

The Effects of Context-Dependency of Seductive Details on Recall and Transfer in a Multimedia
Learning Environment

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ABSTRACT

The purpose of this study was to investigate the effects of context-dependency of seductive details on recall and transfer in multimedia learning environments. Two experiments were conducted. In Experiment 1, the purpose was to identify context-dependent vs. context-independent seductive details in a lightning animation. Seductive details were considered as interesting yet irrelevant sentences in the narration of lightning animation. Sixty-seven undergraduate students participated in Experiment 1 and assigned interestingness scores to the 28 content irrelevant sentences. Participants were assigned to two different groups, context-dependent seductive details group (CDS) and context-independent seductive details group (CISD). Participants in the CDS group assigned interestingness scores after watching a lightning animation to be familiarized with the context of lightning formation. Participants in the CISD group watched a historical inquiry animation as a distraction task before assigning interestingness scores. The results of Experiment 1 revealed that 13 of 28 sentences in the lightning formation text were seductive details according to participants of the study. Ultimately, 6 of the 13 seductive details were determined to be context-dependent and 7 were determined to be seductive details were context-independent.

The purpose of Experiment 2 was to investigate the effects of context-dependency of seductive details on recall and transfer in multimedia learning environments. Undergraduate students ($n = 184$) were randomly assigned into four groups. Participants in all groups watched a lightning animation, and performed a recall and a transfer task. The first group watched an animation that did not include any seductive details. The second group watched the animation with context-dependent seductive details only. The third group watched the animation with context-independent seductive details only. The last group watched the animation with both types of seductive details. A 2x2 ANOVA for both recall and transfer, and contrast analyses

were conducted to determine the effects of context-dependency of seductive details on recall and transfer. The results indicated that there was no significant effect of context-dependency of seductive details on recall or transfer. The findings are discussed in the context of the related literature and directions for future research are suggested.

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CHAPTER ONE: INTRODUCTION

In recent years, multimedia learning has been demonstrated to be an effective learning strategy through various empirical studies (e.g., Mayer, 1999, 2005a; Mayer, Dow, & Mayer, 2003). According to Mayer (2005a), multimedia learning occurs when learners simultaneously create knowledge from information in different formats such as words and pictures. The effectiveness of this strategy depends on the design of multimedia environments as well as other factors (Park & Hannafin, 1993; Sorden, 2005). For this reason, several design principles have been offered for effective multimedia learning environments (e.g., Clark, Nguyen, & Sweller, 2006a; Mayer, 2005a).

One of these principles is called the coherence principle (Mayer, 2005c; Moreno & Mayer, 2000) which is the focus of this study. The coherence principle claims that “people learn more deeply from a multimedia message when extraneous material is excluded rather than included” (Mayer, 2005c, p. 184). According to Mayer (2005c), this extraneous material includes details that are not relevant to the learning goals even if they might be interesting for learners.

Currently this principle conflicts with the “situational interest” paradigm. Situational interest is defined as an interest “generated primarily by certain conditions and/or concrete objects (e.g., texts, film) in the environment” (Krapp, Hidi, & Renninger, 1992, p. 8). The idea behind this paradigm is that under conditions where the main themes in learning material are not interesting and may not be attractive to learners, the integration of interesting material may increase the motivation of learners, and therefore may improve learning (Garner, Brown, Sanders, & Menke, 1992). While these materials are contextually related to the learning topic, such as interesting facts about the topic or interesting stories related to the topic, they may not be relevant to the learning goals (Garner, Gillingham, & White, 1989).

Research studies investigating the potential effects of adding interesting yet irrelevant material into instructional materials have yielded contradictory results (Schraw & Lehman, 2001; Silvia, 2006). On one side, research studies showed that interesting yet irrelevant materials such as stories or facts affected learning negatively (e.g., Garner, et al., 1989; Harp & Mayer, 1997, 1998; Lehman, Schraw, McCrudden, & Hartley, 2007). According to these research results, these interesting yet irrelevant materials were recalled more often than the important and relevant materials, and learners who learned without these interesting yet irrelevant materials performed

better on tests (e.g., Garner, et al., 1989). Therefore, these materials were called “seductive details” (Garner, et al., 1992; Harp & Mayer, 1998). Later, Thalheimer (2004) broadened the term and called it seductive augmentation, which included visual and audio effects in multimedia presentations in addition to seductive text segments.

On the other side, researchers also found neutral or positive effects of those interesting yet irrelevant materials on learning (e.g., Garner & Gillingham, 1991; Garner, et al., 1989; Hidi & Baird, 1988; Moreno & Mayer, 2000; Sanchez & Wiley, 2006; Schraw, 1998). They found either non-significant differences between groups who did and did not have the interesting yet irrelevant materials, or they reported that those materials were beneficial in learning performance (e.g., Schraw & Lehman, 2001; Silvia, 2006; Thalheimer, 2004).

Aside from the existence of contradictory results, several design problems with these studies have been reported (e.g., Goetz & Sadoski, 1995; Schraw & Lehman, 2001; Silvia, 2006). As a result, the information regarding the effect of interesting yet irrelevant details on learning has become unreliable. Therefore, this study aims to refine the previous studies by addressing their design problems and considering potential factors which may cause their conflicting results.

From a pragmatic approach, it is possible to say that both types of studies, supporting and non-supporting, might be accurate in their own context. The reason for these conflicting results might be related to the structure of seductive details used in these studies. This study will examine context-dependency of seductive details as a potential reason for the conflicting results.

In this study, context-dependent seductive details are described as the seductive details that are identified as more interesting provided learners are familiar with the context of the topic of interest. This familiarity was created by presenting the particular multimedia material to the participants of this study in advance. On the other hand, context-independent seductive details are described as those that are identified as equally interesting by the learners who are not familiar with the context of the topic of interest. According to Schraw (1998), “context-dependent seductive details were more interesting in its own context partly as a result of referential coherence; moreover, context-independent seductive details were memorable because they involved sensational themes such as sex, violence, and romantic intrigue” (p. 7).

Significance of the Study

The results of this study will give instructional designers a clearer idea of the effects of seductive details in multimedia learning. This study will provide evidence whether there are any potential effects of context-dependency of seductive details in animations on recall and transfer. Based on Mayer's (1999) definition, transfer stands for "problem-solving transfer" which "occurs when a student is able to use what was learned to solve problems that are different from those presented during instruction" (p. 612).

With respect to the results of this study, instructional designers may decide whether or not to use different types of seductive details in the design of animations. It will also demonstrate what type or types of seductive details might be more detrimental or beneficial for different types of learners for recall and transfer of information through animations.

Research Questions

There are two research questions to be answered in this study.

1. What are the effects of context-dependency of seductive details on the recall of knowledge?
2. What are the effects of context-dependency of seductive details on the transfer of knowledge?

CHAPTER TWO: LITERATURE REVIEW

In recent years, the increasing amount of available information for learners has made efficient learning more crucial for every individual. Efficient learning is described as learning which requires low mental effort to obtain high learning performance (Clark, et al., 2006a). Efficient learning environments will depend on many factors such as characteristics of learners, content and the available resources in the environment. The design of these environments is one of the main interests in the field of Instructional Design and Technology. The field is described as “the study and ethical practice of facilitating learning and improving performance by creating, using, and managing appropriate technological processes and resources” (Januszewski & Molenda, 2008, p. 1). The broad purpose of this study is to explore strategies to improve multimedia learning environments for efficient learning. Multimedia learning occurs when learners simultaneously create their knowledge from information in different media formats such as words and pictures (Mayer, 2005a). There are numerous studies indicating the effectiveness of multimedia learning (e.g., Clark, Nguyen, & Sweller, 2006b; Mayer, 1999, 2005a; Mayer, et al., 2003; Mousavi, Low, & Sweller, 1995; Tabbers, Martens, & van Merriënboer, 2004). There are also design principles of multimedia learning environments to sustain the effectiveness of those environments. This study will focus on one of those principles: the coherence principle. The coherence principle in multimedia learning claims that “people learn more deeply from a multimedia message when extraneous material is excluded rather than included” (Mayer, 2005c, p. 184). According to Mayer (2005c), this extraneous material includes details that are not relevant to learning goals even if they might be interesting for learners. This principle conflicts with the “situational interest” paradigm. Situational interest is defined as an interest “generated primarily by certain conditions and/or concrete objects (e.g., texts, film) in the environment” (Krapp, et al., 1992, p. 8). According to the situational interest paradigm, it is believed that the inclusion of interesting materials will engage learners even if they may not be directly related to learning goals (Schraw & Lehman, 2001).

In the literature, researchers mainly split into two groups. The first group of researchers supports the idea of detrimental effects of interesting yet irrelevant materials on the recall of important information (e.g., Garner, et al., 1992; Garner, et al., 1989; Harp & Mayer, 1998; Lehman, et al., 2007). They called these materials seductive details. Others, who believe that

interesting yet irrelevant materials might be motivating for students and improve their learning, support the situational interest paradigm (e.g., Chen & Darst, 2001, 2002; Mitchell, 1992; Palmer, 2004; Schraw, 1997; Schraw, Bruning, & Svoboda, 1995; Schraw, Flowerday, & Lehman, 2001; Schraw & Lehman, 2001). The current study claims that contradictory results might be related to the structural differences of seductive details used in the previous studies. One of those structural differences might be context-dependency of seductive details.

This chapter will provide a comprehensive literature review for the study. There are five sections in this chapter. The first section elaborates on the coherence principle in multimedia learning and analyzes the related studies. The second section focuses on the seductive details effect which claims to be one of the factors that hinders the coherence of instructional material. The third section presents the counter-argument of the seductive details effect which is known as the situational interest paradigm. The fourth section analyzes the research studies which criticize seductive detail studies. The last section discusses the potential effect of context-dependency of seductive details on learning with relevant studies.

Coherence Principle in Multimedia Learning

Coherence is one of the attributes of instructional materials that plays a crucial role in the quality of learning. In the field of text comprehension, coherence refers to “the extent to which text segments are structurally linked to other text segments” (Lehman & Schraw, 2002, p. 738). According to Lehman and Schraw (2002), there are two types of coherence: local coherence and global coherence. Local coherence occurs when there is a clear semantic pattern between the consecutive sentences of a text passage. On the other hand, global coherence refers to the extent where learners are able to capture the important information by combining the main themes embedded in the text. There are many studies showing that coherence of textual material influences recall and comprehension (e.g., Boscolo & Mason, 2003; Lehman & Schraw, 2002; Mayer & Jackson, 2005).

Different strategies have been offered in the literature to improve the coherence of instructional materials. Some strategies recommended adding particular components into the instructional materials to increase their coherence. In the literature, some of these particular components are causal connectives (Lehman & Schraw, 2002), topic headers (Boscolo & Mason,

2003), and explanations into text to familiarize readers with some specific concepts inside the text (McNamara, Kintsch, Songer, & Kintsch, 1996). Others recommended removing some particular components from the instructional materials. These components are called extraneous materials (Mayer, 2005c). Some of the extraneous materials are quantitative details in scientific explanations (Mayer & Jackson, 2005), interesting facts and stories which are irrelevant to the learning topic (Harp & Mayer, 1997, 1998), and background music in animations (Moreno & Mayer, 2000).

