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Example Postings' Effects on Online Discussion and Cognitive Load

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EXAMPLE POSTINGS’ EFFECTS ON ONLINE DISCUSSION AND COGNITIVE LOAD

BY

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ABSTRACT

This study investigated the effects of example-postings on students’ cognitive load and performance in online discussions. Cognitive overload was assumed as the cause of the lack of reflective and thoughtful contributions in student discussions. The design of example-postings was based on cognitive load theory and principles. The goal of using these examples was to reduce cognitive load and therefore to improve student performance in online discussions, which demonstrates thoughtfulness, reflection, and knowledge construction. The example-postings used in this study demonstrated the proper ways to follow the abstract discussion rubric and illustrated the abstract requirements in the context of the content that was familiar to students. In order to foster understanding and transfer, these examples were accompanied by explanations on how the requirements stated in the rubric were met. This study examined whether the use of example-postings had reduced cognitive load and improved performance, whether the effects sustained when the examples were removed, and the relationship between the changes in cognitive load and the improvement in discussion performance.

In order to examine the effects of example-postings, I used a 2X2 cross-over experimental design, where two groups of participants got two treatments (instruction with example-postings and instruction without example-postings) but in different order. Fifty-eight undergraduate students enrolled in an online course of New Communication Technology in a large public university in the United States participated in this study. They were randomly assigned into two groups. Group 1 was provided with a discussion instruction that had no examples in discussion 1 and was provided with a discussion instruction that had examples in discussion 2 (Treatment B-A). As the same time, Group 2 was provided with the same treatment conditions but in reversed order (Treatment A-B). This type of design enabled the investigation of the within-subject difference, which would reduce the variance due to the differences between the subjects and therefore would reveal a possible larger effect size. Secondly, the cross-over design allowed for the comparison of the treatment condition to the after-treatment condition (Treatment B condition in Treatment A-B group), which would reveal whether the use of example-postings could foster skill transfer (schema acquisition and automation).

The results showed that the online discussion instructions imposed medium level cognitive load on the students and the use of example-postings did not affect it. However,
compared to the no-example condition, students’ performance in the discussions was improved in the example conditions (when the example-postings were provided) and the after-treatment condition (when the example-postings were removed). These findings indicated that: (1) With the increasingly broadly use of online discussions, students were more experienced with this instructional activity therefore cognitive overload was less likely a problem; (2) With the aid of example-postings, the students were able to construct more thoughtful and reflective online discussion postings without investing more cognitive load; (3) The students were able to transfer the skills they learned from the example-postings to new discussion tasks.

Results of this study are discussed in terms of the proposed research questions and alternative explanations (other than the cognitive load theory approach). Finally, implications and limitations of the study are also presented.
CHAPTER 1

INTRODUCTION

Context of Study

Online discussion is a popular instructional method in online, blended, and face-to-face courses. It is described as a text-based online activity that allows students to interact with one another without the constraints of time and place (Hew, Cheung, & Ng, 2010). Online discussion provides a primary means for students to exchange ideas, share perspectives, and clarify understandings (Dunlap, 2005) outside the classrooms. A unique benefit of online discussion is that it provides increased opportunities for reflection because the contributors have time to think over the topics being discussed and the ideas posted by others and to compose their own contributions (Garrison, Anderson, & Archer, 2001; Goodyear, 2001). Besides, Sautter (2007) points out that the opportunities to question and exchange ideas in writing in online discussions hold particular promise in advancing students’ higher-order thinking skills. Furthermore, the ability for students to express their ideas without interruption in asynchronous communication is considered to be able to foster reflection and self-consciousness (Hara, Bonk, & Angeli, 2000). It is not surprising that online discussion has been anticipated to help students to synthesize and evaluate materials from multiple perspectives and develop critical thinking (Hara, et al., 2000; Wu & Hiltz, 2004) in a way not possible before.

