussion of the problem, and studying relevant resources.

Research studies (Woodward & Ferrier, 1983; Woodward, 1984; West, 1985; Kaufman, 1989; Neufeld & Sibley, 1989; van Hessen & Verwijnen, 1989; Baca, Mennin, Kaufman, & Moore-West, 1990; Saunders, McIntosh, McPherson, & Engle, 1990; Santos-Gomez, Kalishman, Rezler, Skipper, & Mennin 1990; Verwijen, 1990; Goodman, 1991) have compared the performance of students who have participated in a problem-based learning curriculum with that of students from traditional curriculum, based on multiple choice, essay questions, and licensing examinations. These studies have reported no real advantage in knowledge acquisition and retrieval for students' participating in either curriculum. However, as discussed below, other researchers have reported different learning approaches and higher ratings of interest by students who have participated in problem-based learning compared to traditional instruction.

Learning Approaches.

Studies that have investigated the cognitive differences between students' learning approaches (Marton & Saljo, 1976,a,b; Marton, Hounsell, & Entwistle, 1984) have suggested that students' engage either a surface, deep, or strategic approach to tasks. The surface approach was characterized by rote learning and reproduction of information, whereas, the deep approach was characterized by integration of information. The strategic approach was defined as students' attempt to be successful with minimum effort. These authors have suggested that students who employed a surface approach to learning were more likely to focus on the verbatim memorization of facts, and reproduction of those facts. Alternatively, those who employed a deep approach, were found to focus on concepts within a task, and to invest effort in attempts to understanding their meaning and interrelationships.

Coles (1985) reported that the learning approaches of students from problem-based learning programs showed less reproducing at the end of year one than on entry to medical school. Alternatively, students from a traditional curriculum showed a significant shift towards poorer studying approaches: greater reproducing, lower meaning and lower versatility. Coles (1985) suggested that the type of instruction students are exposed to can influence their learning styles. Newble and Clarke (1986) investigated the effect of instruction on students' approaches to learning. In order to explore the relationship between educational context and approaches to learning, they compared students' attending a traditional medical school with those attending a problem-based learning school. Students from the first, third, and sixth years completed the Lancaster

Approaches to Studying Inventory, designed to measure learning approaches. The study found highly significant differences (.001) between problem-based learning and traditional students in terms of their assessment of the extent to which their approach to learning was meaning-oriented (deep), including intrinsic motivation, that is, interest (.001). Alternatively, students from traditional curriculum rated themselves as significantly higher on reproducing orientation (surface) (.001). Therefore, it appears that students who participate in a problem-based learning curriculum are more likely to approach learning using meaning-oriented than reproducing strategies. Further, students from problem-based learning curricula have reported greater interest in learning than did those from a traditional curriculum.

Motivation and Interest

Barrows (1986) has proposed that problem-based learning comprises a variety of educational methods, which can address different educational objectives. While common to all methods is the use of patient problems in the instructional sequence, he suggested that this method has the potential to address a number of objectives important to medical education. These include structuring of knowledge for use in clinical contexts, the development of effective clinical reasoning skills, the development of self-directed learning skills, and increased motivation for learning, that is, interest. He further proposed that the perceived relevance of work with medical problems, and the challenge of solving problems provided strong motivation for learning (Barrows, 1986). It has been suggested that this motivation increases students' internal drive for learning, and facilitates the extraction and understanding of information (Berner, Hamilton & Best,

1974).

The goal of teaching basic science in a clinical context was to make information interesting for medical students. It has also been suggested that the problem-based approach to learning captures student interest in the basic sciences to a greater extent than does the lecture format. Schmidt (1993) proposed that problem-based learning has several cognitive effects on students' learning including activation, elaboration, and restructuring of knowledge; learning in context; and the emergence of curiosity. He also suggested that this emergence of curiosity occurs due to students' exposure to clinical relevance, and their open-ended questions about a clinical case (Schmidt, 1993). Therefore, this interest in clinical cases is likely to focus students' attention to learning more about basic science information, resulting in their engagement of deep processing strategies while learning this information.

The effect of student curiosity, that is, interest for students who have been presented with clinical problems has been investigated (DeVolder, Schmidt, Moust, & DeGrave, 1986; DeVolder Schmidt, DeGrave, & Moust, 1989). During this series of studies, groups of students were presented with a problem about either "blood-cell" or "a plane taking off." The "blood-cell problem was presented in the form of an experiment in which a red blood cell was placed in pure water under a microscope. Students watched the cell swell and eventually burst. Another blood cell was then added to an aqueous salt solution and the students watched it shrink. The "plane taking off" problem was presented as a description of a plane taking off. Following their exposure to one of these problems, students were asked to indicate to what extent they were interested in receiving

information about "osmosis." Following this they studied a text on the subject and were then asked whether they would like to read more about these subjects, and whether they were interested in additional information that was sent to them by the investigators. These studies found that both before and after reading the texts, students who tackled the "blood-cell" problem displayed significantly larger curiosity than did those students who studied the "airplane" problem.

The assumption that learning based on clinical case presentation provided a more enjoyable learning experience than sitting through long hours of lectures in a conventional curriculum, has been evaluated by studies that have investigated the degree of satisfaction reported by students after their exposure to this instructional approach. In a comparison of student distress and attitudes toward their learning environment, Moore-West, Harrington, Mennin, Kaufman and Skipper (1989) administered a symptom and learning environment questionnaire to students from problem-based learning and traditional curriculum tracks. These authors reported that students from the problem-based learning track indicated less stress and more positive learning experiences than their traditional counterparts.

In a review of the literature, Albanese and Mitchell (1993) reported high levels of student satisfaction for several basic science courses during which students were exposed to information presented within a clinical context. Further, using an interview technique, Moore, Block, and Mitchell (1990) found that students who were exposed to content presented in a clinical context, reported their preclinical (basic science) years in medical school as being engaging, difficult, and useful ($p < .05$), whereas those who where

presented basic science information in isolation reported their preclinical experience to be irrelevant, passive, and boring. Therefore, it appears that when students are exposed to basic science information presented within a clinical context, this information holds greater interest for them than basic science material presented in isolation.

The results of the above studies indicate that when students are exposed to a problem-based learning instructional methodology, their interest in learning is increased compared to those students who must learn by attending lectures. Further, these students appear to approach the learning of basic science information at a deeper level compared to their traditional counterparts superficial approach (Newble & Clark, 1986).

Despite the reports of increased student satisfaction and deeper processing of information when basic science information is presented within a clinical context, the effect of traditional instruction compared to a problem-based learning approach on students' application of basic science while reasoning with clinical problems is more controversial. Patel et. al. (1989) have suggested that students who are exposed to basic and clinical sciences simultaneously may acquire a superficial knowledge of the basic sciences resulting in their inadequate use of this information when explaining clinical problems. Further, Berkson (1993) has suggested that patient problems are a rich collection of details, not all pertinent to diagnosis and patient management. She proposed that clinicians are highly skilled in discriminating between "noise" and significant data, whereas beginning students may have trouble discerning important details from background noise and encode many misleading details along with relevant knowledge. She further asserts that more structured foundations may be necessary before a student

can profit from patient simulations.

Hybrid Approaches

Due to the demands of problem-based learning curricula on medical school faculty time, this method of instruction has been introduced in many hybrid forms. Barrows (1986) has outlined alternate ways in which the problem-based learning instructional methodology can be integrated into medical education. One approach suggested by him is the use of "lecture-based cases" during which the instructor presents information followed by case vignettes to demonstrate the relevance of the presented information.

Hybrid approaches to problem-based learning may offer an alternative within traditional curricula. To date, approaches that have attempted to provide integrative experiences for students have presented students with patient problems and expected them to identify and gather relevant basic science information; presented a clinical case followed by basic science information, or presented basic science information followed by a clinical case. Other approaches that focus on integrating clinical and basic science information throughout reading materials and/or lectures may also generate interest and clinical relevance for students, resulting in their better integration and application of basic science information.

Summary and Rationale

Researchers who have investigated the effect of various interventions on student learning, have usually found the cognitive processes used by students to be somewhat variable and inconsistent (Paris, 1988; Tobias, 1988,1989). One possible explanation that has received little attention is the degree to which students are energized by their interest

in the learning task.

While early researchers proposed that interest plays a role in student learning (Dewey 1913,1933,1938; Herbart, 1806/1965, 1841/1965; James 1890), it has been suggested recently that interest is an especially important affective factor that strongly influences how people select and persist in processing certain types of information in preference to others (Hidi, 1990). Mishkin and Appenzeller (1987) proposed that affect plays a key role in integrating experience. They suggested that emotion serves as a filter that limits attention, and that selective attention to specific external and internal events/thoughts may have a profound effect on a person's learning or schema construction. Interest is one type of affect that has been shown to facilitate student comprehension and learning (Krapp, Hidi, & Renninger, 1992).

A link between interest, attention, and learning was proposed by several early researchers (Berlyne, 1960; Dewey, 1913; James, 1890; Thorndike, 1935). Studies that have attempted to establish a causal relationship between interest, attention, and learning (Anderson, 1982; Anderson, Mason, & Shirey, 1984; and Shirey & Reynolds, 1988), predicted that attentional factors would result in longer reading and secondary task reaction times for interesting text segments. In these studies, fourth grade and college students read isolated sentences and responded to a tone (secondary task). Attention was measured as a joint function of attention duration (reading time) and attention intensity (response latency to secondary task). These studies found that adult readers allocated fewer cognitive resources to interesting information, whereas younger readers spend more time reading and reacting to the secondary task. However, no causal relationship

between interest, attention, and learning was established.

Research studies that have investigated the effect of interest on students' level of text processing and comprehension, have found that high interest resulted in deeper text processing by students (Fransson, 1977; Schiefele & Krapp, 1988; Schiefele, Winteler, & Krapp, 1988). In two studies, Schiefele (1990) demonstrated that interest exerts a substantial influence on those processes that contribute to the representation of the meaning of text, independent of both prior knowledge and intelligence. These studies found that high levels of topic interest contributed to an increased level of activation and the experience of flow, causing students to engage in more pronounced elaborative processing, and to make more use of learning techniques. Other studies (Anderson, Mason, & Shirey, 1984; McLaren & Hidi, 1991; Saks, 1989; Wade, Schraw, Buxton, & Hayes, 1991) have also found qualitative differences in student learning of interesting text.

The failure of research studies to establish a causal link between interest, attention, and learning appears to be due to the inadequacy of reading and secondary task reaction times as measures of attention. Therefore, investigating which of two stimulus sources would result in deeper comprehension by students may provide a clearer index of attention. The assumption underlying this method is that a student must pay attention to stimulus materials in order to demonstrate comprehension.

Research that has investigated the manner in which students' allocate attention to concurrent tasks has often employed a dual-task paradigm. This paradigm was used in two studies that investigated students' susceptibility to distraction. Baker and Madell

(1965) required achieving and underachieving college students to read a Cooperative English Test while listening to comedy text (secondary task). The study found that the presence of a secondary task impaired students' performance. Tobias (1973) required students to memorize nonsense syllables, while reading text written about myocardial infarction. This study found no significant differences in learning between the experimental and control groups, however, students in the treatment group spent more time reading the text, than did controls.

Tobias (1973) explained the inconsistent findings of these studies by suggesting that interest/motivation may have influenced student performance. Baker and Madell's students' impaired performance may have been due to their increased interest in the comedy text causing them to focus their attention on the secondary task. In the Tobias study, the myocardial infarction text may have been more interesting than the secondary task, however, the extra time spent reading under secondary task conditions, may be an indication that students switched their attention back and forth between both tasks (i.e., serial processing) resulting in little interference. It has been suggested (Knowles, 1963), that according to a limited capacity resource model, as a primary task demands more resources, fewer are available for the concurrent secondary task, and the latter will deteriorate. Interest may result in more resources being allocated to one task, compromising the performance of the other. In order to isolate the effect of interest on primary and secondary task performance, students should be allowed unlimited reading time so that they are able to engage in the serial processing of primary and secondary tasks.

Medical educators have attempted to provide students with experiences during which patient problems become the stimuli for the integration of basic science and clinical information. The philosophy behind this approach was that learning should be fun, and that basic science concepts would be better understood, remembered and subsequently applied if learned in a clinically relevant manner (Berkson, 1993). Further, students who were exposed to clinical information while learning basic science, have been found to engage in more meaning-oriented (deep) approaches, compared to the reproducing orientation (surface) approach of those students learning basic science in isolation (Newble & Clark, 1986). To date, there has been no investigation of whether providing students with basic science information within a clinical context during their reading and/or lecture experiences may increase student interest, causing them to direct their attention to this information, resulting in greater and deeper comprehension and recall.

This study plans to provide medical students with expository text written about important concepts and principles related to the topics of Anorexia Nervosa and Bipolar Disorder. These passages will be presented in two formats: one that is expository only (low interest), and the other expository text that includes a clinical case history (high interest). The assumption of greater interest in text that includes a case history will be tested during pilot study. In this study, subjects will be exposed to primary and secondary tasks that will consist of either high or low interest text that presents information about one of the above topics. The purpose of the study is to determine whether interest will differentially influence students' allocation of attention resulting in greater and "deeper" comprehension and recall of primary and secondary tasks.

Hypothesis

This study employed a dual-task paradigm to investigate the effect of interest on student comprehension of primary and secondary tasks. It was hypothesized that interest would direct students' attention to primary and secondary tasks causing them to resist distraction, and be related to greater and "deeper" comprehension of these tasks. Specifically, it was expected that:

1. Students who were exposed to high interest primary text would demonstrate greater and "deeper" comprehension of primary text than those students who were exposed to low interest primary text.
2. Students who were exposed to high interest secondary text would demonstrate greater and "deeper" comprehension of secondary text than those students who were exposed to low interest secondary task.
3. Students who were exposed to a high interest secondary task combined with low interest primary text would demonstrate greater and "deeper" comprehension of secondary text than those students who were exposed to a low interest secondary task combined with low interest primary text.
4. Students who were exposed to low interest primary text combined with a high interest secondary task would demonstrate lower comprehension of the primary text than those students who were exposed to low interest primary text combined with a low interest secondary task.
5. Students who were exposed to a high interest secondary task combined with high interest primary text would demonstrate greater and "deeper" comprehension of

secondary text than those students who were exposed to a low interest secondary task combined with high interest primary text.

6. Students who were exposed to a high interest secondary task combined with primary text would demonstrate increased reading time of primary text compared to those students who were exposed to primary text without a high interest secondary task.

7. Students who were exposed to primary text without a secondary task would demonstrate greater and "deeper" comprehension of primary text than those students who were exposed to a high interest secondary task combined with primary text.

Method

Subjects

Subjects were recruited from among students attending the State University of New York, Health Science Center at Brooklyn. As indicated in Table 1 below, a total of 81 subjects from several degree programs participated in this study.

Table 1: Description of Subjects

			Interest					
Primary Task			Case-Illustrated (CI)			Expository (E)		
Secondary Task			CI	E	No Task	CI	E	No Task
Subjects	N	Total						
Gender:								
Female		40	9	4	5	8	8	6
Male		41	6	11	6	7	7	4
Degree Programs:								
Medical		24	5	6	3	6	4	0
Nursing		13	2	2	2	0	3	4
Physician Assistant		7	1	1	2	0	3	0
Allied Health		16	3	2	3	2	3	2
PreMed		21	4	4	0	7	2	4

Materials

Primary and secondary task texts were written about topics selected from the domain of Psychiatry. The topics chosen were Anorexia Nervosa and Bipolar Disorder. Each text had two versions: one an expository passage that contained basic information about the

clinical condition (low interest), the other comprised the same information with additional case-illustrative paragraphs (high interest), (see appendix A-D).

As indicated in Table 2 below, case-illustrated text versions were longer than the expository, due to the inclusion of the descriptive paragraphs throughout this text. These paragraphs contained information that described the symptoms and behaviors of a patient with either Anorexia Nervosa or Bipolar Disorder. Information described in the paragraphs was removed from the expository text and included in a case presentation that unfolded throughout the case-illustrated text's presentation of important supporting information.