The coherence principle is described as “people learn[ing] more deeply from a multimedia message when extraneous material is excluded rather than included” (Mayer, 2005c, p. 183). This principle is based on Cognitive Theory of Multimedia Learning (CTML) (Mayer, 2005b). CTML is a theory that attempts to explain how cognitive systems operate in multimedia learning environments. There are three main assumptions of the theory: dual channel assumption, limited capacity assumption, and active processing assumption (Mayer, 2002). According to the dual-channel assumption, cognitive systems contain two distinct channels which are responsible for processing visual-pictorial and auditory-verbal information (Mayer, 2002). According to this assumption, the human cognitive system is able to process the information in different formats simultaneously (Low & Sweller, 2005). This characteristic of the cognitive system makes multimedia learning environments more beneficial. In addition to the dual-channel assumption, CTML also assumes that each channel is limited in terms of storage and processing capacity (Mayer, 2002). Therefore, overloading these channels will result in poor cognitive performance according to CTML (Mayer, 2005c). The last assumption of the theory states that active processing occurs within limited dual channels of the human cognitive system (Mayer, 2002). This last assumption states that meaningful learning occurs through selecting relevant words and pictures, organizing them into coherent mental verbal and pictorial representations, integrating them with each other and appropriate prior knowledge from long-term memory (Mayer, 2002, 2005b).

Since the human cognitive system is limited, according to CTML, the amount and structure of information presented in instructional materials become more important for efficient learning. According to the coherence principle, coherence of the material will ensure that the cognitive system is not overloaded (Mayer, 2005c). According to Mayer (2005b), integration of extraneous materials into the instructional material causes extraneous cognitive processing for

learners which results in extraneous cognitive overload. Mayer (2005b) claimed that extraneous cognitive overload will cause a lack of cognitive resources for comprehension of important information.

As previously stated, extraneous materials represent words and pictures in multimedia presentations that do not help learners achieve the instructional objectives (Mayer, 2005c). Along this line, several experiments were conducted in previous studies to investigate the effects of extraneous materials on the recall and transfer in multimedia learning environments. According to Mayer (1999), transfer stands for “problem-solving transfer” which “occurs when a student is able to use what was learned to solve problems that are different from those presented during instruction” (p. 612). Extraneous materials were added to make the instructional materials more interesting (e.g., Harp & Mayer, 1997; Harp & Mayer, 1998; Mayer, Heiser, & Lonn, 2001) to create an environment which learners might feel more comfortable (e.g., Moreno & Mayer, 2000), and to give more information to students which they might use to improve their understanding (e.g., Mayer, Bove, Bryman, Mars, & Tapangco, 1996; Mayer & Jackson, 2005). Throughout these studies, multimedia learning environments included annotated illustrations; text passages with photos, illustrations, and video segments; animations with text and narration; animations with context-appropriate sounds, music, and narration. These studies found that the inclusion of extraneous material, regardless of its format, hindered recall and transfer.

Mayer et al. (1996). The first study was conducted by Mayer, Bove, Bryman, Mars, and Tapangco (1996). In their study, they tried to find out whether providing more information for learners in multimedia learning environments will result in better learning. They conducted three sets of experiments. In their experiments, college students tried to understand lightning formation from multimedia presentations. In Experiment 1, they used four different treatment groups. The first group received a full text passage with a summary about lightning formation. The summary included five step-by-step annotated illustrations of lightning formation which included a one sentence explanation of the illustration at the bottom of each illustration. The second group received the summary alone. The third group received the full text passage alone. The last group received no instruction. After the treatment in each group, all participants were asked to recall and write down how lightning occurs in recall task and they were expected to answer some questions in transfer task. These questions asked learners “to troubleshoot the lightning system, to redesign the lightning system, or to describe how various elements fit into the lightning

system” (Mayer, 1999, p. 612). For instance, one of the transfer questions asked students to write down the explanation for “why there can be clouds, but no lightning” (Mayer, et al., 1996, p. 64). According to the results, participants in the summary-alone group outperformed all other groups in the recall task and participants in the passage-and-summary and summary-alone groups outperformed in the transfer task compared to other groups. At the end of Experiment 1, Mayer et al. (1996) concluded that summary is a type of instructional material as effective as a full text with summary to comprehend scientific explanations. In this experiment, participants in the passage-alone group performed poorly in both recall and transfer tests compared to the summary-alone group. This result indicated the potential existence of extraneous materials in full text passage compared to the summary version which made the summary alone group more successful than the full text alone group. For this reason, it was in line with the coherence principle according to Mayer (2005c).

In Experiment 2, Mayer et al. (1996) attempted to find out which section of the summary was more effective to understanding scientific explanations. They separated the visual and verbal sections of the summary related to lightning formation. As mentioned before, the summary consisted of five step-by-step annotated illustrations with a one sentence explanation at the bottom of each illustration. The verbal summary in this experiment included the explanations and the annotations of the illustrations. The visual summary included five frames of illustrations without any verbal information integrated into them. They had four different treatment groups. In the first group, participants received a full text passage and a full summary. In the second group, participants received a full summary alone. In the third group, participants received a verbal summary alone. In the last group, participants received a visual summary alone. In the recall task, participants in the full-summary-alone group and verbal-summary-alone group performed equally well compared to others. In the transfer task, participants in the full summary-alone group performed significantly better compared to other groups. They concluded that a summary including verbal and visual information helped participants the most to understand the scientific explanation. In this experiment, participants in the passage-and-full-summary group performed worse than participants in the full-summary-alone group. This finding was similar to the findings of Experiment 1.

In Experiment 3, Mayer et al. (1996) investigated the potential effect of the length of text passage on recall and transfer. Therefore, they manipulated the number of words that the

lightning formation text passages included. They created a 50-words text passage and 550-words text passage about lightning. In this experiment, they had three treatment groups. The first group received a summary and 550-words text passage. The second group received a summary and 50-words text passage. The last group received a summary alone. The results of the recall and transfer task showed that participants receiving a summary alone performed significantly higher compared to other groups. This result was consistent with the coherence principle.

At the end of their study, Mayer et al. (1996) concluded that multimedia summaries which included visual and verbal components were more effective than full text passages which contained a large amount of text. The result of their study pointed out that the existence of extraneous material in text passages may hinder learners' understanding of scientific explanations (Mayer, 2005c).

Harp and Mayer (1997). Harp and Mayer (1997) conducted another study which contributed to the coherence principle in multimedia learning. In their study, they investigated whether interesting yet irrelevant materials motivate learners to learn more in multimedia learning environments as hypothesized by Kintsch (1980) or hinder their learning as claimed by the coherence principle. They conducted two experiments. In their first experiment, they focused on the effects of interesting yet irrelevant materials on the recall and transfer. Throughout their experiment, they used a base multimedia presentation which included 550 words and 6 black-and-white captioned annotated illustrations depicting step-by-step lightning formation. They modified this base material by adding interesting yet irrelevant materials. Those materials included interesting yet irrelevant text and illustrations. The interesting yet irrelevant text included 150 words and illustrations including 6 black-and-white illustrations. For example, one of the interesting yet irrelevant texts was "Flying through clouds with updrafts can cause the plane ride to be bumpy." and the relevant illustration was a black and white illustration of a flying plane through lightning in a cloudy weather. These details were related to interesting facts and stories which were not related to lightning formation even if they were generally related to lightning. Four treatment groups were used in Experiment 1. The first group received base material. The second group received base material with interesting yet irrelevant text. The third group received base material with interesting yet irrelevant illustrations. Last group received base material with both types of interesting yet irrelevant details. At the end of multimedia presentation, each group was asked to recall lightning formation, to answer some transfer

questions, and to evaluate the interestingness of the multimedia presentation. The results showed that participants in the base material group outperformed participants in other groups in both recall and transfer tasks. They interpreted this result as interesting yet irrelevant details in multimedia learning affecting the coherence of the material negatively by seducing learners' attention away from important material (Garner, et al., 1989). According to this result, interesting yet irrelevant materials are considered as seductive details in multimedia learning and categorized as extraneous materials. However, they failed to confirm the interestingness of the interesting yet irrelevant materials. Interest ratings collected in Experiment 1 did not significantly differ between groups receiving and not receiving interesting yet irrelevant details. Therefore, they conducted another experiment to investigate this situation.

In Experiment 2, they asked participants to evaluate four different materials used in Experiment 1. They were base text used in base material, explanative illustrations used in base material, seductive text, and seductive illustrations. They tried to measure cognitive interest and emotional interest values of these materials as described by Kintsch (1980). Kintsch (1980) defined cognitive interest as an interest triggered by an intricate pattern of events in a story, surprises a story holds, and the way the story is told. Furthermore, he defined emotional interest as an interest triggered by prototypical events in a story such as sex and violence, and has direct emotional impacts. Harp and Mayer (1997) asked participants the following questions to measure cognitive interest: "how much does this material help you to understand the process of lightning?", "How helpful is this material for organizing the steps involved in the process of lightning?" To measure emotional interest value of the materials, Harp and Mayer (1997) asked participants "How interesting is this material?" and "How entertaining is this material?" They found that text and explanative illustrations used in base materials were rated cognitively more interesting whereas seductive details were rated emotionally more interesting. Based on their results, they concluded that base material including important information created more cognitive interest, therefore, participants performed better in recall and transfer test. On the other hand, seductive materials increased emotional interest and influenced learning negatively.

Harp and Mayer (1998). In 1998, Harp and Mayer conducted another study to extend the investigation on the effects of seductive details on recall and transfer in multimedia learning environments. In this study, they proposed three hypotheses of how seductive details may hinder recall and transfer. The first hypothesis was the *distraction hypothesis*. According to the

distraction hypothesis, seductive details were seducing learners' attention away from main ideas. The second hypothesis was the *disruption hypothesis* which claimed that "seductive details interfere with the building of an organized mental model of causal chain" (p. 415). The last hypothesis was the *diversion hypothesis* which assumed that "seductive details activate inappropriate prior knowledge" (p. 415). All experiments tested these hypotheses. In Experiment 1, Harp and Mayer (1998) investigated the interaction between a highlighting strategy and seductive details effect. They conducted a 2 (highlighting vs. no highlighting) x 2 (seductive details vs. no seductive details) experiment. They used the same materials as in Harp and Mayer (1997) for base material and seductive details. They attached seductive details into the base material in the seductive details group while omitting them in the no-seductive details group. In the highlighting version of the materials, they highlighted the important information in the base material by italicizing the letters and making them bold. In the no highlighting version, all the letters in the base material were in the same plain format. In Experiment 1, they found that highlighting did not affect recall and transfer while the inclusion of seductive details negatively affected recall and transfer. They also found highlighting seductive details did not reduce the seductive details effect on the recall and transfer.

In Experiment 2, they used the same settings. In this experiment, they manipulated the existence of learning goals instead of highlighting. Therefore, they conducted a 2 (learning goals vs. no learning goals) x 2 (seductive details vs. no seductive details) experiment. In the learning goals version of the material, participants were told that they should be looking for the steps involved in lightning formation before the multimedia presentation. The result of Experiment 2 revealed that presenting learning objectives before the multimedia presentation helped participants to perform better in recall and transfer tests. In addition, they also confirmed the detrimental effect of seductive details on both recall and transfer. In this experiment, they did not find any effect of the presentation of learning goals on seductive details effect.

In Experiment 3, they attempted to find out whether a signaling strategy reduces the effects of seductive details on recall and transfer. They conducted a 2(signaling vs. no signaling) x 2 (seductive details vs. no seductive details) experiment. Instead of highlighting or presenting learning goals, they presented outlines of the main steps of lightning formation and signaled each step by numbering them in the signaling groups of the experiment. They found that seductive

details affected recall and transfer negatively and signaling had no effect on recall and transfer. Finally, they did not find any positive effect of signaling on the seductive details effect.

In Experiment 4, Harp and Mayer (1998) investigated the changes in the seductive details effect depending on their allocation in multimedia presentation. There were 4 treatment groups. In the first group, participants received base material alone. In the second group, participants received base material and seductive details at the beginning of the base material. In the third group, participants received base material and seductive details interspersed throughout the base material. In the last group, seductive details were presented at the end of the base material. Participants in all groups performed recall and transfer tasks. According to the results of Experiment 4, seductive details interspersed throughout the material had the most detrimental effects on recall and transfer. Harp and Mayer (1998) concluded that all of the experiments above partially supported the diversion hypothesis which means that “seductive details do their damage by priming an inappropriate context for reading” (p. 431).