Despite the promise of using online discussions, a lack of thoughtfulness and reflection in online discussion has been reported in many studies. For example, in a study conducted by Gunawardena, Lowe, and Anderson (1997), practicing specialists and advanced students in the field of distance education discussed controversial issues of the role and importance of interaction in effective teaching and learning. Although the goal was to co-create knowledge, about 93% (191 out of 206) of the posted messages indicated the sharing and comparing of knowledge with no deep-level processing. Sing and Khine (2006) also reported that when pre-service teachers were prompted to develop lesson plans, provide feedback on each other’s ideas, and make reflections and improvements, they were sharing and comparing information, seeking verification and identifying disagreement in 80% of their postings. Participants in Schellens and Vackle’s (2005) study were undergraduate students. They worked on solutions to real-life
authentic cases and commented on peers’ work via an online discussion board. Less than 3% of
t heir postings indicated high-level efforts of constructing or testing of new knowledge. These
studies revealed that the lack of deep-level processing of information has been a frequently
observed problem in online discussions. As a result, there is a strong call for instructional
structures that intend to foster higher levels of cognitive thinking (Garrison & Cleveland-Innes,
2005).

In response to this call, many researchers have proposed different instructional strategies
to improve the quality of online discussion. For example, Anderson, Rourke, Garrison, and
Archer (2001) recommended that instructors select topics that were suitable for discussion and
establish clear expectations. Similarly, Black (2005) suggested that students should be provided
with guidelines, checklists, or rubrics regarding acceptable responses. By analyzing the survey
results and students’ contributions in several online discussions, Sautter (2007) concluded that
setting specific rules for engagement was essential in building critical thinking skills and higher-
order learning in students. The online discussion rules in her study stated that the students’
contributions to the discussion must be task/content oriented and require students to actively
listen/read the contributions of other students. Hara et al. (2000) found that the development of
interaction in online discussion was highly dependent on the directions the students have been
provided (how the students were directed to do). Therefore, they recommended presenting a
template or a sample posting to stimulate ideas, help the students to be aware of prototypical
examples of extended and modest interactions. In the study conducted by Tollison (2009), the
use of worked-examples in online discussion instruction improved students’ perception of the
effectiveness of online discussion. Klisc, McGill, & Hobbs (2009) investigated the use of
assessment in online discussions. Online instructors reported that the students had exhibited
more thoughts about the discussion topics, deeper depth of thinking, critical analysis and
reflection, and broader awareness of different perspectives when the students were notified that
their online discussion postings would be assessed.

**Problem Statement**

Little research in current literature has approached the problem of lack of reflective and
thoughtful contributions in online discussion from the cognitive load perspectives. Cognitive
load theory (CLT; Chandler & Sweller, 1991; Paas, Renkl, & Sweller, 2003 & 2004; Sweller,
1988; Sweller, van Merrienboer, & Paas, 1998) suggests that in order for learning to occur, instructions should be designed in ways that limit the cognitive load posted on learners to the extent of human capacity. Besides, the use of knowledge stored in long-term memory can expand human’s cognitive capacity. The conventional online discussion instruction, which consists of a discussion topic, a rubric that specifies the participation rules and the quality of an acceptable response, fails to consider the cognitive load aspect and generates heavy cognitive load on discussants. Consequently, the heavy cognitive load associated with conventional online discussion instructions may hinder students’ understanding of the requirements by taking too much of the discussants’ cognitive capacity and the students fail to demonstrate reflection and knowledge construction in their discussions as required by the instructions.

In order for the students to demonstrate thoughtfulness and reflection in online discussions, they must understand the discussion instruction (including the discussion tasks and the participation rubrics) and develop ways to fulfill the tasks. This is a complex task that posts heavy cognitive load on the discussants. This load emanates from multiple sources: the effort of understanding the discussion tasks and the requirements of the rubric, the search for appropriate steps to fulfill the task (constructing a posting that aligns with the rubric), and the effort to handle multiple information at the same time. For example, the rubric of participation of an online discussion may state that the students are expected to make thoughtful observation about the content and engage in critical reflection on own and others’ ideas. Here, the purpose of the rubric is to request the students to carefully read the postings in online discussion, analyze the ideas being stated in these postings by identifying similarities and conflicts, and make judgments on how well these ideas are supported or weakened by the evidences provided. But because the rubric is stated in such an abstract way, the students may not be able to understand its meaning, cannot figure out the ways to follow it, or cannot make efforts accordingly. As a result, students may post superficial postings that don’t satisfy the requirements of the rubric.