Table 2: Description of Case-Illustrated and Expository Texts

Text	Anorexia Nervosa		Bipolar Disorder	
Interest	CI	E	CI	E
No. of Pages	11	9	11	9
No. of Paragraphs	39	32	48	34
No. of Words	2053	1901	2079	1978
Grade Level (Flesh Kincaid)	13	13	13	13

CI = Case-Illustrated
I = Expository

The study assumed that embedding basic science information in a clinical context would generate greater interest by students, than would basic science information presented in an expository format. This assumption was based on studies that have

reported students' greater interest in basic science information when it was presented in a clinical context (Albanese & Mitchell, 1993; Moore et. al, 1990), than when it was presented in isolation. Further support for this assumption was provided by Renninger (1992) who found that embedding content in an interesting context created greater interest for students, than did content presented in isolation.

Pilot Study

The assumption of greater interest in case material was tested by a pilot study during which subjects (n=13) were randomly assigned to read one of the four text versions and to answer five questions that asked them to rate their degree of interest in the text using a 4-point Likert scale (see appendix E). As indicated in Table 3 below, subjects' rated the format illustrated by case history as being of greater interest to them than the expository versions.

Table 3: Means and Standard Deviations for Text Interest

	N	Mean	SD	t-test
Anorexia Nervosa				
Case-Illustrated Text	4	18.75	1.50	
Expository Text	3	11.33	.58	7.97***
Bipolar Disorder				
Case-Illustrated Text	3	15.67	1.15	
Expository Text	3	10.67	3.21	2.54*

p. < .10 *
p. < .05**
p. < .01***
p. < .001****

Primary and Secondary Task Free Recall

Participants free recall of primary and secondary task texts were coded and scored according to the categories proposed by Schiefele (1991). Inter-rater agreement by two graduate students was 82% for the Anorexia Nervosa text and 80% for the Bipolar Disorder text. Subjects' recall protocols were read and the number of complete, incomplete and wrong main ideas identified. The total number of main ideas recalled was also computed. Subjects' recall of new, complete, incomplete and wrong idea units was identified, and a total number computed. Two additional categories were identified for this study. These included recall of clinical main ideas and idea units. Clinical recall was defined as information that either described the case in the case-illustrated passages, or families concerns about the symptoms patients' experience when suffering from Anorexia Nervosa or Bipolar Disorder. These ideas were independent of content related to the clinical disorder presented in the text. Examples of free recall categories are included in Appendix J.

Primary and Secondary Task Multiple Choice Posttests

Two multiple choice posttests were developed. Each contained 10 questions intended to cover key areas presented in each topic (see Appendix F-G). The tests measured subjects' comprehension and recall of texts. Posttest scores for the secondary task were computed as a proportion of the number of questions that subjects could be expected to answer based on the sentence in the text where the tape was stopped. This proportion was calculated because of the unlimited reading time participants were allowed, some heard the entire tape presentation while others did not. Therefore, for subjects who did not

listen to the entire secondary task text, the number of questions correctly answered were divided by the total number they could have been expected to answer correctly out of the total of 10 posttest questions. This resulted in a proportioned decimal number which was then converted back to a whole number.

Posttest reliabilities were conducted on the multiple choice posttests. The results of this analysis were a reliability of Alpha=.75 for Anorexia Nervosa and Alpha=.34 for Bipolar Disorder posttests. The low reliability found for the Bipolar Disorder posttest may be attributed to the fact that some subjects answered questions related to text content they did not hear. These participants finished reading the primary task text before the secondary task tape presentation had ended resulting in the tape being stopped. Reliabilities were computed for the Anorexia Nervosa and Bipolar Disorder posttests presented as primary and secondary tasks. For Anorexia Nervosa, primary task presentation posttest reliability was Alpha=.51 compared to Alpha=.49 for secondary task presentation. For Bipolar Disorder posttest, primary task presentation resulted in a reliability of Alpha=.34 compared to Alpha= -.32 for secondary task presentation. Therefore, it appears that secondary task presentation did have a greater effect on the reliability of the Bipolar Disorder posttest than it did on the Anorexia Nervosa posttest.

In order to determine if this low reliability affected subjects' recall of primary and secondary tasks, posttest scores were compared for the Anorexia Nervosa and Bipolar Disorder passages. For primary task presentation, there were no significant differences in participants' recall of the case-illustrated Anorexia Nervosa (Mean=5.46;SD=2.46) and Bipolar Disorder (Mean=5.47;SD=1.45) texts. For expository conditions, subjects'

posttest recall for Anorexia Nervosa (Mean=6.17;SD=2.29) and Bipolar Disorder (Mean=5.97;SD=1.76) passages did not differ significantly. Comparison of secondary task text presentation found that subjects' recall was not significantly different for case-illustrated Anorexia Nervosa (Mean=6.27;SD=1.10) and Bipolar Disorder (Mean=6.10;SD=1.90), expository Anorexia Nervosa (Mean=5.67;SD=2.54) and Bipolar Disorder (Mean=5.63;SD=1.59), or no task Anorexia Nervosa (Mean=5.38;SD=2.67) and Bipolar Disorder (Mean=5.81;SD=1.12) conditions. These results indicate that despite the low reliability of the Bipolar Disorder posttest, subjects' posttest scores did not differ significantly for either text.

Interest Scale

A 4-point Likert scale comprising five questions (see Appendix E) measured the extent to which subjects were interested in the primary and secondary task Anorexia Nervosa and Bipolar Disorder texts. Reliabilities for this scale were Alpha=.65 for Anorexia Nervosa and Alpha=.88 for Bipolar Disorder.

Cognitive Processes Questionnaire

A Cognitive Processes Questionnaire comprising 16 questions was designed to determine subjects' perceptions about their mastery of primary and secondary tasks, and strategies used while processing each text's content (see Appendix H).

Procedures

The materials were administered during individual sessions that lasted for approximately one hour. Subjects were randomly assigned to one of four experimental and two control conditions: case-illustrated primary and secondary tasks; case-illustrated

primary and expository secondary tasks; case-illustrated primary only; expository primary and case-illustrated secondary tasks; expository primary and secondary tasks; expository primary only. Primary and secondary task texts were randomly assigned to ensure that each passage was given equal exposure as either a primary or secondary task.

On arrival for their session, participants were directed to a computer terminal and told they would be required to answer questions following their reading. The assigned primary text topic was presented by computer, one screenful at a time. Instructions were given to each subject, both on computer and verbally. A split screen format was used: one side of the screen contained written instructions informing subjects that they were about to read about the assigned topic while listening to an audio recording of a topic, and that following their reading they would be required to answer questions. The other side of the computer screen comprised icons indicating 'begin', 'next page', 'finish', and 'quit', together with instructions to subjects about how to use these icons. This side of the screen remained visible while subjects read the text. Participants who were assigned to the experimental conditions listened to an auditory recording of the secondary task during their reading of the primary task text. All subjects were allowed unlimited time to read the primary task text, and the computer recorded the length of time spent reading. On completion of their reading, subjects selected the 'finish' icon, and two beeps signaled the experimenter to stop the audio recording.

Following their reading of the primary task text, subjects completed the two interest questionnaires. They then wrote down all they could remember about the content of primary and secondary task passages, and completed the two multiple choice posttests.

The experimenter then asked a series of questions from the Cognitive Processes Questionnaire and recorded subjects' responses.

Participants who were assigned to control groups followed the same procedures as the experimental groups, however, they did not hear the audio-recording of the secondary task, and they were not required to complete the interest questionnaire or free recall task related to that topic.

Results

The study hypothesized that interest would direct subjects' attention to primary and secondary tasks causing them to resist distraction, and lead to greater and "deeper" comprehension of these tasks. All data were analyzed using SPSS for Windows, Release 6.0 (1993).

A 2 (primary task high vs. low interest) x 3 (secondary task high vs. low interest vs. no task) Multivariate Analysis of Variance was computed with interest as the independent variable and primary and secondary task multiple choice posttest scores, reading time, and primary task interest as dependent variables. This analysis found no significant multivariate main effects for primary or secondary task interest. However, a significant multivariate interaction was found for primary (A) x secondary task (B) $\{F(8,144)=2.15, p.<.05\}$, with significant univariate effects for primary $\{F(2,75)=6.29, p.<.01\}$ and secondary task $\{F(2,75)=3.04, p.<.05\}$ posttests (see Table 4 on the adjacent page). Means and standard deviations for all variables are reported in Tables 5 and 6 appearing on adjacent pages.

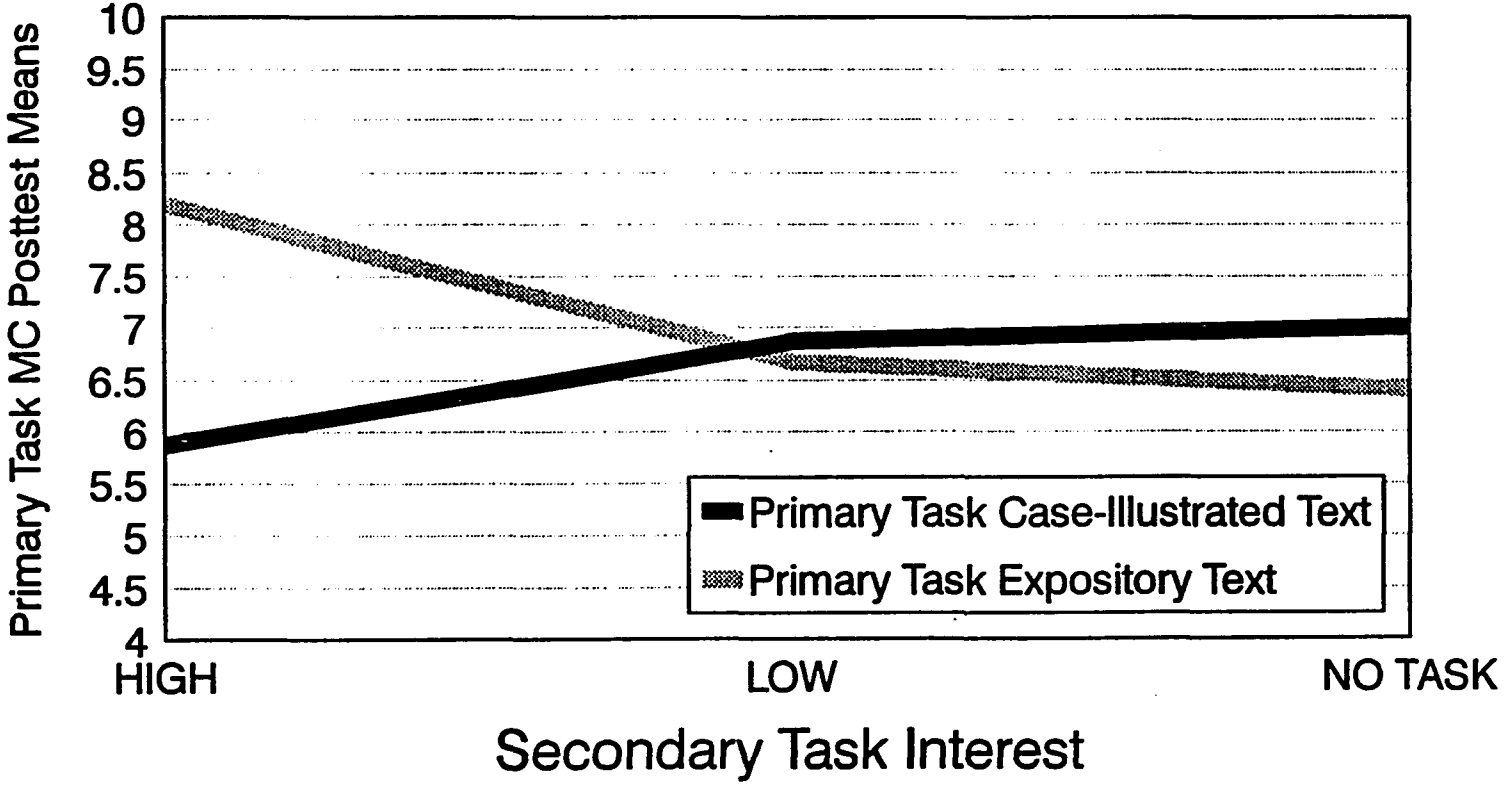
As indicated in Figure 1 (see adjacent page), subjects who were assigned to an

expository (low interest) primary task combined with case-illustrated (high interest) secondary task text condition answered significantly more questions correctly on primary task posttest than did those who were assigned to a primary and secondary task condition in which both passages were case-illustrated text versions. Further, participants who were assigned to an expository primary task text combined with a case-illustrated secondary task passage condition, recalled significantly more questions correctly than did those assigned to a combined primary and secondary task expository text condition and those who only read expository text. In addition, subjects who were assigned to a combined primary and secondary task case-illustrated passages condition answered significantly fewer questions correctly on primary task posttest than did those assigned to a case-illustrated primary task passage combined with an expository secondary task text condition, and those who only read case-illustrated text.

For secondary task posttest recall (see Figure 2, adjacent page), subjects who were assigned to a secondary task case-illustrated passage combined with primary task expository text answered significantly more questions correctly on posttest than did those who were assigned to combined secondary and primary task expository passages or no secondary task conditions. Further, participants who were assigned to case-illustrated secondary task text combined with a case-illustrated primary task passage answered an equal number of questions correctly on secondary task posttest compared to those subjects who were assigned to an expository secondary task passage combined with case-illustrated primary task text or no secondary task conditions.

Figure 1: Interaction between Primary and Secondary Tasks on Primary Task Multiple Choice Posttest

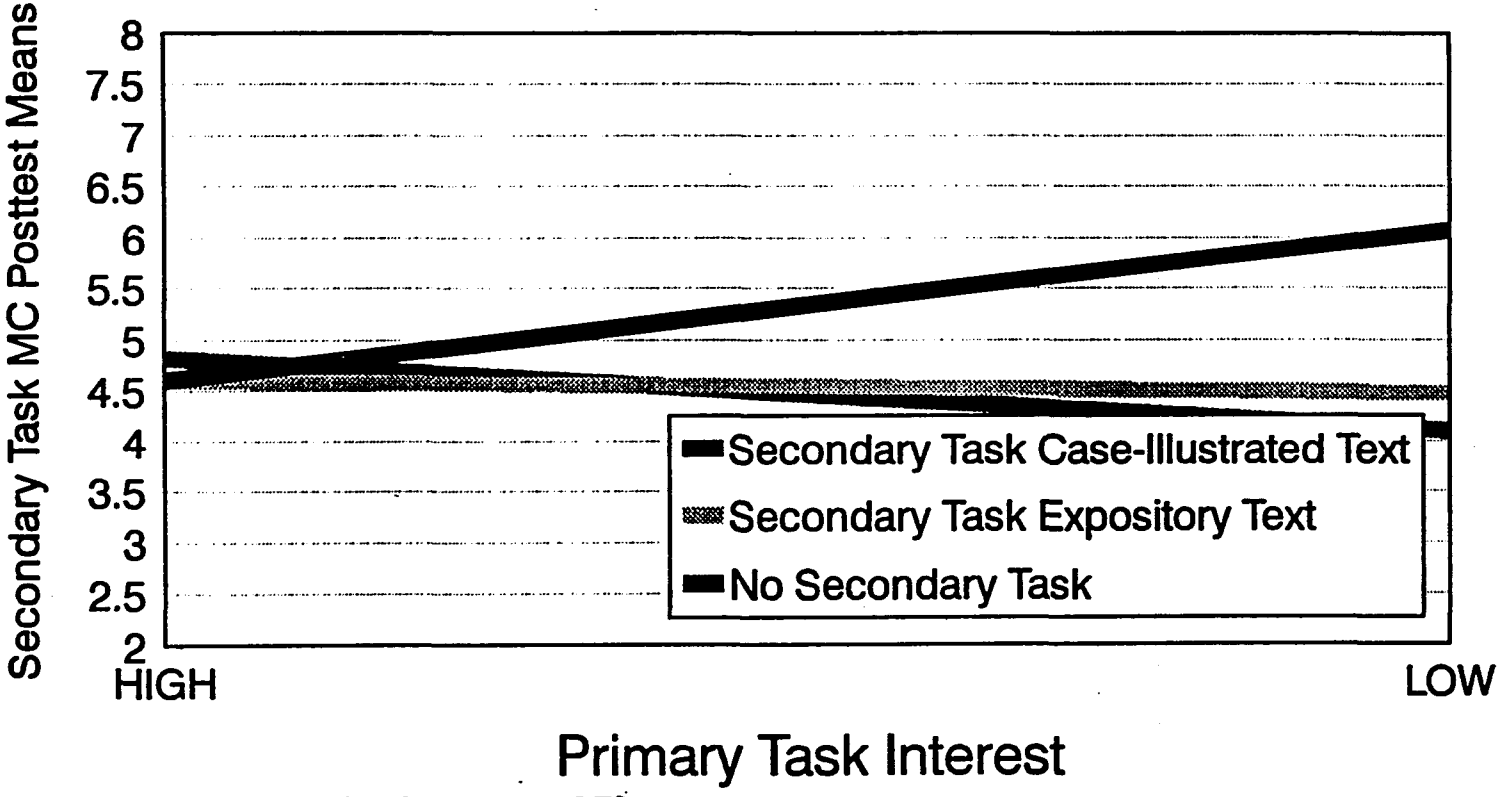
{F(8,144)=2.15,p.<.05}



Univariate {F(2,75)=6.29,p.<.01}

Figure 2: Interaction between Primary and Secondary Tasks on Secondary Task Multiple Choice Posttest