Moreno and Mayer (2000). Up to this point, extraneous materials were photos, texts, and illustrations. In 2000, Moreno and Mayer tested the effects of context-appropriate sounds and background music on the recall and transfer in multimedia environments. The selected multimedia environment was animation with concurrent narration. They conducted two experiments to test the effects of sounds and music. In both experiments, they had four groups. All groups watched an animation with concurrent narration. Context-appropriate sounds and music were added into the animations for relevant groups. The difference between the two experiments was the topic of the animations. In the first experiment, the topic was the lightning formation. In the second experiment, the topic was the operation of hydraulic braking systems. The first group received animation with concurrent narration only. The second group received animation with concurrent narration and background music. The third group received animation with concurrent narration and context-appropriate sounds. The fourth group received animation with concurrent narration, music, and context-appropriate sounds. After watching the animation in both experiments, participants performed the recall and transfer tasks as done in previous studies. The structure of those tasks was very similar to the previous recall and transfer tasks. Results of these experiments showed that music affects recall and transfer negatively in both experiments. However, context-appropriate sounds like brake or piston sounds only affected

recall and transfer in Experiment 2. Regarding the inclusion of music into animations, results of this study was in line with the coherence principle.

Researchers continued to test materials in different formats to find out whether the effects of the extraneous materials might be related to their format. For this reason, Mayer, et al., (Experiment 3, 2001) examined the effects of interesting yet irrelevant video segments on the recall and transfer. Like previous studies, they found that video segments interspersed into multimedia presentation hindered the recall and transfer. This result supported the coherence principle.

Mayer and Jackson (2005). Mayer and Jackson (2005) conducted a study in the context of coherence principle. Unlike some of the previous studies, they did not intend to make the multimedia presentation interesting. They attempted to provide details to learners to find out whether these details would improve recall and transfer. For this reason, they prepared concise and expanded versions of multimedia presentations. The topic of the multimedia presentations was ocean waves. Three experiments were conducted. The first two experiments used a booklet as the multimedia presentation. The third experiment used animation with concurrent narration as multimedia environment. The only difference between the first two experiments was the time limitation. In the first experiment, participants had limited time to read the booklet during the study. In the second experiment, they were given unlimited time. In all experiments, transfer was the only dependent variable. Results of this study revealed that participants in the concise group performed better in transfer tests compared to participants in expanded version. This result supported the coherence principle.

All the studies above attempted to show the importance of coherence in multimedia learning. Those studies are summarized in table below. According to the previous studies, extraneous materials in different formats and integrated for different reasons had detrimental consequences on recall and transfer. Extraneous materials which are interesting yet irrelevant are described as seductive details. Seductive details are not unique to multimedia learning. Previous studies related to text comprehension also pointed out the negative effects of seductive details. The next section covers the seductive details in text comprehension due to its relation to the coherence principle.

Table 1.

Summary of the Coherence Principle Studies in Multimedia Learning

Experiment	Experiment	Extraneous Material	Dependent Variable	Results
Mayer et al., (1996)	1, 2, and 3	Textual details in the full text passage	Recall and Transfer	CP confirmed
Harp and Mayer (1997)	1	Seductive text, photos, illustrations	Recall and Transfer	CP confirmed
Harp and Mayer (1998)	1,2,3, and 4	Seductive text, seductive photos, and illustrations	Recall and Transfer	CP confirmed
Moreno and Mayer (2000)	1 and 2	Background Music and Context-Appropriate Sounds	Recall and Transfer	CP confirmed
Mayer et al., (2001)	3	Seductive Video Segments	Recall and Transfer	CP confirmed
Mayer and Jackson (2005)	1,2, and 3	Textual Details in Expanded Multimedia Booklet Narrative Details in Animation	Transfer	CP confirmed

Note: CP represents the Coherence Principle.

Seductive Details

The effects of seductive details on recall and comprehension have been a major issue in the field of text comprehension for a long time. Dewey (1913) was one of the first philosophers who talked about adding interesting yet irrelevant materials into instruction to make instruction interesting. He used the metaphor “sugar coating” and he claimed that adding interesting yet irrelevant material into instruction will not really make the learning topic more interesting. He also warned practitioners that sugar coating might have some detrimental effects on learning in the long term.

Schank (1979) listed the factors which make a text interesting. He mentioned that themes such as death, danger, power, sex, money, destruction, chaos, romance, and disease make a story interesting and factors such as unexpectedness and personal relatedness improve the interestingness of those themes. According to Schank (1979), controlling inferences of learners during their reading is a crucial part of creating an effective story passage and overusing interesting themes may divert readers’ attention and lead the readers to create inappropriate inferences which will hinder their learning.

Even if there had been philosophical and theoretical approaches to potential detrimental effects of interesting yet irrelevant materials in the first half of the 20th century, it was late 1980s when researchers started to conduct empirical studies to investigate the effects of interesting yet irrelevant materials.

Hidi et al. (1982). Interesting yet irrelevant materials in school textbooks were first identified by empirical studies at the beginning of the 1980s. In 1982, Hidi, Baird, & Hildyard analyzed school texts in terms of their importance and interestingness by collecting data from 5th and 7th graders. They found that some school texts included segments which were identified as interesting yet irrelevant to learn. In 1989, Garner, Gillingham, and White conducted an empirical study to investigate the effects of interesting yet irrelevant details on recall and comprehension of expository text. They conducted two experiments. Experiment 1 included two treatment groups: interesting yet irrelevant details group and no interesting yet irrelevant details group. They used a three-paragraph expository text about differences among insects for the no interesting yet irrelevant details group. Three interesting yet irrelevant sentences were added into the text for the other group. Participants of Experiment 1 were 20 graduate students. During the experiments, participants were asked to read the relevant text silently. After reading, participants engaged in the macroprocessing and microprocessing tasks. The macroprocessing task asked participants to write down the main ideas in the text, evaluate the text according to its interestingness, and to write down the single most important piece of information read. The microprocessing task expected participants to match pictures of different insects according to the given criterion by the research session administrator and to explain the reason for choosing the picture. Results of Experiment 1 showed that participants in the no interesting yet irrelevant details group remembered significantly more main ideas than participants in the other group. Deep analysis of the macroprocessing task showed that most of the important information described by participants was also identified as interesting. However, there was no significant difference in microprocessing scores between groups. After Experiment 1, researchers explained that inclusion of interesting yet irrelevant information seduced learners' attention away from important material. Therefore, learners could not recall important information as much as the ones in the no interesting yet irrelevant information group. Researchers called these interesting yet irrelevant details "seductive details".

They conducted a second experiment to investigate whether the effects of seductive details were more detrimental for younger learners. Experiment 2 had three treatment groups and involved 36 seventh-graders. The material used in Experiment 1 was also used in Experiment 2. The groups were seductive details, no seductive details, and no seductive details with signaling. Researchers tried to investigate whether signaling might be helpful in the case of seductive details being more detrimental on recall. Participants went through the same procedure as in Experiment 1. Unlike Experiment 1, results showed that seductive details were detrimental in microprocessing rather than macroprocessing. Researchers concluded that the inclusion of seductive details may harm cognition at different levels for different age groups.

Wade and Adams (1990). Wade and Adams (1990) conducted a mixed study to identify the effects of interest and importance on recall of biographical text. Their study included two experiments. The first experiment was conducted to identify different types of information in a biographical text about a character's life. Experiment 2 was conducted to find out what kind of information readers recall from text either immediately after reading the text or one week later. In Experiment 1, the participants were 52 college students. During the experiment, participants were asked to assign an interestingness and importance score to each of the sentences of the text passage. A week later, the same participants were asked to assign an interestingness and importance score for the same sentences. Results were analyzed by comparing the mean scores of interestingness and importance for each sentence. The four groups were identified and content analysis was conducted for the sentences in each group. The results of the content analysis revealed that sentences in each group were distinct. The groups identified in this experiment were *main ideas* (high importance / high interest), *factual details* (high importance / low interest), *seductive details* (low importance / high interest), and *common events* in a person's life history that are unrelated to the main ideas (low importance / low interest).

In Experiment 2, the participants were 48 college students and they were asked to read the biographical text which was used in Experiment 1. After they read the text, they were asked to recall what they read either immediately or one week later. The most recalled information were the main ideas and seductive details. The least recalled important information were factual details. Information which had low importance and low interest were better recalled than factual details. Researchers of this study concluded that importance and interest were highly related and information rated as interesting was the most memorable information either immediately or one

week later. Considering that seductive details were remembered more than factual details, researchers claimed that this study confirmed the seductive details effect on recall of important information. However, Schraw and Lehman (2001) claimed that this study failed to show the seductive details effect since seductive details and main ideas were recalled equally.

Garner and Gillingham (1991). In the literature, some studies also failed to confirm seductive details effect on the recall of important information. For instance, Garner and Gillingham (1991) conducted a study focusing on the examination of the relationship between topic knowledge, cognitive interest and text recall. The experimental material was a biographical text. Researchers identified seductive details inside the text based on their characteristics and relatedness to main theme in the biographical text. The participants were 36 undergraduate students. Participants were assigned to seductive details and no seductive details groups. At the beginning of the experiment, they were asked to complete a topic knowledge pretest. After completing the test, they were asked to read the biographical text. When they finished, they were directed to evaluate the paragraphs of text according to their interestingness, and perform a recall task that included two different scales. The results of this experiment showed that the existence of seductive details in the biographical text passage did not affect participants' recall of important ideas. Therefore, they reported that they could not confirm seductive details effect on recall of important ideas. However, they also noted that seductive details assumed by researchers were moderately interesting for participants based on the data they provided.

Garner et al. (1991). Regarding seductive details effect, Garner, Alexander, Gillingham and Kulikowich (1991) investigated how the placement of seductive details in generally interesting vs. not interesting text passages affect the recall of information for learners with different level of prior knowledge. In Experiment 1, they used a biographical text which included five paragraphs. They identified three of these paragraphs as important paragraphs, one of them as generally interesting, and one of them as seductive details paragraph based on the results of their previous experiment conducted for this experiment. Generally the interesting paragraph was identified as moderately interesting and moderately important in the text. On the other hand, the seductive details paragraph was identified as a highly interesting yet irrelevant paragraph. They created four different versions of the biographical text by adding or removing the generally interesting paragraph, and by changing the location of the seductive details in the material. During this study, participants in each group were asked to read the relevant text. After reading

the text, they were asked to perform a recall task. Results of this experiment showed that seductive details and main ideas were recalled more than uninteresting yet irrelevant results. In this aspect, this study supported the seductive details effect. It also showed that placement of seductive details did not make any difference on recall. In Experiment 2, they used the same material. The difference was that they measured participants' prior knowledge about the topic. The results of this experiment were the same as in Experiment 1 in terms of the seductive details effect.

Wade et al. (1993). Up to this point, researchers claimed the existence of the detrimental effects of seductive details on recall of important information; however, they were not able to detect what caused this effect. Wade, et al., (1993) conducted a study to investigate this situation. Their study included two experiments. In Experiment 1, they investigated the duration of participants' attention to different types of information in a text passage and recall of different types of information. Regarding different types of information, they considered main themes (high importance / high interest), factual details (high importance / low interest), seductive details (low importance / high interest), and boring trivia (low importance / low interest) which were described in Wade and Adams (1990). Before Experiment 1, different types of information in a biographical text were identified by another experimental study. During Experiment 1, participants read each sentence of the biographical text individually on a computer screen and moved to the next sentence by pressing the space bar of their keyboard. Reading times of each sentence was recorded by computer. Therefore, total reading times which belonged to different types of information was calculated at the end of reading. Later, participants were asked to recall the biographical text. For each recalled sentence in the text, one point was assigned. At the end of the analysis, reading times for each relevant type of information and their recall scores were calculated. The results of Experiment 1 revealed that interesting materials were recalled more frequently than uninteresting materials. Seductive details were the most recalled information. Factual details were the least recalled information. Factual details were also the type of information that participants spent most of their time reading. Results also showed that seductive details took a longer amount of time for participants to read compared to main themes and boring trivia in the biographical text. In Experiment 2, they conducted an interview study to understand the reading strategies of learners for different types of information. The results of Experiment 2 revealed that participants used the criteria of difficulty and importance while deciding to use time

and effort in reading except seductive details. According to results of the study, participants spent a considerable amount of time even if they stated that seductive details were easy to understand and remember. When they were specifically asked about their strategies on seductive details, they mentioned that they slowed down, paused, thought back to previous information or reread them. Contradictory results between the actual time participants spent and the time they thought they spent were an interesting aspect of seductive details.

