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REVISITING THE SEDUCTIVE DETAILS EFFECT IN MULTIMEDIA LEARNING: CONTEXT-DEPENDENCY OF SEDUCTIVE DETAILS

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The purpose of this study was to investigate the effects of context-dependency of seductive details on recall and transfer in multimedia learning environments. Seductive details were interesting yet irrelevant sentences in the instructional text. Two experiments were conducted. The purpose of Experiment 1 was to identify context-dependent and context-independent seductive details in the narration of a lightning animation. Participants (n=67) were randomly assigned to context-dependent and context-independent seductive details groups. They assigned interestingness scores to the 28 sentences which were irrelevant to the lightning formation. The results of Experiment 1 identified six context-dependent and seven context-independent seductive details in the narration of the lightning formation.

The purpose of Experiment 2 was to investigate the effects of context-dependency of seductive details on recall and transfer in multimedia learning environments. Randomly assigned participants (n=184) in four experimental groups performed recall and transfer tasks after watching the lightning animation. 2x2 ANOVAs 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 and directions for future research are suggested.

INTRODUCTION

As introduced to emerging technologies every day, new opportunities to learn from multimedia resources arise. This situation brings more attention to the effectiveness of multimedia learning. (e.g., Mayer, 1999, 2005a; Mayer, Dow, & Mayer, 2003). According to Mayer (2005a), multimedia learning occurs when learners create their knowledge through the simultaneous processing of information in different formats such as words and pictures. The effectiveness of multimedia learning depends on the design of multimedia environments as well as many other factors (Park & Hannafin, 1993; Sorden, 2005). Several design principles have been provided in the literature for effective multimedia learning environments (e.g., Clark, Nguyen, & Sweller, 2006; Mayer, 2005a).

One of these principles is called the coherence principle (Mayer, 2005b; Moreno & Mayer, 2000). The coherence principle states 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 those that are not relevant to the learning goals even if they might be interesting for learners.

Based on the literature, the results of the research studies supporting the coherence principle conflict with the assertions of 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 materials are not interesting and may not be attractive to learners, the integration of interesting materials may increase the motivation of learners, and therefore may improve learning (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 (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 (Garner et al., 1989). Therefore, these materials were called "seductive details" (Garner, Brown, Sanders, & Menke, 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 insignificant 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).

This study examines whether participants perform differently in recall and transfer tasks in response to the context-dependency of seductive details in multimedia materials.

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).

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

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 (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.

Participants

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 their 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 (CDSD and CISD) for Experiment 1. CDSD was defined as the context-dependent seductive details group and CISD was defined as the context-independent seductive details group. Out of 67 participants, 29 participants were assigned to CDSD and 38 participants were assigned to 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. There were two animations (lightning and historical inquiry) and an interestingness scale used in Experiment 1.

The lightning animation was six minutes in length and created using Adobe Flash. It was an animation with concurrent narration. The lightning formation was explained in the animation. 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. (2007) study and consisted of 50 sentences.

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 interestingness 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

were defined as interesting 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, Bove, Bryman, Mars, and Tapangco (1996). In this study, the sentences in narration which were not related to these eight steps were considered irrelevant. The interest scale included 28 items based on this criterion. The scale started with an instruction, "Please read each of the following sentences and rate 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 laptops. Each session of Experiment 1 was completed in 15 minutes. All sessions were administered by the researchers. In CDSD group, participants first watched a lightning animation and completed the interestingness scale by assigning an interestingness score to each sentence in the narration of the animation. The sentences were 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 CDSD and one in CISD).

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. 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. 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 20 multiple comparisons, the Holm-Bonferroni method was used to determine the adjusted significance level. Familywise error rate is described as the probability of one or more rejections in the collection of hypotheses which is being considered for joint testing (Lehmann & Romano, 2012). It was concluded that only 13 of the sentences in the 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 CDSD and CISD were compared using an independent samples t-test. 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 1

