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Predictors of recall and reading time for seductive and nonseductive text segments

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PREDICTORS OF RECALL AND READING TIME FOR SEDUCTIVE AND NON-SEDUCTIVE TEXT SEGMENTS

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ABSTRACT

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This correlational study explored how concreteness, relevance, importance, and interestingness related to the recall of seductive details and base text, while controlling for text coherence, and student background knowledge. Previous research has provided evidence for the significant relationship between these variables and the seductive details effect in particular and text recall in general. However, this is the first study to consider all these variables simultaneously. A group of 68 undergraduates read an expository text on lightning formation, performed an immediate test on free recall, and rated each text sentence for concreteness, relevance, importance, and interestingness. A simple regression analysis revealed that only interest significantly improved students' recall of seductive sentences. However, none of the four ratings or the reading time predicted recall of base text sentences. Results regarding reading time demonstrated that seductive sentences were read faster than base text sentences. Strong positive correlation was revealed between relevance and importance. This result indicated that in the absence of explicit relevance instruction, relevance and importance could be used interchangeably. Significant positive correlation was revealed between concreteness and interest. However, this correlation was lower than expected. This result was interpreted in the light of Dual Coding Theory.

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CHAPTER 1

INTRODUCTION

This correlational study explores four of the potential variables that presumably affect the processing and recall of seductive details (SDs – highly interesting but unimportant/irrelevant text segments) in the larger context of interest and learning outcomes. The paper begins with a summary of research on interest, seductive details, and several other factors that appear germane to these constructs. Next is a brief description of the present study, followed by the literature review. The literature review explores in detail research on interest and seductive details, as well as briefly discusses relevant findings from the domains of importance, relevance, concreteness, coherence, and background knowledge. The goal of the literature review is to examine what variables underlie the seductive details effect (SD effect – better recall of SDs at the expense of main ideas) and how they exert their influence on text recall (individually or through an interaction).

Historical Perspectives

The last three decades has seen an upsurge in the study of interest due to findings revealing its potential relevance to learning and cognition (Kintsch, 1980). Numerous studies were designed to explore the types of interest and its relations to background knowledge (Alexander, Kulikowich, & Schulze, 1994), instructional design (Harp & Mayer, 1997, 1998), and learning outcomes. Findings from this line of research indicate that interest affects perseverance, attention allocation, and strategy use (Hidi, 1990; Reynolds, 1992; Wade, Schraw, Buxton, & Hayes, 1993). It influences what we choose to learn and the degree to which we learn information (Alexander & Jetton, 1996; Garner,

1992). It also affects cognitive and emotional engagement and the depth of cognitive processing (Schiefele, 1996, 1999; Schraw, 1998).

Researchers have distinguished between several types of interest, including situational interest (spontaneous, transitory, and environmentally recalled) vs. personal interest (less spontaneous, of enduring personal value, and activated internally) and emotional interest (high in affective responses such as elation, disgust, or anger) vs. cognitive interest (focused attention, engagement in otherwise tedious texts; elicited by text characteristics such as coherence, novelty, or unexpectedness of a text element).

A number of studies in the 60s, 70s, and 80s found that children who read high-interest materials performed better on tests of reading comprehension (Asher, 1980; Estes & Vaughan, 1973; Shnayer, 1969; Stanchfield, 1967; Williams, 1983). The same results were found for young adult students (Baldwin, Peleg-Bruckner, & McClintock, 1985; Burnette, 1998; Lanzafame, 1998; Wade & Adams, 1990; Wade, Schraw, Buxton, & Hayes 1993; Sadoski, 2001; Schraw & Dennison, 1994). Although there were some studies that did not corroborate these finding (Brooks, 1972; Feldmann & Blom, 1981; Scholtz, 1975; Shimoda, 1993), the importance of interest to learning has led to the emergence of various instructional practices that incorporated interesting (vivid, sensational, personal, etc.) elements to make expository and highly technical texts more appealing to students.

The inclusion of interesting material that adds little new relevant information into otherwise dry text seems a logical attempt to make a text more engaging and reduce information load on the reader. However, a common effect of this strategy is diverting readers' attention to interesting but irrelevant information, which in turn undermines

learning objectives (Sadoski, 2001). This phenomenon has become known as *the seductive details effect* (SD effect). Dewey discussed it almost a century ago under the name "fictional inducements of attention" (Dewey, 1913) but only in the past two decades has it received researchers' focused attention.

Garner, Gillingham, and White (1989) coined the term *seductive details* and defined them as text elements that readers judge as "interesting, but unimportant information" (Garner et al., 1989, p. 43). In light of this definition, SDs are regarded as a form of situational interest. Because of their vividness along with their low importance, they are considered to affect negatively readers' recall of main ideas (they *seduce* readers into allocating extra attention and effort to them). The seductive details effect spurred a line of research on the relationship between interest, importance, and learning outcomes. Some researchers focused on the documentation of the SD effect (Garner, Alexander, Gillingham, & Brown, 1991; Garner & Gillingham, 1991; Garner et al., 1989; Wade & Adams, 1990), others distinguished between context-dependent and context-independent SDs (Schraw, 1998), still others tested the SD effect in different media, comparing text with PowerPoint presentations and narrated animation (Harp & Mayer, 1997), as well as printed material and lectures (Harp & Maslich, 2005). More recent studies developed viable hypotheses for the SD effect (Harp & Mayer, 1998; Lehman, Schraw, McCrudden, & Hartley, 2007), attributing it to distraction of readers' attention, disruption in text integration, and priming inappropriate schema construction. In spite of this research, there is an ongoing debate concerning the existence of the SD effect and the conditions under which it occurs.

Defining Seductive Details

Researchers have defined SDs in two distinct ways, as interesting, but unimportant information, or as interesting, but irrelevant (to the causal structure of events) information. This confounding of importance and relevance has contributed to the current fuzziness of the SDs concept. In the next paragraphs, the two definitions are compared and discussed in light of their limitations.

Garner et al. (1989) originally classified SDs as "interesting, but unimportant information" (p. 43), with only implicitly defining importance in terms of main ideas in a text's macrostructure. Importance here corresponds to text-based importance (Alexander & Jetton, 1996). Readers determine what is important by using "titles and thematic first sentences to guess at the main idea of texts, the ideas that might occur in a succinct summary of the entire text. If the first sentence is tentatively accepted as a macroproposition" (i.e., when a text segment is judged to be of high importance among the set of ideas in a text), "readers then attempt to fit or subsume each succeeding sentence into the provisional main idea" (Alexander & Jetton, 1996, p. 42).

However, there is some debate as to the way that important ideas were established in the study (ratings of text segments by 20 teachers in terms of what they wanted students to learn from the text), which diverged from the typical theoretical definition of importance. Previous studies provided evidence that there is a difference between text-based, teacher-determined and student-determined importance (Alexander & Jetton, 1996). It seems that Garner et al. (1989) did not differentiate between these types of importance. This inconsistency could be a source of potential threats for the reliability of the study. Nevertheless, the same definition was adopted in subsequent studies by Garner

and colleagues (Garner, 1992; Garner et al., 1991; Garner & Gillingham, 1991) and by a variety of other researchers (Wade, Schraw, Buxton, & Hayes, 1993).

In contrast to Garner et al. (1989), Harp and Mayer (1997, 1998) defined SDs as "interesting but irrelevant details that are added to a passage to make it more interesting" (Harp & Mayer, 1997, p. 92). They defined *irrelevant* as text elements that are not related to a step in the cause-and-effect explanation, although it may be related to the general topic of the passage. It is questionable how similar this definition is to Garner et al.'s (1989) conceptualization of text-based importance. It could be argued that what is relevant in terms of causal sequences of main ideas is not necessary important regarding text structure and may be even less meaningful vis-à-vis readers' perceptions of importance (reader-determined importance). For example, in the "Lightning" passage used in Harp and Mayer (1997, 1998), the presence of SDs was found to shift readers' attention from what causes lightning (teacher-determined importance) to what lightning may cause (student-determined importance). Consequent studies of the seductive details effect used similar definitions (in terms of relevance) or one that combined both importance and relevance (Lehman, Schraw, McCrudden, & Hartley, 2007). For example, Lehman et al. (2007) defined SDs as "segments that readers judge as highly interesting, but unimportant or irrelevant to the text's main ideas" (p. 570). Thus, the inconsistency and vagueness in conceptualizing SDs has been a problem in all studies of the SD effect. One goal of the present study is to determine the correlation between relevance and importance ratings as well as whether they are related to text recall in the same way.

Hypotheses About the Effects of Seductive Details

The SD effect has been observed primarily in learning short, expository texts (such as textbook chapters). The majority of studies implementing biographical (narrative) passages failed to detect the SD effect (Garner & Gillingham, 1991; Hegarty, 1995; Hidi & Baird, 1988; Schraw, 1998). One explanation is that in narratives, text elements rated high in interestingness are rated high for importance as well. On the other hand, main ideas in dry, expository texts (high in importance) are low in interestingness (Wade & Adams, 1990). Furthermore, some experiments using expository text also failed to detect the SD effect on text recall (Experiment 2 in Garner et al., 1989; Harp & Mayer, 1998).

Wade and Adams (1990) distinguished four mutually exclusive types of text segments, including main ideas (i.e., highly interesting and important), factual details (i.e., uninteresting, but important information), seductive details (i.e., highly interesting, but unimportant information), and boring trivia (i.e., uninteresting and unimportant). These researchers found that readers use different processing strategies when reading different types of text segments.

In some experiments readers spent more time reading seductive passages while spending less time reading main ideas. In one study, interviewed participants said that they related seductive details to prior personal experiences, visualized the described scene, or savored the pleasantness of the details (Wade, Schraw, Buxton, & Hayes, 1993). In other cases, readers spent more time reading main ideas, especially when these were positioned after seductive sentences. This was due to breaks in the coherence of the text, which caused students to spend more time integrating main ideas (Lehman et al.,

2007). Generally, there are two explanations for longer reading times. According to the first, readers take longer time in order to integrate different text elements within a coherent schema. The second explanation says that readers visualize the described scene and/or savor the pleasantness of the details. Those researchers who found shorter reading times for some text segments hypothesized that this happened because readers considered particular information irrelevant (so they skimmed through it) or because readers found the text highly familiar, salient, or important, which made it easier to remember.

Three hypotheses have been proposed to explain the causes of the SD effect (Harp & Mayer, 1998). According to the *distraction hypothesis*, seductive details draw attention away from main ideas and thus cause poorer comprehension and recall of base text idea units as well as reduced time spent reading base text sentences. The *disruption hypothesis* suggests that seductive details cause poor comprehension by disrupting the flow of cause and effect ideas as well as the coherence of text. The negative consequence from this process hypothetically is reduced holistic understanding of base text and increased reading time for base text sentences that follow seductive details sentences. The *diversion hypothesis* suggests that seductive details cause poor comprehension by prompting readers to construct a coherent mental representation around the seductive details rather than around the main ideas of the passage. This process potentially causes reduced holistic understanding of base text as well as better recall of seductive details idea units compared to base text idea units. Research findings have supported the diversion hypothesis (Harp & Mayer, 1998) as well as the distraction and the disruption hypotheses (Lehman et al., 2007).

Previous research suggests that seductive details placed at the beginning of or

interspersed throughout a lesson do their damage by priming inappropriate prior knowledge and confusing readers as to what a lesson is actually about. In contrast, seductive details placed at the end of a lesson are less harmful of all conditions (Harp & Mayer, 1998). In addition, seductive details have a strong unfavorable effect on readers' deep-level processing and their holistic understanding of the text (Lehman et al., 2007), which is a potential explanation why in some cases readers performed well on recall but poorly on problem-solving transfer tasks (Harp & Mayer, 1998).

In contrast, Sadoski, Goetz, and associates (Goetz & Sadoski, 1995; Sadoski, 2001; Sadoski & Paivio, 1994; Sadoski, Paivio, & Goetz, 1991) provided evidence that concreteness of text elements increased memory. They grounded their arguments in the Dual Coding Theory (Clark & Paivio, 1991), which posits that information that is represented through verbal propositions as well as through visual images (i.e. dual modality) is more easily retrieved because of stronger and more diverse neural connections in the brain. Considering the fact that main ideas in expository texts are mostly abstract and uninteresting, one potential explanation of the SD effect is that differences in concreteness may cause differences in recall of SDs and main ideas. Thus, expressing main ideas in a more concrete language may facilitate their recall and cancel out the SD effect.

Overall, studies on SDs have been largely criticized for the lack of uniformity between conditions in the experiments as well as for the controversy of findings (Goetz & Sadoski, 1995). Some of the experiments (e.g., Garner et al., 1991; Wade & Adams, 1990; Wade et al., 1993) lacked a no-SDs control group. In other studies, the SDs text was produced by adding sentences that comprised a substantial part of the length of the

whole text (e.g., nearly 40% in Garner et al., 1989). Furthermore, a consistent operational definition of seductive details has not been established and applied in this research. For example, in most definitions of SDs, researchers did not distinguish importance from relevance – an inconsistency that may have confounded their experiments (Lehman & Schraw, 2002).

Finally, researchers investigating the SD effect have failed to incorporate potentially useful findings from the domains of personal/situational interest, domain/topic knowledge (knowledge that one has about a particular field/topic of study), importance (the extent to which a text element contains information essential for understanding a text), relevance (the degree to which a sentence is germane to the reader's goals and purposes), and concreteness (information that is vivid and easy to imagine with often material referent). No single experiment has accounted simultaneously for all potentially confounding variables such as relevance, importance, coherence, background knowledge, and concreteness, although there is evidence for their relationship with interest and SDs. Thus, in most studies, it was unclear whether SDs interfered with students' learning because they were seductive (very interesting), incohesive, or simply irrelevant.

Purpose of the Study

The study was exploratory in nature and employed a correlational design in order to examine the relationship between four predictor variables (relevance, interestingness, importance, and concreteness) and two outcome variables (recall and reading time of SDs and base text). The main research question concerned how relevance, importance, concreteness, and interestingness affected students' processing and recall of seductive details and base text information in an expository text as well as how these variables were

correlated with each other.

There were several hypotheses concerning the results of the experiment. The first hypothesis stated that in the absence of relevance instruction, the distinction between importance and relevance would become meaningless so they would be construed as the same construct; that is, the correlation between importance and relevance would be close to 1. A second prediction was that seductive details sentences were going to be rated as significantly more interesting and concrete and less important and relevant than non-seductive sentences. Next, all predictor variables were hypothesized to increase text recall. Furthermore, in the context of a dry, expository text with abstract main ideas, it was expected that importance will be negatively correlated with concreteness and interestingness. Also, concreteness and interestingness were hypothesized to exhibit positive correlation because concrete details tend to be vivid and easy to visualize. These factors have been shown to increase situational interest (Sadoski, 2001).

The anticipated findings from the study were important for both theoretical and practical reasons. They were to bring clarity to the nature of the SDs effect by showing how variables such as concreteness, relevance, interestingness, and importance work to produce a positive or negative effect on text processing and recall. This study also was expected to contribute to clarifying issues related to the definition of SDs. In the past, SDs have been defined in terms of importance (Garner et al., 1989; Garner et al., 1991) as well as relevance (Harp & Mayer, 1997, 1998; Lehman et al., 2007), with researchers quite often confusing these two constructs. Findings in this experiment were supposed to bring light to this issue and give more solid ground for future definitions of SDs.

Definitions of Key Terms

Seductive details: text segments that are highly interesting but unimportant in terms of text's main ideas (Schraw & Lehman, 2001).

Seductive details effect: the cognitive consequences of adding seductive details to a text, i.e. better recall of SDs at the expense of main ideas as well as longer reading time of SDs (Harp & Maslich, 2005).

Domain/Topic knowledge: the realm of knowledge that individuals have about a particular field/topic of study (Alexander & Judy, 1988). For example, a student may have high domain knowledge of mathematics but low topic knowledge of trigonometry.

Situational interest: the level of interest of a particular learning situation. This is referred to as the conditions or objects in a particular learning environment that encourage a learner to interact with the environment (Song, 2003).

Interestingness: a text-based level of interest. This is a measure usually represented by a rating score on a 7-point Likert-type scale (from 1, not at all, to 7, very much). This is referred to as situational interest usually caused by the novelty, vividness, unexpectedness of text (surprise), shift in topic, increasing the coherence, relating seemingly mundane information to main text ideas (cognitive interest), or major life themes such as such as death, sex, religion, politics, and romantic intrigue (emotional interest) (Schraw & Lehman, 2001; Song, 2003).