Schraw (1998). The reason for contradictory results between the time learners actually spent and they think they spent became more understandable with Schraw's (1998) study. Schraw (1998) conducted an experimental study which included three experiments. In Experiment 1, he investigated whether seductive details had structural differences in terms of context-dependency. He conducted a 2(context vs. no context) x 2(seductive detail vs. main ideas) mixed model factorial design study. A biographical text was used to identify context-dependent vs. context-independent seductive details. This text included 143 text segments. These text segments were previously categorized as main ideas, factual details, seductive details, and boring trivia in Wade et al. (1993). According to Wade et al. (1993), each category included 26 text segments except seductive details. The seductive details category included 21 text segments. Schraw (1998) chose 16 of 26 main ideas and 16 of 21 seductive details for his study. During Experiment 1, participants were assigned to two groups (context-dependent vs. context-independent). Participants in the context-dependent group first read the entire biographical text, then evaluated 16 main ideas and 16 seductive details according to their interestingness. After evaluation, they solved 10 multiplication questions which were designed as an interpolated task. At the end, they were asked to recall the 32 sentences they evaluated. Participants in the context-independent group followed the same procedure as participants in the context-dependent group except they read the entire biographical text. According to results of Experiment 1, two different types of seductive details were identified: *context-dependent seductive details* and *context-independent seductive details*. The interestingness ratings of the context-dependent seductive details were significantly higher in the context-dependent group compared to the context-independent group. For context-independent seductive details, there was no significant difference in interestingness ratings between groups. Schraw (1998) found that context-independent seductive details included sensational themes while context-dependent seductive details were more related to the story characters.

In Experiment 2, Schraw (1998) tried to determine the effects of context-dependent and context-independent seductive details on the recall of main ideas. He used the same biographical text used in the previous experiment. However, sentences of the text were presented one by one to measure the reading time of each sentence. Participants moved to the next sentence by pressing the space bar on their keyboard. They had an interpolated task similar to the previous experiment after they finished reading. At the end of the experiment, participants had a free recall task. Results showed that context-dependent seductive details require more reading time compared to context-independent seductive details and main ideas. There was no significant difference in reading times between context-independent seductive details and main ideas. In terms of recall, context-dependent and context-independent seductive details were recalled better than main ideas. There was no significant difference in recall scores between context-dependent and context-independent seductive details. The last finding of this experiment was contrary to the seductive details effect. Correlation analysis showed that there was significant and positive relationship between the recall of seductive details and total story.

In Experiment 3, Schraw (1998) examined the effects of seductive details on the recall of other text segments. He had four groups of participants in this experiment. In the first group, participants received a booklet which included a biographical text with both types of seductive details. In the second and third groups, participants received the text with either context-independent or context-dependent seductive details. In the last group, participants received the text without seductive details. After reading the relevant texts, participants had the interpolated task and free recall task similar to previous experiments. Results showed that context-dependent and context-independent seductive details were recalled better than main ideas in all groups. Moreover, they showed that there was no significant difference in the recall of main ideas between groups who received different types of seductive details and those who did not. The most interesting result was that a positive, significant relationship between recall of seductive details and total story recall was found. The results of Experiment 3 showed that seductive details did not affect the recall of main ideas; moreover, they helped participants to recall the total story better.

Sanchez and Wiley (2006). Other than structural differences in seductive details, research studies also showed that individual factors among learners may change the effects of seductive details on learning. One of these studies was conducted by Sanchez and Wiley (2006). Sanchez

and Wiley (2006) investigated the interaction between working memory capacity (WMC) and seductive details. In their study, they described WMC as “the ability to control attention and deal with irrelevant information, and not simply the amount of information that can reside in working memory” (p. 345). They conducted two experiments. The first experiment was related to the coherence principle and it was a 2 (High WMC vs. Low WMC) x 3 (no illustration, conceptual illustration, seductive illustration) design experiment. The multimedia presentation was a text passage about the ice age on a website. The first group read the text page without any illustrations. The second group read the text passage with conceptual illustrations. The third group read the text passage with seductive illustrations. After they read the text passage, participants in all groups were involved in a recall and transfer task. Results showed that seductive details were only detrimental in the recall task for those who have low WMC. High WMC participants who had seductive illustrations performed better in the recall task compared to other groups. Results were similar for transfer scores. The results of this study were contradictory to predictions of the seductive details effect.

Lehman et al. (2007). Recently, Lehman et al., (2007) revisited the studies conducted by Harp and Mayer (1997, 1998). They conducted two studies in order to examine the effects of seductive details on recall and transfer. In Experiment 1, they asked participants to evaluate each sentence in online lightning formation text according to their interestingness and importance similar to Wade and Adams (1990). At the end of this experiment, they identified the base text and seductive details in lightning formation text. Seductive details were considered as interesting yet irrelevant information based on data collected from participants. Base text was considered to be the rest of the text. In Experiment 2, Lehman et al., (2007) examined the effects of seductive details on recall and transfer. They used two groups. The first group received the base text without seductive details and the second group received the text with seductive details. The reading time for each participant was recorded by the administrator of the experimental session. After reading, participants in both groups were asked to recall as much information as possible from the text. At the end of the experiments, they were also asked to answer some transfer questions. Results of this experiment indicated that seductive details had detrimental effects on both recall and transfer. According to the results, they also found that the existence of seductive details caused participants to spend less time on base text.

Table 2 below summarizes the literature on seductive details. It is obvious that there are contradictory results related to the seductive details effect. In the next section, the situational interest paradigm will be presented which supports the use of seductive details to motivate learners during their interaction with instructional material.

Table 2.

Summary of Seductive Detail Studies

Experiment	Experiment	Type of Material	Dependent Variable	Results
Garner, Gillingham, and White (1989)	1 and 2	Expository Text	Recall and Comprehension	SD Partially Confirmed
Wade and Adams (1990)	2	Biographical Text	Recall	SD Confirmed
Garner and Gillingham (1991)	1	Biographical Text	Recall	SD Not Confirmed
Garner et al. (1991)	1 and 2	Biographical Text	Recall	SD Confirmed
Wade et al. (1993)	1	Biographical Text	Recall and Reading Times	SD Confirmed
Schraw (1998)	2 and 3	Biographical Text	Recall and Reading Times	SD Not Confirmed
Sanchez and Wiley (2006)	1	Online Expository Text with illustrations	Recall and Transfer	SD Partially Confirmed
Lehman et al., (2007)	2	Expository Text	Recall and Transfer	SD Confirmed

Note: SD represents the Seductive Detail Effect

Situational Interest

The concept of interest has been a widely investigated topic in education yet it is hard to find a common definition or theory of it. It is possible to find empirical studies that involve some type of interest since the 1970s. Intrinsic interest (Greene & Lepper, 1974; Loveland & Olley, 1979; Reiss & Sushinsky, 1975), topic interest (Baldwin, Peleg-Bruckner, & McClintock, 1985; Stevens, 1980), task interest (Butler, 1989; Campbell & Hackett, 1986; Hackett & Campbell, 1987), subject prior interest (Marsh & Cooper, 1981), interestingness (Frick, 1992; Hidi & Baird, 1986; Sadoski, Goetz, & Fritz, 1993a), individual interest (Ainley, Hillman, & Hidi, 2002; Chen & Darst, 2002; Renninger, Ewen, & Lasher, 2002), and situational interest (Cury, et al., 1996;

Mitchell, 1992; Schraw, Bruning, & Svoboda, 1995) are some forms of interest found in the literature. The variety of approaches to the concept of interest clearly shows the lack of common ground for the concept. Krapp et al., (1992) reviewed the interest studies and summarized the studies under three categories. According to Krapp et al., (1992), researchers approached to the concept of interest as (a) characteristics of the person, (b) characteristics of the learning environment, and (c) psychological state within the person. Researchers who approached the concept of interest as characteristics of the person often used the phrase “individual interest” in their studies. On the other hand, researchers supporting that interest is triggered by the characteristics of learning environment often used the term interestingness in their studies. Psychological state within the person is described as the combination of the actualized state of individual interest and situational interest triggered by interestingness of the instructional material. Therefore, researchers worked on either the effects of the actualized state of individual interest on learning related constructs or the effects of situational interest on learning related constructs.

Researchers following the individual interest paradigm found that individual interest influences attentional shift and recall (Renninger & Wozniak, 1985), individuals’ career decisions (Lent, Brown, & Larkin, 1987; Tranberg, Slane, & Ekeberg, 1993), academic choices (Köller, Baumert, & Schnabel, 2001), and even facial expressions (Reeve, 1993). However, they could not find a direct relationship between individual interest and learning (Köller, et al., 2001). Along this line, most of the studies (e.g., Lent, et al., 1987; Tranberg, et al., 1993) focused on individuals’ career decisions and early determination of their interests for effective counseling.

Researchers following the situational interest paradigm found that situational interest influences individuals’ attitudes towards science (Palmer, 2004), and learning from text (Schraw, 1997). Along this line, research studies mostly focused on text-based interest (Schraw & Lehman, 2001).

Text-based interest refers to the characteristics of text which may increase readers’ interest and therefore improve their learning. Many characteristics of text were considered as potential factors that may create or improve situational interest. Some of these characteristics are coherence and completeness (Boscolo & Mason, 2003; Lehman & Schraw, 2002), concreteness and vividness (Garner, 1992; Sadoski, 2001; Sadoski, Goetz, & Fritz, 1993a, 1993b; Sadoski, Goetz, & Rodriguez, 2000), and seductiveness (Sanchez & Wiley, 2006; Schraw, 1998).

According to research studies, these factors increased text-based interest of learners and improved learners' recall and comprehension during their learning. As mentioned before, there were other studies claiming there are detrimental effects of seductive details on learning.

Design Problems in Previous Studies

Some design problems related to seductive detail studies were reported and discussed in the literature. Under these conditions, the reliability of the results of seductive detail studies became questionable. Therefore, these design problems and how this particular study will respond to these problems is presented below.

There have been four major critiques regarding previous studies. First, Schraw and Lehman (2001) claimed that some of the studies (e.g., Harp & Mayer, 1997, 1998) did not properly control the seductiveness of experimental material which means asserted seductive details in previous studies may not be seductive at all. To address this critique, the present study will identify seductive details in the experimental material in a separate stage. Therefore, seductiveness of materials used in this study will be confirmed by the participants of the study.

Second, Silvia (2006) explained that previous studies did not consider the presence of tedious details in experimental materials which might affect the coherence of mental representation negatively as also stated in the coherence principle in multimedia learning. According to the literature, these details hindered the quality of learning from many aspects (Mohr, Glover, & Ronning, 1984). Therefore, based on the results of the first experiment of this study, the potential tedious details will be identified in the instructional material in addition to the seductive details as stated before. To efficiently measure the seductive details effect, these identified tedious details will be eliminated and only the presence of seductive details will be manipulated in the second stage to efficiently measure the effects of seductive details.