A Solution to the Problem

In order to reduce the cognitive load of the online discussion instruction and hopefully to improve student performance consequently, I propose to provide example-postings as a part of the discussion instruction. This is based on the research findings on the effects of worked-examples (Cooper & Sweller, 1987, Paas, 1992, Paas & van Merrienboer, 1994, Tuovinen &
Sweller (1999). Research indicates that when a learner is provided with worked-examples, his/her attention is directed to the problem states and useful solution steps (van Merrienboer & Sweller, 2005), which will reduce cognitive load and enhance quality of information processing. Worked-examples in online discussion instructions (they are referred to as example-postings in this study) demonstrate proper ways to follow the abstract discussion rubric to construct contributions in the online discussion and are provided as part of the discussion instructions. In order to foster understanding and transfer, these examples are accompanied by explanations on how the requirements stated in the rubric are met. Some self-explanatory requirements in the rubric, such as how many times to post, are illustrated in the example-postings.

The rationale for the use of example-postings is that in online discussion, when provided with these examples, the learners will experience less cognitive load because the abstract rubric requirements are demonstrated in the context of the discussion content and the useful steps to fulfill the task are illustrated as well. Consequently, they will be able to better understand the instruction, which may lead to better performance in the discussions.

**Purpose Statement and Research Questions**

The purpose of this study was to test whether the use of worked-examples in online discussions could reduce the cognitive load of the discussion tasks and could improve the students’ performance in the discussions. The students’ performance in online discussion is a measure of how well the students have followed the discussion rubric that requires thoughtfulness, reflection, and knowledge construction.

The research questions are:

1. Do the students experience less cognitive load of the discussion instructions when they are provided with example-postings compared to when they are not provided with example-postings?
2. Does the students’ performance in online discussion improve when the students are provided with example-postings compared to when they are not provided with example-postings?
3. Does the improvement of the performance in online discussion relate to the change in the cognitive load of the discussion task?
4. Do the effects of the example-postings (change in cognitive load and improvement in performance) sustain when the examples are removed?

**Hypotheses**

The hypotheses regarding the research questions are based on the logic illustrated in figure 1.1.

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Conventional (No Examples)</th>
<th>With Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cognitive load</td>
<td>Impose heavy cognitive load on learners</td>
<td>Reduce cognitive load</td>
</tr>
<tr>
<td>Cognitive capacity available for processing the content</td>
<td>Limited</td>
<td>More</td>
</tr>
<tr>
<td>Understanding of the requirements</td>
<td>Limited</td>
<td>Better</td>
</tr>
<tr>
<td>Performance in discussion</td>
<td>Cursive and superficial</td>
<td>Thoughtful and reflective</td>
</tr>
</tbody>
</table>

*Figure 1.1. Logic model for research hypotheses corresponding to study design*

In specific, the hypotheses are:

A. The students will report lower cognitive load when they are provided with the instruction that includes the discussion topic, participation rubric, and example-postings compared to when they are provided only with the discussion topic and participation rubric (conventional instruction). This is expected because the examples illustrate the abstract discussion rubric in the context of the discussion tasks, and demonstrate proper ways to follow the rubric and participate in the online discussion. As a result, the students should need less
cognitive resources to understand the instruction or to search for appropriate approaches to fulfill the task, which should result in lower cognitive load.

B. Students’ performance in online discussions will be improved when the students are provided with example-postings compared to when they are not provided with examples. This is expected because the discussion tasks should impose less cognitive load with the aids of the example-postings and therefore the learners will be able to better understand the instructions, which may lead to better performance in the discussions.

C. The improvement of the performance of online discussion is expected to be positively related to the decrease of the cognitive load. This is expected because the less the cognitive load the discussion instructions impose on the students, the more cognitive capacity is available for processing the contents, and as a result, the better understanding of the instructions, and therefore better performance of the online discussants.

D. The effects of the example-postings, reduction in cognitive load and improvement in performance, are expected to sustain when the examples are removed. This is expected because the example-postings are to help the students to better understand the abstract rubric with less cognitive load. Once the students thoroughly understand the rubric, and when there is working memory capacity available, they should be able to develop new schemas in their long-term memory. Consequently, the students should be able to apply the skills (new schemas) in new tasks.

Significance of the Study

This study makes several important contributions to the field of instructional design. First, this study applies CLT in the field of online instruction. Although CLT has been very influential in the last decades in providing guidelines for instructional design, few studies in the literature have tried to apply this framework in online instruction. With the increasing concerns about the information overload in online learning, the principles of CLT seem quite pertinent in online situations. The failure of the students to perform satisfactorily in online learning may be due to the heavy cognitive load of the online instruction and relevant activities. This study is an effort of investigating the cognitive load of online learners and developing remediate interventions.
Secondly, this study attempts for a solution to effective online discussion by focusing on cognitive load and the use of the CLT-based instruction. Many researchers have used various approaches for the goal of engaging online students in meaningful interactions and there is no consensus on what approach can make substantial contribution. In this study, the heavy cognitive load and improper design are identified to be the causes for the unsatisfactory performance of the students in online discussions. The investigation of the cognitive load of the online discussion instructions and the effects of the proposed load-reducing strategy may generate new aspects on how to effectively design online discussions.