Concreteness – pertains to information which is highly imageable with easily represented, often material, referent, for example, tree vs. freedom (Sadoski, Goetz, & Fritz, 1993a, 1993b).

Relevance – the extent to which text segments are germane to the reader's goals and

purposes (Lehman & Schraw, 2002).

Importance – the degree to which a segment contains essential information needed to understand a text (McCrudden, Schraw, & Kambe, 2005).

Coherence – the extent to which text segments are linked structurally to other text segments and to information in memory (Lehman & Schraw, 2002). Coherence refers to factors that affect the reader's ability to organize the main ideas in a text (Campbell, 1995).

CHAPTER 2

LITERATURE REVIEW

This section begins with a brief mentioning of the theoretical foundations of this study, namely, how it relates to the information-processing view of cognition and schema theory. In the literature review, I provide an overview of the research findings in the domains of interest and seductive details as well as briefly summarize the research on relevance, importance, coherence, concreteness, and background knowledge. In the first section of the review, I explore types of interest as well as the effects of interest on cognitive processing and emotions. In turn, I relate these findings to the nature of seductive details and their potential deleterious effect on text comprehension and recall. SDs are a type of situational interest and as such they tend to catch readers' attention and increase emotional engagement. As a result, SDs tend to be remembered better than uninteresting text segments.

In the second section, I explore the seductive details literature including the factors that promote the seductive details effect (type of text, reader characteristics, position within text, etc.). I analyze the strengths and weaknesses of the studies on SDs so as to demonstrate how the proposed study advances the current knowledge of the SD effect and of text recall in general.

In the third section, I present findings from the research on relevance, importance, coherence, concreteness, and background knowledge in order to explicate how these variables are related to the seductive details effect. I also elaborate on the purpose of the study, the hypotheses, and predicted results.

Theoretical Foundations of the Study

The current study is not directly relevant to any particular psychological theory. Indirectly, it is based on the tenets of the cognitive information-processing (CIP) view (e.g., Atkinson & Shiffrin, 1968) and schema theory (e.g., Anderson, Reynolds, Schallert, & Goetz, 1977). During the 60s, cognitive scientist proposed a metaphor for the human brain-mind system, namely, the programmable computer. The CIP model portrays the human mind as a structure consisting of components for processing information such as storing, retrieving, transforming, and using. Learning is viewed as formation of associations, with associations varying in type and nature. Furthermore, the type and strength of associations depend on cognitive structure called schemata (which are organized hierarchically). Thus, learning and behavior are the product of the interaction between environmental stimuli and the background knowledge (previous experiences) of the learner, with individuals both responding and acting upon the environment. Moreover, knowledge in long-term memory (including schemata) is used to comprehend experiences and create a meaningful model of input information (Andre & Phye, 1986).

The current study, which explores cognitive processes such as text comprehension (encoding) and recall (retrieval), as well as speed of processing of information, is based on the assumptions of CIP and schema theory. As mentioned above, the hypotheses regarding the seductive details effect concern processes such as distraction of attention, disruption of coherence of text (leading to poor comprehension), and inappropriate schema activation (construct a coherent mental representation around the seductive details rather than around the main ideas of the passage). However, this study does not test these hypotheses and the findings are not directly relevant (do not add) to the CIP and

schema theory. For that reason, I do not discuss any theoretical implications in the conclusion section of the paper.

Important Findings in the Study of Interest

Interest has been defined as liking and willful engagement in a cognitive activity (Schraw & Lehman, 2001) and it refers to readers' predisposition to engage in a particular disciplinary content over time as well as to the psychological state that accompanies this engagement. It is considered to emerge and develop over time in a sequential phase-like fashion (Hidi & Renninger, 2006). Interest is one of the fundamental factors in the learning process, influencing what we choose to learn and the degree to which we learn information (Garner, 1992; Alexander & Jetton, 1996). The effects of interest are projected in active cognitive engagement, allocation of one's attentional resources, and positive learning outcomes (Reynolds, 1992; Schraw & Lehman, 2001). Another function of interest is that it is related to the use of specific learning strategies (Wade, Schraw, Buxton, & Hayes, 1993). Finally, it influences our emotional engagement in a task and the level of processing of information (Schraw, 1998).

Interest emerges in the interaction between a person and a particular content. "The potential for interest is in the person but the content and the environment define the direction of interest and contribute to its development" (Hidi & Renninger, 2006, p. 112). Thus, people, the environment, and individual effort such as self-regulation, can promote interest development. In this light, interest appears to be content specific rather than a predisposition that applies across all domains and activities (Hidi & Renninger, 2006).

Early studies of interest. Early research by Walter Kintsch (1980) distinguished

between emotional interest and cognitive interest. Emotional interest is present "when text information evokes a strong affective response in the reader such as elation, disgust, or anger" (Schraw & Lehman, 2001, p. 25) and is evoked by major life themes such as sex, death, religion, romance, politics, etc. Cognitive interest is related to readers' engagement in otherwise tedious texts and is based on interventions such as increasing the coherence, novelty, or unexpectedness of a text, shift in topic, and relating seemingly mundane information to main text ideas (Schraw & Dennison, 1994).

In their highly influential text-processing theory, van Dijk and Kintsch (1983) and Kintsch (1998) expounded the relationship between interest and processing of different text elements. In a series of studies they found that interest was related to comprehension of a text's macropropositional structure (i.e., thematic main ideas). Further, these authors cautioned against including in text interesting information that was not relevant to the text's macrostructure. According to them, these peripheral ideas interfered with recall of truly important macropropositional segments. This finding has relevance to the SD effect and provides partial explanation for its causes (Schraw & Lehman, 2001).

Schank's (1979) contributions toward a theory of interest also are worth mentioning because of their relevance to seductive details research. He hypothesized that interest was evoked by major life themes such as sex, religion, politics, and death as well as by unusual or unexpected events (novelty, surprise) that tend to attract a reader's attention. According to him, there were two ways that interest was generated during reading. One way was based on readers' goals and prior knowledge, which they used to interpret new information and to identify important text segments. This was referred to as top-down processing and according to contemporary interpretations, it corresponds to

the activation of personal interest. In the other type of processing, called bottom-up, external elements such as text content or structural aspects of text affected readers' attention to produce interest. Bottom-up interest appears to be more situational.

Schank (1979) coined the term *interest-based parsing* to refer to the claim that interest affected the strategic allocation of limited cognitive resources. According to this hypothesis, interesting text elements consumed substantial part of readers' attention. Schank acknowledged that interest and importance may be unrelated and formulated his diverted-attention hypothesis. It stated that interest-based parsing, or readers focusing their attention on information that is engaging, but that has little to do with the text's central themes, may be at the expense of recall of relevant main ideas (Schraw & Lehman, 2001).

Research by Asher and colleagues (1980; Asher, Hymel, & Wigfield, 1978) suggested that interest increased children's learning. Further, Asher claimed that interest directed selective attention and information processing for students with low motivation. However, consequent finding by Anderson, Shirey, Wilson and Fielding (1987) provided evidence that interest increased attention and learning separately. In other words, attention was not directly related to learning (Schraw & Lehman, 2001).

More recent conceptualizations of interest. More recently, researchers have distinguished between two types of interest, usually referred to as situational and personal interest (Hidi, Renninger, & Krapp, 1992). Situational interest is transitory, spontaneous, and highly contextual. "It is a kind of spontaneous interest that appears to fade as rapidly as it emerges, and is almost always place-specific" (Schraw & Lehman, 2001, p. 24). Interest works similarly across individuals and it has been demonstrated to positively

affect cognitive performance such as reading comprehension (Alexander & Jetton, 1996; Hidi, 1990; Hidi & Baird, 1988) and work with computers (Azevedo, 2004; Cordova & Lepper, 1996; diSessa, 2000; Lepper & Cordova, 1992). In addition, it has been found that situational interest can focus attention (Hidi, 1995; McDaniel Waddill, Finstad, & Bourg, 2000), enable integration of information with prior knowledge (Kintsch, 1980), narrow inferencing (McDaniel et al., 2000**),** and enhance levels of learning (Mitchell, 1993; Schraw, Bruning, & Svoboda, 1995; Schraw & Dennison, 1994; Wade, 1992; Wade & Adams, 1990).

More specifically, situational interest increases learning when the to-be-learned information is novel, salient, or relevant to the learning goal. Early research identified several characteristics of situational interest: it is related to attention and learning; it is person specific; it is provoked by prior knowledge, text structure, unexpected text content, and readers' goals (Schraw & Lehman, 2001). Schraw (1997) found that text variables such as coherence, identification with characters, suspense, and the concreteness and imageability of salient text segments increased situational interest and explained over 50 percent of sample variance in students' learning from text.

Previous research has indicated that a variety of text characteristics are related to situational interest. These include text coherence (Wade, 1992), character identification (Anderson, Shirey, Wilson, & Fielding, 1987), the unexpectedness of main events (Iran-Nejad, 1987) or isolated segments (Garner, Brown, Sanders, & Menke, 1992), the insertion of emotionally charged or provocative information (Goetz et al., 1992; Kintsch, 1980), suspense (Jose & Brewer, 1984), the extend to which text information engages the reader (Mitchell, 1993), and the concreteness and imageability of salient text elements

(Sadoski, Goetz, & Fritz, 1993a) (Schraw, 1997).

In contrast, personal interest, also referred to as *individual interest,* is less spontaneous, internally activated, and of enduring personal value. Krapp, Hidi, and Renninger (1992, p. 6) state that "personal interests are considered to be relatively stable and are usually associated with increased knowledge, positive emotions, and increased reference values." Other studies found that personal interest is related to intrinsic motivation (Deci, 1992) and that it plays a role in holding attention, which is essential for sustained engagement and long term learning (Hidi & Renninger, 2006). In this review, I concentrate primarily on situational interest because it is more relevant to seductive details (which are considered a type of situational interest). For a more detailed review of personal interest, see Schraw and Lehman (2001).

Mitchell (1993) pioneered a model of *catch* and *hold* functions of interest, a distinction based on the earlier writings of Dewey (1913). Catching refers to elements that grab attention, activate higher emotional and/or cognitive engagement, and stimulate students to become interested in an activity. Such stimuli are computers, puzzles, and group work as well as vivid or seductive details. Holding interest refers to text elements that give students a clear goal or purpose, make an activity meaningful, stimulate students to ask curiosity questions, provide them with useful feedback, etc.

Mitchell (1993) presented evidence for the catch and hold model by testing 350 high school students in a mathematics learning environment. He found that all variables used in the study (e.g., the use of computers or puzzles in the classroom) were positively correlated with situational interest, with student involvement being the strongest predictor of interest. Mitchell concluded that if educators want to catch and hold interest, they

have to use elements that promote student engagement (e.g., promoting deeper processing).

One important implication of this research is that situational interest can be controlled both internally and externally. On the one hand, students can purposefully and consciously try to make the task meaningful (e.g., ask questions, explore implications, etc.). On the other hand, teachers can stimulate engagement and situational interest by providing specific cognitive goals and diversifying the study format. It is interesting to relate this two-component model to the seductive details effect. Apparently SDs catch attention but this raises the need to differentiate between productive and deleterious catching.

Durik and Harackiewicz (2007) corroborated the catch and hold model with one additional finding. They included initial interest (i.e., a measure of personal interest) in a domain as a mediating variable in two experiments that tested for catch and hold in mathematics. In Experiment 1, they presented college students with math problems high in features promoting collative motivation (manipulations of color, placement, and font size). Students low in initial interest benefited from this manipulation. It appeared that situational factors that enhanced task interest were especially helpful for these unmotivated individuals. The presence of collative features increased students' involvement as well as the extent to which students cared about doing well on the task. On the other hand, collative feature promoting catch were detrimental for students high in initial interest. Durik and Harackiewicz (2007) concluded that these individuals were already motivated so these manipulations were distracting for them.

In Experiment 2, in addition to the catch manipulation, Durik and Harackiewicz

(2007) added a second factor that was intended to manipulate hold. They gave students instruction focused on the meaningfulness of the activity (how the math technique can be relevant to students' everyday life). Again, the two situational factors had different effects depending on students' level of initial interest in the domain. In addition to replicating the findings from Experiment 1 (catch effects) the researchers found that the personal utility emphasis benefited only individuals with high initial interest. These students reported stronger interest and task involvement as well as perceived their competence to be higher. In contrast, there were negative effects from the hold manipulation for students low in initial interest. It seems that the meaningfulness intervention reminded these students that they really did not like math or did not feel competent. These results revealed the need to consider individual differences in initial interest when using or testing situational variables that enhance task interest.

Chen and Darst (2002) provided further information about the role of individual difference variables. They found that level of expertise mediated both situational and personal interest with the correlation between expertise and personal interest significantly stronger than the correlation between expertise and situational interest. Their results suggested that both types of interest were important, but that situational interest did not guarantee the development of personal interest. They concluded that individual and situational interests are independent motivational factors and may have distinctive motivational functions at a particular learning stage.

The development of interest. Hidi and Renninger (2006) created a four-phase model of interest development that integrates recent research and explains the relationship between situational and personal interest. The four phases include the

following: (1) triggered situational interest, (2) maintained situational interest, (3) emerging individual interest, (4) well-developed individual interest. These stages are assumed to be sequential and distinct, representing a cumulative, progressive development. In each phase there is a varying amount of affect, knowledge, and value, as well as differing degree of effort, self-efficacy, goal setting, and ability to self-regulate behavior. Individual experience, temperament, and genetic disposition affect the length and the character of each phase. According to these authors "the four-phase model of interest development describes phases of situational and individual interest in terms of both affective and cognitive processes. It also identifies situational interest as providing a basis for an emerging individual interest" (p. 113). In the first two phases (situational interest, maintained situational interest), situational interest can be sparked by environmental or text features such as incongruous, surprising information; character identification or personal relevance; and intensity (Anderson, Shirey, Wilson, & Fielding, 1987; Garner, Brown, Sanders, & Menke, 1992). In these phases the learner is dependent on external support and needs to be told what to do. Also, this situational interest is held and sustained through meaningfulness of tasks and/or personal involvement.

The phases of personal interest are characterized by positive feelings, stored knowledge, and stored value. Students seek the opportunity to reengage in tasks, ask themselves curious questions, set challenges, and become more resourceful. In these stages, individual interest is typically self-generated and produces effort that feels effortless (Hidi & Renninger, 2006). Overall, the four-phase model provides a concise explanation of how interest develops, is sustained, and how it affects engagement and learning. It has been supported by research and offers a useful framework for empirical

and educational practices (Ainley, Hidi, & Berndorff, 2002; Durik & Harackiewicz, 2007).

Nevertheless, there are several important questions that this model fails to answer. One is how interest regresses when it is not sustained or is replaced by new interest(s). The model assumes that interest erosion or reversal is possible but does not explain the circumstances around this process. Another issue is whether interest is a necessary concomitant of expertise. It is possible that an expert in a domain is not highly interested in its content or that people develop expertise out of necessity or social pressures rather than because of interest. A third issue concerns the applicability of the model across the lifespan. There has not been research on whether the patterns of each phase apply for different age groups. Finally, as it is evident from research on seductive details, well-meaning attempts to increase interest may in fact hamper learning (Lehman et al., 2007; Schraw & Lehman, 2001). This model, although examined in detail, is not directly relevant to the current study, but it is essential part of the interest literature.

Text-based sources of interest. Scholars have acknowledged the importance of text-based factors (i.e., text characteristics of to-be-learned information) affecting interest. Ample research from the last thirty years established the importance of a number of text-based factors, including the structural aspects of the text such as coherence and completeness (Anderson et al., 1987; Hidi and Baird, 1988), concreteness and vividness (Goetz & Sadoski, 1995), the unexpectedness of information, character identification, activity level (Hidi, 1990). Other examples include engagement (Mitchell, 1993), suspense (Jose & Brewer, 1984), coherence (Schraw, Bruning, & Svoboda, 1995; Wade, 1992), ease of comprehension (Schraw, 1997), valuing (Wade, Buxton, & Kelly,

1999), and information complexity (van Dijk & Kintsch, 1983).