Third, Goetz and Sadoski (1995) explained that some of the studies did not use a control group. For instance, Wade, Schraw, Buxton, and Hayes (1993) examined the recall of different types of information in a text passage including seductive details. They found that seductive details were remembered more so than factual details which were described as important and uninteresting information. They interpreted this finding to mean that highly memorable seductive details distracted learners' attention and hindered the recall of factual details (e.g., Wade, Alexander, Schraw, & Kulikowich, 1995). However, according to Goetz and Sadoski (1995), it

was not possible to speculate on this outcome without measuring the recall of factual details in a non-sexuctive details treatment. There was a possibility of obtaining similar results in a text passage without sexuctive details since the recall of factual information might be difficult in general (Goetz & Sadoski, 1995). Therefore, a control group including a treatment without sexuctive detail will be used in the second stage of this particular study to properly measure the potential effects of sexuctive details.

Fourth, some studies have not been designed to measure solely the sexuctive details effect (Goetz & Sadoski, 1995). For instance, Garner et al., (1989) included signaling in their material in addition to sexuctive details which makes the interpretation of their results in Experiment 2 more difficult. It was not possible to say whether the effect they obtained in their second experiment was due to sexuctive details or signaling. Therefore, manipulation of the treatment in this study will be directly related to the structure of sexuctive details.

In summary, the aforementioned problems in previous studies created sufficient reason to design this study in order to effectively examine the effects of sexuctive details in multimedia learning. All reported recommendations in the literature were considered carefully throughout the design of this particular study.

Context-Dependency of Sexuctive Details

The reason to choose context-dependency as a potential factor is due to the conflicting findings of the previous studies about the process of sexuctive details during learning. Regarding the detrimental effects of sexuctive details, Harp and Mayer (1998) proposed three hypotheses. These are the distraction, disruption, and diversion hypotheses. According to the distraction hypothesis, sexuctive details distract learners' attention during learning and therefore trigger them to select irrelevant images and words. This hypothesis is supported by other researchers (e.g., Garner, et al., 1992; Garner, et al., 1989; Wade, et al., 1993). According to the disruption hypothesis, Harp and Mayer (1998) claimed that sexuctive details affect learners during the organization process of relevant information. Since sexuctive details are presented with important information, they affect the coherence of mental representation (Harp & Mayer, 1998). Finally, according to the diversion hypothesis, learners create a coherent mental representation, however, not of structurally important ideas (Harp & Mayer, 1998). According to the results of their study, Harp and Mayer (1998) were only able to support the diversion hypothesis.

Three hypotheses above have assumed that in different stages of cognitive process learners integrate seductive details into their mental representations in addition to important information. This assumption might be acceptable unless learners separate seductive details from important information during their cognitive process of information. Some previous studies (e.g., Schraw, 1998; Wade & Adams, 1990) showed that main themes and seductive details in instructional materials are processed separately in cognitive system which means participants can distinguish the main themes from seductive details during their learning. Therefore, even if learners spend more time on seductive details compared to main themes of instructional material as supported by the distraction hypothesis, they use different strategies for seductive details and main themes, and as a result they remembered them equally (Wade, et al., 1993). In this sense, the hypotheses of Harp and Mayer (1998) and findings of other researchers conflict regarding the cognitive processes of seductive details and important information.

Therefore, this research study hypothesizes that the variations in context-dependency of seductive details alters the strategy of the cognitive process of seductive details. Learners may process different types of seductive details (context-dependent vs. context-independent) in instructional materials differently. As a result, learners may perform differently in recall and transfer if the materials include seductive details with variations in the form of context-dependency. To test this hypothesis, this study will examine whether participants perform differently in recall and transfer tasks in different multimedia learning environments which will be manipulated according to the context-dependency of seductive details.

Schraw (1998) described context-dependent and context-independent seductive details based on his experimental data. According to Schraw (1998), context-dependent seductive details were more interesting in their own context while context-independent seductive details were equally interesting no matter whether they were presented in its context or in isolation. In his study, Schraw (1998) could not find any significant effect of context-dependency of seductive details on the recall of information. However, he found that participants in his study used different strategies for context-dependent and context-independent seductive details.

In the present study, it is hypothesized that context-dependent seductive details affect recall and transfer negatively compared to context-independent seductive details. Because, context-dependent seductive details require more time to process (Schraw, 1998), and may create a different context when it is processed together with main themes which is consistent with the

diversion hypothesis (Harp & Mayer, 1998). On the other hand, context-independent seductive details will not affect the recall and transfer of knowledge since they will be processed separately from important information.

In summary, this study will focus on the context dependency of seductive details and will use one of the multimedia environments used in Moreno and Mayer's (2000) study as the particular multimedia environment. At this point, the context-dependency of seductive details in narrative form will be the focus of this study instead of visual details in the animation.

CHAPTER THREE

EXPERIMENT 1: IDENTIFICATION OF CONTEXT-DEPENDENT VS. CONTEXT-INDEPENDENT SEDUCTIVE DETAILS IN A MULTIMEDIA PRESENTATION

Introduction

One of the critiques of seductive details studies questions the definition and the amount of seductiveness in seductive details (Goetz & Sadoski, 1995). Researchers claimed that seductive details which are assumed to be seductive may not be seductive at all (e.g., Goetz & Sadoski, 1995; Sanchez & Wiley, 2006; Schraw & Lehman, 2001). Indeed, some researchers which examined the seductiveness of their research materials failed to confirm their seductiveness in light of their participants' data (e.g., Harp & Mayer, 1997). Therefore, Experiment 1 is designed to identify the seductive details in a particular multimedia presentation to be used in Experiment 2. Experiment 1 will also identify which of these seductive details are context-dependent or context-independent as described in Schraw's (1998) study. Context-dependent seductive details are described as the seductive details that are identified as more interesting provided learners are familiar with the context of the topic of interest. This familiarity was created by presenting the particular multimedia material to the participants of this study in advance. On the other hand, context-independent seductive details are described as those that are identified as equally interesting by the learners who are not familiar with the context of the topic of interest.

Method

Participants and Design

The participants were 67 undergraduate students enrolled in an undergraduate general health education class for non-majors at a large university in the southeast. All participants volunteered to participate in this experiment for extra credit in the course. They used an online registration form to register into particular sessions of Experiment 1. During their registration, the system randomly assigned participants to one of two groups (CDS and CIS) for Experiment 1. CDS was defined as the context-dependent seductive details group and CIS was defined as the context-independent seductive details group. Out of 67 participants, 29

participants were assigned to CDS and 38 participants were assigned to CISD. In CDS group, participants watched a lightning animation and assigned an interestingness score to each sentence in the narration of the animation. The sentences are presented in the same order as in the narration to obtain context-dependence interest rating. In CISD group, participants watched a different animation addressing historical inquiry as a distraction task, and evaluated each sentence of lightning animation in randomized order to obtain context independence interest rating. Due to technical problems, data were not obtained from two participants (one in CDS and one in CISD).

Materials

All of the materials in this experiment were electronic and delivered through an online web portal. Participants were able to access those materials after they logged into the system by entering their university email address into the login page.

Lightning Animation

The lightning animation was six minutes in length and created using Adobe FlashTM. It was an animation with concurrent narration. The visual part of the lightning animation was based on Harp and Mayer's (1998) study. The narration of the animation was based on Lehman et. al.'s (2007) study and consisted of 50 sentences. The entire narration of the animation is presented in Appendix A. The animation began with instructions reminding the participants to wear headphones and to click the continue button when they were ready. After participants clicked the continue button, they saw a scene which included a picture of the ground, a house, a couple of trees, and the ocean. In the animation, an illustration of cool air waves moved from the ocean to the ground, became heated and rose rapidly from the ground to the air. Then, the air became more heated and formed a cloud. The cloud rose above the freezing level and formed ice crystals. Some of these ice crystals fell from the cloud and dragged air from the cloud and formed downdrafts. These downdrafts spread to the ground in all direction. These downdrafts were represented by arrows pointing to the ground from the clouds and to the sides later. Ice crystals inside the cloud moved up and down inside the cloud and produced electrical charges. In the cloud, positive electrical charges rose to the top of the cloud while negative electrical charges moved to the bottom of the cloud. Negative electrical charges dropped from the bottom of the cloud following a path. The first negative charge was represented by a circle which included a

minus sign. This negative charge met positive electrical charges which rose from the high points of the house and trees. Finally, positive charges rising from the ground followed the path created by the negative charges coming from the cloud. This path was seen as lightning in the animation.

The historical inquiry animation

The historical inquiry animation was 3.5 minutes in length, based on 16 images with concurrent narration. The animation focused on a general description of historical inquiry and a strategy for historical inquiry, SCIM. SCIM stands for summarizing, contextualizing, inferring, and monitoring. This animation was designed to prevent participants of Group B (context-independent seductive details group) from becoming familiar with the concept of lightning formation.

Interestingness Scale

This scale was modified from Lehman et al., (2007) and Wade and Adams (1990). The rationale behind this scale was to identify seductive details in the narration of the lightning animation. Seductive details are defined as unimportant yet irrelevant materials in instructional materials (Garner, et al., 1989). Therefore, the irrelevant sentences of lightning animation narration were chosen as the items of this scale and participants were asked to score each of these sentences according to their interestingness. Irrelevant sentences were determined according to a description of important information previously identified in Mayer, et al., (1996). In 1996, Mayer et al. reviewed several textbooks and encyclopedia chapters. They designed a 600-word lightning passage and showed the effectiveness of their passage. Based on this study, Harp and Mayer (1997) explained the eight steps that depict lightning formation.

In this study, the sentences in narration which were not related to these eight steps were considered unimportant. The interest scale included 28 items based on this criterion. The items of the scale were presented in different formats to both groups. In Group A, items of the scale were presented in the same order as in the narration of the animation. In Group B, the items were presented in a random order. The questionnaire started with an instruction, “Please read each of the following sentences and rate the how interesting you find the content of the sentence (i.e., each sentences’ “interestingness”). After the instruction a 7-point scale was presented next to each of item. In the 7-point scale, 1 = “very uninteresting”, 2 = “mostly uninteresting”, 3 =

“somewhat uninteresting”, 4 = “neutral”, 5 = “somewhat interesting”, 6 = “mostly interesting”, and 7 = “very interesting”. The scale ended with a submit button.

Procedure

Experiment 1 was conducted in a computer lab which included 10 Apple laptops. Each session of Experiment 1 was completed in 15 minutes. All sessions were administered by the researcher. When participants came for each session, they were randomly assigned to a computer and were asked to wait for instructions. The computers were online and were set to display the webpage of the experiment. Some features of the web browsers were blocked to prevent participants from surfing the web.

The sessions started with greetings and brief information about the researcher and the research. Participants were allowed to ask questions before the sessions started. At the beginning of the session, participants logged-in to the session using their university email addresses. After participants logged-in, they went through the two sections of Experiment 1. In the first section, participants watched either the lightning animation or the historical inquiry animation depending on the group to which they were assigned (CSDS or CISD). In the second section, participants completed the appropriate interestingness scale. Participants were allowed 10 minutes to complete the survey. Before each section, participants were provided instructions regarding each section and were asked if they had any questions. During each section, the session administrator circulated around the room to make sure that there was no problem. The session administrator thanked participants for their participation and participants were excused.

Results

The purpose of this experiment was to identify context-dependent vs. context-independent seductive details in particular multimedia presentation. For this reason, the data were analyzed in two stages. The results of these analyses are presented below.

Identification of Seductive Details

The interestingness scale was used to identify seductive details in the instruction as in Wade and Adams (1990), and Wade et al., (1993). In the literature, seductive details were defined as interesting yet irrelevant information in an instructional material. In this scale,

participants assigned interestingness scores to 28 irrelevant sentences of narration in the multimedia presentation. By definition, seductive details were those irrelevant sentences in the narration which were identified as interesting by participants of the experiment. Therefore, seductive details were considered as the items of the scale whose general mean score was significantly higher than four, the mid-point of the interestingness scale. A one sample t-test was conducted to identify the sentences which had a mean score significantly higher than four. Table 3 below shows the results of the one sample t-test analysis. The items are ordered according to their p-values. The scores are out of 7. The items of the scale as are listed in order in Appendix B.