Thirdly, this study extends the concept of worked-example to online discussion domain. The example-postings are developed in accordance with the design principles of worked-examples to illustrate proper ways to follow the abstract discussion rubric to construct contributions in online discussions. The example-postings, however, are different from worked-examples in some ways. For instance, a worked-example provides learners with step-by-step instructions that the learners can replicate in transfer tasks, whereas an example-posting shows how requirements of the rubric may be met in one context but there are no steps specified. The example-postings are to help the students understand the abstract rubric but not to prescribe a solution to the discussion task. To the extent that example posting guides learners to “solve” potential problems with the quality of their discussion and to provide the “correct” discussion points, it functions very similarly to a worked example. This study enriches the instances of worked-example and expands its application to fields other than math or science.

Fourth, this study uses a 2X2 cross-over experimental design to remove the between-subject variance and therefore may reveal a larger effect-size of the treatment, as well as to investigate the sustainability of the effect. Contrary to a control-treatment study, the cross-over design enables the researcher to examine the within-subject effects rather than between-subject effects. Also the cross-over design may generate data on carry-over effects. The carry-over effects may show whether the treatment effects sustain when the treatment is removed. This may convey information on whether the students learn from the example-postings (construct new schema in long-term memory) with only one-time exposure. The absence of the carry-over effect may indicate the need for repeated treatments or failure of the treatment.

In summary, this study contributes to the field of instructional design by (1) utilizing CLT in online situations, (2) developing a strategy of engaging online learners in meaningful and
thoughtful interactions, (3) expand the use of worked-example into online situations, and (4) investigating both the treatment effects and transfer effects.
CHAPTER 2

LITERATURE REVIEW

Chapter Overview

This chapter provides literature review for this study. Figure 2.1 illustrates sections and rationales for the inclusion of these sections in the literature review. This chapter aims to provide information on the following topics:

(1) The online discussion strategies that have been reported in the literature;

The term of “online discussion strategy” refers to all type of online discussion interventions that have been reported in the literature, which includes “online discussion instructions” that is of interest in this study.

(2) The effects of online discussion strategies that are reported in existing studies;

(3) Theoretical frameworks used to develop the online discussion strategies in existing studies;

(4) Cognitive load theory and its principles on instructional design;

(5) The use of cognitive load principles to improve online discussion instructions;

(6) Worked-example effect;

(7) The use of example-postings to improve student performance in online discussion;

(8) Possible effect size (the use of example-postings on cognitive load).
The Online Discussion Strategies Reported in the Literature

Many strategies have been developed to facilitate discussion and learning in online discussions. A conventional online discussion provides discussants with discussion task prompts and allows them to reply to any of the existing postings in current threads or create a new discussion thread. The postings are time-stamped and sequenced under each thread. An online discussion strategy refers to the activities, protocols, or tools designed for online discussion, in addition to the features embedded in a conventional online discussion. An online discussion strategy may provide specially designed discussion task (Jorczak & Bart, 2009), resources (Choi, Land, & Turgeon, 2005), more features of the discussion board (Jin, Darabi, & Cornille, 2009), or rubrics on how to participate in the discussion (Makitalo, Weinberger, Hakkinen, Jarvela, &
In this section, I reviewed the online discussion strategies that had been implemented in previous studies and reported in the literature. The online discussion strategies presented in these studies were grouped into seven categories:

1. providing guidance to students,
2. imposing restraints on student activity,
3. instructor/facilitator’s effect,
4. peers’ effect,
5. characteristics of the discussion task,
6. notifying consequence, and
7. technical feature of the discussion board.