{F(8,144)=2.15,p.<.05}



Univariate {F(2,75)=3.04,p.<.05}

Table 4: Primary and Secondary Task MANOVAs for MC Posttests, Reading Time, and Primary Task Interest

Multivariate	Univariate	F	df
A (Primary)		-	-
	Primary Task Posttest	1.86	1,75
	Secondary Task Posttest	-	-
	Reading Time	-	-
	Primary Task Interest	-	-
B (Secondary)		-	-
	Primary Task Posttest	-	-
	Secondary Task Posttest	2.33*	2,75
	Reading Time	-	-
	Primary Task Interest	-	-
A x B		2.15**	8,144
	Primary Task Posttest	6.29***	2,75
	Secondary Task Posttest	3.04**	2,75
	Reading Time	-	-
	Primary Task Interest	-	-

p. < .10 *
P. < .05 **
p. < .01 ***
p. < .001 ****

F. < 1 deleted

Table 5: Means and Standard Deviations for Primary and Secondary Task Main Effects.

	N	Mean	SD
Primary Posttest			
Primary Task Text:			
Case-Illustrated	41	6.54	1.70
Expository	40	7.17	1.81
Secondary Task Text:			
Case-Illustrated	30	7.03	1.81
Expository	30	6.77	1.92
No task	21	6.71	1.55
Secondary Posttest			
Primary Task Text:			
Case-Illustrated	41	4.66	1.87
Expository	40	4.97	1.61
Secondary Task Text:			
Case-Illustrated	30	5.33	1.69
Expository	30	4.53	1.63
No task	21	4.48	1.86
Reading Time			
Primary Task Text:			
Case-Illustrated	41	887.6	360.4
Expository	40	913.6	334.4
Secondary Task Text:			
Case-Illustrated	30	918.8	472.6
Expository	30	904.1	293.6
No task Case-Illustrated	11	860.8	230.1
No task Expository	10	878.1	57.1
Primary Task Interest			
Primary Task Text:			
Case-Illustrated	41	17.00	1.77
Expository	40	16.65	2.70
Secondary Task Text:			
Case-Illustrated	30	16.43	2.49
Expository	30	17.00	2.00
No task Case-Illustrated	11	16.91	1.97
No task Expository	10	17.40	2.80
Secondary Task Interest			
Primary Task Text:			
Case-Illustrated	30	11.83	4.24
Expository	30	13.60	3.81
Secondary Task Text:			
Case-Illustrated	30	13.00	4.40
Expository	30	12.43	3.82

Table 6: Means and Standard Deviations for Primary x Secondary Task Interaction.

	Primary Task Interest					
	Case-illustrated			Expository		
	N	Mean	SD	N	Mean	SD
Primary Posttest						
Secondary Task:						
Case-Illustrated Text	15	5.87	1.51	15	8.20	1.26
Expository Text	15	6.87	1.85	15	6.67	2.06
No task	11	7.00	1.61	10	6.40	1.50
Secondary Posttest						
Secondary Task:						
Case-Illustrated Text	15	4.60	1.59	15	6.07	1.49
Expository Text	15	4.60	2.06	15	4.47	1.12
No task	11	4.82	2.09	10	4.10	1.59
Reading Time						
Secondary Task:						
Case-Illustrated Text	15	958.6	526.9	15	879.0	426.1
Expository Text	15	836.4	216.4	15	971.8	349.2
No task	11	860.8	230.1	10	878.1	57.1
Primary Task Interest						
Secondary Task:						
Case-Illustrated Text	15	17.00	1.60	15	15.87	3.09
Expository Text	15	17.07	1.91	15	16.93	2.15
No task	11	16.91	1.97	10	17.40	2.80
Secondary Task Interest						
Secondary Task:						
Case-Illustrated Text	15	11.73	4.56	15	14.27	3.99
Expository Text	15	11.93	4.06	15	12.93	3.63

Primary Task Multiple Choice Posttest

For primary task posttest, subjects who read expository passages answered slightly more questions correctly (Mean=7.17;SD=6.54) than did those who read case-illustrated text (Mean=6.54;SD=1.70). This finding did not support hypothesis one. While not significant, participants who read primary task text without a secondary task recalled fewer items correctly on posttest (Mean=6.71;SD=1.55) than did those who read primary task text while listening to case-illustrated secondary task text (Mean=7.03;SD=1.81). Therefore, the study did not support hypothesis seven. As indicated in Figure 1, subjects who read expository text answered significantly more questions correctly on primary task posttest when they listened to case-illustrated text, than they did when they listened to expository passages {F(8,144)=2.15,p.<.05}. This finding was opposite to the prediction of hypothesis four.

Secondary Task Multiple Choice Posttest

For secondary task posttest, subjects who listened to case-illustrated secondary task text answered slightly more questions correctly on posttest (Mean=5.33;SD=1.69) than did participants who listened to expository secondary task passages (Mean=4.53;SD=1.63). This finding did not support hypothesis two. As indicated in Figure 2 on the adjacent page, participants who read expository text, answered significantly more questions correctly on secondary task posttest when they listened to case-illustrated text than they did when they listened to expository passages {F(8,144)=2.15,p.<.05}. This finding confirmed the prediction of hypothesis three. Under case-illustrated primary task conditions, subjects who listened to case-illustrated

text answered an equal number of questions correctly (Mean=4.60;SD=1.59) on secondary task posttest compared to those who listened to expository passages (Mean=4.60;SD=2.06). Thus, hypothesis five was not supported.

Secondary Task Interest

Participants in this study who did not listen to a secondary task were not required to complete the interest scale related to secondary task text. Therefore, a 2 (primary task high vs. low interest) X 2 (secondary task high vs. low interest) Analysis of Variance was computed with interest as the independent variable and secondary task interest Likert scale responses as the dependent variable. No main effect or interaction was found (see Table 7 below). However, subjects who were assigned to primary task expository text conditions rated the secondary task as more interesting (Mean=13.60;SD=3.81) than did those who were assigned to primary task case-illustrated text conditions (Mean=11.83;SD=4.24).

Table 7: Primary and Secondary Task ANOVA for Secondary Task Interest

	F	df
A (Primary)	2.82 *	1,56
B (Secondary)	-	-
A X B	-	-

p. < .10 *
F < 1 deleted

Primary and Secondary Task Free Recall Data

Subjects free recall protocol responses were grouped into categories of zero and >1 responses. These categories were analyzed by 2 (primary task high vs. low interest) x 2 (secondary task high vs. low interest) Chi-square analyses with interest as the independent variable, and primary and secondary task free recall data as dependent variables. For primary task, these analyses compared the number of response categories subjects' recalled for complete, incomplete, wrong, and total main ideas; and new, complete, incomplete, wrong, and total idea units. A further comparison was made between primary task conditions for the number of categories of clinical ideas subjects' recalled. Clinical ideas were defined as an idea that described either information presented in the descriptive paragraphs (case-illustrated), information presented in expository text regarding the concern of families and friends about clinical symptoms and behaviors, or information related to persons with whom subjects' associated the symptoms and behaviors of either Anorexia Nervosa or Bipolar Disorder. These analyses were repeated for secondary task free recall data.

As indicated in Table 8 (see adjacent page) which provides frequency of response categories and percentages, a significant effect was found for primary task recall of incomplete {Chi-square(1)=8.95,p.<.01} and total {Chi-square(1)=7.71,p.<.01} main ideas. Subjects who were assigned to primary task expository text conditions recalled significantly more incomplete and total main ideas, than did those who were assigned to case-illustrated primary task conditions. For idea units, significant effects were found for complete {Chi-square(1)=5.28,p.<.05} and incomplete {Chi-square(1)=11.53,p.<.01}

ideas recalled. Participants assigned to primary task expository text conditions recalled significantly more ideas, than did those who were assigned to case-illustrated primary task conditions.

For clinical ideas, significant effects were found for the number of main ideas {Chi-square(1)=5.20,p.<.05} and idea units {Chi-square(2)=8.83,p.<.01} recalled. Subjects who were assigned to case-illustrated primary task conditions recalled significantly more clinical main ideas and idea units, than did those who were assigned to expository text primary task conditions.

Analysis of secondary task free recall data revealed significant effects for incomplete {Chi-square(1)=4.27,p.<.05} and total {Chi-square(1)=4.80,p.<.05} ideas recalled. Subjects who were assigned to secondary task expository text conditions recalled significantly more incomplete and total ideas, than did those who were assigned to case-illustrated secondary task conditions. A significant effect was also found for clinical ideas recalled {Chi-square(1)=4.34,p.<.05} with participants who were assigned case-illustrated secondary task conditions recalling more clinical ideas than did those who were assigned to expository text secondary task conditions.

Table 8: Chi-Square Analyses for Primary and Secondary Task Free Recall Data.

	C	Case-Illustrated f	%	Expository f	%	Chi-square	df
Primary Task							
Main Ideas:							
Complete	0	34	49.3	35	50.7		
	>=1	7	58.3	5	41.7	2.00	1
Incomplete	0	35	61.4	22	38.6		
	>=1	6	25	18	75	8.95 **	1
Wrong +							
Total	0	28	65.1	15	34.9		
	>=1	13	34.2	25	65.8	7.71 **	1
Idea Units:							
New	0	31	54.4	26	45.6		
	>=1	10	41.7	14	58.3	1.09	1
Complete	0	14	73.6	5	26.4		
	>=1	27	43.5	35	56.5	5.28 *	1
Incomplete	0	16	59.2	11	40.8		
	>=1	25	46.2	29	53.8	11.53 **	1
Wrong	0	35	50	35	50		
	>=1	6	54.5	5	45.5	.08	1
Total	0	4	57.1	3	42.9		
	>=1	37	50	37	50	.13	1
Clinical:							
Main Ideas	0	36	47.4	40	52.6		
	>=1	5	100	0	0	5.20 *	1
Idea Units	1	6	40	9	60		
	2	6	33.3	12	66.7		
	>=3	11	84.6	2	15.4	8.83 **	2

p.<.05 *
p.<.01 **

+=no responses
C=Category
f=Frequency of response

Table 8 continued:

Secondary Task

Main Ideas:							
Complete +							
Incomplete	0	19	52.8	17	47.2		
	>=1	11	45.8	13	54.2	.28	1
Wrong +							
Total	0	19	52.8	17	47.2		
	>=1	11	45.8	13	54.2	.28	1
Idea Units:							
New +							
Complete	0	19	57.6	14	42.4		
	>=1	11	40.7	16	59.3	1.68	1
Incomplete	0	19	63.3	11	36.7		
	>=1	11	36.7	19	63.3	4.27 *	1
Wrong	0	25	47.1	28	52.9		
	>=1	5	71.4	2	28.6	1.45	1
Total	0	14	70	6	30		
	>=1	16	40	24	60	4.80 *	1
Clinical:							
Main Ideas +							
Idea Units	0	13	38.2	21	61.8		
	>=1	17	65.4	9	34.6	4.34 *	1

p. < .05 *
p. < .01 **

+ =no responses
C =Category
f =Frequency of Response

Cognitive Processes Questionnaire

Data from the Cognitive Processes Questionnaire were grouped into categories based on the responses subjects' gave to each question. A 2 (primary task high vs. low interest) x 3 (secondary task high vs. low interest vs. no task) Chi-square analyses compared subjects' responses to each of the questions included in the questionnaire. For primary task text, a significant effect was found for participants' responses to a question that asked them to indicate the things that helped them to learn the primary task {Chi-square(15)=45.09,p. < .001}. As indicated in Table 9 (see adjacent pages) which displays the raw data, those who were assigned to primary task case-illustrated text conditions reported using the case presentation and making associations to persons with the conditions described more often than did those who were assigned to primary task expository text conditions. Subjects who were assigned to primary task expository text conditions reported using reading strategies and blocking the tape more often than did those who were assigned to case-illustrated primary task conditions.

For secondary task text, a significant effect was found for subjects' responses to questions that asked them what they thought about while listening to the secondary task text {Chi-square(12)=20.70,p. < .05} and strategies used to learn this text {Chi-square(9)=18.97,p. < .05}. Subjects who listened to expository passages indicated that they thought the tape was distracting more often than did those who heard case-illustrated text. Further, those who listened to case-illustrated text were more likely to state that they thought about the case than were those who heard expository passages. In addition, those who were assigned to case-illustrated primary task conditions were equally likely

to report thinking about the case regardless of secondary task text presentation. Subjects who were assigned to primary task expository text combined with a case-illustrated secondary task text condition were more likely to report using the case as a strategy to help them learn the secondary task than were participants from all other groups.

Table 9: Primary Task Cognitive Processes - Number of Responses*

Primary Task	Case-Illustrated (CI)			Expository (E)		
Secondary Task	CI	E	None	CI	E	None
N	15	15	11	15	15	10
Primary Task Text						
Perception of amount learned:						
1-3 (least)	9	10	5	9	9	8
>3 (most)	6	5	6	6	6	2
Factors helped learning:						
Case	8	3	7	0	0	0
Reading Strategies	3	7	2	7	12	6
Blocking the tape	2	1	0	5	3	1
Associate to persons	2	1	1	0	0	3
Thinking about during task:						
Blocking the tape	1	1	0	0	1	0
Case	4	3	4	2	0	0
Persons' associations	2	7	3	8	4	4
Reading Strategies	2	1	2	1	3	3
Interest in information	1	1	0	0	0	1
Moving back and forth	1	0	0	4	2	0
Strategies used during task:						
Case	2	1	2	1	0	0
Associations to persons	1	1	0	0	0	0
Reading Strategies	9	7	6	10	8	4
Blocking the tape	3	4	0	1	1	0
Interest	0	1	1	0	1	0
Secondary Task Text						
Perception of Amount Learned:						
<1 (least)	11	15	-	13	14	-
>2 (most)	4	0	-	2	1	-
Listen to Secondary Task:						
Yes	9	5	-	2	8	-
Sometimes	1	6	-	9	6	-
No	5	4	-	4	1	-

*=Raw data

Table 9 continued:

Thinking about task:						
Tape was distracting	2	6	-	1	5	-
Case	5	4	-	6	1	-
Associations to persons	0	0	-	1	3	-
Moving back and forth	3	1	-	1	3	-
Reading Strategies	1	4	-	1	0	-
Strategies used during task:						
Reading Strategies	4	1	-	2	1	-
Block tape	1	5	-	1	3	-
Case	0	0	-	3	0	-
Interest	0	0	-	0	1	-
Success of Strategies:						
Yes	4	3	-	3	3	-
No	11	12	-	12	12	-
Effect of Task on learning Primary:						
Distracting	8	12	-	13	14	-
No effect	4	1	-	1	1	-
Try to learning task:						
Yes	7	4	-	8	6	-
No	8	11	-	7	9	-
Factors that effect learning:						
Read Strategies	7	9	-	9	10	-
Avoid tape	3	4	-	1	4	-
Move back and forth	3	0	-	0	0	-
Case	0	1	-	1	0	-
Task given the most attention:						
Primary	14	15	-	15	15	-
Secondary	1	0	-	0	0	-
Task learned the most about:						
Primary	14	15	-	15	15	-
Secondary	1	0	-	0	0	-

Summary

The hypothesis of greater and "deeper" comprehension and recall of primary and secondary tasks under conditions of high compared to low interest was not supported. However, the study found a significant multivariate interaction for primary x secondary task with significant univariate effects for primary and secondary task multiple choice posttests. The study did not find significant differences in interest between case-illustrated and expository versions of primary and secondary task texts. Further, there were no significant differences in reading time based on interest.