Schraw, Bruning, and Svoboda (1995) presented college students with an 800-word passage adapted from "Time" magazine to investigated potential sources of situational interest. They tested how coherence, vividness, ease of comprehension, emotiveness, prior knowledge, and engagement collectively affected situational interest and text recall. Using several factor and regression analyses, Schraw et al. (1995) provided evidence that each of these text characteristics was related to interest and that interest mediated their influence on text recall. Ease of comprehension and vividness were the factors with the strongest effect on situational interest, accounting for approximately 45% of the variance in perceived interest. Both were related to text recall, though only the ease of comprehension variable was related to recall once the variation due to interest was controlled. These results confirmed previous findings that 1) interest enhanced text recall 2) that perceived interest mediated the relationship between imageability and concreteness, and recall of targeted segments (Sadoski, Goetz, & Fritz, 1993a). Schraw et al. (1995) concluded that interest was a complex cognitive phenomenon, which was affected by multiple text and reader characteristics.

In summary, this brief review of literature on interest shows the effects it has on motivation, cognition, and behavior. It develops in time, starting with situational interest and gradually turning into long-lasting individual interest. Situational interest has the function of catching attention, and is considered to facilitate the development of personal interest, which, in turn, is important for holding attention (Durik & Harackiewitz, 2007). There are three ways in which interest affects learning. First, it increases motivation, engagement, and persistence. The second way is that it facilitates productive strategy

use, elaboration, monitoring and self-regulation (Alexander & Jetton, 1996; Schraw & Lehman, 2001). Last, it produces deeper information processing and attention allocation. Furthermore, there is a compensatory effect in which high interest compensates for lower achievement (Renninger, 2000). Based on these finding there have been well-meaning attempts by teachers to increase interest by adding interesting details to lecture materials. However, this practice may actually have a detrimental effect on learning (Lehman et al., 2007, Schraw & Lehman, 2001). An important caveat is that relevance should always be considered when adding interesting details in text because it plays a central role in the effects of high interest on what is remembered. When interest is focused on irrelevant information, it is at the expense of remembering main ideas and important facts. Numerous studies in this area have suggested that the presence of seductive details interferes with performance. These results have been found during lecture (Harp & Maslich, 2005) or using printed materials (Alexander et al., 1994a; Garner et al., 1989; Harp & Mayer, 1997, 1998; Wade & Adams, 1990).

Review of the Seductive Details Literature

In the early 1980s, Hidi and her colleagues (Hidi & Baird, 1988; Hidi, Baird, & Hildyard, 1982) conducted a series of studies on the relationship of importance and interest. Although they did not use the term *seductive details* explicitly, we can consider these studies to be a factor that spurred the research on SDs.

Hidi et al. (1982) investigated the typical types of texts that children encounter in school. The authors classified six comparable passages into three types: narrative, expository, and mixed, with two instances of three categories. Graduate students rated the importance and interest of idea units. Fifth- and seventh-grade students read one of

the six passages and were measured on immediate and delayed recall (4-day delay). The results indicated poor recall of main ideas, which the researchers attributed to the disruption of the identification of important information by "highly salient, trivial information" (p.72). Another finding was that in narrative texts, ratings of high importance corresponded to ratings of high interest, whereas in expository texts, ideas that were rated high on importance were rated low on interest.

Hidi and Baird (1988) explored the cumulative effects of three means of increasing text-based interest. The authors created a coherent and generally interesting base text about famous inventors. In the second version of the text, they added salient elaborations of main ideas. In the third text version, they inserted questions to induce the need to resolve incompletely understood information. Fourth and sixth graders read the three text versions at their grade level and were measured on immediate and delayed recall (one week after reading). Results indicated that the three text versions did not differ significantly in total recall, recall of important information, or recall of unimportant information. The authors conducted detailed analyses to explain their finding and concluded that interest-enhancing attributes in the base text facilitated recall only for those sentences, which dealt with the active, personally involving experiences of inventors. Salient elaborations (text 2) and resolution question (text 3) did not facilitate recall of the more abstract and general main ideas.

These studies pioneered investigation of the effects of both interest and importance on recall and showed that interesting, concrete information generally is better recalled compared to abstract, general information. However, as Goetz and Sadoski (1995) pointed out, these studies did not provide valid results for the existence of

seductive details effect because seductive details were neither operationally defined nor experimentally varied. The same applies for another set of studies (Britton, Van Dusen, Gulgoez, & Glynn, 1989; Duffy, Shinjo, & Myers, 1990; Graves, Slater, Roen, Redd-boyd, Duin, Furniss, & Hazeltine, 1988) that are frequently included in the discussion of seductive details. They were clearly not designed to test for this effect and cannot be used as a valid point of reference.

Garner, Gillingham, and White (1989) coined the term seductive details and defined them as text elements that readers judge as highly "interesting, but unimportant information" (Garner et al., 1989, p. 43). In their Experiment 1, they gave graduate students a three-paragraph, technical passage on differences between insect species with three main ideas. There were two versions of the text, one plain and one including seductive details in the beginning of the passage. The researchers produced the SDs version by adding in the text three sentences containing details irrelevant to the main ideas. SDs segments (high interest/low importance) were established by having twenty public school teachers rate all paragraphs for interestingness and importance. Immediately after reading, students were asked to recall "not all the information, just the really important information" (p. 47). The no-seduction group recalled significantly more main ideas than the SDs group. In their Experiment 2, Garner et al. (1989) presented seventh-graders with the same story but added an additional group of students, who read a text version containing signaled main ideas (in contrast to minimal signaling in the other groups). The three main ideas were emphasized by semantic, graphic (italics), and lexical (using the word *important*) signaling. As in Experiment 1, students were asked to recall only the really important text elements. The SDs/minimal signaling

group recalled significantly less main idea statements from the text compared to those who read the text with no seductive details and signaled main ideas (Goetz & Sadoski, 1995; Song, 2003).

This was the first study that systematically compares recall of SDs text and no-SDs text. It gave new perspective to previous studies on the interaction between interest and importance (Hidi & Baird, 1988; Hidi et al., 1982) and was seminal for the spur of focused research on SDs. However, the study has been criticized on several grounds. First, in Experiment 2, the comparison between the SDs/no signaling group and the base text/no signaling group did not yield significant differences. Thus, it did not replicate the results from Experiment 1 in finding a SD effect. It might be argued that the differences in Experiment 2 were due to the signaling and not to the presence of SDs (Goetz & Sadoski, 1995).

Another issue raised by Goetz and Sadoski (1995) was that the SDs text was produced by adding sentences that comprised a substantial part of the length of the whole text (nearly 40%). According to them, this practice could be problematic because the probability of recalling a piece of information generally decreases with passage length. Furthermore, introducing a large portion of material that does not fit the conceptual structure of the basic text may disrupt the coherence of the passage. Thus, a reader may become confused about the general idea and wonder what the text is really about.

A final critique concerns the lack of norming of text segments for potentially confounding variables such as coherence, concreteness, and background knowledge. For example, adding substantial amount of text in the beginning of a passage may disrupt the coherence of the text, inducing readers to construct a text schema around the seductive

details rather then around the important statements (Harp & Mayer, 1998). Also, the researchers did not distinguish between importance and relevance. When there is no reading goal instruction, there is a high chance that readers confuse what they subjectively find important with what is relevant from a main idea perspective (Alexander & Jetton, 1996, McCrudden & Schraw, 2007). Finally, there was no delayed measure of memory but only a test for immediate recall.

Garner, Alexander, Gillingham, Kulikowich, and Brown (1991) conducted two experiments to shed more light on the SDs issue. In Experiment 1, they asked undergraduate students to read one of four versions of a text about the renowned physicist Stephen Hawking. In the first condition, students read three passages, which focused on important aspect of Hawking's scientific work. Seductive details about Hawking's wager with a colleague were imbedded in one of the three paragraphs. In the second condition, the base text was made more interesting by adding in the beginning of the text a paragraph about Hawking's brilliant career and health problems. Respectively, the third and fourth text versions were identical to the first two with the only difference that the seductive details were in a separate paragraph. Text interestingness and importance were based on ratings of eight doctoral students enrolled in a seminar on text comprehension. After reading, participants were asked to recall the 'really important information', to generate titles for the text, and to answer five short questions. Results showed that 35% of the students included interesting details about the wager in the unstructured recall protocols, and 96% included moderately interesting and important details. In contrast, recall of the highly important but uninteresting elements was not particularly high (44%). Second, in generating titles for the text, 17% of students focused exclusively on the

wager. On the short answer questions, there were 100% correct answers for high/moderate interest information versus 52% correct answers for low interest/high importance information. Experiment 2 replicated the conditions with the addition of a measure of students' domain knowledge. Results were similar to those in Experiment 1 (though only 17% recalled the wager as really important) with the addition that low-knowledge students recalled fewer important ideas than high-knowledge students. The position of the seductive details in the text made no effect on recall.

Goetz and Sadoski (1995) criticized this study on the grounds that it did not have a non-seductive details control group, the recall of seductive details was relatively lower than the other groups (35% and 17% compared to 44% and 52% respectively for the two experiments), and that "the inclusion of engaging personal information about Hawking in the generally interesting passage versions improved the recall of the important but uninteresting main ideas in Experiment 1, despite the fact that addition of this information made the passages nearly 30% longer" (p. 504). Furthermore, the study lacked ratings for text coherence, concreteness, relevance, etc. and there was no delayed measure of memory but only a test for immediate recall. The researchers provided a measure of background knowledge and used three different measures, which gives the study some merit.

Garner and Gillingham (1991) presented college students with a passage about Stephen Hawking (similar to the one used by Garner et al., 1991). The experimental group read a version of the text containing an additional paragraph rich in highly interesting details about Hawking's disease and a wager with a colleague (seductive details version). The control group read the original text (four paragraphs) where such

details were missing. Each paragraph of the passage was rated for interest by undergraduates. Then students were instructed to recall the "really important information" and responded to five short-answer questions. Both of the memory measures revealed no significant difference between the two groups, thus failing to evidence the presence of SD effect.

This study (as well as Garner et al, 1991) was of the group that used biographical narrative text rather than expository text. As mentioned earlier, in narratives, text elements rated for high interestingness are rated high for importance as well. In contrast, main ideas in dry, expository texts (high importance) are low in interestingness (Wade & Adams, 1990). Also, important information in narratives tends to be both concrete and interesting because stories involve characters, settings, events, and emotional conflicts. Important plot events (e.g., climax) are typically imaged, felt, and remembered well (Sadoski et al., 1990). This means that the type of text is a significant variable for the generation of SD effect. The shortcomings of the study are the lack of norming of text segments for potentially confounding variables such as coherence, concreteness, and background knowledge. For example, important as well as unimportant ideas in a narrative text may be equally interesting (Wade & Adams, 1990) because they are equally concrete and/or vivid, which, according to Dual Coding Theory (Clark & Paivio, 1991) would make readers remember them equally well. Two additional flaws of the study were that researchers did not differentiate between importance and relevance and there was no delayed measure of memory.

Wade and Adams (1990) constructed two experiments in order to explore the relationship between importance and interest in a text using a 1700-word biography of

Horatio Nelson. College students first read the passage and then rated each sentence for interest and importance. The procedure required them to assign an equal number of sentences to each of four categories (mentioned below). On the basis of these ratings the authors distinguished four mutually exclusive types of text segments, including main ideas (i.e., highly interesting and important), factual details (i.e., uninteresting, but important information), seductive details (i.e., highly interesting, but unimportant information), and boring trivia (i.e., low in interest and importance). In their second experiment, the researcher measured immediate and delayed recall of sentences that fit the four categories by college students of high and low ability. Analyses of scores revealed that readers recalled interesting information better than uninteresting information. One important conclusion was that readers use different processing strategies when reading different types of text segments (Goetz & Sadoski, 1995; Song, 2003).

Wade, Schraw, Buxton, and Hayes (1993) replicated and extended these findings. They gave college students a version of the Horatio Nelson text used by Wade and Adams (1990) (with text segments rated for the four categories), first sentence by sentence online (Experiment 1) and then as a printed text (Experiment 2). Students recalled SDs better than uninteresting facts, implying the presence of SD effect. Measures of reading time revealed that readers spent more time reading seductive passages while spending less time reading main ideas. Interviewed participants said that they related seductive details to prior personal experiences, visualized the described scene, and/or savored the pleasantness of the details.

These two studies also used a biographical rather that expository text, which bears

the shortcomings mentioned above for the rest of this type of studies. As Goetz and Sadoski (1995) explained, “if a biography is taken as a representative record of someone's life, is it appropriate or desirable to eliminate personal, interesting facts (e.g., how Nelson died) that do not support the “main ideas” of that person's life?” The authors stated that “it may be difficult to stress exclusively historical importance in such texts without sacrificing biographical accuracy and representativeness” (Goetz & Sadoski, 1995, p. 506).

The limitations of these studies, as with the previous ones, include the lack of norming of text segments for coherence, concreteness, background knowledge and other important variables, which detracts from their informative power. An example of the importance of such variables is a study by Chen and Darst (2002) who found that background level of experience had a mediating effect on situational and personal interest. In another study, Alexander, Kulikowich, and Schulze (1994) provided evidence that learners with higher level of domain and topic knowledge were less susceptible to the SDs effect. These high-knowledge students were as attracted to seductive details as low-knowledge students, but without interference to their comprehension.

Furthermore, both studies lacked a control group (no-SDs) so no causal claims about the existence of the SD effect could be forwarded. Two additional flaws of these studies are that researchers did not differentiate between importance and relevance and there were no measures of delayed recall.

Schraw (1998) examined the homogeneity of SDs as a unitary concept; that is, Do SDs consistently lead to the same reading time and recall outcomes? He utilized the Horatio Nelson passage used in Wade at al. (1993) and Wade and Adams (1990). In

Experiment 1, he provided evidence that there are two types of seductive details. Context-dependent SDs are considered interesting only when they appear in an elaborating context. Context-independent SDs are judged interesting even when they appear in isolation. In Experiment 2, Schraw (1998) found that readers took longer time reading context-dependent SDs than context-independent SDs and base text because they needed to integrate them within the text structure. This experiment implies that SDs may be a multifaceted concept requiring narrower definition than the current one (highly interesting but unimportant details). In Experiment 3, the author measured college students' recall and found that even though SDs were remembered better than main ideas, their recall was uncorrelated with and did not hamper the recall of main ideas. Thus, the results of this study were not consistent with previous research that established the existence of SD effect. This study shares the limitations typical for narrative text studies of SDs mentioned above.

Harp and Mayer (1997) found that SDs hindered comprehension of a technical, expository text about the process of lightning formation. They tested the effect of seductive text elements and seductive illustrations on recall and problem solving (transfer) in two experiments. In Experiment 1, college students read text with SDs, seductive illustrations, or both. The results showed that the presence of seductive elements caused lower performance on recall and transfer tasks. In Experiment 2, Harp and Mayer (1997) compared ratings of cognitive interest ("How much does this material help you understand the process of lightning?") and emotional interest ("How entertaining is the material?"), a distinction based on the work of Kintsch (1980). Seductive text and illustrations had higher rating of emotional interest, whereas non-

seductive text and illustrations of important relationships were rated as more cognitively interesting. The authors concluded that elements that augment emotional interest have a weakening effect on learning, whereas adjuncts that increase cognitive interest have a facilitative effect on learning. This study had serious methodological shortcomings (to be discussed shortly) but was one of the few to distinguish between the influences of cognitive and emotional interest on the SD effect.

Harp and Mayer (1998) conducted four experiments with college students to explore the reasons why seductive details cause their damage on recall of expository text. Along with immediate recall, the authors tested students on a transfer task. In Experiment 1, 2, and 3, the authors revised the passage to include either highlighting of main ideas, a statement of learning objectives, or signaling, respectively, but neither helped learners to avoid recalling SDs better than main ideas. In Experiment 4, inserting the SDs at the beginning of the passage enhanced the SD effect, whereas presenting them at the end of the passage reduced the SD effect. In each experiment, prior knowledge was controlled via a questionnaire probing students' knowledge of weather. The authors generated three hypotheses that could possibly explain the SD effect. According to the *distraction hypothesis*, seductive details cause poor comprehension by drawing away attention from main ideas. The *disruption hypothesis* suggests that seductive details cause poor comprehension by disrupting the flow of cause and effect ideas and generally the coherence of the text. The *diversion hypothesis* suggests that seductive details cause poor comprehension by prompting readers to construct a coherent mental representation around the seductive details rather than around the main ideas of the passage. Results from the four experiments provided evidence only in support of the diversion hypothesis,

thus indicating that seductive details do their damage by priming inappropriate schema around which readers organize the material.