Table 3.

One Sample T-test Results of Interestingness Scale

Item	Mean	SD	T	df	P	Adjusted α
Item 19	5.66	1.51	8.852	64	.0000*	0.0025
Item 18	5.92	1.35	11.312	62	.0000*	0.0026
Item 1	4.97	1.24	6.317	64	.0000*	0.0027
Item 11	5.05	1.43	5.898	64	.0000*	0.0029
Item 5	5.00	1.54	5.231	64	.0000*	0.0031
Item 24	4.89	1.40	5.122	64	.0000*	0.0033
Item 28	4.89	1.39	5.115	63	.0000*	0.0035
Item 20	4.98	1.57	5.069	64	.0000*	0.0038
Item 8	4.89	1.44	4.956	63	.0000*	0.0041
Item 2	4.78	1.35	4.679	64	.0000*	0.0045
Item 16	4.65	1.57	3.328	64	.0014*	0.0050
Item 15	4.55	1.49	2.997	64	.0039*	0.0055
Item 4	4.52	1.47	2.870	64	.0055*	0.0062
Item 22	4.48	1.46	2.636	64	.011	0.0071
Item 14	4.39	1.54	2.030	63	.047	0.0083
Item 27	4.37	1.57	1.900	64	.062	0.0100
Item 6	4.31	1.74	1.425	64	.159	0.0125
Item 3	4.25	1.60	1.240	64	.220	0.0166
Item 23	4.17	1.43	.960	63	.340	0.0250
Item 17	4.08	1.43	.434	64	.666	0.0500
Item 21	4.00	1.47				
Item 26	3.85	1.72				
Item 7	3.83	1.71				
Item 10	3.77	1.59				
Item 25	3.72	1.52				
Item 13	3.70	1.44				
Item 9	3.49	1.62				
Item 12	3.26	1.37				

Note: Means below 4 were not included in further analysis.

* p < adjusted α

According to the results above, 8 out of 28 items (Item 7, item 9, item 10, item 12, item 13, item 21, item 25, and item 26) had mean scores lower than 4 and were automatically eliminated from the analysis. 20 out of 28 items had general mean scores higher than 4. According to the t-test results, 13 out of these 20 items were found to have general mean scores which were significantly higher than 4. To control familywise error during multiple comparisons, the Holm-Bonferroni method was used to determine the adjusted significance level. Table 3 above shows the adjusted significance levels of the items. It was concluded that only 13 of the sentences in the 50-sentence narration of the lightning animation should be considered as seductive details.

Identification of Context-Dependent vs. Context-Independent Seductive Details

In the last section of the analyses of Experiment 1, the mean scores of those 13 items were analyzed to find out which of those items were context-dependent vs. context-independent seductive details. In order to determine the context-dependent and context-independent seductive details, mean scores of the 13 items in CDS and CISD were compared using an independent samples t-test. According to Schraw (1998), context-dependent seductive details are described as the seductive details that are identified as more interesting provided learners are familiar with the context of the topic of interest. This familiarity was created by presenting the particular multimedia material to the participants of this study in advance. On the other hand, context-independent seductive details are described as those that are identified as equally interesting by the learners who are not familiar with the context of the topic of interest. Based on the analysis, the items which had significant mean differences between groups were identified as context-dependent seductive details. The items which had no significant mean differences were identified as context-independent seductive details. In this particular analysis, controlling the familywise error was not the main concern since means compared were collected from independent samples. The results are shown below.

Table 4.

T-test Results between CDS and CISD

	Group	M	SD	T	df	P																																																																																																																				
Item 1	CDS	5.2500	1.10972	1.612	63	.112																																																																																																																				
	CISD	4.7568	1.29969				Item 2	CDS	5.1786	1.24881	2.097	63	.040*	CISD	4.4865	1.36670	Item 4	CDS	4.9643	1.10494	2.166	63	.034*	CISD	4.1892	1.63023	Item 5	CDS	5.0000	1.63299	.000	63	1.000	CISD	5.0000	1.49071	Item 8	CDS	5.0357	1.34666	.709	62	.481	CISD	4.7778	1.51396	Item 11	CDS	5.2143	1.37051	.823	63	.414	CISD	4.9189	1.47908	Item 15	CDS	5.1071	1.44886	2.733	63	.0088	CISD	4.1351	1.39766	Item 16	CDS	5.3214	1.33482	3.242	63	.002*	CISD	4.1351	1.54851	Item 18	CDS	6.2143	1.19744	1.565	61	.123	CISD	5.6857	1.43017	Item 19	CDS	6.6071	.62889	5.198	63	.000*	CISD	4.9459	1.59767	Item 20	CDS	5.6071	1.52362	2.951	63	.004*	CISD	4.5135	1.44571	Item 24	CDS	5.2500	1.14261	1.818	63	.074	CISD	4.6216	1.53390	Item 28	CDS	5.2500	1.23603	1.855	62
Item 2	CDS	5.1786	1.24881	2.097	63	.040*																																																																																																																				
	CISD	4.4865	1.36670				Item 4	CDS	4.9643	1.10494	2.166	63	.034*	CISD	4.1892	1.63023	Item 5	CDS	5.0000	1.63299	.000	63	1.000	CISD	5.0000	1.49071	Item 8	CDS	5.0357	1.34666	.709	62	.481	CISD	4.7778	1.51396	Item 11	CDS	5.2143	1.37051	.823	63	.414	CISD	4.9189	1.47908	Item 15	CDS	5.1071	1.44886	2.733	63	.0088	CISD	4.1351	1.39766	Item 16	CDS	5.3214	1.33482	3.242	63	.002*	CISD	4.1351	1.54851	Item 18	CDS	6.2143	1.19744	1.565	61	.123	CISD	5.6857	1.43017	Item 19	CDS	6.6071	.62889	5.198	63	.000*	CISD	4.9459	1.59767	Item 20	CDS	5.6071	1.52362	2.951	63	.004*	CISD	4.5135	1.44571	Item 24	CDS	5.2500	1.14261	1.818	63	.074	CISD	4.6216	1.53390	Item 28	CDS	5.2500	1.23603	1.855	62	.068	CISD	4.6111	1.45951						
Item 4	CDS	4.9643	1.10494	2.166	63	.034*																																																																																																																				
	CISD	4.1892	1.63023				Item 5	CDS	5.0000	1.63299	.000	63	1.000	CISD	5.0000	1.49071	Item 8	CDS	5.0357	1.34666	.709	62	.481	CISD	4.7778	1.51396	Item 11	CDS	5.2143	1.37051	.823	63	.414	CISD	4.9189	1.47908	Item 15	CDS	5.1071	1.44886	2.733	63	.0088	CISD	4.1351	1.39766	Item 16	CDS	5.3214	1.33482	3.242	63	.002*	CISD	4.1351	1.54851	Item 18	CDS	6.2143	1.19744	1.565	61	.123	CISD	5.6857	1.43017	Item 19	CDS	6.6071	.62889	5.198	63	.000*	CISD	4.9459	1.59767	Item 20	CDS	5.6071	1.52362	2.951	63	.004*	CISD	4.5135	1.44571	Item 24	CDS	5.2500	1.14261	1.818	63	.074	CISD	4.6216	1.53390	Item 28	CDS	5.2500	1.23603	1.855	62	.068	CISD	4.6111	1.45951																
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Note: $p=.05$

According to the results, six context-dependent seductive details and seven context-independent seductive details were found. The list of context-dependent and context-independent seductive details is listed in Appendix C.

Discussion

The purpose of this experiment was to identify context-dependent vs. context-independent seductive details in a particular multimedia presentation. The results of this experiment revealed that some of the unimportant information presented as seductive details in previous studies were not confirmed as seductive details based on empirical data of this experiment. For instance Lehman, et al., (2007) reported 11 seductive details according to their analyses. However, the current experiment only confirmed 9 of those 11 seductive details based on empirical data. Besides, the results of the current experiment also revealed 4 additional seductive details which were not identified in Lehman et al. (2007). Lehman et al. (2007) identified seductive details according to their importance and interestingness in the lightning text passage. This particular study did not ask participants how important they thought the materials were since importance of the materials was justified with scientific knowledge related to lightning formation. Lehman et al. (2007) assumed that materials differing from seductive details should be considered as base materials. However, Silvia (2006) warned researchers about the possibility of the existence of boring materials in instructional materials. Boring materials are described as unimportant and uninteresting information in instructional materials (Wade, et al., 1993). The results of this experiment identified 13 of 28 unimportant sentences in narration as seductive details. Therefore, the remaining 15 unimportant sentences in the narration were considered as boring information instead of being considered as base material in Lehman et al., (2007).

This experiment also found similar results as in Harp and Mayer (1997, 1998). Through their experiments, Harp and Mayer (1997, 1998) assumed 11 sentences to be seductive details in their lightning text passages. The present experiment confirmed the seductiveness of those 11 sentences out of 13 total seductive details identified. In addition to this finding, the present experiment also found structural differences in those seductive details. Of the 13 seductive details used in the present experiment, six of them were determined to be context-dependent and seven of them were determined to be context-independent. The complete list of context-dependent and context-independent seductive details is presented in Appendix C.

In summary, a 50-sentence text explaining lightning formation was used in this particular experiment as the narrative segment of the lightning animation. The text was adapted from Lehman et al. (2007). Out of 50 sentences, 22 important sentences, 15 boring sentences, and 13

seductive details (6 context-dependent and 7 context-independent) were identified. Important sentences and seductive details were used in Experiment 2.

Schraw (1998) found that context-dependent and context-independent seductive details were processed differently during their reading in a text passage. However, the context-dependency of seductive details in animation had not been investigated before. This particular experiment showed that the narration of the particular lightning animation also contained context-dependent and context-independent seductive details.

The existence of differences in the structure of seductive details presented in animations raised a new question: “Does the context-dependency of seductive details affect recall and transfer?” The answer to this question is investigated in Experiment 2.

CHAPTER FOUR

EXPERIMENT 2: THE EXAMINATION OF THE EFFECTS OF CONTEXT-DEPENDENCY OF SEDUCTIVE DETAILS IN MULTIMEDIA PRESENTATIONS

Introduction

The purpose of this experiment is to examine the effects of context-dependency of seductive details on the recall and transfer in multimedia learning environments. Previous studies related to the effects of seductive details in animations revealed contradictory results. Some of the studies (e.g., Harp & Mayer, 1997; Harp & Mayer, 1998) showed that seductive details affected the recall and transfer negatively. On the other hand, some studies (e.g., Doolittle & Altstaedter, 2009) showed that seductive details did not affect the recall and transfer. This experiment investigates whether the differences in the context-dependency of seductive details may be a reason of those contradictory results.

Schraw (1998) found that context-dependent and context-independent seductive details in text-passages were processed differently. However, the effects of context-dependency of seductive details have not been investigated in multimedia environments. Therefore, this study investigates the effects of context-dependency of seductive details in animations on the recall and transfer.

Method

Participants and Design

The selection and characteristics of participants were similar to those participated into Experiment 1. In Experiment 2, participants were 184 undergraduate students enrolled in an undergraduate general health education class for non-majors at a large university in the southeast. All participants volunteered to participate in this experiment for extra credit in the course. They used an online registration form to register into particular sessions of Experiment 2. During their registration, the system randomly assigned participants to one of four groups. Group 1 was designed as a control group which watched an animation without any seductive details. Group 2 was designed as a context-dependent seductive details (CDS) group which watched an animation with CDS. Group 3 was designed as a context-independent seductive details group (CIS) which watched an animation with CIS. Group 4 was designed as a general seductive

details (SD) group which watched an animation with both types of seductive details (CDS + CISD).