Discussion

The failure of the study to support the hypothesis of greater and "deeper" comprehension and recall of primary and secondary task text under conditions of high compared to low interest may be explained by several factors which are discussed below. These include the degree to which subjects' perceived primary task text to be important, together with their ability to employ strategies for resisting distraction from the case-illustrated passages. Further, the inclusion of case descriptive paragraphs in case-illustrated primary and secondary task text may also explain the results of this study.

Primary and Secondary Task Interest

The failure of this study to find significant differences for primary task interest raises questions about the degree to which the case-illustrated and expository text versions were differentially interesting to subjects who participated in the study. Questions about the interest of the different text versions are surprising in light of reports of greater interest by students when basic science information is presented in a clinical context, than when

it is presented in isolation (Albanese & Mitchell, 1993; Moore, et. al., 1990). In addition, significant differences between high and low interest versions of both Anorexia Nervosa and Bipolar Disorder texts were found during the pilot study (see Table 3).

Participants who read case-illustrated text rated it on the Likert scale as slightly more interesting (Mean=17.00;SD=1.77) than did those who read expository passages (Mean=16.65;SD=2.70), even though this difference was not significant. Comparison of overall interest ratings for primary and secondary task passages revealed that subjects' perceived the primary task to be more interesting (Mean=16.83;SD=2.27) than the secondary task (Mean=9.42;SD=6.62), irrespective of text format. Specifically, participants rated the primary task as significantly more interesting than the secondary for both case-illustrated ($t=3.95, p. < .001$) and expository passages ($t=4.64, p. < .001$). This significant difference in interest ratings based on task presentation may be explained by the importance of primary task information to subjects, as discussed later. The Anorexia Nervosa and Bipolar Disorder passages were randomly assigned as either primary or secondary tasks, therefore, a difference in interest ratings would not be expected.

One explanation for the difference in subjects' interest ratings for case-illustrated and expository texts between the pilot and main studies, may be that assigning participants to combined primary and secondary task conditions in the main experiment resulted in their comparing these passages when deciding the extent to which each text version interested them. Students who participated in the pilot study could not have compared the two texts because they only read and rated for interest one version of either the

Anorexia Nervosa or Bipolar Disorder passages.

There is some support for the suggestion that subjects' compared primary and secondary tasks when rating their interest in text format. This can be found in the finding, though nonsignificant, that participants who listened to case-illustrated secondary task text rated primary task passages as less interesting (Mean=16.43,SD=2.49) than did those who listened to expository text (Mean=17.00,SD=2.00), or those who did not listen to a secondary task (Mean=17.14,SD=2.35). As predicted, subjects who read an expository passage while listening to case-illustrated text were the least, though not significantly, interested in the primary task passage, and the most interested in secondary task text (see Table 6). Specifically, these subjects reported less interest in primary task text (Mean=15.87;SD=3.09), than did those who read and listened to expository passages (Mean=16.93;SD=2.15) and those who only read expository text (Mean=17.14;SD=2.35). Thus, participants who did not listen to a case-illustrated secondary task passage rated the primary task as more interesting, irrespective of its format.

Similar, though nonsignificant results were revealed for subjects' ratings of secondary task interest. Participants who were assigned to read primary task case-illustrated passages rated secondary task text as less interesting irrespective of its format (Mean=11.83;SD=4.24) compared to those who were assigned to primary task expository text conditions (Mean=13.60;SD=3.81).

Strategies for Resisting Distraction

The finding that participants who listened to case-illustrated text rated primary task

passages as less interesting suggests that subjects may have been aware of the interestingness of the text versions they read and heard. It is possible that they rated the expository primary task text as less interesting due to their comparing primary and secondary task passages. However, despite their lower interest ratings for primary task text, participants appear to have directed their attention toward the primary task as indicated by their greater comprehension and recall of its content. One explanation for this finding may be that the majority of subjects were students who were required to pass coursework at a professional degree level. Therefore, they probably had already developed strategies for studying under conditions of distraction due to their many years of experience with studying for high stakes examinations. It is possible that they were very efficient at employing effective strategies for resisting distraction from case-illustrated text, thus directing their attention toward reading primary task text when they knew they would be required to answer questions related to the content of these passages. Some support for the suggestion that subjects' directed their attention toward the primary task can be found in the cognitive processes questionnaire data. In response to a question that asked them which task they paid the most attention to, all but one subject cited the primary task. The finding that subjects appear to have directed their attention toward the primary task text may provide an explanation for the study's failure to support the hypothesis that subjects' greater interest in case-illustrated passages would cause them to direct their attention toward this text, resulting in greater and "deeper" comprehension and recall.

Importance

A further and related explanation for the results of this experiment may be found in the instruction to participants that they would be tested on primary task content following their reading. Subjects' motivation to learn information for later recall may help to explain the overall significant difference found between their interest in primary and secondary tasks irrespective of format, despite the fact that the texts were randomly assigned as either a primary or secondary task. It appears that the importance of primary and secondary task content may have been a greater factor in influencing the manner in which participants' approached the task, than was passage format.

The fact that subjects' knew they would be required to answer questions related to primary task content appears to have caused them to direct their attention toward important, less interesting information included in this text. This focused attention may also have caused them to find ways to make this information more interesting when assigned to primary task expository text conditions. In contrast, subjects in the pilot study were not told they would be expected to recall text information, therefore, they may have been less concerned about attending to important information included in the passages they read, and more likely to attend to interesting content.

The fact that subjects who read an expository passage while listening to case-illustrated text answered significantly more questions correctly on primary and secondary task posttests compared to all other groups, indicates that subjects in this group may have been the most strategic in their approach to this task. It appears that when instructed to pay attention to the primary task, they became motivated to invest additional cognitive

energy into learning this information. Thus, they made a strategic decision to direct their attention toward important, less interesting information within the passage, while selectively listening to secondary task text. Further, participants who were assigned to this condition indicated the least interest in the primary task and the greatest interest in the secondary task compared to all other groups. Therefore, they may have been aware of the case-illustrated text's potential to distract them from reading the primary task expository passage on which they were to be tested, and made a strategic decision to invest additional cognitive resources into attending to the content of the expository primary task text. Some support for the strategic approach of these subjects can be found in their responses to the cognitive processes questionnaire. When asked questions about the cognitive processes they used during primary task presentation, they reported that they made associations to persons they knew with the clinical conditions presented (53%), and that they employed reading strategies (75%) to help them learn the information. The fact that they related the text content to their personal experiences indicates that they may also have made a strategic decision to make the information more memorable by taking cues from the secondary task case descriptive paragraphs and attaching cases they had encountered to the information presented in the expository passages.

These subjects were mature students, who it can be assumed had already developed effective strategies for studying under conditions of distraction. Their experience in learning important, uninteresting information for forthcoming examinations appears to have caused them to make a strategic decision to direct their attention toward reading the

expository passage when they were told their would be required to answer questions following their reading. Differences between readers' recall of important, interesting information have been found by Garner, Gillingham and White (1989), who reported that mature readers who read text without interesting detail, recalled an average of 93% of the ideas rated as most important, whereas those who read interesting detail recalled an average of only 43% of these ideas. Wade and Schraw (1990) also reported that mature readers allocate their attention in a strategic manner. Further, Baker and Maddell (1965) demonstrated that poor students' achievement was affected to a greater extent when they read and listened to text, than were good students.

The implications of these findings are that when mature students are required to learn information under conditions of distraction, importance may override interest in directing their attention to text information. This finding refutes that of Wade et. al. (1990) who reported that important factual details were the least well remembered information, despite the fact that readers' allocated more time (attention) to this information. In this study, importance appeared to override interest for mature students who were strategic in directing their attention toward this information resulting in their greater comprehension and recall of important, less interesting information compared to all other groups.

In his definition of interest, Schiefele (1991) described two components: feeling-related and value-related valences. According to him, value-related valences occur when a topic has particular value to the individual, thus measuring student motivation toward the topic. In this experiment motivation was not measured. Interest was determined by

the degree to which participants found reading the text to be an enjoyable experience. It is possible, that if subjects had been required to rate importance and interest while reading each paragraph, they may have indicated that they perceived information within the primary task text to be of importance. Further, they may also have reported a great deal of interest in the descriptive paragraphs included in case-illustrated text. Therefore, the failure to find significant differences between case-illustrated and expository passages may be due to the fact that subjects' interest in the descriptive paragraphs was not measured. Despite the fact that participants may have found these paragraphs to be very interesting, they were strategically mature enough to resist distraction from case-illustrated text and generate an interest in expository passages when required to learn important information.

Primary Task Multiple Choice Posttest

The results of this study revealed that subjects who read expository text answered slightly more questions correctly on multiple choice posttest (Mean=7.17;SD=1.81) than did those who read case-illustrated passages (Mean=6.54;SD=1.70). This finding of increased comprehension and recall under expository compared to case-illustrated conditions, is opposite to the predicted. Further, participants who read expository passages recalled significantly more total main ideas and complete idea units than did those who read case-illustrated text (see Table 8). This finding does not support that of Schiefele (1991), who reported a significant relationship between interest and number of complete and new idea units, and number of complete main ideas.

Seductive Details

It appears that the readers in this study who were mature students were able to employ effective strategies when required to read text that contained important, less interesting information under conditions of distraction. Nevertheless, they were not strategic when it came to passages that included case descriptive paragraphs.

One explanation for the results of this study may be that the inclusion of these paragraphs in case-illustrated text caused subjects to direct their attention away from important, less interesting information and toward the case history information included in the descriptive paragraphs. This direction of attention away from important, less interesting information appears to have resulted in the decreased comprehension and recall of subjects who read case-illustrated text, as evidenced by their lower posttest scores compared to those who read expository passages. This finding suggests that the descriptive paragraphs may have been very interesting to subjects, despite the study's failure to find significant interest differences between case-illustrated and expository primary task texts. Support for this explanation can be found in studies that have reported greater interest and recall for unimportant, but highly interesting information (seductive details) inserted into text (Garner, Alexander, Gillingham, Kulikowich & Brown, 1991; Wade & Adams, 1991; Wade et. al., 1991). Wade et. al. (1991) concluded that seductive details included in text directed readers' attention away from important, hard to learn material.

Further support for the suggestion that subjects who were assigned to read case-illustrated passages directed their attention away from important, less interesting

information included in these passages can be found in subjects' primary task free recall data. Subjects who read case-illustrated passages recalled significantly fewer main ideas and complete idea units than did those who read expository text (see Table 8). Further, in response to a question that asked them what helped them to learn the primary task text, 44% of those who read a case-illustrative passage stated that the "case" helped them to learn this information. A further 10% appear to have used the cues from the descriptive paragraphs, reporting that they associated the information in the text to persons they knew with either Anorexia Nervosa or Bipolar Disorder. Alternatively, as evidenced by their greater comprehension and recall of primary task content, subjects who read expository passages were more likely than those who read case-illustrated text to direct their attention toward important, less interesting information, especially when they knew they would be required to answer questions following their reading.

These findings suggest that the case descriptive paragraphs included in case-illustrated text acted as seductive details. Wade et. al (1990,1991) have reported that seductive details included in passages caused students to be nonstrategic in their approach to reading. In this study, subjects may have directed their attention toward primary task case-illustrated passages, but focused on reading the information included in case descriptive paragraphs resulting in their decreasing comprehension and recall of important, less interesting information.

The time subjects' spent reading primary task passages under varying secondary task conditions provides further support for the effect of seductive details on text comprehension and recall. Participants who read case-illustrated passages spent less time

reading (Mean=887.6;SD=360.4) than did those who read expository text (Mean=913.6;SD=334.4), even though the case-illustrated passages were longer due to the inclusion of descriptive paragraphs. While this difference was not significant, it does provide further evidence that when reading case-illustrated passages, subjects may have directed their attention toward the descriptive paragraphs and used their time to read this relatively unimportant information. The study did not measure the time subjects spent reading descriptive paragraphs or their interest ratings of these paragraphs, therefore, this suggestion cannot be supported. However, other studies that have investigated the effect of interest on attention and learning (Kintsch et. al., 1975; Graesser & Riha, 1984; and Shirey & Reynolds, 1988) have also reported decreased reading time by students who read interesting passages. Future research studies may include such measurements to determine the extent to which the case descriptive paragraphs may have affected the comprehension and recall of participants in this study.

Hidi (1990) has suggested that learning as a result of interest may be under dynamic control and may elicit spontaneous rather than conscious, selective allocation of attention. It appears that when they read case-illustrated text, subjects in this study were spontaneous and nonstrategic in their allocation of attention to paragraphs containing seductive details. However, when required to read expository passages, participants appeared to make a conscious decision to be strategic in their allocation of attention to important, less interesting information when they knew they would be required to recall it.

Primary and Secondary Task Case-Illustrated Text Under Varying Conditions

Investigation of primary task recall for subjects who read and listened to case-illustrated text revealed that participants who were assigned to primary and secondary task case-illustrated passages answered significantly fewer questions correctly (Mean=5.87;SD=1.51) than did those who read an expository passage while listening to case-illustrated text (Mean=8.20;SD=1.26). Further, participants assigned to this condition answered significantly fewer questions correctly (Mean=5.87;SD=1.51) than did those who read case-illustrated text while listening to an expository passage (Mean=6.87;SD=1.85) and those who only read case-illustrated text (Mean=7.00;SD=1.61).

It appears that when subjects were required to attend to two case-illustrated passages, their ability to apply effective strategies to learning important, less interesting information was affected to a greater extent than it was for those who were assigned to a condition in which only one passage contained case descriptive paragraphs. Further, reading times for those assigned to primary and secondary task case-illustrated texts indicated that these participants' spent more time reading (Mean=958.6;SD=526.9) the primary task passage than did those who read case-illustrated text while listening to an expository passage (Mean=836.4;SD=216.4).

One possible explanation for the finding of decreased comprehension and recall and increased reading times by subjects who both read and listened to case-illustrated texts compared to those who were exposed to only one passage that included descriptive paragraphs, may be that these subjects directed their attention back and forth between the

two case-illustrated texts. However, this attention may have been focused on reading information in the descriptive paragraphs resulting in their decreased comprehension and recall of important supporting information included in the passages. This suggestion finds some support in the cognitive processes questionnaire responses of participants who were assigned to a condition that required them to read and listen to case-illustrated texts. Some of these subjects (20%) indicated that they moved back and forth between the two passages. Further, the finding of increased reading time for subjects who may have moved back and forth between texts is supported by Tobias (1973) who reported that exposing subjects to primary and secondary task conditions resulted in increased reading time due to subjects' need to move back and forth between tasks.