Overall, Harp and Mayer (1997, 1998) contributed to the SDs literature by focusing attention on the possibility that SDs affect readers' text processing. Further, these authors generated and tested viable hypotheses concerning the potential causes of the SD effect that opened areas for future research and raised important questions. One novelty in these studies was that they measured learning in terms of problem-solving transfer and retention rather than solely based on retention of the presented material, which was the approach taken in many previous studies. Measures of problem-solving transfer were intended to gauge learners' understanding. Also, this was the first study to conceptualize SDs in terms of relevance instead of importance.

However, the study has numerous limitations, only some of which were acknowledged by the authors, for example, the use of a single text and the lack of delayed measures of recall and transfer. The presence of illustrations may have distracted students' attention or may have caused cognitive load in students' working memory, thus accounting for the poor recall of main ideas. The 1998 study failed to find positive effect from the use of highlighting and signaling of target ideas, which is inconsistent with the body of research in this area. This raises important questions about the internal validity of the experiments. For example, in both studies, the authors did not provide any indicators of what makes SDs seductive. There was no control for potentially confounding variables such as coherence, concreteness, and mode of cognitive processing. Thus, it is not clear whether readers recalled less because of the interference of SDs or due to other variables such as low coherence of the text. Further, the authors

assumed that the "Lightning" text is coherent and well-organized but they did not provide evidence for that assumption. Subsequent studies examining Harp and Mayer's hypotheses (Lehman et al., 2007) suggested that their text on lightning had substantial flaws. Thus, the structure and clarity of the text was a potential confound. Also, a major shortcoming of the study is that the three processes predicted by the three hypotheses were not considered to work in conjunction and interactively as evidenced by the Lehman et al.'s (2007) study.

Lehman, Schraw, McCrudden, and Hartley (2007) designed a study to refine and extend Harp and Mayer's (1997, 1998) research on the impact of seductive details in technical, expository text and to further clarify the reasons for the controversial influence of seductive details. I will examine this study in detail because it is recent, comprehensive, and has a more reliable design compared to previous studies. Another reason for a closer look is that I used the same version of the "Lightning" passage as well as built on the findings of Lehman et al. (2007).

In Lehman et al.'s (2007) study, a treatment group of college students read a text with seductive details and a control group read the same technical, scientific text without seductive details. The text was an improved version (higher coherence) of the "Lightning" passage that Harp and Mayer (1997, 1998). Free recall, deep processing (ability to produce legitimate claims to support explanations), and recorded reading time for each sentence of the text were used to measure the differences between the two groups.

Three hypotheses were formulated that paralleling those of Harp and Mayer (1998): reduced attention hypothesis, the coherence break hypothesis, and the

inappropriate schema hypothesis (readers construct an inappropriate schema around seductive details instead of around main ideas). Results indicated that students took less time to read base text sentences when seductive details were present (SDs version). Furthermore, the presence of seductive details reduced recall of the base text idea units and interfered with deep-level processing (decreased ability to produce legitimate claims to support explanations). Also, seductive details had a strong unfavorable effect on readers' holistic understanding of the text. Readers of the SDs version demonstrated reduced ability to remember and integrate important aspects of the text's main ideas.

The authors attributed the detrimental effect of seductive details to several causes. First, those who read the SDs text spent extra time reading base text sentences placed after the seductive detail sentences. This result supports the coherence break hypothesis, which asserts that seductive details reduce the coherence of understanding, causing the reader to generate a less complete representation of the important events in the text. In other words, transitioning between seductive detail sentences and base text sentences disrupts readers' processing of base text information. Second, seductive details reduced attention devoted to important main ideas, thus impeding recall and deep processing of more relevant information. These results confirmed the reduced attention hypothesis developed by Harp and Mayer (1998). Third, those who read the seductive detail text did not remember seductive detail idea units at a higher rate than base text idea units, as should be the case if the readers' mental representation was constructed around seductive details. However, the inappropriate schema hypothesis was only partially corroborated by the decrease in deeper understanding.

Besides replicating Harp and Mayer's (1998) findings that seductive details lead

to less deep processing of relevant text information, Lehman et al. (2007) also extended Harp and Mayer's findings using online measures suggesting that SDs impede text comprehension both by disrupting the coherence of the text and by consuming readers' limited attention resources. The major conclusion of this study was that the three processes predicted by the three hypotheses seem to work in conjunction and may do so interactively.

Nevertheless, Lehman et al.'s (2007) experiment did not clarify many of the important issues in the area such as how type and length of text, type of seductive details, location of seductive details in the text, and their relevance to it, influence information processing, interest, and recall. As indicated by some of the previous studies (e.g., Garner et al., 1991; Schraw, 1998), seductive details effect do not appear consistently across texts and contexts, but it may induce interference when SDs distract readers' attention away from main ideas or create breaks in coherence that readers then have to repair. "The extent to which seductive details interfere with learning may depend on the extent to which the seductive details are context dependent (Schraw, 2000), the proportion of seductive detail text to base text (seductive detail density), and the relative difficulty of establishing coherence in the text" (Lehman et al., 2007, p. 583). Some of the limitations of the study are the lack of control for students' background knowledge as well as the lack of any delayed memory measure. Also, these researchers defined SDs as segments that are interesting but unimportant or irrelevant to main text ideas, but did not define importance and relevance as well as did not discuss the difference between them.

Mayer, Griffith, Jurkowitz, and Rothman (2008) examined the effects of extraneous text elements that differ in interestingness on learning. In other words, do

students learn more deeply when high-interest adjunct elements are added to a scientific explanation than when low-interest adjunct elements are added? Before this study, extraneousness had not been examined as a separate independent variable in research on seductive details with low prior knowledge of biology. In two experiments related to different domains of knowledge (viral infections and digestion) Mayer et al. (2008) presented students with an illustrated booklet, PowerPoint presentation, or narrated animation (Experiment 1) and with a PowerPoint lesson (Experiment 2). They inserted in the texts sentences that were related to the topic but irrelevant to the goal of understanding the cause-and-effect system—which they called extraneous details (or irrelevant details). The inserted sentences were either high in interest (so they can be considered seductive details) or low in interest (so they cannot be considered seductive details). In both experiments, the low-interest group outperformed the high-interest group on problem-solving transfer but not on retention tests.

Mayer et al. (2008) partially confirmed the SD effect and further extended previous research on seductive details in three ways. First, the authors examined the effects of details that vary in their level of interestingness (i.e., by calibrating the interestingness of the added material) rather than simply the presence or absence of seductive details, which is the approach taken in most other studies on SDs. Second, they measured learning in terms of problem-solving transfer and retention rather than just retention of the presented material. Third, Mayer et al. (2008) compared the effects of high-interest and low-interest extraneous details using various multimedia contexts including booklets, PowerPoint presentations, and narrated animation, rather than printed text alone.

A major limitation of the study is the lack of control group that would allow comparing materials containing extraneous elements (low and high in interest) to a text without extraneous elements. Also, Mayer et al. (2008) did not provide an adequate conceptualization of SDs. They linked SDs to relevance but did not discuss how relevance differs from importance. Further, Mayer and colleagues were not consistent in the labels they used for the hypothesis of the seductive details effect. In his previous studies, Mayer (Harp & Mayer, 1997, 1998) used the term distraction hypothesis, according to which seductive details cause poor comprehension by drawing attention away from main ideas. In the current study he replaced it with the term seduction hypothesis without providing any rationale for that decision. Another major shortcoming of the study is that the authors did not measure reading/watching time of seductive segments. They claimed that increasing the interestingness of extraneous details from low to high decreased deeper processing aimed at mentally organizing and integrating the main ideas but they did not have a direct measure of cognitive processing during learning (which they admitted). Transfer as an indirect measure is not enough for a strong claim such as theirs. In experiment 2, the authors measured overall learning time of the lesson but this is a vague indicator of information processing since it does not differentiate between reading of seductive and non-seductive details. As in previous studies on SDs, researchers did not control for potentially confounding variables such as coherence and concreteness.

Summary of the literature on seductive details. The analysis of the literature on SDs indicates that there are numerous issues that need to be clarified by future research. Several lines of inquiry seem relevant in the context of the current review. One

is that the homogeneity of SDs as a unitary concept needs to be established. In most studies on SDs, it is not clear whether readers recall less because of the interference of SDs or due to other variables such as text coherence (Lehman et al., 2007) or differences in concreteness of text elements (Goetz & Sadoski, 1995; Sadoski, 2001). Second, researchers should clearly distinguish between importance and relevance. In most studies, SDs were defined in terms of importance (highly interesting but unimportant details). However, Mayer and colleagues (Harp & Mayer, 1997, 1998; Mayer et al., 2008) as well as Lehman et al. (2007) defined SDs in terms of relevance (highly interesting but irrelevant details). As it has been indicated by research on relevance and importance, it is possible that in the absence of relevance instructions, readers use importance as a default criterion for assessing text (McCrudden & Schraw, 2007). If this is the case, relevance and importance could mean the same thing because what is relevant would be determined in terms of what is important for the text structure (e.g., main ideas). In the present study, I adopted the instructions condition of previous research on SDs (no relevance instructions) and used exploratory factor analysis to determine whether there are differences between relevance and importance. I expected findings to indicate that these two variables can be used interchangeably in the absence of relevance instruction.

A third source of controversy in the SDs studies has been the type of text used (narrative vs. expository). "Even though informative text has typically been the medium of choice, marked differences in the character of text are evident. These differences have to do with the extensiveness of the written materials, and whether they were intentionally constructed, purposefully manipulated, or naturally occurring" (Alexander & Jetton,

1996, p. 101). Most studies using narrative text have failed to detect the presence of SD effect. One reason for that may be the overlap of importance and interest in this type of text (i.e., important main ideas are also high in interestingness), which is "due to the presence of a story schema in narratives that mark important elements such as the setting, characters, or plot or to other factors" (Alexander & Jetton, 1996, p. 101). This contrasts with scientific, expository texts where main ideas are not considered interesting. For this reason, I think it was more appropriate to use an expository text for the study of seductive details. The text that I employed in the current study has been used in three previous experiments (Harp & Mayer, 1997, 1998; Lehman et al., 2007) and has always produced results that support the SD effect. I took this as a starting point and built on it by further exploring how different variables were related to one another and to the SD effect. In particular, I used the highly coherent version developed by Lehman et al. (2007).

Another systematic problem in SDs studies has been the lack of control for potentially confounding variables such as text coherence and background (domain/topic) knowledge. I considered this issue and constructed an experiment that controlled for background knowledge and coherence (using a highly coherent text). Further, students normed each text sentence for interestingness, concreteness, importance, and relevance so that the influence of these variables on recall could be separated by simple regression analysis.

In terms of data-gathering methods, a number of techniques have been used to gather relevant information. A few examples are the generation of titles (e.g., Garner et al., 1989), short-answer measures (Garner et al., 1991), question writing (e.g., Alexander et al., 1994b), interviews (Wade et al., 1993), on-line techniques (e.g., Lehman et al.,

2007), problem-solving/transfer (e.g., Harp & Mayer, 1997, 1998), other deep-level processing measures (e.g., Lehman et al., 2007), recall (e.g., Harp & Mayer, 1997, 1998; Lehman et al., 2007), and various text-rating tasks (e.g., Hidi et al., 1982; Lehman et al., 2007; Sadoski et al., 1993; Wade et al., 1993), with the last two types being most common. Generally, it is recommended that studies of SDs employ measures of both surface-level learning (recall, recognition) and deep-level learning (transfer, problem-solving, essays, etc.). In some previous experiments, recall and recognition measures failed to detect the presence of the seductive details effect (Harp & Mayer, 1998). In the current study, I used only immediate recall because of time limitations imposed by the rating phase. However, the design of this study did not aim at providing evidence for the SD effect (which has been already established with this text), but only at studying the interplay of variables underlying it. This might be considered a flaw in light of the fact that Harp and Mayer (1998) failed to find differences in students' recall after reading the seductive and non-seductive versions of the "Lightning" passage, but this finding can be explained with the low coherence of their version (Lehman et al., 2007). Loxterman, Beck, and McKeown (1994) and McKeown, Beck, Sinatra, and Loxterman (1992) found that when a text is low in coherence, this may hamper readers' recall of text information. The text version that I used was identical with Lehman et al.'s (2007) text, which was found to be highly coherent and produced differences in recall due to the SD effect.

Literature Review of Text Characteristics Related to Seductive Details

In this section I present a brief overview of the main findings from research on coherence, importance/relevance, concreteness (imagery), and background knowledge. These variables will be used in the proposed experiment and for that reason I provide a

brief summary of findings from other studies as evidence for their relevance to the seductive details effect.

Findings from research on coherence. Coherence is the extent to which text segments are linked structurally to other text segments and to information in memory (Lehman & Schraw, 2002). It increases the number of inferences while reading and the degree of connectedness between those inferences that unifies them in an integrated representation of the text in memory (Graesser, Singer, & Trabasso, 1994; Kintsch, 1998). There are two types of coherence: local and global.

Local coherence represents the unambiguous logical relationship between text segments and those that precede or follow them. Text segments may be stated explicitly or may take the form of main ideas inferred from the text. Local coherence is determined by the contiguity of ideas in the text and the consistency of text structure. "High levels of local coherence positively influence syntactic processing and comprehension of main ideas by enabling readers to construct referential and causal links between adjacent text segments" (Lehman & Schraw, 2002, p. 738). Research has provided evidence that high local coherence affects positively lower level cognitive measures such as recall and recognition. In contrast, when local coherence is low, there are positive effects on deeper processing. In other words, low local coherence (logical gaps between text segments) stimulates readers to elaborate and to make logical connections between text segments in order to integrate each new sentence with the previous ones. This activity promotes readers' deeper processing of text ideas.

In contrast, global coherence is "the extent to which the reader is able to construct textwide inferences and integrate broad text ideas into a situation model" (Lehman &

Schraw, 2002, p. 738). A situation model is a mental representation of the text that puts together background knowledge and text information in order to construct a meaningful picture of the text (Graesser, Singer, & Trabasso, 1994). Background knowledge mediates the effects of global coherence by enabling readers to relate ideas in the text to that knowledge. Whereas local coherence helps readers to understand a text literally, global coherence is what readers understand conceptually by constructing broad themes and generating meaning. Nonetheless, coherence, both local and global, is necessary in a text so that a reader can connect main ideas, compose a mental representation of the text, and comprehend its meaning. When coherence is high, each new idea is integrated in the composite mental representation of the text.

Several experiments exploring coherence were conducted by Beck, Loxterman, McKeown, and associates (Loxterman, Beck, & McKeown, 1994; McKeown, Beck, Sinatra, & Loxterman, 1992). Their results suggested that when a text is highly coherent, readers recall more text information compared to those who read a low coherent text. Further, high background knowledge mediates the positive influence of coherence on recall. For readers low in background knowledge, enhanced coherence improved recall of explicit text information at shallow levels of text processing (Loxterman et al., 1994; McKeown et al., 1992).

These findings were corroborated by McNamara and Kintsch (1996) and McNamara et al. (1996). They reported that high coherence caused improved performance on shallow processing measures across background knowledge levels; however, coherence interacted with background knowledge on the deep processing measure. Low knowledge readers demonstrated improved deep comprehension when

text was coherent. In contrast, high knowledge readers' deep comprehension increased only when text coherence was low (McNamara & Kintsch, 1996; McNamara, Kintsch, Songer, & Kintsch, 1996).

Lehman and Schraw (2002) studied the interplay between coherence and relevance in two experiments that deserve closer attention. College students read two versions of a 1271-word text about famous explorers (respectively high and low in coherence). The low-coherence text had breaks in local coherence (Experiment 1) and in global coherence (Experiment 2). Relevance was manipulated by asking students to focus on important explorers and what they discovered (i.e., relevant goal for reading) or by providing no instructions (i.e., a no-relevance control group). Measure of shallow processing included a 36-item multiple choice test that assessed recognition of main ideas and a free recall assignment that tapped students' memory for textbase information. Deeper processing measures was represented by "an analysis of causal inferences, evidence in support of causal inferences, and a holistic ranking of each reader's situational model into five levels of completeness based on an argumentative essay written after reading the text passage" (Lehman & Schraw, 2002, p. 740).