T-test Results between CDSD and CISD

Seductive Details	Group	M	SD	T	df	P
Understanding how lightning is formed is important because approximately 150 Americans are killed by lightning every year.	CDSD	5.25	1.11	1.61	63	.112
	CISD	4.76	1.30			
Swimmers in particular are sitting ducks for lightning because water is an excellent conductor of its electrical discharge.	CDSD	5.18	1.25	2.10	63	.040*
	CISD	4.49	1.37			
Flying through clouds with updrafts can cause the plane ride to be bumpy	CDSD	4.96	1.11	2.17	63	.034*
	CISD	4.20	1.63			
When lightning strikes the ground, the heat from the lightning melts the sand, forming fulgurites.	CDSD	5.00	1.63	.00	63	1.000
	CISD	5.00	1.49			
In trying to understand these processes, sometimes scientists launch tiny rockets into overhead clouds to create lightning.	CDSD	5.04	1.34	.71	62	.481
	CISD	4.78	1.51			
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.	CDSD	5.21	1.37	.82	63	.414
	CISD	4.92	1.48			
People in flat, open areas are at greater risk of being struck.	CDSD	5.11	1.45	2.73	63	.0088
	CISD	4.14	1.40			
Golfers are prime targets of lightning strikes because they tend to stand in open grassy welds, or to huddle ender trees.	CDSD	5.32	1.34	3.24	63	.002*
	CISD	4.14	1.55			
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.	CDSD	6.21	1.20	1.57	61	.123
	CISD	5.69	1.43			
The bolt burned his jersey and blew his shoes off.	CDSD	6.61	.63	5.20	63	.000*
	CISD	4.95	1.60			
More than a year later, the young man still won't talk about his near death experience.	CDSD	5.61	1.52	2.95	63	.004*
	CISD	4.51	1.45			
Such intense heating causes the air to expand explosively; producing a sound wave we call thunder.	CDSD	5.25	1.14	1.82	63	.074
	CISD	4.62	1.53			
This knowledge can help to protect the 10.000 Americans who are injured by lightning each year.	CDSD	5.25	1.24	1.86	62	.068
	CISD	4.61	1.46			

Note: p=.05

According to the results, six context-dependent seductive details and seven context-independent seductive details were found.

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 irrelevant 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 in the form of context-dependency. 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.

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 animations 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.

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

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 for those contradictory results.

Participants

The selection and characteristics of participants were similar to those in 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 (CDSD) group which watched an animation with CDSD. Group 3 was

designed as a context-independent seductive details group (CISD) which watched an animation with CISD. Group 4 was designed as a general seductive details (SD) group which watched an animation with both types of seductive details (CDSD + CISD).

Materials

All of the materials in this experiment were electronic and were delivered through an online web portal. There were four different types of animation, an electronic recall test, and an electronic transfer test used in Experiment 2. The visual design of the animation in all groups was the same as in Experiment 1. However, the narration was different. In the control group, the narration only included important information which was defined as information related to the eight steps of lightning formation. In the CDSD group, the narration included important information and context-dependent seductive details. In the CISD group, the narration included important information and context-independent seductive details. In the CDSD + CISD group, the narration included important information and both types of seductive details.

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 laptops. Experiment 2 was completed in 25 minutes. All sessions were administered by the researchers. At the beginning, participants watched a different ver-

sion of lightning formation animation depending on the group to which they were assigned. After watching the animation, the participants completed the recall task (5 minutes) and the transfer task (10 minutes).

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, Heiser, & Lonn, 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 2 shows the descriptive statistics of recall scores among groups.

Table 2
Descriptive Statistics of Recall Scores

Groups	N	Mean	SD	SE	Minimum	Maximum
Control	40	3.13	1.74	0.28	0	6
CDSD	52	3.04	1.95	0.27	0	7
CISD	40	3.15	2.49	0.39	0	8
CDSD + CISD	52	2.62	1.97	0.27	0	7
Total	184	2.96	2.04	0.15	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 3 shows the descriptive statistics of transfer scores among groups.

Table 3
Descriptive Statistics of Transfer Scores

Groups	N	Mean	SD	SE	Minimum	Maximum
Control	40	0.825	0.874	0.138	0	3
CDSD	52	0.500	0.852	0.118	0	3
CISD	40	0.500	0.847	0.134	0	3
CDSD + CISD	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 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 4).

Table 4
2x2 Factorial Design Table

		CDSD	
		No	Yes
CISD	No	Group 1 (control)	Group 2 (CDSD)
	Yes	Group 3 (CISD)	Group 4 (CDSD + CISD)

A 2 (CISD vs. no CISD) x 2 (CDSD vs. no CDSD) between-groups ANOVA was conducted using both the recall and transfer data. The main effects of context-dependent and context-independent seductive details on recall data and transfer data were investigated. Results of the 2x2 factorial ANOVAs based on the recall and transfer data indicated that there were no significant main effects of context-dependent and context-independent seductive details both on recall and transfer. 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 showed that there was no significant interaction effect of context-dependent and context-independent seductive details $F(1, 180) = 0.543$, $p = .462$. Results also showed that context-dependent seductive details had no main effect on transfer, $F(1, 180) = 0.564$, $p = .454$, Cohen's $d = 0.11$. Likewise, context-independent seductive details had no main effect on transfer, $F(1, 180) = 0.564$, $p = .454$, Cohen's $d = .007$. According to the results, 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.

Contrast analysis was conducted to investigate the effects of context-dependency of seductive details on the recall and transfer of knowledge. Recall mean scores of CDSD and CISD groups were compared. Results indicated that there was no significant difference in recall and transfer mean scores between CDSD and CISD groups. It was concluded that there was no significant effect of context-dependency of seductive details on the recall and transfer of knowledge.

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 (CDSD), G3 (CISD), and G4 (CDSD + CISD). 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 5
Results of Contrast Analyses

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

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 after empirically validating the seductiveness of the interesting yet irrelevant details. 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.