Primary Task Expository Text Under Varying Secondary Task Conditions

Further comparison of posttest scores for participants who read an expository passage while listening to case-illustrated text found that these subjects answered significantly more questions correctly (Mean=8.20;SD=1.26), than did those who read an expository passage while listening to expository text (Mean=6.67;SD=2.06) and those who only read an expository passage (Mean=6.40,SD=1.50). These findings provide further evidence for the suggestion that when required to read an expository passage while listening to case-illustrated text, subjects invested additional cognitive resources into learning important, less interesting information. Further, these participants spent less time reading the expository passage (Mean=879.9;SD=426.1), than did those who both read and listened to expository text (Mean=971.8;SD=349.2).

The finding that subjects who listened to case-illustrated text perceived the primary

task to be less interesting (Mean=15.87;SD=3.09) than did those assigned to primary and secondary task expository texts (Mean=16.93;SD=2.15) and those who only read an expository passage (17.40;SD=2.80), provides further evidence that participants from this condition may have been more aware of the potential distraction of the secondary task case-illustrated passage, causing them to be the most strategic in their approach to learning important, less interesting information. They appear to have made a decision to direct their attention toward this information resulting in their greater comprehension and recall of primary task text, compared to those who were exposed to two expository passages.

Subjects who both read and heard expository passages appear to have been less motivated to invest additional cognitive resources into the primary task text than were those who read an expository passage while listening to case-illustrated text. It may be that these subjects were not as aware of the potential distraction from the secondary task when it did not contain case descriptive paragraphs. Further, they were not able to benefit from the cues provided by a secondary task passage that described a case. Participants who heard secondary task case-illustrated text appear to have used the cues provided by these paragraphs to use cases they had encountered to help them make associations to the information presented in the primary task passage.

Secondary Task Multiple Choice Posttest

Analysis of subjects' secondary task posttest data found that subjects who listened to case-illustrated text answered slightly more questions correctly (Mean=5.33;SD=1.69) on multiple choice posttest than did those who heard expository passages

(Mean=4.53;SD=1.63).

This finding provides further evidence for the earlier suggestion that the instruction to participants to pay attention to the primary task passage for later recall may have influenced their approach to primary and secondary tasks. Subjects were unaware that they would be required to answer questions related to information included in the secondary task text, and may have felt free to direct their attention toward information within the passages that interested them.

The finding of greater comprehension and recall for secondary task case-illustrated passages was not supported by subjects' free recall data. During free recall, participants who listened to case-illustrated text, recalled significantly fewer total main ideas than did those who listened to expository passages. No other differences were found. Therefore, it appears that even though they were able to learn information related to multiple choice posttest questions, participants did not listen to enough of these passages to be able to recall content to the extent that subjects were able to do for primary task text.

Primary Task Expository Text Under Secondary Task Case-Illustrated Conditions

Subjects who were assigned to read a primary task expository passage combined with case-illustrated secondary task text answered significantly more questions correctly on secondary task posttest (Mean=6.07;SD=1.49) than did those participants who read an expository passage while listening to secondary task expository text (Mean=4.97;SD=1.61). Further, subjects who read an expository passage indicated greater interest in the secondary task when this passage contained descriptive paragraphs (Mean=14.27;SD=3.99), than when it did not (Mean=12.93;SD-3.63). Therefore,

participants assigned to a primary task expository passage combined with case-illustrated secondary task text were able to recall more information from both primary and secondary task passages compared to all other groups. The combination of primary task expository and secondary task case-illustrated text appears to have caused subjects to invest additional cognitive resources into the task of attending to these passages resulting in their greater comprehension and recall of information included in these texts.

Primary Task Case-Illustrated Text Conditions

The study found no differences in subjects' recall of secondary task text for those assigned to case-illustrated primary task conditions combined with varying secondary task presentations. Further, subjects rated the secondary task passages to be equally interesting, regardless of their format. One explanation for the failure to find differences in secondary task recall for participants who read case-illustrated primary task text may be that subjects were interested in the case-illustrated passages they were reading and were less likely to direct their attention to the secondary task text, especially when they knew they would be tested on information related to their reading. These findings provide further support for the explanation that participants made a strategic decision to invest their cognitive resources into attending to the primary task text content they were to be tested on following their reading.

Subjects

An alternative explanation for the results of this study may be that subjects were students from among various health science professional programs who may have had different levels of proficiency when reading and listening to primary and secondary task

passages. It is possible that differences in proficiency due to the uneven representation of subjects between conditions influenced the outcome of the study.

Conclusion and Implications

The findings of this study did not support the results of other researchers (Fransson, 1977; Schiefele & Krapp, 1988; Schiefele, Winteler, & Krapp, 1988; Schiefele (1990,1991), of increased and more meaningful comprehension by subjects following their reading of high compared to low interest text. One explanation for this may be that interest was manipulated differently in the above research. These studies measured subjects' interest in the topic to be read, whereas in this experiment interest was determined by inserting case descriptive paragraphs throughout text.

Case descriptive paragraphs included in text seem to have acted as seductive details for subjects who read case-illustrated passages. These subjects appear to have directed their attention toward the symptoms and behaviors described in the paragraphs, resulting in their decreased comprehension and recall of important, less interesting information. Other studies have also reported that students' allocate greater attention to seductive details within text (Garner, Kulikowich & Brown, 1991; Wade & Adams, 1991; Wade et. al., 1991).

Participants who were required to read an expository passage while listening to case-illustrated text appear to have been the most strategic in their approach to learning information included in the primary task passage. These subjects seem to have made a strategic decision to direct their attention toward important, less interesting information they knew they would be tested on following their reading. Further, they used the cues

from the secondary task case descriptive paragraphs to think about cases they had encountered with either Anorexia Nervosa or Bipolar Disorder, and associated them to the information included in the expository passage. These findings indicate that when mature students are required to learn information that they are told is important, their interest in the information becomes secondary to its importance.

Students who participated in this study were from professional degree programs and were experienced with learning information for high stakes examinations under conditions of distraction. Therefore, they were more likely than less experienced students, to be able to be strategic in their approach to these tasks. Shirey (1992) has suggested that mature, skilled readers are more effective and efficient in their allocation of attention to reading text, than are immature readers. He proposed that mature readers are able to successfully allocate cognitive resources to information that is relevant to task-related criteria, such as objects and adjunct questions. In this study, subjects were told they would be tested on the information they read; therefore this information may have been perceived as relevant to their success on the test that was to follow. Shirey further suggested that mature readers do not allocate extra attention to information made important by interest. He stated that the reader's ability to decide which information is interesting or important, and to evaluate the effectiveness of strategies will also determine their approach to a task. According to Shirey, mature readers appear to have an externally-driven learning that is related to the task and supports the selective allocation of attention. The readers in this study were mature students who appear to have been influenced by the externally-driven criteria of the forthcoming test, when deciding how they would allocate their cognitive

resources to the task of reading and listening under primary and secondary task high and low interest conditions.

It has been suggested (Shirey, 1992), that internally-driven learning occurs without extra effort on the part of the reader, and is related to interest. In this experiment, subjects who read an expository passage while listening to case-illustrated text, appear to have employed the strategy of generating their own interest in expository passages when they were told to pay attention to this information. However, despite the well-developed strategies of those who read primary task case-illustrated text, they seem to have experienced considerable difficulty attending to important, less interesting information in a passage that included descriptive paragraphs, that is, seductive details. Wade et. al. (1991) also reported that skilled readers tend to be nonstrategic when it comes to seductive details (Wade et. al., 1991). As may have occurred in this study, they found that seductive details within text directed students' attention away from important, hard to learn material.

The findings of this research have implications for the manner in which clinical information is presented to students during the early stages of their medical education. It has been suggested that students should be provided with a link between clinical and basic science information during early knowledge acquisition (Bordage & Lemieux, 1991). However, the results of this study indicate that if the goal is for students to link clinical and basic science information, careful attention should be paid to the manner in which clinical case histories are used to teach basic science concepts and principles.

In this study, case descriptive paragraphs were included in text that contained

information that explained mechanisms and treatment choices for either Anorexia Nervosa or Bipolar Disorder. The inclusion of case information as separate paragraphs appears to have caused mature students to direct their attention toward this information resulting in their decreased comprehension and recall of important, less interesting information. While the study assumed that case descriptive paragraphs would generate interest and relevance for supporting information, participants did not appear to have been able to link patient descriptive information and supporting facts. Therefore, they did not use the case description to create context and relevance for basic science concepts and principles, as was anticipated by the study.

These students, who appear to have been very strategic in their approach to learning under conditions of distraction, were not strategic when exposed to case-illustrated text that included descriptive paragraphs, that is, seductive details. It seems that they found this information to be very interesting and directed their attention toward these paragraphs and away from supporting information. It is possible that if subjects' interest in these paragraphs had been measured, they would have reported a great deal of interest.

Participants who read expository passages were far more strategic in their approach to learning text content. However, these passages did not provide them with an opportunity to create links between clinical and basic science information. While learning information from expository text under conditions of distraction, subjects appear to have allocated additional cognitive resources to comprehending information they read, while simultaneously attending to secondary task content, particularly when it was of interest to them. Further, listening to a case-illustrated secondary task appears to have influenced

participants' approach to the primary task expository text. They reported that they thought about persons they had encountered with symptoms of Anorexia Nervosa or Bipolar Disorder, thus generating their own cases. These strategies seem to have assisted them in learning important, less interesting information as demonstrated by their greater comprehension and recall of primary task text content compared to all other groups.

The findings of this research suggest that when clinical information is introduced to students, it should be used only to highlight key concepts and principles, or to clarify points. Further, it is essential to direct students' attention toward important information included in passages and to ensure that the relationship between clinical and basic science information is made clear to them.

The finding that inserting case descriptive paragraphs in text resulted in decreased comprehension and recall of important, less interesting information suggests that educators may need to pay attention to the methods by which they present clinical information to students. Medical schools that have introduced problem-based learning methodology into their curricula, have presented patient information to students to provide them with interest and relevance while learning basic science concepts and principles. However, in this approach, small group instructors direct students' attention toward information necessary for an understanding of the patient's presenting symptoms.

In this study, the passages were presented via computer terminal and audiotape. A limitation of presenting clinical material to students via textbook, computer, or lecture formats, is that they do not receive guidance in connecting clinical and basic science information. The results of this experiment suggest that when students read text that

includes case descriptive paragraphs their comprehension and recall of important factual information is reduced. This finding is supported by the other research studies that have demonstrated increased recall of seductive details and reduced recall of important factual information when students read highly interesting information (Garner, et. al., 1989).

The results of this study raises questions about ways in which clinical and basic science information can be combined to ensure the allocation of attention to important concepts and principles. One way to encourage the integration of clinical and basic science information may be to introduce case histories throughout paragraphs within text and to limit it's use to the introduction and reinforcement of important concepts and principles. In addition, including instructional objectives to direct students' attention toward important concepts and principles may ensure that they pay attention to this information.

The value of clinical information in motivating students and providing context and relevance for understanding basic science concepts and principles is unquestionable. However, it appears that careful attention needs to be paid to the manner in which this information is integrated into media presentations if students are to learn those facts that are important to their understanding of clinical disorders.

Suggestions For Future Research

One limitation of this study was that the extent to which subjects found text information to be important and interesting was not measured throughout the text. Therefore, future research should assess the extent to which subjects find information presented within text paragraphs to be important and/or interesting during their reading

of text in order to differentiate the effects of importance and interest, and to determine students' allocation of attention. Further, such assessments would also clarify the effects of interest and importance.

Another limitation of the above research was that subjects' interest in primary and secondary task texts presented simultaneously was not measured during the pilot study. Future research studies that require subjects to rate their interest in text formats under the same conditions during both pilot and main studies may help to explain the difference in interest ratings found in this experiment.

A further limitation of this experiment was the maturity level of participants. Future research that replicates this experiment using less mature students may clarify the extent to which the maturity level of students who participated in this study affected the outcome.

Research findings (Patel et. al., 1987) have suggested that in their early stages of learning basic science, students are inept in identifying connections between clinical signs and symptoms and basic science mechanisms independently of instructional objectives. Further, investigation of the impact on students' learning of including instructional objectives in text that uses clinical cases to teach basic science information may be beneficial. This may also clarify the controversy over the extent to which basic and clinical sciences can be integrated during the early stages of learning basic science.

Future research needs to investigate how case-illustrations can be used to demonstrate important generalizations within text. Assessing whether clinical information included in passages only for illustration and clarification will result in greater comprehension and

recall by students than the inclusion of descriptive paragraphs, may clarify the effects of using clinical information to teach basic science concepts and principals. The results of the above research suggest that clinical information should only be used to make a point about important information presented in text, and that this use should focus on the application of information to clinical situations. Feedback obtained from this research can be used to facilitate the transfer of theoretical concepts and principles to practice.

Appendix A

Anorexia Nervosa Case-Illustrated Text

Anorexia Nervosa is a complex disorder manifested by physiological, behavioral, and psychological changes and characterized by morbid fear of fatness, gross distortion of body image, and unrelenting pursuit of thinness. The name is a misnomer, since true anorexia (loss of appetite) does not usually occur until late in the illness. This disorder typically begins in adolescence, with the average age at onset being between 10 and 30 years.

> *At 17 Kathy, a high school senior, decided she needed to lose weight. She was concerned that boys did not find her attractive because she was overweight. She drastically reduced her caloric intake and refused to eat any high-carbohydrate, or fat-containing foods. She became very hyperactive and was obsessed with excessive exercise activities, such as walking, running, swimming, cycling, dancing, and calisthenics. Although she lost so much weight that she became cachexic, her hyperactive behavior continued. Kathy's parents became increasingly concerned about her behaviors.*

Some individuals with anorexia nervosa alternate their fasting with episodes of uncontrolled gorging without any awareness of hunger or satiation. When these eating binges occur, they are often followed by self-induced vomiting. This condition is known as bulimia. It is also common for these persons to consume huge quantities of laxatives. In addition, anorexics often lose weight by abusing diet pills and diuretics.

Kathy's family were concerned by the changes in her eating, particularly when her activities became peculiar, even bizarre. They caught her hoarding large quantities of food and were constantly finding small amounts of food that she had hidden around the house. Her mother was very puzzled by the fact that Kathy ate very little, yet was continually obsessed with food and cooking. She measured all food portions and ate small meals over many hours. She also followed a ritual for storing, preparing, serving, eating, and disposing of food.

The anorexic's highly ritualized behavior extends to everything. These activities, including including exercise and eating, are undertaken as if there were profound consequences for the future well-being of the anorexic and those whom the individual cares the most about.

Kathy's parents became very disturbed by her secretiveness. They also caught her in lies about her eating. They were extremely angry because they suspected Kathy had been removing money from the house. They became outraged when Kathy was caught stealing from a local department store.

Clinicians generally agree that the anorexic's unrelenting pursuit of thinness manifests an underlying psychological struggle to maintain a sense of personal autonomy and self-control. On the surface, these individuals are stubbornly defiant and fiercely independent. They insist they are happy, fully aware of their condition, and able to take care of themselves. Underneath, they are stricken with a paralyzing sense of helplessness and ineffectiveness, with control over eating and body size being the only mechanisms through which they can sustain their sense of autonomy and mastery over their life.

Two other essential features of this disorder are: a misperception of internal body cues, with inability to recognize manifestations of nutritional deprivation; and a disturbance of body image, so that these individuals may see themselves as fat even when exceedingly thin. These cognitive and perceptual distortions accentuate the anorexic's sense of personal ineffectiveness and reinforce the need to continue the pursuit of thinness in order to maintain a sense of control.

Kathy spoke with her best friend about lacking confidence in her ability to control herself. She shared her fears about trusting herself to control her eating. She said that if she allowed herself to give in to her overwhelming impulses to eat, she would gorge herself until she became obese.

Individuals with anorexia nervosa also tend to view themselves in terms of absolutes and polar opposites. Behavior is either all good or all bad; a decision is either completely right or completely wrong; and one is either absolutely in control or totally out of control.