Results from Experiment 1 indicated that relevance increased deeper processing of text by helping readers selectively focus on important information. Through the use this information readers generated justified claims that, in turn, supported the construction of a situation model. In contrast, relevance manipulations did not affect shallow processing. The authors concluded that sometimes college students process factual information and main ideas regardless of experimenter-imposed manipulations mainly because they have automated shallow text processing, and that skilled readers

easily overcome minor breaks in coherence in texts with a strong narrative component. If this is true, it provides a potential explanation why tests for the existence of SD effect using narrative texts have failed to produce positive results. In Experiment 2, the authors found a strong interaction between coherence and relevance. Breaks in global coherence impeded readers' ability to recall text information but did not affect their ability to recognize text facts on a multiple-choice quiz. Another finding was that relevance compensated in part for breaks in global coherence. On both measures of deep processing students performed better when relevance was high compared to those in the low-relevance condition. In sum, this study is consistent with previous research findings suggesting that improving a text's coherence improves comprehension whereas breaks in coherence disturb reading and reduce comprehension (Loxterman et al., 1994; McKeown et al., 1992).

In terms of seductive details effect, low coherence presumably would make it difficult for readers to distinguish main ideas and relate them into an integrated representation (e.g., a situation model of the text) which would eventually reduce the recall of these ideas. In most seductive details studies, background knowledge and text coherence were not controlled for so the effects of this interaction could have gone in any direction. In those studies where researchers controlled for background knowledge (Harp & Mayer, 1997, 1998; Mayer et al., 2008), readers were selected from the low-knowledge group. As it is evident from research on coherence, low-knowledge readers demonstrate poor memory when the text coherence is low. This effect is a potential explanation of the presence of a SD effect in some studies, especially in those, which have been criticized for low coherence of the text they used (e.g., Harp & Mayer, 1997, 1998). Also, the fact

that increased coherence had no impact on recognition or recall performance in Lehman and Schraw's (2002) Experiment 1 (coherence affected recall in Experiment 2) may explain why some studies did not find a SD effect on recall (Schraw, 1998), but only on deep processing measures (e.g., Harp & Mayer, 1997, 1998, Schraw, 1998).

Research on concreteness. Goetz, Sadoski, and associates (Goetz & Sadoski, 1995; Sadoski, 2001; Sadoski, Goetz, & Fritz, 1993a, b; Sadoski & Paivio, 1994; Sadoski, Paivio, & Goetz, 1991) provided evidence that concreteness of text elements increased memory. Concreteness was defined as information which is highly imageable or vivid with easily represented, often material, referent (tree vs. freedom). Sadoski and colleagues grounded their arguments in the Dual Coding Theory (Clark & Paivio, 1991), which posits that there are two distinct cognitive systems: the verbal (language) and the nonverbal (mental imagery). "Referential connections between the system accounts for evocation of mental images by language (or language by images)" (Sadoski, 2001, p. 264). Concrete language is easier to visualize and is rich in such connections compared to abstract language, which makes it more comprehensible and memorable. Thus, according to the Dual Coding Theory, information that is represented through verbal propositions as well as visual images (i.e. dual modality) is more easily retrieved because of stronger and more diverse neural connections in the brain.

Sadoski et al. (1993b) investigated the effects of concreteness on the familiarity, comprehensibility, and interestingness of long sentences and short and long paragraphs in both immediate and delayed recall. They found that concreteness made text more comprehensible and interesting. Concrete text was recalled better and additionally improved recall of abstract sentences that followed a concrete one by approximately

70%. Sadoski et al. (2000) replicated these findings with narrative, expository, persuasive, and literary passages that dealt with a variety of topics and covered a variety of readability levels.

Sadoski and colleagues (Sadoski et al., 1993a; Sadoski et al., 1993b; Sadoski et al., 2000) have constructed a causal path model of the relationship among concreteness, familiarity, comprehensibility, and interestingness. They provided evidence that from these three factors, concreteness is the most effective predictor of interestingness. Furthermore, apart from its direct influence, it exerts an indirect effect on interestingness through comprehensibility. Sadoski (2001) concluded that "highly unfamiliar text with obscure, abstract vocabulary would be neither comprehensible nor interesting" (p. 268), a common phenomenon in textbook chapters. These results are consistent with the tenets of Dual Coding Theory (Clark & Paivio, 1991).

These findings relate to research on SDs because interesting material might in fact detract from the comprehension and recall of abstract, less interesting, but more important material because of its high concreteness. Estes (1982) commented on the results of a study of the recall of a science textbook (p. 90):

> When we looked closely, we could see that there were several highly important idea units which were recalled by only a small proportion of our readers and there were several meaning units of relatively low importance which were recalled by a disconcertingly high proportion of our readers. When these problematic units were reviewed aside from the rest of the text, a curious (but now we find, rather widespread) pattern of characteristics emerged. Important but poorly recalled ideas were often extremely dense, containing much information in few words.

Considering the fact that main ideas in expository texts are mostly abstract and uninteresting, one potential explanation of the SD effect is that differences in concreteness may cause differences in recall of SDs and main ideas. Thus, expressing main ideas in a more concrete language may facilitate their recall and cancel the SD

effect. In this study, I isolated the effects of concreteness on recall as well as aimed to further illuminate its relationship to interest.

Research on importance and relevance. Research by McCrudden, Schraw, and colleagues (McCrudden, 2005; McCrudden & Schraw, 2007; McCrudden, Schraw, & Kambe, 2005) found that there is a clear distinction between importance and relevance. Importance indicates the degree to which a segment contains essential information needed to understand a text (McCrudden, Schraw, & Kambe, 2005). In other words, it signifies to what degree a text segment is high in the propositional structure of a text (Alexander & Jetton, 1996; Kintsch, 1998). "A sentence containing a main idea is higher in a text's propositional structure and has greater structural importance than a sentence containing an elaborative detail. Important segments generally are essential to understanding the text's main ideas regardless of the reader's goals" (McCrudden & Schraw, 2007, p. 114). In contrast, relevance refers to the extent to which text segments are germane to the reader's goals and purposes (Lehman & Schraw, 2002). Its importance to text processing and recall has been verified in numerous studies, which provided evidence for the existence of relevance effect. This effect "occurs whenever text segments are designated as relevant to a particular goal, task, or learning outcome" (McCrudden, 2005, p. 7). It has been found that relevance instructions exert significant influence on readers' goals and purposes when reading text (McCrudden, Schraw, & Kambe, 2005). There two types of relevance instructions – specific and general – both of which prompt readers to focus on specific terms or sentences. Specific relevance instructions concern reading that is guided by specific questions or objectives (McCrudden et al., 2005), use of inserted post-questions (Reynolds, 1992), use of

inserted pre-questions (Shavelson, Berliner, Ravitch, & Loeding, 1974), whereas general relevance instructions include assigning readers a perspective during reading and reading for a specific purpose (for a test vs. for entertainment). For a detailed review of types of relevance see McCrudden and Schraw (2007).

Schraw, Wade, & Kardash (1993) had college students read a text from an assigned perspective in order to examine the separate and combined effects of relevance and importance on text learning. Both relevance and importance increased recall of text. The findings revealed that readers relied primarily on relevance rather than importance to choose what text elements to remember. When text had high relevance, the level of text-based importance was irrelevant for recall. Conversely, low-relevance text was recalled better when the level of text-based importance was high in comparison to low importance text. In sum, this study suggested that when readers lack criteria to distinguish relevant from less relevant information they use importance as their default criterion for assessing text (McCrudden, 2005).

McCrudden and Schraw (2007) provided additional evidence for the compensatory mechanism between relevance and importance, indicating that 1) both specific and general relevance instruction promoted learning of relevant text; 2) general relevance instructions, but not specific instructions, increased reading time for relevant segments; 3) ability and age seemed to interact with specific relevance instructions, which was conducive for high-ability readers and older reader; 4) relevance offset deficiencies in reader characteristics concerning working memory capacity, background knowledge, interest, and reading ability. It compensated for text-related factors such as importance, coherence, and text length.

Another important finding is that relevance has been related to interest. In a study by Schraw and Dennison (1994), college students who read a text from an assigned perspective rated perspective-relevant segments as more interesting than perspective-irrelevant segments. This finding implies that interest changes as a function of relevance instructions.

Alexander and Jetton (1996) defined importance as the value or relative significance assigned to some object, event, or individual. They differentiated between three types of importance: author-determined, reader-determined, and teacher-determined. Author-determined importance corresponds to structural importance. Important elements are considered those, which are central to the semantic structure of the text. One finding concerning this type of importance was that older and more capable readers were better able to recognize the underlying structure of the text, which, in turn, improved their understanding and recall. Reader-determined importance is base on judgment that is specific to the individual reader, or, in other words, a personal construction. Thus, any aspect of the text could be viewed as important depending on reader's background knowledge and interests. Teacher-determined importance or instructional importance represents "the influence of variables outside of the reader or the text, such as the tasks that are given, and the goals and intentions of the teacher in determining importance for learners" (Alexander & Jetton, 1996, p. 95). There is some evidence that it is not the reader's interests and perceptions of importance that guide attention and learning in the classroom. Rather, students try to discern what the teacher values. This type of importance overlaps with our conceptualization of relevance as external instruction that drives students' attention and effort.

In sum, importance is a default strategy for guiding students' attention and memory, but when relevance criteria are present, readers switch to them to guide processing. "Importance and interest are not invariant characteristics of text. Rather, both importance and interest vary as a function of relevance such that relevant segments tend to receive higher importance and interest ratings than non-relevant text" (McCrudden, 2005, p. 15). On this view, relevance instructions increase interest in relevant text by making information more salient.

Research on background knowledge (domain/topic knowledge). Another possible variable related to the potential negative effects of seductive details is background knowledge. Several researchers found that personal interest was highly related to prior knowledge. Renninger and Wozniak (1985) provided evidence that preschoolers' personal and gender-specific interests affected their attention allocation. Interest also increased pictorial recognition and recall of play objects. Baldwin, Peleg-Bruckner, and McClintock (1985) found that prior knowledge and interest were good predictors of learning for middle-school students, but that they were not related to each other (Schraw & Lehman, 2001).

Chen and Darst (2002) found that background level of experience had a mediating effect on situational and personal interest. In another study, Alexander, Kulikowich, and Schulze (1994) proposed a model of the relationship between subject-matter knowledge and interest, which included three stages in domain learning: acclimation, competency, and proficiency/expertise. Grounding their experiment in this model, they provided evidence that learners with higher level of domain and topic knowledge were less susceptible to the SDs effect. These more knowledgeable students were as attracted to

seductive details as students with less background knowledge but without interference to their comprehension. The authors explained this tendency with the finding that "more knowledgeable learners tend to distinguish text that is interesting from that which is important, whereas less knowledgeable learners students seem much less able to do so" (p. 327). Thus, even when drawn by "tantalizing tidbits in a text" (p. 317), knowledgeable learners can recognize them as less important to the domain and consequently focus their effort to remember main ideas. Their richer and better structured knowledge base mitigates the effects of personally involving and seductive information. These findings indicate that in studies on seductive details, background knowledge could be a confounding variable if researchers do not control for it. In the present study, participants were tested for background knowledge with a questionnaire on meteorology.

Purpose of the Study and Expected Findings

This study was exploratory in nature and employed a correlational design in order to examine the relationship between four predictor variables (relevance, interestingness, importance, and concreteness) and two outcome variables (recall and reading time of SDs and base text). The main research question concerned how relevance, importance, concreteness, and interestingness affected students' processing and recall of seductive details and base text information in an expository text as well as how these variables were correlated with each other. None of the previous studies on SDs has adopted a design that measures all these variables simultaneously while controlling for coherence and background knowledge. Although there is empirical evidence for their importance, it is relatively unknown how powerful the effect of each of them is as well as how they are

related to one another.

I made a number of predictions concerning the results of the experiment. The first one was that in the absence of relevance instruction, the distinction between importance and relevance would become meaningless, and the correlation between them would be close to 1. A second prediction was that seductive details sentences were going to be rated as significantly more interesting and concrete and less important and relevant than non-seductive sentences. A third prediction was that all predictor variables were going to increase text recall. A fourth prediction was that in the context of a dry, expository text with abstract main ideas importance would be negatively correlated with concreteness. For the same reason (nature of the text) I predicted that importance would be negatively correlated with interestingness (prediction five). A sixth prediction was that concreteness and interestingness may exhibit positive correlation because concrete details tend to be vivid and easy to visualize. These factors have been shown to increase situational interest (Sadoski, 2001).

I conducted a simple regression analysis to measure how each variable contributed to recall as well as to see if these variables interact with each other. I expected that results would reveal significant main effects for interestingness, concreteness, importance, and relevance. I made no predictions in regard to reading time because results from previous studies (Lehman et al., 2007; Wade et al., 1993) had been mixed.

There were two reasons why coherence and background knowledge were not manipulated experimentally but only controlled for. First, manipulation would have put additional burden on students' rating process. Students needed to rate each sentence for

four different variable so having additional variables would have increased substantially rating time and may have caused fatigue and other problems (e.g., boredom). Second, these two variables have been researched extensively and their effects on text comprehension and recall are known. For instance, readers high in background knowledge are not susceptible to the SDs effect to the same degree as readers low in background knowledge. Also, using a highly coherent text provided basis for a more straightforward interpretation of results. If readers remembered seductive details better than base text segments, coherence could be excluded from the possible reasons for this effect. Thus, coherence was controlled for by using a text version of the "Lightning" passage that has been established as highly coherent (Lehman et al., 2007), while background knowledge was controlled for by administering a questionnaire that taps students' domain knowledge of meteorology.

The findings were expected to contribute to clarifying the issues with the definition of SDs. In the past, SDs have been defined in terms of importance (Garner et al., 1989; Garner et al., 1991) as well as relevance (Harp & Mayer, 1997, 1998; Lehman et al., 2007), with researchers quite often confusing these two constructs. One of the expected findings in the current experiment was that in the absence of relevance instruction, students would use importance as a default criterion for assessing text (McCrudden & Schraw, 2007). A potential consequence from this is that defining SDs in terms of importance rather than relevance would be considered more appropriate. Alternatively, in case of using relevance in the definition of SDs, students would interpret it as importance so in effect the two terms could be used interchangeably.

CHAPTER 3

METHODS SECTION

Participants

Sixty-eight undergraduate education majors from an introductory educational psychology course at a large western university participated in the study in partial fulfillment of their class requirement. There were 13 male (19.1%) and 55 female (80.9%) participants, mostly Caucasian (60.3) and Latino (25.0), averaging three years in college, with mean age of 23 years.

Materials

The participant questionnaire was almost identical to the one used by Harp and Mayer (1997, 1998) and included questions about demographic information, including age, gender, ethnicity, and years in college. It also asked the participants to rate their knowledge of weather by writing a check mark on a 5-point scale (ranging from *very little* to *very much),* and to write a check by each of six weather-related items that applied to them, including the following: (a) "I know what a cold front is," (b) "I can distinguish between cumulous and nimbus clouds," (c) "I know what a low pressure system is," (d) "I can explain what makes wind blow," (e) "I know what this symbol means" [symbol for warm front], and (f) "I know what this symbol means" [symbol for cold front]. The background knowledge questionnaire is available in Appendix B.

The text was a 50 sentence, 967-word passage that describes the formation of lightning and the conditions under which lightning is most likely to occur. It was identical to the seductive details text used by Lehman et al. (2007), who adapted it from Harp and Mayer (1998). As with Harp and Mayer's version, seductive detail sentences

were dispersed throughout the base text. The passage was modified to increase referential clarity by either modifying sentences or by adding bridging sentences. Overall, the modification increased the coherence of the text compared to Harp and Mayer's (1998) version of the text. In Lehman et al.'s (2007) 50-sentence text, 11 sentences (22%) were labeled *seductive details* (high interest/low importance). The following is an example: "For example, eye witnesses in Burtonsville, Maryland, watched as a bolt of lightning tore a hole in the helmet of a high school football player during practice." The remaining 39 sentences were classified as "base text sentences." The following is an example of a base text sentence: "The electrical differences between cloud and ground begin when warm, moist air near the earth's surface becomes heated and rises rapidly, producing an updraft." I used the same version of the text so its structure remained the same.

The ratings of each sentence were conducted as a paper and pencil task. The directions on the interest rating scale asked participants to rate their interest in each sentence of the text using a 4-point Likert-type scale (1 = uninteresting, 2 = somewhat uninteresting, 3 = interesting, 4 = very interesting). Each sentence was numbered and listed individually in the order it was presented in the text. The interest rating scale included the following instructions at the top of the page: "Whenever someone reads a passage, some information is more interesting than others. Now that you have read the "Lightning" passage, we would like you to rate your interest in each of the sentences in the story. Use the 4-point scale below to rate the relative interest of each sentence in the passage. Circle one number for each sentence."