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) also found no effect of seductive details on recall and transfer in their experiments even if they used a similar multimedia environment. In a recent study, Rey (2011) also found seductive details effect on recall but not transfer.

Based on our literature review, our study was the first study which empirically identified the seductive details and focused on an important attribute of seductive details: context-dependency. According to the results of the Experiment 1, 15 out of 28 sentences which were thought to be seductive details in the previous studies were eliminated from Experiment 2 in this study. They were considered to be boring rather than seductive. Context-dependency of these seductive details were also validated for the first time with empirical data. Therefore, this study indicated that there was no significant effect of the context-dependency of seductive details on recall and transfer of learning. Regardless of learners' familiarity with the context of provided seductive details, these details did not affect their recall and transfer of learning. In addition, this study failed to confirm the overall seductive details effect. In our experimental group which received more than one third of the instructional material as seductive details, their recall and transfer of learning was not significantly different from those who did not receive any seductive details in their instructions. This means for those previous studies in the literature which found seductive details effect on recall

and transfer of learning, the identified detrimental effect may be due to the overall amount of extraneous materials included into the instructions rather than the seductiveness of these materials. Therefore, this study cautions future researchers to empirically validate the seductiveness of details provided in the experiments before investigating the effects of seductive details.

CONCLUSIONS

This study investigated the effects of the context-dependency of seductive details on recall and transfer during multimedia learning. The previous studies in the literature demonstrated conflicting results. In the first group of studies which focused on "seductive details" demonstrated the detrimental effects of seductive details on learning. Second group of studies supporting the "situational interest" paradigm argued that interesting materials could improve learning. The context-dependency of seductive details was investigated as a potential factor which may influence the effects of seductive details on learning. This study purposefully utilized the research tools and strategies which were used in previous studies focusing on "seductive details". There were three important findings.

First, this study failed to confirm some of the interestingness of previously identified seductive details based on the empirical results in Experiment 1. In fact, more than half of the materials claimed to be interesting by previous studies were not identified significantly interesting by our participants. This finding resulted with including significantly less number of seductive details in the next experiment comparing with the previous studies. This finding is important for future researchers that they may consider validating the interestingness of their materials based on empirical data before conducting the research on seductive details. It may also explain that the negative effects found on learning regarding seductive details may be due to amount of extraneous materials rather than the seductiveness of the materials which is in line with the coherence principle (Mayer, 2005c).

Second, the results of this study showed that context-dependency of seductive details had no significant positive or negative effect on recall and transfer. This result was significant to understand the effects of context-dependency of seductive details during the learning of scientific information through multimedia animations. Schraw (1998) found that context-dependent seductive details in a textual information took longer time to read than context-independent seductive details, yet, both types of seductive details were recalled equally. Schraw (1998) concluded that context-dependen-

cy did not affect the recall of overall story and main ideas. Unlike reading where learner can control his or her own pace to focus on the important information, this study investigated if context-dependency of seductive details could affect the recall and transfer of important information from multimedia animations in which the pace of the presentation of the materials cannot be controlled by the learner. Our results showed that there were no significant difference which may indicate that the differences in the cognitive processing of context-dependent and context-independent seductive details did not interfere with the recall and transfer of learning. This result shows that context-dependency attribute of seductive details may not be the factor causing the impact on learning in previous seductive detail studies in which researchers used multimedia animations.

Third, the results also revealed that there was neither positive nor detrimental effects of seductive details on recall and transfer. Therefore, the results of this study do not support the detrimental effects of seductive details on learning. However, it also fails to support the positive effects of interesting yet irrelevant materials on learning. This study falls into the third category that demonstrates the interesting yet irrelevant materials neither seduce nor improve student learning. So far, there is only one other study found in the literature which fail to demonstrate seductive details effect (e.g., Doolittle & Altstaedter, 2009). Among other seductive details studies, perhaps, this is the first study which validates the interestingness of the details with empirical data before investigating the effects of the so-called seductive details on learning. This finding that there is no significant effect of interesting yet irrelevant materials on learning is particularly important considering the amount of time and energy invested by the instructors and multimedia developers during the development of these interesting materials in multimedia presentations.

In addition to the significant results of this study, it is important to keep in mind that this study has some limitations like other research studies. This study investigated the context-dependency of seductive details in a particular topic: lightning formation. Therefore, it is possible that other topics used in future may provide different results. The concept of interest used in this study might be approached as a characteristic of an individual rather than situational. Therefore, it may change from person to person. In order to minimize the differences in individual interests, participants in both experiments of this study were chosen from the same participant pool. It is also possible to experience different effects of context-dependency of seductive details when the number of context-dependent and context-independent seductive details increase.

Secondly, context-dependency was not 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. Park, Moreno, Seufert, & Brünken (2011) demonstrated that the modality of the seductive details (on-screen vs. narration) may change the effects of seductive details. 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.

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