One morning Kathy screamed hysterically. Her mother found Kathy standing on the bathroom scale in a state of horror because she had gained an ounce since she last weighing herself and was convinced that she was extremely obese. Kathy further talked of her fears of becoming an adult. She was particularly anxious about taking responsibility for interpersonal and sexual relationships. She told her friend that she feared having sex with her boyfriend. When they did engage in sexual activities, she either backed out at the last minute, or did not enjoy the experience.

Depressive symptoms are commonly associated with anorexia nervosa. These symptoms include dysphoric mood, crying spells, sleep disturbances (i.e., insomnia or hypersomnia), and occasionally, suicidal behavior. Low self-esteem is also characteristic, with many anorexics claiming that thinness and the ability to lose weight are the only things they like about themselves. Other psychiatric symptoms frequently associated with anorexia nervosa include obsessive compulsive or histrionic traits, anxiety, perfectionism, and hypochondriasis.

Many symptoms observed in anorexia nervosa also occur in individuals subjected to enforced starvation (e.g., prisoners of war, famine victims, and research subjects). Thus, the reversal of starvation is the necessary first step in the treatment of anorexia nervosa. To establish a diagnosis of anorexia nervosa, there must be a weight loss of at least 15% of the baseline or ideal body weight.

> *Kathy lost even more weight and her parents became alarmed by her appearance. She looked like she was suffering from malnutrition and was continually stressed. She finally revealed to her mother that she had been experiencing symptoms of amenorrhea during the past months.*

Anorexia nervosa with premenarcheal onset often results in short stature with delayed breast development. Prolonged amenorrhea in women with anorexia nervosa may lead to the development of osteoporosis. Anorexics frequently complain of epigastric distress, and their gastric emptying time is prolonged. Vomiting, constipation, cold intolerance, headache, polyuria, and sleep disturbances are also commonly reported. Autophonia is sometimes noted. Besides emaciation, physical findings may include edema, lanugo, low

blood pressure, bradycardia, arrhythmias, diminished cardiac mass, and infantile uterus. Males with anorexia frequently have hemorrhoids and experience loss of libido. Low testosterone levels associated with emaciation often do not return to normal after weight gain.

Kathy told her best friend that she had been worried about bodily changes since puberty. She also worried about her parents separating when she left home for college.

Typically, anorexia nervosa begins in individuals who are at normal weight or slightly to moderately overweight. Dieting is initially supported, even actively encouraged, by family and friends as well as in many cases by dance teachers and sports coaches. The individual is thus praised for the initial weight loss and takes pleasure in the achievement. When the anorexic reaches the original weight reduction goal, a new one is set. Ostensibly, this is for "insurance" to offset future weight gains, but weight loss in the pursuit of thinness soon becomes an objective.

Kathy continued to experience amenorrhea, as well as edema, constipation and abdominal pain. She also continued to purchase diet pills, despite the many fights that followed when her parents discovered the pills. When Kathy's mother told her she had made an appointment for her with the family physician, she became outraged screaming that her problems were due to "food allergies."

Anorexics may end up in emergency departments, since the complications of dieting or vomiting, such as dehydration and fluid and electrolyte imbalance, may be severe. The anorexic may be brought in by the parents, who become worried when weight loss is

extreme or are alarmed by bizarre eating habits and personality changes.

The physician made a diagnosis of anorexia nervosa, explaining it could run a variable course. He hoped that this was the only episode that Kathy experienced and felt she could achieve a complete recovery. He alerted them that multiple episodes can occur and may span many years.

A single anorexic episode may also be chronic and unremitting. Complete or partial recovery may occur spontaneously, or may follow treatment. Both single episodes and fluctuating courses may progress to death.

The physician explained that in order make a definitive diagnosis it would be necessary to rule out other medical illnesses that can cause weight loss. Therefore, he took a history and conducted a physical examination with laboratory tests.

Anorexia nervosa must be distinguished from weight loss due to medical illnesses such as neoplasms, tuberculosis, hypothalamic disease, and primary endocrinopathies (anterior pituitary insufficiency, Addison's disease, hyperthyroidism, and diabetes mellitus). Individuals with these medical illnesses do not experience the dread of fatness, unrelenting pursuit of thinness, and hyperactivity that are characteristic of anorexia nervosa.

Weight loss frequently occurs in individuals with depressive disorders or certain schizophrenic disorders characterized by peculiar eating habits prompted by delusions about food. Individuals with other disorders also lack the anorexic's preoccupation with caloric intake, obsessions with body shape and size, and hyperactivity. Individuals with

somatization disorder may manifest weight fluctuations, vomiting, and peculiar food habits, but weight loss is usually not severe, and amenorrhea for longer than three months is unusual.

Kathy's parents felt reassured when told her prognosis was favorable because she had a good premorbid level of psychosocial adjustment, her early age at onset, and her less extreme weight loss. He also considered the fact that she did not deny her illness when confronted with the medical reality of her situation to be a favorable sign.

Unfavorable prognostic factors include poor premorbid level of psychosocial adjustment, low socioeconomic status, extreme weight loss, greater denial of illness, and the presence of bulimia, vomiting and laxative abuse. These indicators are all relative, since no single feature or set of factors can reliably predict the prognosis for any given individual.

The physician further explained that complete recovery in less than two years is unusual. He said that the longer Kathy was symptom free before follow up, the greater the likelihood of her recovery.

The initial goal of treatment is to counteract the effects of starvation by promoting weight gain and restoring normal nutritional balance. In mild cases, this may be accomplished on an outpatient basis; in moderate to severe cases, an initial period of hospitalization is usually required.

Weight gain may be accomplished by hyperalimentation or total parenteral nutrition. However, because of the risks of intravenous feedings, most programs use behavior

modification protocols based on the principles of operant conditioning. While behavior modification may be effective in prompting initial weight gain, most outcome studies have concluded that behavior modification alone is not sufficient treatment. Lasting recovery occurs only when such methods are used with psychotherapy that addresses the underlying psychological conflicts. Clinicians should be aware that too rapid weight gain may cause dangerous gastric dilatation or precipitate congestive heart failure.

Drug therapy may be useful with some individuals who present with anorexia nervosa. Some clinicians have considered the perceptual and body image disturbances characteristic of anorexia nervosa to be manifestations of psychosis, and chlorpromazine and similar drugs have facilitated weight gain in some patients. However, it is not clear whether the benefits of such medications are due to their antipsychotic or their sedative effects. Antidepressants have also helped some anorexics, thus supporting the argument that a subgroup of individuals with anorexia nervosa may have a primary affective illness. Cyproheptadine, an appetite stimulator and serotonin antagonist, has proven helpful in the treatment of a subgroup of anorexic patients with especially severe symptoms and a history of birth trauma.

> *The physician said that psychoanalysis for anorexia was generally not effective. However, psychodynamically oriented psychotherapy that provided Kathy with support, and helped her to focus on issues relating to her struggle for autonomy and personal control could be beneficial. He further recommended family therapy, especially since Kathy lived at home. He said it was important for the family to understand the meaning of Kathy's symptoms.*

To effectively treat anorexia nervosa, the biological, psychological, and behavioral changes must all be addressed. Effective treatment programs should not be welded to any single approach. Clinicians should be familiar with various methods of treatment and use them singly or in combination as called for.

Kathy was responsive to individual and family therapy. She resolved some issues regarding her autonomy and self-doubts. She was also very happy when her parents agreed to work on their marital problems. Kathy reported that for the first time in years she could imagine liking herself. She stayed in individual therapy during her first year of college and continued to thrive.

Appendix B

Anorexia Nervosa Expository Text

Anorexia Nervosa is a complex disorder manifested by physiological, behavioral, and psychological changes and characterized by morbid fear of fatness, gross distortion of body image, and unrelenting pursuit of thinness. The name is a misnomer, since true anorexia (loss of appetite) does not usually occur until late in the illness. This disorder typically begins in adolescence, with the average age at onset being between 10 and 30 years.

Anorexics often cause their families concern because they go to extremes to lose weight. They drastically reduce their caloric intake and refuse to eat any high-carbohydrate and fat-containing foods. Their families notice that they become very hyperactive and obsessed with excessive exercise activities. They walk, run, swim, cycle, dance, and engage in calisthenic activities. Although they lose so much weight that they become cachexic, their hyperactivity continues.

Some individuals with anorexia nervosa alternate their fasting with episodes of uncontrolled gorging without any awareness of hunger or satiation. When these eating binges occur, they are often followed by self-induced vomiting. This condition is known as bulimia. It is also common for these persons to consume huge quantities of laxatives. In addition, anorexics often lose weight by abusing diet pills and diuretics.

Families of anorexics become concerned by the changes in their eating behaviors. They worry when they notice the individuals activities have become peculiar, even bizarre. Anorexics often hoard large quantities of food, or hide small amounts of food

around the house. Families are puzzled by the fact that they eat very little, but are obsessed with food and cooking. Parents of anorexics report that they measure all food portions and eat small meals over many hours. Further, anorexics follow a ritual for storing, preparing, serving, eating, and disposing of food.

The anorexic's highly ritualized behavior extends to everything. All activities, including eating and exercise, are undertaken as if there were profound consequences for the future well-being of the anorexic and those whom the individual cares the most about. These behaviors cause family members to become alarmed.

Families become disturbed by the anorexics secretiveness when they catch them in lies about their eating. Anorexics engage in kleptomania and are often caught stealing.

Clinicians generally agree that the anorexic's unrelenting pursuit of thinness manifests an underlying psychological struggle to maintain a sense of personal autonomy and self-control. On the surface, they are stubbornly defiant and fiercely independent. They insist they are happy, fully aware of their condition, and able to take care of themselves. Underneath, they are stricken with a paralyzing sense of helplessness and ineffectiveness, with control over eating and body size being the only mechanisms through which they can sustain their sense of autonomy and mastery over their life.

Two other essential features of this disorder are: a misperception of internal body cues, with inability to recognize manifestations of nutritional deprivation; and a disturbance of body image, so that anorexics may see themselves as fat even when exceedingly thin. These cognitive and perceptual distortions accentuate the anorexics' sense of personal ineffectiveness and reinforce the need to continue the pursuit of

thinness to maintain a sense of control.

Anorexics lack confidence in their ability to impose self-control. These individuals often share with close friends their concern about trusting themselves to control their own eating. They are afraid that if they allow themselves to give in to their overwhelming impulses to eat, they will quite likely gorge themselves so much that they will become obese.

Individuals with anorexia nervosa also tend to view themselves in terms of absolutes and polar opposites. Behavior is either all good or all bad; a decision is either completely right or completely wrong; and one is either absolutely in control or totally out of control.

Anorexics cause alarm within their families when they respond to the gain of an ounce with the same horror as they would experience if they had gained 100 lb. This self-mistrust, and tendency to view the world in absolutes reinforce the exaggerated need of the anorexic to maintain rigid control over what is and is not eaten.

Anorexics are often afraid of becoming an adult, since adulthood means taking responsibility for interpersonal and sexual relationships. They fear their sexuality and usually avoid having sex. When they do engage in sexual activity, it is usually without enjoyment.

Depressive symptoms are commonly associated with anorexia nervosa. These symptoms include dysphoric mood, crying spells, sleep disturbances (i.e., insomnia or hypersomnia), and, occasionally, suicidal behavior. Low self-esteem is also characteristic, with many anorexics claiming that thinness and the ability to lose weight

are the only things they like about themselves. Other psychiatric symptoms frequently associated with anorexia nervosa include obsessive compulsive or histrionic traits, anxiety, perfectionism, and hypochondriasis.

Many symptoms observed in anorexia nervosa also occur in individuals subjected to enforced starvation (e.g., prisoners of war, famine victims, and research subjects). Thus, the reversal of starvation is the necessary first step in the treatment of anorexia nervosa. To establish a diagnosis of anorexia nervosa, there must be a weight loss of at least 15% of the baseline or ideal body weight.

Anorexics often look like they are suffering from malnutrition and are continually stressed. Amenorrhea, independent of weight loss and often preceding initial weight loss, is always present in women.

Anorexia nervosa with premenarcheal onset often results in short stature with delayed breast development. Prolonged amenorrhea in women with anorexia nervosa may lead to the development of osteoporosis. Anorexics frequently complain of epigastric distress, and their gastric emptying time is prolonged. Vomiting, constipation, cold intolerance, headache, polyuria, and sleep disturbances are also commonly reported. Autophonia is sometimes noted. Besides emaciation, physical findings may include edema, lanugo, low blood pressure, bradycardia, arrhythmias, diminished cardiac mass, and infantile uterus. Males with anorexia frequently have hemorrhoids and experience loss of libido. Low testosterone levels associated with emaciation often do not return to normal after weight gain.

The history of anorexia nervosa often follows new life situations in which the

individual feels inadequate or unable to cope. Onset may follow changes such as puberty, adolescence, or entering high school or college, or the breakup of a relationship.

Typically, anorexia nervosa begins in individuals who are at normal weight or slightly to moderately overweight. Dieting is initially supported, even actively encouraged, by family and friends as well as in many cases by dance teachers and sports coaches. The individual is praised for the initial weight loss and takes pleasure in the achievement. When the anorexic reaches the original weight reduction goal, a new one is set. Ostensibly, this is for "insurance" to offset future weight gains, but weight loss in the pursuit of thinness soon becomes an objective.

Families of anorexics usually bring them for medical attention, not because of weight loss, but because of their concern over complaints such as amenorrhea, edema, constipation, or abdominal pain. The anorexic may complain of specific "food allergies." They often continue to purchase diet pills, despite the objection of their parents.

Anorexics may end up in a emergency departments, since the complications of dieting or vomiting, such as dehydration and fluid and electrolyte imbalance, may be severe. The anorexic may be brought in by the parents, who become worried when weight loss is extreme or are alarmed by bizarre eating habits and personality changes.

Anorexia can run a variable course. There may be only one episode with a complete recovery achieved. Multiple episodes can occur, and may span many years. A single episode may also be chronic and unremitting. Complete or partial recovery may occur spontaneously, or may follow treatment. Both single episodes and fluctuating courses may progress to death.

Anorexia nervosa must be distinguished from weight loss due to medical illnesses such as neoplasms, tuberculosis, hypothalamic disease, and primary endocrinopathies (anterior pituitary insufficiency, Addison's disease, hyperthyroidism, and diabetes mellitus). These can generally be diagnosed thorough histories, physical examinations, and laboratory studies. Individuals with these medical illnesses do not experience the dread of fatness, unrelenting pursuit of thinness, and hyperactivity that are characteristic of anorexia nervosa.

Weight loss frequently occurs in individuals with depressive disorders or certain schizophrenic disorders characterized by peculiar eating habits prompted by delusions about food. Individuals with other disorders also lack the anorexic's preoccupation with caloric intake, obsessions with body shape and size, and hyperactivity. Individuals with somatization disorder may manifest weight fluctuations, vomiting, and peculiar food habits, but weight loss is usually not severe, and amenorrhea for longer than three months is unusual.

The anorexics prognosis is considered favorable when there is a good premorbid level of psychosocial adjustment, early age at onset, less extreme weight loss, and there is less denial of the illness.

Unfavorable prognostic factors include poor premorbid level of psychosocial adjustment, low socioeconomic status, extreme weight loss, greater denial of illness, and the presence of bulimia, vomiting and laxative abuse. These indicators are all relative, since no single feature or set of factors can reliably predict the prognosis for any given individual.

Complete recovery in less than two years is unusual. The longer time that passes system free before the Anorexic's follow up, the greater the likelihood of recovery.

The initial goal of treatment is to counteract the effects of starvation by promoting weight gain and restoring normal nutritional balance. In mild cases, this may be accomplished on an outpatient basis; in moderate to severe cases, an initial period of hospitalization is usually required.

Weight gain may be accomplished by hyperalimentation or total parenteral nutrition. However, because of the risks of intravenous feedings, most programs use behavior modification protocols based on the principles of operant conditioning. While behavior modification may be effective in prompting initial weight gain, most outcome studies have concluded that behavior modification alone is not sufficient treatment. Lasting recovery occurs only when such methods are used with psychotherapy that addresses the underlying psychological conflicts. Clinicians should be aware that too rapid weight gain may cause dangerous gastric dilatation or precipitate congestive heart failure.