The directions on the importance rating scale asked participants to rate the

importance of each sentence of the text using a 4-point Likert-type scale (1 = unimportant, 2 = somewhat unimportant, 3 = important, 4 = very important). Each sentence was numbered and listed individually in the order it was presented in the text. The importance rating scale included the following instructions at the top of the page: "Whenever someone reads a passage, some information is more important to the passage than others. Now that you have read the "Lightning" passage, we would like you to rate the importance of each of the sentences to the story's overall meaning. Use the 4-point scale below to rate the relative importance of each sentence in the passage. Circle one number for each sentence."

The directions on the relevance rating scale asked participants to rate the relevance of each sentence of the text using a 4-point Likert-type scale (1 = totally irrelevant, 2 = somewhat irrelevant, 3 = relevant, 4 = very relevant). Each sentence was numbered and listed individually in the order it was presented in the text. The relevance rating scale included the following instructions at the top of the page: "Whenever someone reads a passage, some information is more relevant to the passage than others. Now that you have read the "Lightning" passage, we would like you to rate the relevance of each of the sentences to the story's overall meaning. Use the 4-point scale below to rate the relative relevance of each sentence in the passage. Circle one number for each sentence."

The directions on the concreteness rating scale, established by Sadoski, Goetz, & Fritz (1993a, 1993b), asked participants to rate the concreteness of each sentence of the text using a 4-point Likert-type scale (1 = very abstract, hard for me to form mental images of it, 2 = abstract, 3 = concrete, 4 = very concrete, easy for me to form mental

images of it). Each sentence was numbered and listed individually in the order it was presented in the text. The concreteness rating scale included the following instructions at the top of the page: "Whenever someone reads a passage, some sentences are more concrete and imageable than others. Now that you have read the "Lightning" passage, we would like you to rate the concreteness of each of the sentences to the story's overall meaning. Use the 4-point scale below to rate the relative concreteness of each sentence in the passage. Circle one number for each sentence."

Coding

The base text contained 39 sentences and the remaining 11 sentences were seductive details. The text sentences were not parsed into idea units and divided into important main ideas, trivial details, and SDs as in Lehman et al. (2007) but were coded on the sentence level. Partial recall of an idea was coded 1. Complete recall of an idea was coded 2. Inferences were given code 3. An example for code 1 (partial) is, "Lightning strikes the highest point" (#33082). An example for code 2 (complete) is, "10 000 people a year are injured by lightning" (#33082). An example for code 3 (inference) is, "Once they [the stepped leaders] meet, a bolt of lightning occurs" (#32767).

Outcome Measures

Two types of outcome measures were used, including reading time and recall of text sentences. Reading time was recorded for each sentence of the text to the nearest millisecond. For the free recall task, participants were asked to write down as much as they could remember about the story.

Procedure

Students' domain knowledge of meteorology was measured via a questionnaire.

Students also provided demographic information, including age, gender, ethnicity, and years in college. Next, participants were informed that they would be reading a text about lightning formation at a self-selected pace. They were instructed that they should read the text for understanding and that they would be doing three tasks after they finish. Next, they read the text on a computer screen sentence by sentence so that reading time information could be collected. When a student was finished reading a sentence, he or she pressed a button to go to the next sentence. Once all participants were finished reading, they were tested on a free recall task asking them to remember as much as they could from the text. Next, they worked for five minutes on a fill-in task that included basic math problems such as 213 – 67 = ?. The goal of this task was to preclude (inhibit) memory traces from the free recall procedure to leak into the rating task. Finally, participants were asked to rate each sentence for interestingness, importance, relevance, and concreteness. The researcher read aloud the instructions and indicated that students should wait for further instructions once they finished the scale.

CHAPTER 4

RESULTS AND STATISTICAL ANALYSES

Data Analyses

Six different analyses were conducted. The first examined questionnaire reliability. The second and third examined differences between reading time and recall for base text and seductive text segments using dependent *t*-tests. Composite reading time and recall scores were created for base text and seductive details in the passage. The fourth set of analyses compared ratings for base text and seductive segments for the interestingness, concreteness, importance, and relevance variables using dependent *t*-tests. The fifth set examined pairwise correlations between variables, while the sixth set used simple regression analysis to examine how the interestingness, concreteness, importance, and relevance variables were related to recall and reading time.

Questionnaire Reliability

Means and standard deviations for each of the seven items appear in Table 1. The mean score for all the participants was M = 2.036, which indicates overall low knowledge of weather. The meteorology questionnaire displayed acceptable reliability with Cronbach's Alpha $\alpha = .718$ (see Table 2).

Background Knowledge

I created a single composite score for the seven items from the questionnaire, which represented the background knowledge variable. The mean score was M = 14.250, SD = 4.912. This result indicates that on average participants had very low knowledge of weather and meteorology. A correlational analysis revealed that background knowledge was not significantly correlated with reading time for seductive sentences ($r = .005$) and

base text sentences (r = .063) as well as with recall of seductive sentences (r = -.011) and base text sentences (r = .057). These results mean that background knowledge did not play a role in this study mainly due to students' low knowledge on the subject.

Table 1. Mean Scores for the Background Knowledge Questionnaire

	Mean	Std. Deviation	N
MQ1	1.8382	1.21692	68
MQ2	2.7647	1.21087	68
MQ3	2.2941	1.07978	68
MQ4	1.9559	1.12547	68
MQ5	2.0735	1.21331	68
MQ6	1.6618	1.10102	68
MQ7	1.6618	1.10102	68

Table 2. Overall Reliability for the Background Knowledge Questionnaire

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.718	.723	7

Reading Time

I compared the reading times for the base text and the seductive details sentences. I analyzed reading time by computing the mean time spent reading each word in a sentence. Time per word was computed by dividing sentence time by the number of words in that sentence. The procedure was identical to the one used in Lehman et al. (2007). Several reading times were greater than four standard deviations from the mean and were replaced by the participant's mean reading time for comparable segments (i.e., base text or seductive details). These corrections occurred in less than one percent of all reading times.

There was a statistically significant difference between reading times for the base text sentences (M = 407.48; SD = 105.514) and the seductive details sentences (M = 376.03; SD = 113.253), $t = 3.545$, $p = .001$, as shown in Table 3. More specifically, seductive sentences were read faster than base text, as shown in Table 4. Further, there was a significant correlation between the reading times for the two types of sentences ($r = .778$, $p = .000$), as shown in Table 5. This finding is in contrast to findings from previous research (Lehman et al., 2007) and will be discussed in detail in the discussion section. However, reading time for seductive and base text was not significantly correlated with recall.

Table 3. Paired Samples Statistics for Reading Time

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Time2_NSD	407.4853	68	105.51431	12.79549
	Time2_SD	376.0314	68	113.25385	13.73405

Table 4. Paired Samples Correlations for Reading Time

		N	Correlation	Sig.
Pair 1	Time2_NSD & Time2_SD	68	.778	.000

Table 5. Paired Samples Test for Reading Time

		Paired Differences							
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	T	df	Sig. (2-tailed)
Pair 1	Time2_NSD - Time2_SD	31.45389	73.16918	8.87307	13.74317	49.16460	3.545	67	.001

Recall

The recall scores were coded 1 = partial idea unit; 2 = complete idea unit; 3 = inference. I conducted four *t*-tests to evaluate scores for each level as well as overall recall. The four *t*-tests in Table 6 revealed that: 1) the total number of recalled idea units for seductive detail sentences (M = .481; SD = .173) was significantly higher than those for base text sentences (M = .186; SD = .123); 2) the number of recalled incomplete idea

units for seductive detail sentences (M = .207; SD = .134) was significantly higher than incomplete idea units for base text sentences (M = .111; SD = .075); 3) the number of recalled complete idea units for seductive detail sentences (M = .274; SD = .160) was significantly higher than complete idea units for base text sentences (M = .075; SD = .070); and 4) the number of recalled inferences for seductive detail sentences (M = .016; SD = .044) was significantly lower than inferences for base text sentences (M = .038; SD = .40).

Table 6. Paired Samples Test for Recall

		Paired Differences							
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	Df	Sig. (2-tailed)
Pair 1	SDrecall_total - NSDrecall_total	.29501	.19937	.02418	.24675	.34327	12.202	67	.000
Pair 2	SDrecall1 - NSDrecall1	.09598	.15566	.01888	.05831	.13366	5.085	67	.000
Pair 3	SDrecall2 - NSDrecall2	.19903	.15529	.01883	.16144	.23661	10.569	67	.000
Pair 4	SDrecall3 - NSDrecall3	-.02242	.05190	.00629	-.03498	-.00986	-3.562	67	.001

Notes: 1.Proportion of SD recalled greater than NSD using 1, 2 or total (1 +2) scores. 2. Paraphrases (3's) greater for NSD than SD

Table 7. Paired Samples Correlations for Recall

		N	Correlation	Sig.
Pair 1	SDrecall_total & NSDrecall_total	68	.132	.282
Pair 2	SDrecall1 & NSDrecall1	68	-.015	.903
Pair 3	SDrecall2 & NSDrecall2	68	.293	.015
Pair 4	SDrecall3 & NSDrecall3	68	.252	.038

These results are in agreement with previous research indicating that people tend to remember seductive details better than base text sentences. The finding that the number of recalled inferences for seductive detail sentences was significantly lower than inferences for base text sentences further corroborates the tendency that people have trouble remembering main ideas (less interesting and less concrete compared to seductive details). In other words, when ideas are relatively uninteresting, people cannot remember the complete or even partial idea and in the case when they remember anything, it is mostly inferences.

Ratings

Table 8 shows mean ratings for interest, importance, concreteness and relevance for seductive and base text segments, while Table 9 shows differences between means. Participants rated SDs sentences as significantly more interesting (M = 3.331; SD = .480) than base text sentences (M = 2.817; SD = .614), t (67) = 8.392, p = .000. They also rated seductive sentences (M = 3.243; SD = .464) as significantly more concrete compared to base text sentences (M = 2.877; SD = .446), t (67) = 6.346, p = .000. The

opposite tendency was found in terms of importance and relevance. Base text sentences were rated significantly more important (M = 3.073; SD = .407) than seductive sentences (M = 2.830; SD = .571), t (67) = -3.655, p = .001 as well as significantly more relevant (M = 3.092; SD = .417) than seductive sentences (M = 2.819; SD = .621), t (67) = -3.661, p = .000.

This finding is in accord with previous studies on seductive details, which characterized seductive details as interesting but unimportant/irrelevant text segments (Wade & Adams, 1990; Wade et al., 1993). Furthermore, the results comply with Sadoski and Goetz's (Sadoski, 2001; Sadoski, Paivio, & Goetz, 1991) hypothesis that seductive details are comparatively more concrete and imageable than base text.

Table 8. Paired Samples Statistics for Ratings

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	IN_SD	3.3316	68	.48022	.05823
	IN_NSD	2.8175	68	.61408	.07447
Pair 2	IM_SD	2.8302	68	.57128	.06928
	IM_NSD	3.0739	68	.40734	.04940
Pair 3	C_SD	3.2433	68	.46420	.05629
	C_NSD	2.8771	68	.44635	.05413
Pair 4	R_SD	2.8195	68	.62106	.07531
	R_NSD	3.0924	68	.41704	.05057

Table 9. Paired Samples Test for Ratings

	Paired Differences							
				95% Confidence Interval of the Difference				
	Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Pair 1 IN_SD - IN_NSD	.51405	.50510	.06125	.39180	.63631	8.392	67	.000
Pair 2 IM_SD - IM_NSD	-.24369	.54978	.06667	-.37677	-.11062	-3.655	67	.001
Pair 3 C_SD - C_NSD	.36624	.47594	.05772	.25104	.48144	6.346	67	.000
Pair 4 R_SD - R_NSD	-.27286	.61459	.07453	-.42163	-.12410	-3.661	67	.000

Correlations

The analysis of correlations between students' ratings of interest, importance, concreteness, and relevance for seductive and non-seductive sentences are shown in Table 10. There are (8 X 7) / 2 = 28 possible correlations between these variables. I briefly describe nine of the significant correlations that are relevant to the initial predictions (the rest of the correlations can be seen in Table 10):

1) Interest for seductive sentences was moderately correlated with importance for seductive sentences (r = .488, p = .01);

2) Interest for seductive sentences was moderately correlated with concreteness for seductive sentences (r = .480, p = .01);

3) Importance for seductive sentences was moderately correlated with concreteness for seductive sentences (r = .446, p = .01);

4) Importance for seductive sentences was strongly correlated with relevance for seductive sentences (r = .862, p = .01);

5) Interest for non-seductive sentences exhibited moderate to high correlation with importance for non-seductive sentences (r = .698, p = .01);

6) Interest for non-seductive sentences was moderately correlated with concreteness for non-seductive sentences (r = .533, p = .01);

7) Interest for non-seductive sentences was moderately correlated with relevance for non-seductive sentences (r = .570, p = .01);

8) Importance for non-seductive sentences was moderately correlated with concreteness for non-seductive sentences (r = .608, p = .01);

9) Importance for non-seductive sentences was highly correlated with relevance for non-seductive sentences (r = .846, p = .01);

Table 10 also includes correlations between ratings, reading time, and recall. The most important of these results are described below:

1) Reading time for seductive and non-seductive sentences was uncorrelated with recall of both seductive and non-seductive sentences (see the table below).

2) Interest ratings for seductive sentences were modestly correlated with recall of seductive sentences (r = .320, p = .008) as well as interest ratings for non-seductive were modestly correlated with recall of non-seductive sentences (r = .305, p = .011).

3) Recall for SD and NSD segments was not correlated (r = .132, p = .282).

4) Importance and relevance were highly correlated for NSD (r = .846, p = .000) as well as for SD (r = .862, p = .000).

These four results are highly relevant to the initial hypotheses of the study and are discussed in detail in the next section.

Table 10. Correlations

		IN_SD	IM_SD	C_SD	R_SD	IN_NSD	IM_NSD	C_NSD	R_NSD	Time_SD	Word Time_NSD	Sd recall_total	NSD recall_total
IN_SD	Pearson Correlation	1.000	.488**	.480**	.333**	.598**	.475**	.317**	.364**	-.087	-.022	.320**	-.071
	Sig. (2-tailed)		.000	.000	.006	.000	.000	.008	.002	.482	.859	.008	.564
	N	68	68	68	68	68	68	68	68	68	68	68	68
IM_SD	Pearson Correlation	.488**	1.000	.446**	.862**	.361**	.408**	.147	.238	.092	.053	.050	-.226
	Sig. (2-tailed)	.000		.000	.000	.002	.001	.232	.051	.456	.665	.684	.064
	N	68	68	68	68	68	68	68	68	68	68	68	68
C_SD	Pearson Correlation	.480**	.446**	1.000	.364**	.440**	.480**	.454**	.418**	.011	.089	.002	.228
	Sig.2-tailed	.000	.000		.002	.000	.000	.000	.000	.932	.469	.985	.062
	N	68	68	68	68	68	68	68	68	68	68	68	68

R_SD	Pearson Correlation	.333**	.862**	.364**	1.000	.244*	.359**	.096	.351**	.024	-.022	.012	-.269*
	Sig. (2-tailed)	.006	.000	.002		.045	.003	.435	.003	.844	.859	.921	.026
	N	68	68	68	68	68	68	68	68	68	68	68	68
IN_NSD	Pearson Correlation	.598**	.361**	.440**	.244*	1.000	.698**	.533**	.570**	.142	.178	.144	.305*
	Sig. (2-tailed)	.000	.002	.000	.045		.000	.000	.000	.248	.146	.241	.011
	N	68	68	68	68	68	68	68	68	68	68	68	68
IM_NSD	Pearson Correlation	.475**	.408**	.480**	.359**	.698**	1.000	.608**	.846**	.187	.161	.081	.319**
	Sig. (2-tailed)	.000	.001	.000	.003	.000		.000	.000	.127	.189	.509	.008
	N	68	68	68	68	68	68	68	68	68	68	68	68
C_NSD	Pearson Correlation	.317**	.147	.454**	.096	.533**	.608**	1.000	.576**	.247*	.173	.001	.218
	Sig. (2-tailed)	.008	.232	.000	.435	.000	.000		.000	.042	.157	.995	.074
	N	68	68	68	68	68	68	68	68	68	68	68	68
R_NSD	Pearson Correlation	.364**	.238	.418**	.351**	.570**	.846**	.576**	1.000	.178	.167	.049	.271*
	Sig.2-tailed	.002	.051	.000	.003	.000	.000	.000		.146	.174	.694	.025
	N	68	68	68	68	68	68	68	68	68	68	68	68

Word Time_SD	Pearson Correlation	-.087	.092	.011	.024	.142	.187	.247*	.178	1.000	.769**	-.115	.086
	Sig. (2-tailed)	.482	.456	.932	.844	.248	.127	.042	.146		.000	.350	.486
	N	68	68	68	68	68	68	68	68	68	68	68	68
Time_ NSD	Pearson Correlation	-.022	.053	.089	-.022	.178	.161	.173	.167	.769**	1.000	-.053	.199
	Sig. (2-tailed)	.859	.665	.469	.859	.146	.189	.157	.174	.000		.666	.105
	N	68	68	68	68	68	68	68	68	68	68	68	68
SDrecall_ Total	Pearson Correlation	.320**	.050	.002	.012	.144	.081	.001	.049	-.115	-.053	1.000	.132
	Sig. (2-tailed)	.008	.684	.985	.921	.241	.509	.995	.694	.350	.666		.282
	N	68	68	68	68	68	68	68	68	68	68	68	68
NSD recall_ total	Pearson Correlation	-.071	-.226	.228	-.269*	.305*	.319**	.218	.271*	.086	.199	.132	1.000
	Sig. (2-tailed)	.564	.064	.062	.026	.011	.008	.074	.025	.486	.105	.282	
	N	68	68	68	68	68	68	68	68	68	68	68	68

**. Correlation is significant at the 0.01 level (2-tailed test).

*. Correlation is significant at the 0.05 level (2-tailed test).