Materials

All of the materials in this experiment were electronic and were delivered through an online web portal. Participants were able to access those materials after they logged into the system by entering their university email addresses into the login page of Experiment 2.

Animations

There were four different types of animation. The visual design of the animation in all groups was the same as in Experiment 1. However, the narration was different. In the first group, the narration only included important information which was defined as information related to the eight steps of lightning formation. In the second group, the narration included important information and context-dependent seductive details. In the third group, the narration included important information and context-independent seductive details. In the fourth group, the narration included important information and both types of seductive details. The context-dependent and context-independent seductive details which were used in this Experiment are listed in Appendix C.

Recall and Transfer Tests

The recall test was adapted from Moreno and Mayer (2000). This test required that participants answered the following question on the computer, “Please provide an explanation of what causes lightning.” The recall question was provided on its own screen with a response box located directly below it.

The transfer test included answering three questions used by Moreno and Mayer (2000): “What could you do to decrease the intensity of lightning?, Suppose you see clouds in the sky, but no lightning. Why might this happen?, and What does air temperature have to do with lightning?” (p. 119). These three transfer questions were provided on the same computer screen such that each question was followed by its own response box.

Procedure

The location and setting of Experiment 2 were similar to Experiment 1. Experiment 2 was conducted in a computer lab which included 10 Apple laptops. Experiment 2 was completed in 25 minutes. All sessions were administered by the researcher. When participants came for each session, they were randomly assigned to a computer and were asked to wait for instructions. The computers were online and set to display the webpage of the experiment. Some features of the web browsers were blocked to prevent participants from surfing the web.

Each session started with greetings and brief information about the researcher and the research. Participants were allowed to ask questions before the session starts. Participants then logged-in to the session using their university email addresses. After they logged in, participants went through the sections of Experiment 2. In the first section, participants watched a different version of lightning formation animation depending on the group to which they were assigned. In Group 1, participants watched an animation which included only important information. In Group 2, participants watched an animation which included important information and context-dependent seductive details. In Group 3, animation included important information and context-independent seductive details. In Group 4, animation included important information and both types of seductive details. After watching the animation, the participants completed the recall task (5 minutes) and the transfer task (10 minutes). Before each section, participants were provided particular instructions regarding each section and were asked if they had any questions. During each section, the researcher circulated around the room to ensure that there were no problems. After the completion of the session, the researcher thanked participants for their participation and participants were excused.

Results

Recall Test

Each participant's recall response was evaluated and a recall score was computed by counting the presence of idea units by two trained independent raters (inter-rater reliability, $r = .875$). Disagreements in scoring were settled by negotiation. The idea units were: (a) air rises, (b) water condenses, (c) water and crystals fall, (d) wind is dragged downward, (e) negative charges fall to the bottom of the cloud, (f) the leaders meet, (g) negative charges rush down, and (h) positive charges rush up (Mayer, et al., 2001, p. 191). One point was given to participants for

the inclusion of each of the idea units. The total number of recalled main idea units was the recall score of each participant. Table 5 shows the descriptive statistics of recall scores among groups.

Table 5.

Descriptive Statistics of Recall Scores

Groups	N	Mean	Std. Deviation	Std. Error	Minimum	Maximum
Control	40	3.125	1.742	0.275	0	6
CDS	52	3.039	1.950	0.270	0	7
CISD	40	3.150	2.486	0.393	0	8
CDS + CISD	52	2.615	1.972	0.274	0	7
Total	184	2.962	2.039	0.150	0	8

Note: Maximum Recall Score = 8

Transfer test

Each participant’s transfer response was evaluated and a transfer score was computed by counting the total number of valid answers for the three transfer questions by two trained independent raters (inter-rater reliability, $r = 0.751$). Disagreements were settled by negotiation. These questions were adapted from Mayer et al., (2001) and acceptable answers were determined by those established by Mayer et al. (2001). Acceptable answers for the first transfer question, “What could you do to decrease the intensity of lightning?”, included decreasing the quantity of positively charged particles on land, and increasing the quantity of positively charged particles next to the cloud. Acceptable answers for the second transfer question, “Suppose you see clouds in the sky but no lightning, why not?”, included the cloud not rising above the freezing level, and ice crystals not forming. Acceptable answers for the third transfer question, “What does air temperature have to do with lightning?”, included the necessity of warm land and cool air, and the bottom part of the cloud being below the freezing level while the top of the cloud is above the freezing level. Table 6 shows the descriptive statistics of transfer scores among groups.

Table 6.

Descriptive Statistics of Transfer Scores

Group	N	Mean	Std. Deviation	Std. Error	Minimum	Maximum
Control	40	0.825	0.874	0.138	0	3
CDS	52	0.500	0.852	0.118	0	3
CIS	40	0.500	0.847	0.134	0	3
CDS + CIS	52	0.635	0.841	0.117	0	3
Total	184	0.609	0.855	0.063	0	3

Note: Maximum Transfer Score = 6.

Effects of Context-Dependency of Seductive Details on Recall and Transfer

The purpose of this analysis was to answer the research questions of this study: “What are the effects of context-dependency of seductive details on recall of procedural knowledge?”, and “what are the effects of context-dependency of seductive details on transfer of procedural knowledge?” The effects of context-dependency of seductive details on recall and transfer were examined by analyzing the main effects of context-dependent seductive details and context-independent seductive details on both recall and transfer. Two 2x2 factorial analyses of variance (ANOVAs) were conducted to analyze the main effects (see Table 7).

Table 7.

2x2 Factorial Design Table

		CDS	
		N	Y
CIS	N	G1 (control)	G2 (CDS)
	Y	G3 (CIS)	G4 (CDS + CIS)

Recall. A 2 (CIS vs. no CIS) x 2 (CDS vs. no CDS) between-groups ANOVA was conducted using the recall data. The main effects of context-dependent and context-independent seductive details on recall data were investigated. Results of the 2x2 factorial ANOVAs based on the recall data indicated that there were no significant main effects of context-dependent and context-independent seductive details on recall. Results showed that context-dependent seductive

details had no main effect on recall, $F(1, 180) = 1.044$, $p = .308$, Cohen's $d = 0.15$. Likewise, context-independent seductive details had no main effect on recall, $F(1, 180) = 0.429$, $p = .513$, Cohen's $d = 0.11$. Results also showed that there was no significant interaction effect of context-dependent and context-independent seductive details $F(1, 180) = 0.543$, $p = .462$. Table 8 summarizes the ANOVA results of recall data.

Table 8.

ANOVA Table for Recall Results

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Observed Power(a)
Corrected Model	9.028(b)	3	3.009	.721	.541	.202
Intercept	1608.579	1	1608.579	385.183	.000	1.000
CD	4.362	1	4.362	1.044	.308	.174
CI	1.791	1	1.791	.429	.513	.100
CD * CI	2.270	1	2.270	.543	.462	.114
Error	751.706	180	4.176			
Total	2375.000	184				
Corrected Total	760.734	183				

Note: $p = .05$.

Contrast analysis was conducted to answer the first research question of this study “What are the effects of context-dependency of seductive details on the recall of knowledge?” Recall mean scores of CDS and CISD groups were compared. Results indicated that there was no significant difference between recall mean scores in CDS and CISD groups. It was concluded that there was no significant effect of context-dependency of seductive details on the recall of knowledge. Table 9 below summarizes the contrast analysis results.

Table 9.

Results of Contrast Analysis

	Value of Contrast	Std. Error	T	df	Sig. (2-tailed)
Recall	.1115	.42978	.260	180	.796

Note: $p = .05$

Transfer. A 2 (CISD vs. no CISD) x 2 (CDS D vs. no CDS D) between-groups analyses of variance (ANOVAs) was conducted using the transfer data. The main effects of context-dependent and context-independent seductive details on transfer data were investigated. Results of the 2x2 factorial ANOVAs based on the transfer data indicated that there were no significant main effects of context-dependent and context-independent seductive details on transfer. Results showed that context-dependent seductive details had no main effect on transfer, $F(1, 180) = 0.564, p = .454, \text{Cohen's } d = 0.11$. Likewise, context-independent seductive details had no main effect on transfer, $F(1, 180) = 0.564, p = .454, \text{Cohen's } d = .007$. Results also showed that there was no significant interaction effect of context-dependent and context-independent seductive details $F(1,180) = 3.285, p = .072$. Table 10 summarizes the ANOVA results of transfer data.

Table 10.

ANOVA Table for Transfer Results

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Observed Power(a)
Corrected Model	2.993(b)	3	.998	1.373	.253	.361
Intercept	68.388	1	68.388	94.088	.000	1.000
CD	.410	1	.410	.564	.454	.116
CI	.410	1	.410	.564	.454	.116
CD * CI	2.388	1	2.388	3.285	.072	.438
Error	130.833	180	.727			
Total	202.000	184				
Corrected Total	133.826	183				

Note: p = .05

Contrast analysis was conducted to answer the second research question of this study “What are the effects of context-dependency of seductive details on the transfer of knowledge?” Transfer mean scores of CDS D and CISD groups were compared. Results indicated that there was no significant difference between transfer mean scores in CDS D and CISD groups. It was concluded that there was no significant effect of context-dependency of seductive details on the transfer of knowledge. Table 11 below summarizes the contrast analysis results.

Table 11.

Results of Contrast Analysis

	Value of Contrast	Std. Error	T	Df	Sig. (2-tailed)
Transfer	.0000	.17930	.000	180	1.000

Note: p = .05

Validation of Seductive Details Effect

Results were also analyzed to determine whether the results of this experiment validate the general effect of seductive details on recall and transfer. The effect of seductive details on recall and transfer were determined by using a contrast analysis comparing G1 (control group) to a combined mean of G2 (CDS), G3 (CIS), and G4 (CDS + CIS). The groups are illustrated in Table 8.

The results of contrast analysis indicated that there was no significant difference between G1 and the combined mean of G2, G3, and G4 for either recall or transfer scores. These results failed to validate the effect of seductive details on recall and transfer. Table 12 below shows the results of contrast analysis.

Table 12.

Results of Contrast Analysis

	Value of Contrast	Std. Error	T	Df	Sig. (2-tailed)
Recall	-.5712	1.09757	-.520	180	.603
Transfer	-.8404	.45789	-1.835	180	.068

Note: p = .05

Discussion

The purpose of this experiment was to examine the effect of context-dependency of seductive details on the recall and transfer in multimedia learning environments. The results of this experiment revealed that the context-dependency of seductive details had no significant effect on recall and transfer. In addition, the results of this experiment failed to validate the seductive details effect on recall and transfer.

Two important points were identified in this experiment. First, it is still too early to claim that seductive details adversely affect multimedia learning for every type of learner under any condition. This experiment failed to validate the effect of seductive details even though the material used in this experiment was adapted from the previous studies that supported the existence of the effect. Though it is contradictory to previous studies conducted by Mayer and his colleagues (e.g., Harp & Mayer, 1997, 1998), it is not the first experiment failing to validate the effect of seductive details on recall and transfer. Doolittle and Aldstaedter (2009) and Lusk (2008) also found no effect of seductive details on recall and transfer in their experiments even if they used a similar multimedia environment. These contradictory results encourage researchers to focus on the investigation of unidentified factors that might be the reason of those results. Secondly, context-dependency was not determined to be one of the unidentified factors responsible for the conflicting results. It is possible to claim that the changes in the quantity or placement of context-dependent and context-independent seductive details may affect recall and transfer. Additionally, it is possible that different types of seductive details may interact differently with individual differences that learners possess such as working memory capacity and prior knowledge of learners. Therefore, more experiments should be conducted in the future regarding the context-dependency of seductive details to gain a better understanding of the effects of context-dependency on the seductive details effect. Lastly, this study is limited within the context of lightning animation. Similar studies investigating the effects of context-dependency of seductive details on recall and transfer may provide different results.