Drug therapy may be useful with some individuals who present with anorexia nervosa. Some clinicians have considered the perceptual and body image disturbances characteristic of anorexia nervosa to be manifestations of psychosis, and chlorpromazine and similar drugs have facilitated weight gain in some patients. However, it is not clear whether the benefits of such medications are due to their antipsychotic or their sedative effects. Antidepressants have also helped some anorexics, thus supporting the argument that a subgroup of individuals with anorexia nervosa may have a primary affective illness. Cyproheptadine, an appetite stimulator and serotonin antagonist, has proven

helpful in the treatment of a subgroup of anorexic patients with especially severe symptoms and a history of birth trauma.

Psychoanalysis has not generally been an effective treatment approach. However, a psychodynamically oriented psychotherapy that provides the anorexic with support and help in focusing on issues related to the struggle for autonomy and personal control can be beneficial. Family therapy can he helpful when the individual lives at home. It is important for the family too understand the meaning of the symptoms of anorexia nervosa.

To effectively treat anorexia nervosa, the biological, psychological, and behavioral changes must all be addressed. Effective treatment programs should not be welded to any single approach. Clinicians should be familiar with various methods of treatment and use them singly or in combination as called for.

Anorexics are often most responsive to individual and family therapy. They benefit from resolving some issues they face regarding their autonomy and self-doubts.

Appendix C

Bipolar Disorder Case-Illustrated Text

Individuals who experience manic episodes display elevated, expansive, or irritable moods. The changes in mood that occur in persons who suffer from bipolar disorder, are a prominent or persistent part of the illness.

Jason, a 27 year old extremely energetic graduate student began constructing a mathematic code. He told his wife that this code would allow only him and his appointed "prophets" to understand the content of his thesis, which will be seen as the "new bible of the computer age." His wife was already concerned about his recent involvement in multiple activities and ventures. At first, she thought Jason was very productive, and the code very creative, but mildly eccentric. However, she was now very worried.

In time, as the bipolar patient's investment in activities becomes excessive, the individual loses the capacity to behave with reasonable caution and judgement. These individuals also find it difficult to conform to social expectations and norms.

The predominant mood of bipolar patients is euphoria. This mood is often accompanied by a sense of absolute conviction or certitude. This usually involves a self-perceived talent or perception, but occasionally centers on more metaphysical and cosmic matters. A new, or dramatically enhanced interest in religious or sexual experiences is commonly reported by these patients.

The euphoria felt by the manic patient has an infectious quality and may mislead some people, including those who are close to the individual, into accepting behavior that

otherwise might not be tolerated. The manic individual can be quite engaging. They are known for their buying sprees and improvident business ventures. These ventures are often accompanied, at least for a time, by a remarkable ability to obtain loans or gifts of money from others. The individual is often encouraged by people whose judgement is usually better.

> *The first symptom Jason's wife noticed was that he no longer slept during the night. She became concerned when he had not slept at all for three days. His* "hunger" *for social interchange led him to make frequent and inappropriate phone calls to distant acquaintances. These calls often occurred late at night when social stimulation was low. He also developed a fascination with music and tried to play a variety of musical instruments. Jason also began wearing very bright colors and his unusual combinations of eccentric attire were often noticed by others. His wife was very angry when he met her for dinner wearing a mismatched three-piece suit. Jason exhibited carelessness about his clothes in general. His wife was very troubled when he was returned to his home by police who found him walking in a public street without clothing.*

The speech of manic patients is rapid and discursive. They are difficult to interrupt, and have difficulty not interrupting when others are speaking. The speech itself may involve rhyming, punning and bizarre associations, but there are no pathognomonic elements.

> *Jason was easily distracted and he responded to all stimuli in a self-referential manner. His wife noticed that he was getting worse. He changed from being*

euphoric and grandiose, to behaving in a very irritable way. He was also paranoid that someone was trying to steal his thesis ideas.

The anxiety and feelings of suspicion displayed by the manic patient can cause decreased verbal output that can lead physicians to erroneous diagnostic conclusions. While acute mania and hypomania have commonly been diagnosed among individuals with a psychiatric treatment history who commit violent crimes, significant aggression is rare.

Jason's mood was depressed along with his manic state. He often changed abruptly from a manic, to depressed, to a manic state.

The manic patient may experience true delusions and auditory hallucinations, causing the physician problems with differential diagnosis. The content of the delusions or hallucinations is often consistent with the predominant mood.

In severe cases, mania can present as a state of catatonia. The individual appears "willfully" unresponsive, often assuming a fixed posture and appearing mute except for occasional shouts or guttural sounds. Less severe states of mania may be characterized by primitive delusions, fecal smearing, and extremes of tearfulness and emotional lability.

Traditionally, bipolar illness has been associated with a late age at onset. However, current evidence suggests that this illness peaks between 20 and 25 years. Onset after age 60 is rare. During adolescence, bipolar illness is often mistaken for adjustment disorder. This may reflect historical diagnostic bias or diagnostic confusion arising from normal physical and psychological developmental changes that take place during this period.

Jason's wife took him to the hospital emergency department. The physician could not determine whether his symptoms were due to an organic disorder or bipolar disorder on the basis of his presenting characteristics.

When manic symptoms occur in association with known organic disorders, the diagnosis should be organic mood disorder (i.e., "secondary mania"), and not bipolar disorder. It is probable that future research will result in the shifting of many manic diagnoses from a primary to a secondary category. The list of known causal agents for this illness is long. These agents include drugs (e.g., corticosteroid, levodopa, stimulants), metabolic disturbances (such as those associated with hemodialysis), infection, neoplastic diseases, and epilepsy (particularly partial complex seizures).

In manic patients who experience prominent delusions and hallucinations, the physician's differential diagnosis is likely to include schizophrenia, paranoid type because both syndromes can present with identical clinical symptoms. Therefore, the basis for diagnosis of bipolar illness is the clinical course, or secondary features. These include a family history of mood disorder, the level of premorbid adjustment, a history of manic symptoms, or a prior response to treatment. The diagnosis of schizoaffective disorder can be made when the clinician is unable to choose between manic episodes and schizophrenia. Unfortunately, there is presently no agreement on how this category should be defined or on its etiological or prognostic relationship to schizophrenia or mood disorder.

Jason was diagnosed as suffering from bipolar disorder and treatment with drug therapy was recommended. The physician explained that Jason should be watched

carefully because up to 15% of bipolar patients have an inadequate response to medication and may endure chronic or recurrent symptoms. Jason's wife was anxious because there was a significant risk of suicide.

The phases of bipolar illness may differ in their responsiveness to treatment and in their effect on ultimate outcome. Some individuals, for example, experience complete remission of acute manic symptoms and prophylactic benefit from medication, but continue to have unmodified or attenuated depressive episodes.

Jason's wife recalled an aunt who was hospitalized twice following the birth of her two children. She also said that Jason's older brother was married four times and was "quite moody."

The individual's personal and family psychiatric history is the best predictor of the frequency with which the bipolar patient swings from the manic state to depression, and of the individual's response to treatment. Once the initial episode has resolved, the duration of the interval during which an individual is symptom free, varies greatly.

Patients who satisfy the criteria for bipolar disorder will experience another episode within 2-4 years. The complete cycle i.e. from manic, to depressed, to manic state may be as short as 48 hours or so long that the concept of cyclicity becomes meaningless.

Patients with bipolar disorder who experience rapid cycles - three or more a year - do not respond as well to lithium as individuals with longer symptom free intervals. Prognosis depends on the frequency and duration of individual episodes and the response to medication. Since lithium is often effective in moderating the severity of symptoms, there is always a strong possibility that recurrences are a result of patient noncompliance

with the drug regimen.

Jason denied the physician's diagnosis. He admitted he may have problems, but attributed them to overwork and to stress both at work and at home.

Patients with mild bipolar episodes probably can function adequately during a period in which they display most of the symptoms of a manic episode. For these patients, factors such as psychological coping mechanisms, social supports, and socioeconomic status influence the outcome as much as response to medication.

Jason began taking neuroleptic medication and within five days his symptoms alleviated. His wife was extremely happy when his suspicious stopped and his grandiose beliefs were under control.

Lithium is the standard treatment for manic episodes and is usually the first-line agent unless there has been documented treatment failure or the drug is medically contraindicated. It is over 95% effective in the management of acute mania. Anticonvulsants, especially carbamazsepine and valproic acid may also be prescribed. Calcium channel blockers have been tried experimentally with variable results. Lithium's antimanic effects have a fairly slow onset (7-10 days). Therefore, other agents such as benzodiazepines, may also be used early in treatment along with lithium to help manage the patient.

The first symptoms that disappeared during Jason's treatment were his increased psychomotor activity, pressured speech, and his lack of sleep. Following these, Jason's expansive mood, grandiosity and intrusiveness to others improved.

Some manic patients have affective symptoms which include irritability and hostility

instead of expansiveness. Their mood may also be labile and shift from day to day or from hour to hour. Symptoms relating to disorganization of the form of thought (e.g., flight or ideas, loosening of association) are more likely to respond to lithium than delusional content, such as paranoia. The symptoms displayed by the manic patient often do not begin to abate until one to two weeks after the patient's treatment is initiated. These symptoms may then diminish slowly over time. Lithium alone is often not effective in treating psychotic manic symptoms, such as delusions and hallucinations.

> *Jason's family were confused when the Physician explained that there is no reliable evidence that indicates that psychosocial factors are a cause of bipolar disorder. The physician further told them that despite this evidence, psychosocial factors may have precipitated Jason's state. He further explained that because Jason's case appeared to be mild, it may have been necessary for these factors to be present before he began to experience symptoms.*

The history of patients with bipolar disorder has been analyzed to determine the contribution of life experiences to this illness. These studies have been carried out retrospectively. The findings of this research have been found to be unreliable. Each patient whose life history has been examined, has been found to have had environmental experiences that could explain those behavioral changes that occurred.

Families have been encouraged by findings from recent research studies that have investigated the role of biological circadian rhythmicity in bipolar disorder. The findings of these studies indicate that subtle changes in the light-dark cycle (e.g., seasonal variations) are a better predictor of individuals who may be at risk for bipolar disorder

than is life history.

Jason's physician told his family that some form of psychosocial intervention is almost always needed in the treatment of bipolar disorder. He further explained that the type of therapy and the length of time needed for therapy depended on the degree to which Jason's behavior is disruptive to his family, the degree to which it is disruptive to his financial situation, his baseline behaviors, and his response to somatic treatment.

Bipolar disorder has a strong genetic component. This component makes it almost impossible for physicians to determine the contribution of other factors to the disorder. Therefore, health care workers who attempt to treat bipolar patients experience a great deal of difficulty. These workers must attempt to distinguish the extent to which the patient's illness is due to a genetic contribution, and/or those aspects of the illness which are not genetic. Those aspects reflect the patient's environmental and developmental experiences that are a result of a primary disorder in parents and siblings of these patients.

Jason's family were even more concerned when told that Jason's health care workers will find it very difficult to plan therapeutic intervention for him. The physician explained this difficulty as being due to the nature of the biological contribution to Jason's illness. He explained to Jason's family that this contribution makes it almost impossible to determine in advance what Jason's ongoing psychosocial needs may be once his acute symptoms have subsided. He told the family that some individuals with bipolar disorder have infrequent

recurrences, experience long symptom-free intervals, and are able to lead productive lives. He then told them that others may have a particularly malignant form of the disorder or may exhibit pathological degrees of denial and lead turbulent lives. He explained that these individuals may require active psychosocial involvement by their therapists.

Appendix D

Bipolar Disorder Expository Text

Individuals who experience manic episodes display elevated, expansive, or irritable moods. The changes in mood that occur in persons who suffer from Bipolar Disorder are a prominent or persistent part of the illness.

Families of these patients are concerned by their excessive energy and involvement in multiple activities and ventures. At first, manic patients appear to be very productive and creative, but mildly eccentric.

In time, as the bipolar patient's investment in activities becomes excessive, the manic individual loses the capacity to behave with reasonable caution and judgement. These individuals also find it difficult to conform to social expectations and norms. The predominant mood of bipolar patients is euphoria. This mood is often accompanied by a sense of absolute conviction or certitude. This usually involves a self-perceived talent or perception, but occasionally centers on more metaphysical and cosmic matters. A new, or dramatically enhanced interest in religious or sexual experiences is commonly reported by these patients.

The euphoria felt by the manic patient has an infectious quality and mislead some people, including those who are close to the individual, into accepting behavior that otherwise might not be tolerated. Families find that the manic individual can be quite engaging. They are known for their buying sprees and improvident business ventures. These ventures are often accompanied, at least for a time, by a remarkable ability to obtain loans or gifts of money from others. The individual is often encouraged by people

whose judgement is usually better.

The first symptom others notice is a decreased need for sleep. Family members are concerned when the individual does not sleep at all for three or four days. A "hunger" for social interchange leads these patients to make frequent and inappropriate phone calls to distant acquaintances. These calls are more likely to occur during late night periods when social stimulation is low. Families often notice that the manic patient also develops a fascination with music and tries to play a variety of musical instruments.

Manic patients also begin wearing very bright colors, and their unusual combinations of eccentric attire are often noticed by others. They cause families concern when they exhibit carelessness about their clothes, bringing attention to themselves. Families are most troubled when they are found in public without clothing. The speech of manic patients is rapid and discursive. They are difficult to interrupt, and have difficulty not interrupting when others are speaking. The speech itself may involve rhyming, punning and bizarre associations, but there are no pathognomonic elements.

Manic patients are easily distracted and respond to all stimuli in a self-referential manner. Families find that as they get worse, their mood changes from being euphoric and grandiose, to becoming irritable and paranoid.

The anxiety and feelings of suspicion displayed by the manic patient can cause decreased verbal output that can lead physicians to erroneous diagnostic conclusions. While acute mania and hypomania have commonly been diagnosed among individuals with a psychiatric treatment history who commit violent crimes, significant social aggression is rare.

The manic individual may experience depression along with the manic state. Further, their mood may change abruptly from manic, to depressed, to a manic state. This causes worry to the patient's family.

The manic patient may experience true delusions and auditory hallucinations, causing the physician problems with differential diagnosis. The content of the delusions or hallucinations is often consistent with the predominant mood.

In severe cases, mania can present as a state of catatonia. The individual appears "willfully" unresponsive, often assuming a fixed posture and appearing mute except for occasional shouts or guttural sounds. Less severe states of mania may be characterized by primitive delusions, fecal smearing, and extremes of tearfulness and emotional lability.

Traditionally, bipolar illness has been associated with late age at onset. However, current evidence suggests that this illness peaks between 20 and 25 years of age. Onset after age 60 is rare. During adolescence, bipolar illness is often mistaken for adjustment disorder. This may reflect historical diagnostic bias or diagnostic confusion arising from normal physical and psychological developmental changes that take place during this period.

Families are told that when manic symptoms occur in association with known organic disorders, the diagnosis should be organic mood disorder (i.e., "secondary mania"), and not bipolar disorder. It is difficult for a physician to differentiate between organic and bipolar disorder using clinical characteristics.

It is probable that future research will result in the shifting of many manic diagnoses

from a primary to a secondary category. The list of known causal agents for this illness is long. These agents include drugs (e.g., corticosteroid, levodopa, stimulants), metabolic disturbances (such as those associated with hemodialysis), infection, neoplastic diseases, and epilepsy (particularly partial complex seizures).

In manic patients who experience prominent delusions and hallucinations, the physician's differential diagnosis is likely to include schizophrenia, paranoid type because both syndromes can present with identical clinical symptoms. Therefore, the basis for diagnosis of bipolar illness is the clinical course, or secondary features. These include a family history of mood disorder, the level of premorbid adjustment, a history of manic symptoms, or a prior response to treatment. The diagnosis of schizoaffective disorder can be made when the clinician is unable to choose between manic episodes and schizophrenia. Unfortunately, there is presently no agreement on how this category should be defined or on its etiological or prognostic relationship to schizophrenia or mood disorder.