Regression Analyses

Table 11 shows the descriptive statistics for the interestingness, concreteness, importance, relevance, and reading time variables used in the regression analysis, while Tables 12, 13, and 14 show the model summary table with total correlations, the ANOVA results, and the regression coefficients respectively. Table 14 revealed that only interest was a significant predictor of recall of seductive details ($t = 2.932$, $p = .05$). This finding is in accord with the seductive details effect hypothesis (Harp & Mayer, 1997, 1998; Lehman et al., 2007). However, the overall correlation between the five variables and recall, as shown in Table 12, was not significant ($R = .377$, $R^2 = .142$, $p = .083$). The finding that importance, relevance, and concreteness were not significant predictors was surprising and was against predictions based on pervious research. Potential explanations are provided in the discussion section.

Table 11. Descriptive Statistics for Recall and Reading Time of Seductive Sentences

	Mean	Std. Deviation	N
Sdrecall_total	.4813	.17353	68
IN_SD	3.3316	.48022	68
IM_SD	2.8302	.57128	68
C_SD	3.2433	.46420	68
R_SD	2.8195	.62106	68
WordTime_SD	376.0314	113.25385	68

Table 12. Model Summary for Regression Analysis of Seductive Details Sentences

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.377[a]	.142	.073	.16705	.142	2.059	5	62	.083

a. Predictors: (Constant), WordTime_SD, C_SD, R_SD, IN_SD, IM_SD

Table 13. ANOVA[b] for Recall of Seductive Details Sentences

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.287	5	.057	2.059	.083[a]
	Residual	1.730	62	.028		
	Total	2.018	67			

a. Predictors: (Constant), WordTime_SD, C_SD, R_SD, IN_SD, IM_SD.

b. Dependent Variable: SD_Recall_total

Table 14. Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.	Correlations		
		B	Std. Error	Beta			Zero-order	Partial	Part
1	(Constant)	.272	.187		1.453	.151			
	IN_SD	.157	.054	.434	2.932	.005	.320	.349	.345
	IM_SD	-.024	.080	-.079	-.302	.764	.050	-.038	-.035
	C_SD	-.064	.052	-.170	-1.217	.228	.002	-.153	-.143
	R_SD	-7.528	.067	.000	-.001	.999	.012	.000	.000
	WordTime_SD	.000	.000	-.068	-.566	.573	-.115	-.072	-.067

a. Dependent Variable: SDrecall_total

A replication of the above analysis using base text sentences as the outcome variable indicated that none of the five predictors reached significance. Descriptive statistics are shown in Table 15. A one way analysis of variance in Table 17 demonstrated that the total effect of the four variables on recall was insignificant (F = 1.923, p = .103). The regression analysis in Table 18 confirmed this result for total effect. The correlation between all four variables and recall was insignificant (R = .366, R^2 = .134, p = .103). In a simultaneous regression analysis, none of the predictor variables were significant because the "part correlations" (i.e., the variance in recall

scores explained uniquely by each variable) was insignificantly small (the coefficients and part correlations are displayed in Table 16). These results indicate that the five variables do not explain individually, or collectively as a set of variables, a significant proportion of the variance in the recall of base text sentences. Each of the variables explains a small, but non-significant amount of unique variation in recall of base text sentences. In other words, none of the four ratings is very predictive of recall.

Table 15. Descriptive Statistics for Recall and Reading Time of Non-seductive Sentences

	Mean	Std. Deviation	N
NSDrecall_total	.1863	.12377	68
IN_NSD	2.8175	.61408	68
IM_NSD	3.0739	.40734	68
C_NSD	2.8771	.44635	68
R_NSD	3.0924	.41704	68
WordTime_NSD	409.2534	106.50663	68

Table 16. Model Summary for Regression Analysis of Non-seductive Sentences

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.366[a]	.134	.064	.11972	.134	1.923	5	62	.103

a. Predictors: (Constant), WordTime_NSD, IM_NSD, C_NSD, IN_NSD, R_NSD

Table 17. ANOVA[b] for Recall for Non-seductive (base text) Sentences

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.138	5	.028	1.923	.103[a]
	Residual	.889	62	.014		
	Total	1.026	67			

a. Predictors: (Constant), WordTime_NSD, IM_NSD, C_NSD, IN_NSD, R_NSD

b. Dependent Variable: NSDrecall_total

Table 18. Coefficients (Dependent Variable: NSDRecall total)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations		
		B	Std. Error	Beta			Zero-order	Partial	Part
1	(Constant)	-.145	.126		-1.154	.253			
	IN_NSD	.029	.034	.144	.848	.400	.305	.107	.100
	IM_NSD	.060	.078	.196	.759	.451	.319	.096	.090
	C_NSD	.000	.043	-.003	-.019	.985	.218	-.002	-.002
	R_NSD	.001	.067	.002	.009	.993	.271	.001	.001
	WordTime_NSD	.000	.000	.142	1.171	.246	.199	.147	.138

One especially important finding in Table 18 was that concreteness was not a significant predictor of recall of seductive sentences. According to Sadoski, Goetz and colleagues (Goetz & Sadoski, 1995; Sadoski, 2001; Sadoski, Goetz, & Fritz, 1993a, 1993b; Sadoski, Paivio, 1994; Sadoski, Paivio, & Goetz, 1991), concreteness increases memory, because, consistent with the Dual Coding Theory, information that is represented through verbal propositions as well as visual images is more easily retrieved because of stronger and more diverse neural connections in the brain.

Another unexpected finding was that importance was not a significant predictor of recall of non-seductive sentences. According to previous research (Schraw, Wade, & Kardash, 1993), both relevance and importance increase recall of text. Thus, it seems that there are unexplained contextual factors that cause importance to have different degrees of impact as a predictor of text recall.

Summary of Results

In sum, seductive details were recalled far more than non-SD segments. Interestingly, the inference scores displayed the reverse tendency (NSD > SD). Interest ratings were correlated with recall for SD but not for non-SD segments, whereas concreteness, importance, and relevance were not significantly correlated with recall for either type of text. In other words, only interest predicted recall for SD segments, whereas none of the ratings or reading time scores predicted recall for NSD segments. Recall scores for SD and NSD segments were not correlated. As expected, importance and relevance were highly correlated for NSD as well as for SD sentences. Interestingness and concreteness were only moderately correlated for both types of sentences. Further, seductive sentences were read faster than non-seductive ones.

CHAPTER 5

DISCUSSION AND CONCLUSIONS

Review and Discussion of Results

This study explored the relationship between relevance, interestingness, importance, and concreteness, on the one hand, and recall and reading time of seductive and base text sentences, on the other. The main research question concerned how the four predictor variables affected students' recall of seductive details and base text information in an expository text.

Background knowledge was not a significant factor in this experiment because it did not affect students' recall and reading time scores. On average, participants had very low knowledge of weather and meteorology so probably that was the reason for the insignificant correlations. Another potential explanation is that understanding lightning formation (topic knowledge) is not facilitated by knowledge of weather (domain knowledge).

I made six predictions concerning the results of the experiment. I began with the most straightforward, which stated that in the absence of relevance instruction, the distinction between importance and relevance would become meaningless, and the correlation between them would be close to 1. This was the case, with relevance and importance being highly correlated for seductive (r = .862) and base text (r = .846) sentences. This finding provides a rationale for researchers to use the two terms interchangeably in the absence of relevance instructions. Furthermore, this lack of differentiation between the two concepts resolves the problem of defining seductive details as being of low importance or relevance. Although in practical terms there is no

difference between students' perception of importance and relevance (the latter being interpreted as importance), technically it is more appropriate to use importance in the definition of seductive details.

Students' ratings of seductive and non-seductive sentences confirmed the initial expectations (prediction 2). Seductive details sentences were rated as significantly more interesting and concrete and less important and relevant than non-seductive sentences. This finding is in accord with previous studies on seductive details, which characterized seductive details as interesting but unimportant/irrelevant text segments (Wade & Adams, 1990; Wade et al., 1993). Furthermore, the results comply with Sadoski and Goetz's (Sadoski, 2001; Sadoski, Goetz, & Fritz, 1993a; Sadoski, Paivio, & Goetz, 1991) hypothesis that seductive details are comparatively more concrete and imageable than base text.

A third prediction was that all predictor variables would increase text recall. However, the findings from the regression analyses demonstrated that only interest was a significant predictor of recall, and only for seductive sentences. This result corresponds to previous findings that situational interest facilitates learning of text information (Mitchell, 1993; Schraw, Bruning, & Svoboda, 1995; Schraw & Dennison, 1994; Wade, 1992; Wade & Adams, 1990). Students probably found seductive sentences interesting because of their unexpectedness (Iran-Nejad, 1987), emotional charge or provocativeness (Goetz et al., 1992; Kintsch, 1980), suspense (Jose & Brewer, 1984), familiarity and comprehensibility (Sadoski et al., 1993a; Schraw et al., 1995), personal relevance (e.g., how to avoid being struck by lightning), and their promoting character identification (Anderson, Shirey, Wilson, & Fielding, 1987). My interpretation of these effects is that

the above-mentioned characteristics of seductive sentences increased the extent to which the readers engaged with the text, which facilitated recall (Mitchell, 1993). This position is in agreement with Schraw et al. (1995), who provided evidence that coherence, vividness, ease of comprehension, emotiveness, prior knowledge, and engagement were related to interest and that interest mediated their influence on text recall. Thus, there are many factors that affect recall indirectly through their influence on interest. The current study did not explore these relationships, but the abundance of previous findings in this area makes the current interpretation viable.

On the other hand, a surprising finding in this study was that concreteness did not significantly affect recall of seductive sentences. The results revealed that concreteness affected memory of seductive sentences, but this effect was far from statistical significance ($p = .228$). In previous studies, Sadoski, Goetz, and associates (Goetz & Sadoski, 1995; Sadoski, 2001; Sadoski, Goetz, & Fritz, 1993a, 1993b; Sadoski & Paivio, 1994; Sadoski, Paivio, & Goetz, 1991) found that concreteness of SDs had a direct influence on recall. They explained this result using Dual Coding Theory (Clark & Paivio, 1991), according to which seductive details, being concrete and highly imageable compared to non-seductive text segments, are more easily encoded via visual modality in addition to verbal modality. This dual coding of seductive segments facilitates their more successful encoding in and retrieval from long-term memory. Possible explanations why the current results may be different from those of Sadoski and colleagues include peculiarities of the sample population, idiosyncrasies of the text, or specifics in situational factors such as differences in reading/rating instructions or 'noise' in the environment.

Previous research has established that assigning a perspective when reading a text (Schraw, Wade, & Kardash, 1993) or giving relevance instructions such as "read to prepare for a multiple choice test" increased recall of text (McCrudden, Schraw, & Kambe, 2005). In this light, the results of this study indicating that relevance does not predict recall of either seductive or non-seductive sentences are not surprising considering the lack of specific relevance instructions. When readers lack criteria to distinguish relevant from less relevant information, they use importance as their default criterion for assessing text (Schraw et al., 1993).

Another unexpected finding was that importance did not predict recall for base text ideas. This did not match my initial hypothesis and goes counter the results from previous studies, which found that importance increased recall (Alexander & Jetton, 1996; McCrudden & Schraw, 2007). As mentioned above, in the absence of relevance instruction, importance is the strategy for guiding students' attention and memory. One possible explanation for the insignificant effect of importance on text recall for both types of text segments is that readers did not pay much attention to the definition of importance in the rating instructions, but instead used reader-determined importance (Alexander & Jetton, 1996) to decide what is important. For example, in the "Lightning" text there were sentences discussing how understanding the process of lightning was important for saving many human lives, which might have been rated as important from an everyday perspective instead of being assessed as important for understanding the process of lightning formation (Harp & Mayer, 1998) or important because being central to the semantic structure of the text (structural importance as defined by Alexander and Jetton, 1996).

Furthermore, the lack of systematic definitions of importance in the seductive details literature makes it hard to compare findings from different studies. Not only did researchers use different definition of importance, but studies differed in terms of who rated the text (e.g., text structure experts, teachers, or students). The fact that the findings of this study diverge from previous ones need not imply a logical inconsistency but requires a more detailed exploration of the issue. Moreover, none of the previous studies of seductive details has examined the effects of importance via regression and correlational analyses so it is hard to do a comparative analysis of the current findings.

My fourth prediction was that in the context of a dry, expository text with abstract main ideas importance would be negatively correlated with concreteness. The findings exhibited an unexpected pattern. Importance for seductive sentences was moderately correlated with concreteness for seductive sentences ($r = .446$, $p = .01$) and importance for non-seductive sentences was moderately correlated with concreteness for non-seductive sentences ($r = .608$, $p = .01$). It is hard to explain these results in terms of the established theoretical thinking and empirical findings. According to Dual Coding Theory (Clark & Paivio, 1991), which was discussed above, main ideas (high importance) in a dry, expository text usually are hard to remember because they are highly abstract and therefore hard to imagine (and be processed in both verbal and visual modality). One explanation is that idiosyncrasies of the text or/and the readers may have affected these correlations in the current study. For example, the base text sentences in the "Lightning" passage (e.g., the "return stroke" is the electrical current that returns to the cloud) may be more concrete and imageable than what is normal for a scientific text. Also, the current study did not differentiate between main ideas (important but

interesting), supporting ideas (important but uninteresting) and trivial details (unimportant and uninteresting). Most previous studies of seductive details (Lehman et al., 2007; Wade at al., 1993) made this distinction so it is possible that the difference in findings is due to this inconsistency between studies. In the current experiment, high concreteness of unimportant base text information could have increased the correlation between base text and seductive sentences.

Previous research (e.g., Lehman et al., 2007) established that seductive details in the "Lightning" passage were rated as interesting but unimportant (based on independent raters) in contrast to main ideas which were important but uninteresting. Based on that finding, my initial hypothesis (prediction five) was that importance would be negatively correlated with interestingness. However, in the current study, interest for seductive sentences was moderately correlated with importance for seductive sentences (r = .488) and with importance for base text sentences (r = .475); and interest for base text sentences was moderately correlated with importance for base text sentences (r = .698). In other words, readers considered main ideas to be somewhat interesting and seductive sentences to be somewhat important. Even though interest ratings for seductive details (M = 3.331) were significantly higher than those for base text sentences (M = 2.817), and importance ratings for base text sentences (M = 3.073) were significantly higher than those for seductive sentences (M = 2.830), these moderate correlations require explanation so a more detailed further inquiry into the rating methodology and the differences between the two types of text elements is needed. These moderate correlations between interest and importance may be due to the lack of differentiations between main ideas (i.e., highly interesting and important), factual details (i.e.,

uninteresting, but important information), and boring trivia (i.e., low in interest and importance), which was the case in some of the previous studies on seductive details (Lehman et al., 2007; Wade & Adams, 1990; Wade et al., 1993). Thus, researchers using the "Lightning" passage need to separate base text segments into these three categories so that it can be established how interest and importance correlate for each category.