CHAPTER FIVE: GENERAL DISCUSSION

Multimedia learning has been shown to be an effective strategy for the acquisition and transfer of knowledge in several empirical studies in literature (Mayer, 2005a). The success of multimedia learning relies on the efficient design of multimedia environments. In this context, cognitive theory of multimedia learning provides several design principles which should be considered during the design of multimedia environments. One of these principles is called the coherence principle. The coherence principle recommends that instructional designers remove any extraneous material from the multimedia environment to have better results for efficient learning (Mayer, 2005c). Extraneous materials are described as ones that are not relevant to learning goals (Mayer, 2005c). In this case, they also include the interesting yet irrelevant materials which are added to make instructional material more interesting and therefore possibly more engaging. The idea of adding interesting yet irrelevant materials to make the instructional materials more motivating is supported by the situational interest paradigm (e.g., Krapp, et al., 1992).

The studies in literature provide conflicting results for the decision of adding or removing interesting yet irrelevant materials from the multimedia environment. In order to create a common terminology, the interesting yet irrelevant materials were referred to as seductive details for the present study. The goal of this study was to explore the possibility of structural differences in seductive details in the form of context-dependency. Using this jargon, context-dependent seductive details are described as the seductive details that are identified as more interesting provided learners are familiar with the context of the topic of interest. This familiarity was created by presenting the particular multimedia material to the participants of this study in advance. On the other hand, context-independent seductive details are described as those that are identified as equally interesting by the learners who are not familiar with the context of the topic of interest. In addition to the investigation of the effects of context-dependency, this study also attempted to refine the previous studies by addressing design problems.

Two experiments were conducted in this study. The purpose of the first experiment was to identify context-dependent and context-independent seductive details in a particular multimedia environment. This experiment was the prerequisite for the second experiment which

investigated the effects of context-dependency of seductive details on recall and transfer. The first experiment also addressed the design issues presented in previous studies.

The results of the first experiment indicated that it was necessary to confirm the existence of seductive details in a multimedia environment with data collected from learners instead of identifying them based on the assumptions of the researchers and instructional designers. The results showed that only 13 of 28 sentences assumed to be seductive details in Lehman (2007) were confirmed to be seductive details by data collected from the participants of the first experiment. Of these sentences, 15 were identified as boring materials by the participants instead of interesting materials. This result pointed out that seductive details used in previous studies may not be seductive at all which was also claimed by Schraw and Lehman (2001). The results also indicated that the detrimental effect found in previous studies might be related to the existence boring material instead of seductive details which was also claimed by Silvia (2006). The findings of the first experiment were crucial for the interpretation of the results found in previous studies.

The first experiment of this study also revealed some important results about the existence of different types of seductive details used in previous studies. Out of 13 identified seductive details in this study, six were identified as context-dependent and seven were identified as context-independent. Schraw (1998) claimed that “context-dependent seductive details were more interesting in its own context partly as a result of referential coherence; moreover, context-independent seductive details were memorable because they involved sensational themes such as sex, violence, and romantic intrigue” (p. 7). Unfortunately, there was no common pattern to distinguish one type of seductive details from another in this study.

The second experiment in this study investigated the effect of context-dependency of seductive details on recall and transfer by analyzing the main effects of context-dependent seductive details and context-independent seductive details. The results show that context-dependency of seductive details had no significant effect on recall and transfer. However, the results also revealed that there was no detrimental effect of seductive details on recall and transfer.

The results of this study showed that context-dependency of seductive details included in multimedia presentations should not be a concern for instructional designers during the design of these multimedia presentations. This study clearly showed that variation in context-dependency

of seductive details will not make any significant difference on recall and transfer. Considering previous studies, context-dependency of seductive details was investigated as a potential factor of conflicting results regarding the effects of seductive details. However, this particular study indicated that investment of time and effort by instructional designers on the identification of context-dependent vs. context-independent seductive details is not necessary for the effective design of multimedia presentations.

This study has some limitations like other research studies. First of all, the topic of the multimedia presentation was lightning formation. However, other topics used in future may provide different results. Second limitation was related to the effectiveness of instruction provided by the particular multimedia presentation in this study. Based on the recall and transfer data, instruction provided by the multimedia presentation was not very effective.

The concept of interest used in this study might be approached as a characteristic of an individual. Therefore, it may change from person to person. This fact may put the identification of interesting materials in Experiment 1 into question. One may claim that whatever identified as interesting by the participants of Experiment 1 may not be interesting for the participants of Experiment 2. However, it should be noted that interest is also related to participants' background and general interests exist. Participants in both experiments of this particular study were chosen from the same pool. This fact indicated that they were coming from relatively similar background with similar individual interests. In addition, randomization is used to assign participants into experimental groups in both studies to prevent sensitivity of the results based on variation in individual interest factors. Regarding previous seductive detail studies, this study also accessed to larger sample sizes which was also an indication of less sensitivity of the results based on individual interests.

In summary, this study falls into the group which does not confirm the seductive details effect in multimedia learning. In addition, this study clearly shows that context-dependency is not a variable of interest for the conflicting results regarding seductive details effect. The results of this particular study indicate that factors other than context-dependency of seductive details might be a reason for conflicting results in literature regarding seductive details effect.

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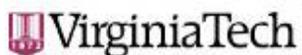
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APPENDICES

Appendix A

IRB Approval Letter



Office of Research Compliance
Institutional Review Board
2000 Kraft Drive, Suite 2000 (0497)
Blacksburg, Virginia 24061
540/231-4991 Fax 540/231-0959
e-mail moored@vt.edu
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FWA00000072 (expires 1/20/2010)
IRB # is IRB00000087

DATE: April 21, 2009

MEMORANDUM

TO: Peter E. Doolittle
Devrim Ozdemir

FROM: David M. Moore 

Approval date: 4/21/2009
Continuing Review Due Date: 4/6/2010
Expiration Date: 4/20/2010

SUBJECT: **IRB Expedited Approval:** "The Examination of the Effects of Context-Dependency of Seductive Details in Multimedia Presentations", IRB # 09-194

This memo is regarding the above-mentioned protocol. The proposed research is eligible for expedited review according to the specifications authorized by 45 CFR 46.110 and 21 CFR 56.110. As Chair of the Virginia Tech Institutional Review Board, I have granted approval to the study for a period of 12 months, effective April 21, 2009.

As an investigator of human subjects, your responsibilities include the following:

1. Report promptly proposed changes in previously approved human subject research activities to the IRB, including changes to your study forms, procedures and investigators, regardless of how minor. The proposed changes must not be initiated without IRB review and approval, except where necessary to eliminate apparent immediate hazards to the subjects.
2. Report promptly to the IRB any injuries or other unanticipated or adverse events involving risks or harms to human research subjects or others.
3. Report promptly to the IRB of the study's closing (i.e., data collecting and data analysis complete at Virginia Tech). If the study is to continue past the expiration date (listed above), investigators must submit a request for continuing review prior to the continuing review due date (listed above). It is the researcher's responsibility to obtain re-approval from the IRB before the study's expiration date.
4. If re-approval is not obtained (unless the study has been reported to the IRB as closed) prior to the expiration date, all activities involving human subjects and data analysis must cease immediately, except where necessary to eliminate apparent immediate hazards to the subjects.

Important:

If you are conducting **federally funded non-exempt research**, please send the applicable OSP/grant proposal to the IRB office, once available. OSP funds may not be released until the IRB has compared and found consistent the proposal and related IRB application.

cc: File

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Appendix B

The Text Version of the Narration of Lightning Animation Used in Experiment 1

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 C

The Interestingness Scale Used in Experiment 1

Directions: Please read each of the following sentence and rate the how interesting you find the content of the sentence (i.e., each sentence “interestingness”).							
Sentence	Very Uninteresting 1	Uninteresting 2	Somewhat Uninteresting 3	Neutral 4	Somewhat Interesting 5	Interesting 6	Very Interesting 7
1. Understanding how lightning is formed is important because approximately 150 Americans are killed by lightning every year.	0	0	0	0	0	0	0
2. Swimmers in particular are sitting ducks for lightning because water is an excellent conductor of its electrical discharge.	0	0	0	0	0	0	0
3. You may have experienced these updrafts on airplanes.	0	0	0	0	0	0	0
4. Flying through clouds with updrafts can cause the plane ride to be bumpy.	0	0	0	0	0	0	0
5. When lightning strikes the ground, the heat from the lightning melts the sand, forming fulgurites.	0	0	0	0	0	0	0
6. Fulgurites are glassy, root-like tubes shaped by the electricity’s path.	0	0	0	0	0	0	0
7. Fulgurites help scientists understand how lightning spreads	0	0	0	0	0	0	0

and acts against resistance from the soil							
8. In trying to understand these processes, sometimes scientists launch tiny rockets into overhead clouds to create lightning	O	O	O	O	O	O	O
9. 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	O	O	O	O	O	O	O
10. It pauses between steps for about 50 millionths of a second	O	O	O	O	O	O	O
11. 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.	O	O	O	O	O	O	O
12. The two leaders generally meet about 165 feet above the ground.	O	O	O	O	O	O	O
13. This type of lightning is not very bright and usually has many branches.	O	O	O	O	O	O	O
14. Understanding that lightning often strikes the	O	O	O	O	O	O	O

tallest object in the area can help reduce the number of lightning injuries.							
15. People in flat, open areas are at greater risk of being struck.	O	O	O	O	O	O	O
16. Golfers are prime targets of lightning strikes because they tend to stand in open grassy fields, or to huddle under trees.	O	O	O	O	O	O	O
17. These lightning strikes can be very dangerous.	O	O	O	O	O	O	O
18. 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.	O	O	O	O	O	O	O
19. The bolt burned this jersey, and blew his shoes off.	O	O	O	O	O	O	O
20. More than a year, the young man still won't talk about his near death experience.	O	O	O	O	O	O	O
21. This upward motion of the current is the "return stroke," and it reaches the cloud in about 70 millionths of a second.	O	O	O	O	O	O	O
22. The lightning flash usually consists of an electrical potential of	O	O	O	O	O	O	O

hundreds of millions of volts.							
23. The powerful electrical charge of the return stroke causes air along the lightning channel to be heated briefly to a very high temperature.	O	O	O	O	O	O	O
24. Such intense heating causes the air to expand explosively; producing a sound wave we call thunder.	O	O	O	O	O	O	O
25. Understanding the process of lightning is important to both scientists and the public.	O	O	O	O	O	O	O
26. Scientists need to know how lightning is created.	O	O	O	O	O	O	O
27. People in general need to understand how lightning behaves, where it strikes, and how to avoid risk.	O	O	O	O	O	O	O
28. This knowledge can help to protect the 10,000 Americans who are injured by lightning each year.	O	O	O	O	O	O	O

Appendix D

The List of Context-Dependent and Context-Independent Seductive Details

Context-dependent seductive details

1. Swimmers in particular are sitting ducks for lightning because water is an excellent conductor of its electrical discharge.
2. Flying through clouds with updrafts can cause the plane ride to be bumpy.
3. People in flat, open areas are at greater risk of being struck.
4. Golfers are prime targets of lightning strikes because they tend to stand in open grassy fields, or to huddle under trees.
5. The bolt burned this jersey, and blew his shoes off.
6. More than a year, the young man still won't talk about his near death experience.

Context-independent seductive details

1. Understanding how lightning is formed is important because approximately 150 Americans are killed by lightning every year.
2. When lightning strikes the ground, the heat from the lightning melts the sand, forming fulgurites.
3. In trying to understand these processes, sometimes scientists launch tiny rockets into overhead clouds to create lightning.
4. 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.
5. 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.
6. Such intense heating causes the air to expand explosively; producing a sound wave we call thunder.
7. This knowledge can help to protect the 10,000 Americans who are injured by lightning each year.