Families worry when told that up to 15% of bipolar patients have an inadequate response to medication and may endure chronic or recurrent symptoms. Suicide is also a significant risk among these individuals. This causes their family members anxiety.

The phases of bipolar illness may differ in their responsiveness to treatment and in their effect on ultimate outcome. Some individuals, for example, experience complete remission of acute manic symptoms and prophylactic benefit from medication but continue to have unmodified or attenuated depressive episodes.

The individual's personal and family psychiatric history is the best predictor of the

frequency with which the bipolar patient swings from the manic state to depression, and of the individual's response to treatment. Once the initial episode has resolved, the duration of the interval during which an individual is symptom free, varies greatly.

Patients who satisfy the criteria for bipolar disorder will experience another episode within 2-4 years. The complete cycle, i.e. from manic, to depressed, to manic state may be as short as 48 hours or so long that the concept of cyclicity becomes meaningless.

Patients with bipolar disorder who experience rapid cycles - three or more a year - do not respond as well to lithium as individuals with longer symptom free intervals. Prognosis depends on the frequency and duration of individual episodes and the response of the individual to medication. Since lithium is often effective in moderating the severity of symptoms, there is always a strong possibility that recurrences are a result of the patient's noncompliance with the drug regimen.

Families worry when the individual denies the physician's diagnosis. Manic patients admit they may have problems, but attribute them to overwork and to stress both at work and at home. Patients with mild bipolar episodes probably can function adequately during a period in which they display most of the symptoms of a manic episode. For these patients, factors such as psychological coping mechanisms, social supports, and socioeconomic status influence the outcome as much as their individual response to medication.

The family of the manic patient is relieved when treatment with neuroleptic medication alleviates the symptoms within five days. Families are extremely happy when the individual's suspiciousness and grandiose beliefs are under control.

Lithium is the standard treatment for manic episodes and is usually the first-line agent unless there has been documented treatment failure or the drug is medically contraindicated. It is over 95% effective in the management of acute mania.

Anticonvulsants, especially carbamazsepine and valproic acid may also be prescribed. Calcium channel blockers have been tried experimentally with variable results. Lithium's antimanic effects have a fairly slow onset (7-10 days). Therefore, other agents such as benzodiazepines, may also be used early in treatment along with lithium to help manage the patient.

Families notice the first symptoms that disappear during treatment are the patient's increased psychomotor activity, pressured speech, and lack of sleep. Families are very relieved when these are followed by improvement in the patient's expansive mood, grandiosity, and intrusiveness to others.

Some manic patients have affective symptoms that include irritability and hostility instead of expansiveness. Their mood may also be labile and shift from day to day or from hour to hour. Symptoms relating to disorganization of the form of thought (e.g., flight or ideas, loosening of association) are more likely to respond to lithium than delusional content, such as paranoia.

The symptoms displayed by the manic patient often do not begin to abate until one to two weeks after the patient's treatment is initiated. These symptoms may then diminish slowly over time. Lithium alone is often not effective in treating psychotic manic symptoms, such as delusions and hallucinations.

Families are often confused by the fact that there is no reliable evidence that

indicates that psychosocial factors are a cause of bipolar disorder. Despite this lack of evidence, psychosocial factors may precipitate manic or depressed bipolar states. It may also be necessary for these factors to be present in milder cases of bipolar disorder before the individual will begin to experience symptoms.

The history of patients with bipolar disorder has been analyzed to determine the contribution of life experiences to this illness. These studies have been carried out retrospectively. The findings of this research have been found to be unreliable. Each patient whose life history has been examined, has been found to have had environmental experiences that could explain those behavioral changes that occurred.

Families have been encouraged by findings from recent research studies that have investigated the role of biological circadian rhythmicity in bipolar disorder. The findings of these studies indicate that subtle changes in the light-dark cycle (e.g., seasonal variations) are a better predictor of individuals who may be at risk for bipolar disorder than is life history.

Families of bipolar patients are told that some form of psychosocial intervention is almost always needed in the treatment of bipolar disorder. However, the type of therapy and the length of time needed for therapy will depend upon several factors. These factors include the degree to which the individual's behavior is disruptive to the family, the degree of disruption to the individual's financial situation, the baseline behaviors of the individual, and the individual's response to somatic treatment.

Bipolar Disorder has a strong genetic component. This component makes it almost impossible for physicians to determine the contribution of other factors to the disorder.

Therefore, health care workers who attempt to treat bipolar patients experience a great deal of difficulty. These workers must attempt to distinguish the extent to which the patient's illness is due to a genetic contribution, and/or those aspects of the illness which are not genetic. These aspects reflect the patient's environmental and developmental experiences that are a result of a primary disorder in parents and siblings of these patients.

Families are concerned when they are told that health care workers find it very difficult to plan therapeutic intervention for the bipolar patient. Physicians often find themselves explaining to families why this difficulty in planning occurs. Their explanation is based on the nature of the biological contribution to this illness. This contribution makes it almost impossible to determine in advance what the individual's ongoing psychosocial needs may be once acute symptoms have subsided.

Families are told that some individuals with bipolar disorder have infrequent recurrences, experience long symptom-free intervals, and are able to lead productive lives. However, others may have a particularly malignant form of the disorder or may exhibit pathological degrees of denial and lead turbulent lives. These individuals may require active psychosocial involvement by the therapist.

Appendix E

Interest Scale

In order to ascertain your responses to the passage that you just read, we would appreciate it if you could answer the following questions.

1. How do you feel about the passage you just read? (check one)

-------- liked it a lot

-------- liked it a little

-------- disliked it a little

-------- disliked it a lot

2. How interested were you in the information presented in the passage?

-------- very interested

-------- interested

-------- a little interested

-------- not interested

3. Did reading about the clinical disorder described in this passage make you want to read more about this condition?

--------- definitely

--------- probably

--------- probably not

--------- definitely not

4. Compared to other text passages that you are required to read in medical school, did you find this passage to be

--------- much more interesting

--------- a little more interesting

--------- a little less interesting

--------- much less interesting

5. Would you be interested in reading more passages like the one you read about other topics?

--------- definitely

--------- probably

--------- probably not

--------- definitely not

Appendix F

Anorexia Nervosa Multiple Choice Posttest

For each of the following questions, choose the one best answer.

1. Anorexics are often characterized by:

   A. short stature
   B. delayed development of secondary sexual characteristics
   C. depression
   D. all of the above

2. Before onset anorexics are likely to be:

   A. markedly overweight
   B. of average weight or slightly overweight
   C. markedly underweight
   D. all of the above

3. The behavior of individuals suffering from anorexia nervosa is:

   A. dependent
   B. highly ritualistic
   C. conforming
   D. not hyperactive

4. The psychological driving force which underlies anorexia is:

   A. need for automomy
   B. better nutrition
   C. helplessness
   D. need for achievement

5. Symptoms that are associated with anorexia nervosa include:

   A. drastically reduced food intake
   B. hyperactivity
   C. gross distortion of body image
   D. all of the above

6. Anorexics often also experience psychiatric symptoms such as:

   A. paranoia
   B. delusions
   C. loss of reality
   D. histrionic traits

7. A medical illness that can cause severe weight loss, and should be considered in the differential diagnosis for anorexia nervosa is:

   A. Addison's disease
   B. Hepatitis
   C. Food allergies
   D. Diverticulitis

8. The first step in treating patients with anorexia nervosa is:

   A. medication for symptoms of depression
   B. reversal of starvation
   C. restoring normal nutritional balance
   D. stress reduction

9. Recovery for an individual who experiences a single anorexic episode is:

   A. unlikely without medication
   B. sometimes spontaneous
   C. dependent on therapy
   D. dependent on symptoms experienced

10. Successful treatments for anorexia nervosa include:

   A. psychoanalysis
   B. behavior modification and psychotherapy
   C. nutritional instruction
   D. low impact exercise programming

Appendix G

Bipolar Disorder Multiple Choice Posttest

For each of the following questions, choose the one best answer.

1. The most persistent symptom experienced by patients who suffer from bipolar disorder is:

   A. an elevated mood
   B. an irritable mood
   C. changes in mood
   D. irritability

2. As the illness progresses, manic patients tend to

   A. reduce their activities
   B. lose the capacity to demonstrate judgement
   C. become more anxious
   D. become more creative

3. An early symptom of a manic episode is:

   A. a decreased need for sleep
   B. a need for social interchange
   C. a fascination with playing musical instruments
   D. hypergraphia

4. Physicians sometimes make erroneous diagnostic conclusions due to the manic patient's:

   A. tendency to wear bright colors
   B. socially aggressive behaviors
   C. feelings of suspicion
   D. decreased verbal output

5. The differential diagnosis for bipolar disorder is often difficult due to:

   A. the patient's rapid speech
   B. the level of depression
   C. the presence of delusions and auditory hallucinations
   D. anxiety and suspiciousness

6. Other disorders which are likely to be included in the differential diagnosis for bipolar disorder are:

   A. Schizophrenia, paranoid type
   B. Somatization disorder
   C. Anxiety disorder
   D. Delusional disorder

7. The percentage of bipolar patients who have an inadequate response to medication is:

   A. 25%
   B. 15%
   C. 5%
   D. 1%

8. The best predictor of the frequency of manic cycles and response to treatment is:

   A. duration of the interval without symptoms
   B. personal and family psychiatric history
   C. personal history
   D. family history

9. Manic patients often use the psychological defense mechanism of:

   A. sublimation
   B. projection
   C. regression
   D. denial

10. The first line agent for the treatment of bipolar disorder is:

   A. carbamazsepine
   B. lithium
   C. valproic acid
   D. benzodiazepines

Appendix H

Cognitive Processes Questionnaire

ID NO: ..... Sex:.....

Condition: .....Program:. .....

Reading time ..... Listen time .....

Tape stop .....

Primary Post ..... Secondary Post .....

Primary Interest .....Secondary Interest .....

How much do you think you learned about (Anorexia Nervosa/Bipolar Disorder)?

(Scale 1=least;5=most)

Was there anything that you did to help you to learn about

(Anorexia Nervosa/Bipolar Disorder)?

Was there anything that you were thinking about while you reading about (Anorexia Nervosa/Bipolar Disorder)?

What study strategies did you use to help you learn/remember what you were reading?

Did you listen to the materials presented on the tape about (Anorexia Nervosa/Bipolar Disorder)?

Was there anything you were thinking about while the information on the tape was being presented?

What study strategies did you use to help you to learn/remember the information (AN/BP) presented on the tape?

How successful do you think these strategies were? ----------

How much do you think you learned about (AN/BP)? ----------

(Scale1 =least;5 =most)

Did you try to learn about (AN/BP)? ----------

What effect did the tape about (AN/BP) have on your reading of the information about

(AN/BP)?

What did you do to help you to learn about AN/BP while AN/BP was being presented on the tape?

What advice would you give to others to help them to learn AN/BP most effectively?

What topic did you find yourself paying the most attention to? ----------

Which topic do you think you learned the most about? ----------

Why? ----------

Anyothercomments?----------

Appendix I

Correlation Matrix for Primary x Secondary Task MANOVA

Group 1: Case-Illustrated Primary combined with Case-Illustrated Secondary Task

	InterestPrim	PrimPosttest	ReadingTime	SecondaryPosttest
InterestPrimary	1.604			
PrimaryPosttest	.000	.151		
ReadingTime	.448	.060	526.885	
SecondaryPosttest	-.112	-.054	.300	.159

Group 2: Case-Illustrated Primary combined with Expository Secondary Task

	InterestPrim	PrimPosttest	ReadingTime	SecondaryPosttest
InterestPrimary	1.907			
PrimaryPosttest	.408	.185		
ReadingTime	-.159	-.414	216.443	
SecondaryPosttest	-.029	.566	-.594	.206

Group 3: Case-Illustrated Primary Task without a Secondary Task

	InterestPrim	PrimPosttest	ReadingTime	SecondaryPosttest
InterestPrimary	1.973			
PrimaryPosttest	-.283	.161		
ReadingTime	.234	-.014	230.141	
SecondaryPosttest	-.053	-.208	-.450	.209

Group4: Expository Primary combined with Case-Illustrated Secondary Task

	InterestPrim	PrimPosttest	ReadingTime	SecondaryPosttest
InterestPrimary	3.091			
PrimaryPosttest	-.139	.126		
ReadingTime	.545	.163	426.112	
SecondaryPosttest	-.216	.296	.063	.149

Group5: Expository Primary combined with Expository Secondary Task

	InterestPrim	PrimPosttest	ReadingTime	SecondaryPosttest
InterestPrimary	2.154			
PrimaryPosttest	-.021	.206		
ReadingTime	-.097	.520	349.221	
SecondaryPosttest	-.428	.658	.366	.113

Group6: Expository Primary without a Secondary Task

	InterestPrim	PrimPosttest	ReadingTime	SecondaryPosttest
InterestPrimary	2.797			
PrimaryPosttest	.169	.151		
ReadingTime	-.670	.430	57.093	
SecondaryPosttest	.463	.028	-.593	.160

Appendix J

Examples of Primary and Secondary Task Free Recall Data

Main Ideas:

Complete "The passage described what anorexia was, it gave the signs and symptoms of the disease. It then went on to state the population that is more at risk. Behaviors of the patients were also discussed. Different methods of treatment were also written in the article."

"Anorexic people are obsessed with looking very thin and if they were to go on a scale and put on an onze or a pound more than they were originally wearing, they would be distraught and go through drastic measures to loose the weight back (such as using a laxative, starving themselves, etc.)."

Incomplete "Anorexia Nervosa is a disorder in which a person becomes obsessed with becoming thinner."

"Anorexia is a disorder in which one sees themselves as fat or obese."

"Anorexia is an eating disorder in which the person is uneasy about the way they look."

"Bipolar disorders and the patients and how they are treated with lithium in conjunction with other medications."

Wrong no data

Idea Units:

Complete "Anorexia Nervosa is an eating disorder of adolescents beginning between the age of 10-30."

"Even when the ideal weight goal is met, the person keeps loosing weight so that the future weight gain will be avoided."

"Lithium is the drug that is used to treat bipolar disorder, but it is rarely used as the only form of medication prescribed."

"The doctor should be aware of gastric dilatation and CHF (congestive heart failure) if the weight gain is too rapid."

Incomplete	"Anorexia Nervosa is a condition where there is less than body requirement of weight."
	"It is a disorder that is psychologically based."
	"Anorexic patients don't eat much and do a lot of exercise."
	"Bulimic individuals will consume enormous amounts of calories in a single sitting."
	"Some medications which increase appetite are useful in a lot of anorexics."
	"Must be distinguished from wt loss from other medical conditions."
	"Bipolar patients experience abrupt shifts."
Wrong	"Anorexics eat a lot of food and then vomit it all."
	"I remember hearing something to the effect of they like to have fun and dance."
	"Bipolar is a condition characterized by mania, depression, epileptic seizures."
	"Doctors normally treat these patients with psychosis treatments and by trying to alter their diets."
New	"Extreme views on all aspects of life."
	"Anorexia may result in death."
	"Bulimia is very dangerous because the bulimic rids herself of necessary nutrients and electrolytes."
	"They seem to be in total control of their lives on the outside, but on the inside, they are only in control of their weight and body size."
	"The feeling of insecurity that the person acquires may cause problems between his or her significant other."

Clinical Ideas:

Main "The patient discussed here was a 27 year old math student who was married and began to show symptoms to his wife after working on a math code."

Idea Unit "Kathy started talking to her friend about her problems."

"Kathy's parents found out that she was taking diet pills and hoarding her food."

"The young man told his wife that he developed a mathematical equation so that only he and his partners would have access to his thesis on the computer."

"Jason's family was very worried about the causes of his problem."

"Something about a pt. wandering the streets without any clothes on."

"Family members worry about them because of their obsession with food."

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