A sixth prediction was that concreteness and interestingness will exhibit a positive correlation because concrete details tend to be vivid and easy to visualize. These factors have been shown to increase situational interest (Sadoski, 2001). However, the results revealed only a moderate correlation between interest and concreteness for seductive (r = .480) and for base text (r = .533) sentences. This correlation was much lower than what was expected initially. According to the concreteness hypothesis for the SD effect propounded by Goetz and Sadoski (1995), seductive (interesting) details are remembered because they are highly concrete compared to the usually abstract non-seductive ones (esp. main ideas). Again, a potential explanation for the discrepancy between results may be some inadequacies in the rating procedure (e.g., poor instructions, lack of student engagement). Another possible explanation is the lack of differentiation between main ideas (usually abstract) and uninteresting supporting ideas or trivia (not necessarily abstract), which was adopted in some of the previous studies (Wade & Adams, 1990). This blending of main ideas, supporting ideas, and trivia may have increased the total concreteness of base text sentences.

Further, the results from this study revealed that students read seductive sentences significantly faster than base text sentences. These results suggest that readers skimmed rapidly over seductive sentences but devoted more attention to encoding the base text

sentences. It makes sense that readers would take longer to read base text sentences because they are more abstract in nature and more difficult to comprehend. Another possible reason is that readers took longer to read base text sentences because seductive details, breaking the coherence of the text, made it harder for them to integrate each main idea into the global structure of the text (how lightning is formed). This is in accord with the *disruption hypothesis* discussed above, which suggests that seductive details cause poor comprehension by disrupting the flow of cause and effect ideas as well as the coherence of text. Actually, this is what Harp and Mayer (1998) and Lehman et al. (2007) found in their study using the same text.

Finally, the results from this study revealed that students remembered very few ideas related to the process of lightning formation. The poor recall of base text sentences (close to 19%) compared to seductive details (over 48%) can be potentially explained by several factors. One is the lack of relevance instruction (e.g., read for a multiple-choice test), which is present in most educational situations. Another is the potential low local coherence (the unambiguous logical relationship between text segments and those that precede or follow them) of the text. Although Lehman et al. (2007) tried to improve the coherence of the "Lightning" passage, the mere presence of seductive sentences impairs the local coherence of the text, which has been found to be detrimental to immediate recall (Lehman & Schraw, 2002). Actually, this was one of the important findings from Lehman et al.'s (2007) study. The effect was called the *coherence break hypothesis* and was evidenced by the slower reading times for base text sentences that followed seductive sentences.

Current Results within the Context of Previous Research

Although I already discussed most findings in the light of previous research, I reiterate and emphasize major findings below as well as discuss some issues that have not been mentioned so far.

First, this study used an established text that consistently has produced the seductive details effect in the past (Harp and Mayer, 1997, 1998; Lehman et al., 2007). Although this study did not use a control group in the current experiment, the results are consistent with those of previous studies in indicating that seductive details tend to be remembered better that base text ideas. The only exception is an inconsistency with Harp and Mayer (1998), who found the presence of the seductive details effect only in students deep processing (operationalized as problem-solving transfer), but failed to find differences in students' recall after reading the seductive and non-seductive versions of the "Lightning" passage. One reason for that discrepancy in recall findings is the different version of the text used in the two studies. Harp and Mayer's (1998) version was low in coherence so for that reason the coherence of the passage was improved by Lehman et al. (2007) in their follow-up study. Loxterman, Beck, and McKeown (1994) and McKeown, Beck, Sinatra, and Loxterman (1992) found that when a text is low in coherence, this may hamper readers' recall of text information. The text version used in this study was identical with Lehman et al.'s (2007) text, which was more coherent and produced differences in recall due to the SD effect. Alternative explanations are also possible but the most probable one is the existence of methodological differences.

Second, the finding that situational interest predicted recall of seductive details is in agreement with previous research as well as with my initial hypothesis. It has been

established that interest is one of the fundamental factors in the learning process, influencing what we choose to learn and the degree to which we learn information (Alexander & Jetton, 1996; Garner, 1992). The numerous reasons why it is so are described above, especially page 77.

Third, it is important to elaborate further on this study's finding that concreteness did not predict text recall, which is in conflict with previous studies and the predictions of Dual Coding Theory (Clark & Paivio, 1991). In addition to the potential methodological (type of text) and contextual differences between this study and those mentioned in the previous section, one alternative explanation is that concreteness may not be as important factor for recall as posited by dual coding theorists (Sadoski, 2001; Sadoski, Goetz, & Fritz, 1993a; Sadoski, Paivio, & Goetz, 1991). As already mentioned, Dual Coding Theory postulates separate verbal and imaginal systems in memory that draw on different pools of cognitive resources and yield additive effects on recall. According to the theory, concrete information is easier to visualize and is rich in referential connections compared to abstract language, which makes it more comprehensible and memorable (Sadoski, 2001). Thus, information that is represented through verbal propositions as well as visual images (i.e. dual modality) is more easily retrieved because of stronger and more diverse neural connections in the brain.

However, it may be the case that no matter how concrete a sentence is it would not be processed efficiently in memory unless it is interesting enough to grab attention and engage the reader. Consequently, high concreteness of a sentence may not be enough for engaging attention and may have only conditional effect on memory. This interpretation is consistent with previous findings that attention is critical for information

processing (Reynolds, 1992; Renninger & Wozniak, 1985). If this interpretation is valid, it would mean that interestingness and concreteness of information interact to produce the dual coding effect posited by Dual Coding Theory. Accordingly, some parts of the theory would have to be revised to fit that data.

Furthermore, one potential (and strictly tentative) interpretation of the current results is that Dual Coding Theory (DCT) is flawed as a whole and is in need of replacement. An alternative theoretical framework describing the effects of dual modality on recall is the Integrative Model of Text and Picture Comprehension (Schnotz, 2002), which postulates separate verbal and imaginal systems in memory that draw not on two separate pools (DCT) but on a single pool of cognitive resources and yield interactive (in contrast to additive, DCT) effects on recall. According to the Integrative Model, concreteness by itself does not predict text recall. Instead, in terms of the current study, the model predicts an interaction effect for interest and concreteness due to interactive, conjoint processing of the two variables.

The current findings are more consistent with the Integrative Model of Text and Picture Comprehension than with Dual Coding Theory. Further research is needed in order to provide additional evidence for the validity of the interpretations discussed above. Thus, a logical step following this experiment would be to analyze the data for interactions between high/low interestingness and high/low concreteness sentences.

Fourth, according to previous research (Alexander & Jetton, 1996; McCrudden & Schraw, 2007; Schraw, Wade, & Kardash, 1993), both relevance and importance increase recall of text. This was not the case in the current study, with both variables being insignificant predictors of immediate recall for seductive and base text ideas. The causes

of this discrepancy were discussed in the previous section. It is essential to add that discussing relevance as a predictor of recall in the absence of relevance instruction is meaningless, because it is interpreted by readers as importance. Thus, the fact that importance ratings, which were relatively high (2.830 and 3.073 for seductive and base text sentences respectively), did not predict recall for either type of text (especially for base text) raises important questions for future research. Efforts should be concentrated on replicating this finding in order to see whether it is due to methodological flaws of this study or to contextual factors, students' characteristics (e.g., background knowledge), etc. It is essential to replicate this experiment with a more precise definition of importance, operationalizing it as reader-determined, author/researcher/expert-determined, or teacher-determined (Alexander & Jetton, 1996).

Fifth, it was hard to make clear predictions about the results concerning reading time because previous studies had yielded mixed findings. Wade, Schraw, Buxton, & Hayes (1993) and Schraw (1998), using a narrative passage, found that reading time was longer for seductive details, whereas Lehman et al. (2007), using the same version of the "Lightning" text adopted in this study, indicated that seductive and base text sentences were read at the same rate. Generally, researchers have proposed several hypotheses why seductive passages take longer to read in comparison to base text segments. One conjecture has been that because seductive details are tangential to the semantic structure of the text, additional time or effort is needed to establish referential coherence between these segments and the surrounding text (van Dijk & Kintsch, 1983). In this light, the current results go against this hypothesis. Potential explanations include text differences and readers' characteristics such as poor reading comprehension, major, age, etc.

Sixth, the high correlations between importance and relevance fit nicely to previous finding indicating that even though there is a clear distinction between importance and relevance (McCrudden, Schraw, & Kambe, 2005), when readers lack criteria to distinguish relevant from less relevant information they use importance as their default criterion for assessing text (McCrudden, 2005). Based on these findings, my interpretation of the high correlations between importance and relevance is that when there is no relevance instruction provided students perceive relevance as importance.

Educational Implications

This study produced several results that are relevant to promoting learning and text comprehension. In the light of interest being a strong predictor of text recall, one way to increase recall is by using coherent texts with interesting details that are structurally related to main ideas and support their understanding (instead of diverting attention from them and breaking the local coherence of the text). Another way to improve text recall is to provide specific relevance instructions. Relevance offsets deficiencies in reader characteristics concerning working memory capacity, background knowledge, interest, and reading ability (McCrudden & Schraw, 2007). It compensated for text-related factors such as importance, coherence, and text length. Importance is a default strategy for guiding students' attention and memory, but when relevance criteria are present, readers switch to them to guide processing. "Importance and interest are not invariant characteristics of text. Rather, both importance and interest vary as a function of relevance such that relevant segments tend to receive higher importance and interest ratings than non-relevant text" (McCrudden, 2005, p. 15). On this view, relevance instructions increase interest in relevant text by making information more salient.

Limitations

In the context of conducting this study as a masters' thesis, there were multiple constraints in time and resources that prevented a full-blown exploration of the issues at hand. First, the study did not use any measure of deep processing (operationalized by Lehman et al., 2007 as the ability to produce legitimate claims to support explanations, and by Harp & Mayer, 1998 as problem solving or transfer). Such a measure may be useful in future studies because learning goes beyond mechanical memorization of facts. My impression from the recall protocols was that many of the students' lacked a deeper understanding of was being recalled.

Second, the study did not employ a measure of delayed recall, which would have enriched the findings with an indication of the long term retention of seductive and base text sentences. It can be cautiously concluded that seductive details are remembered better than main ideas on an immediate free recall text (though not always, as indicated by Harp & Mayer, 1998), but that does not guarantee that they will be retained.

Third, this study was designed to have a single group of participants. As evident from the criticisms by Goetz and Sadoski (1995), the lack of control group precludes any causal inferences about the existence of the seductive details effect. However, my goal was not so much to verify the existence of the seductive details effect (which has been established for this text in three previous experiments), but to explore the factor influencing the recall of SDs and base text sentences.

Finally, the use of college undergraduates diminishes the generalizability of the result to dissimilar populations. Also, the number of participants (68) was much lower than initially requested (100) due to lack of available subjects. A larger sample would

have added power to the results and would have made the conclusions more confident. In light of these limitations, the current results should be considered with caution.

APPENDIX A

THE PROCESS OF LIGHTNING FORMATION (SEDUCTIVE DETAILS SENTENCES IN ITALICS)

Lightning can be defined as the discharge of electricity resulting from the difference in electrical charges between the cloud and the ground. Understanding how lightning is formed is important because approximately 150 Americans are killed by lightning every year. *Swimmers in particular are sitting ducks for lightning because water is an excellent conductor of its electrical discharge*.

The electrical differences between cloud and ground begin when warm, moist air near the earth's surface becomes heated and rises rapidly, producing an updraft. You may have experienced these updrafts on airplanes. *Flying through clouds with updrafts can cause the plane ride to be bumpy.* As the air in these updrafts cools in the cold upper atmosphere, moisture from the updraft condenses into water droplets and forms a cloud. The cloud's top extends high into the atmosphere. At this altitude, the air temperature is well below freezing, so the water droplets become tiny ice crystals.

Within the cloud, the water droplets and ice crystals gradually become too large to be suspended by the updrafts rising from the earth's warm surface. As the ice crystals within the cloud begin to fall, they drag some of the air from the cloud downward, producing downdrafts. These downdrafts meet the updrafts from the surface within the cloud. These rising and falling air currents within the cloud may cause hailstones to form because the water droplets are carried back up to the cold upper atmosphere. As we will see shortly, these hailstones play an important role in the formation of lightning. Eventually, the downdrafts overcome the updrafts and descend to the earth, where they

spread out in all directions, producing the gusts of cool wind people feel just before the start of the rain. When lightning strikes the ground, the heat from the lightning melts the sand, forming fulgurites. *Fulgurites are glassy, root-like tubes shaped by the electricity's path.* Fulgurites help scientists understand how lightning spreads and acts against resistance from the soil.

Inside the cloud, it is the movement of the updrafts and the downdrafts that cause electrical charges to build, although scientists do not fully understand how it occurs. Most believe that the charge results from the collision of rising water droplets and tiny ice crystals in the updraft with hailstones in the downdraft. This movement causes static electricity to develop with the negatively charged particles falling to the bottom of the cloud, while most of the positively charged particles rise to the top.

The negatively charged particles at the bottom of the cloud provide the power for the first downward stroke of a cloud-to-ground lightning flash, which is started by a "stepped leader." Many scientists believe that this first stroke is triggered by a spark between the areas of positive and negative charges within the cloud. *In trying to understand these processes, sometimes scientists launch tiny rockets into overhead clouds to create lightning.* Once triggered, the stepped leader moves downward in a series of steps, each of which is about 50 yards long, and lasts for about 1 millionth of a second. It pauses between steps for about 50 millionths of a second. *Stepped leaders can strike a metal airplane, but rarely do any damage because airplane nosecones are built with lightning rods, which diffuse the lightning so it passes through the plane without harming it.*

As the stepped leader nears the ground, positively charged upward-moving

leaders travel up from such objects as trees and buildings, to meet the negative charges. Usually, the upward moving leader from the tallest object is the first to meet the downward moving stepped leader and complete a path between the cloud and earth. The two leaders generally meet about 165 feet above the ground. Negatively charged particles then rush from the cloud to the ground along the path created by the leaders. This type of lightning is not very bright and usually has many branches.

Understanding that lightning often strikes the tallest object in the area can help reduce the number of lightning injuries. People in flat, open areas are at greater risk of being struck. *Golfers are prime targets of lightning strikes because they tend to stand in open grassy fields, or to huddle under trees. These lightning strikes can be very dangerous. For example, eye witnesses in Burtonsville, Maryland, watched as a bolt of lightning tore a hole in the helmet of a high school football player during practice. The bolt burned his jersey, and blew his shoes off. More than a year later, the young man still won't talk about his near death experience.*

The "return stroke" is the electrical current that returns to the cloud. As mentioned previously, when the negatively charged stepped leader nears the earth, it induces an opposite charge, so that when the two leaders connect the cloud to the ground, positively charged particles from the ground rush upward along the same path. This upward motion of the current is the "return stroke," and it reaches the cloud in about 70 millionths of a second. It produces the bright light that people notice in a flash of lightning, but the current moves so quickly that its upward motion cannot be perceived. The lightning flash usually consists of an electrical potential of hundreds of millions of volts. The powerful electrical charge of the return stroke causes air along the lightning

channel to be heated briefly to a very high temperature. Such intense heating causes the air to expand explosively, producing a sound wave we call thunder.

Understanding the process of lightning is important to both scientists and the public. Scientists need to know how lightning is created. People in general need to understand how lightning behaves, where it strikes, and how to avoid risk. *This knowledge can help to protect the 10,000 Americans who are injured by lightning each year.*

APPENDIX B

THE METEOROLOGY BACKGROUND KNOWLEDGE QUESTIONNAIRE

(ADAPTED FROM HARP AND MAYER, 1998)

Please rate your knowledge of weather by writing a check mark on a 5-point scale (ranging from *very little* to *very much),* and by writing a check by each of six weather-related items.

_____ (a) I regularly read the weather maps in a newspaper.

_____ (b) I know what a cold front is.

_____ (c) I know what a low pressure system is.

_____ (d) I can distinguish between cumulous and nimbus clouds.

_____ (e) I can explain what makes wind blow.

_____ (f) I know what this symbol means" [symbol for warm front].

_____ (g) I know what this symbol means" [symbol for cold front].

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