I reviewed the online discussion strategies in each of the seven categories and presented the findings of these studies in terms of how the strategies have impacted the quality of discussion and the learning outcomes. I included only the studies that report both online discussion strategy and its impacts on discussion and/or learning. Please refer to Table 2.1 for the list of studies reviewed in this section.
<table>
<thead>
<tr>
<th>Study</th>
<th>Treatment</th>
<th>Measurement Method</th>
<th>Outcome</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bai2009</td>
<td>inquiry model</td>
<td>content analysis</td>
<td>discussion quality</td>
<td>positive</td>
</tr>
<tr>
<td>Brewer&amp;Klein 2006</td>
<td>positive independence-role</td>
<td>posttest</td>
<td>learning</td>
<td>no effect</td>
</tr>
<tr>
<td>Brewer&amp;Klein 2006</td>
<td>rewards</td>
<td>posttest</td>
<td>learning</td>
<td>no effect</td>
</tr>
<tr>
<td>Buder&amp;Bodemer 2008</td>
<td>group awareness tool</td>
<td>project quality</td>
<td>learning</td>
<td>positive</td>
</tr>
<tr>
<td>Buder&amp;Bodemer 2008</td>
<td>group awareness tool</td>
<td>content analysis</td>
<td>discussion quality</td>
<td>positive</td>
</tr>
<tr>
<td>Chang2005</td>
<td>facilitator</td>
<td>content analysis</td>
<td>discussion quality</td>
<td>no effect</td>
</tr>
<tr>
<td>Chanlin etal.2009</td>
<td>labeling postings with an ID</td>
<td>content analysis</td>
<td>discussion quality</td>
<td>positive</td>
</tr>
<tr>
<td>Chen 2005</td>
<td>structured threading</td>
<td>posttest</td>
<td>learning</td>
<td>no effect</td>
</tr>
<tr>
<td>Cho&amp;Jonassen 2002</td>
<td>constrain-based argumentation</td>
<td>content analysis</td>
<td>discussion</td>
<td>positive</td>
</tr>
<tr>
<td>Cho&amp;Jonassen 2002</td>
<td>constrain-based argumentation</td>
<td>problem solving task</td>
<td>learning</td>
<td>no effect</td>
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<tr>
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<td>posttest</td>
<td>learning</td>
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<td>Choi etal. 2005</td>
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</tr>
<tr>
<td>Choi etal. 2007</td>
<td>instructor modeling</td>
<td>content analysis</td>
<td>discussion quality</td>
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</tr>
<tr>
<td>Chung 1999</td>
<td>cognitive supporting tools</td>
<td>final project</td>
<td>project score</td>
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<td>cognitive supporting tools</td>
<td>content analysis</td>
<td>discussion quality</td>
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</tr>
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<td>Ertmer etal. 2007</td>
<td>peer feedback</td>
<td>posttest</td>
<td>learning</td>
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<td>peer feedback</td>
<td>content analysis</td>
<td>discussion quality</td>
<td>no effect</td>
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<td>Gao &amp; Putnam 2009</td>
<td>embedding questions in text</td>
<td>content analysis</td>
<td>discussion quality</td>
<td>mixed</td>
</tr>
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<td>Gerber et al 2005</td>
<td>higher order topic level</td>
<td>content analysis</td>
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</tr>
<tr>
<td>Gilbert &amp; Dabbagh 2005</td>
<td>tips &amp; pacing and frequency of posting</td>
<td>content analysis</td>
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<td>Gilbert &amp; Dabbagh 2005</td>
<td>evaluation rubrics</td>
<td>content analysis</td>
<td>discussion quality</td>
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Table 2.1 (Continued)

Studies reviewed, online discussion strategies reported, outcomes measured, and results

<table>
<thead>
<tr>
<th>Study</th>
<th>Treatment</th>
<th>Measurement Method</th>
<th>Outcome</th>
<th>Results</th>
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<tr>
<td>Janssen et al 2007</td>
<td>providing visualization of group agreement message restraints labels</td>
<td>group performance content analysis</td>
<td>learning</td>
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<td>Jeong &amp; Joung 2007</td>
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<td>content analysis</td>
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<td>Jorczak &amp; Bart 2009</td>
<td>openness of the task question prompts</td>
<td>content analysis</td>
<td>discussion quality</td>
<td>no effect</td>
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<td>Ke &amp; Xie 2009</td>
<td>experienced learner modeling</td>
<td>content analysis</td>
<td>discussion quality</td>
<td>no effect</td>
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<tr>
<td>Lai 2006</td>
<td>instructor as participant providing prompting questions</td>
<td>post-test</td>
<td>learning</td>
<td>positive</td>
</tr>
<tr>
<td>Lai &amp; Law 2006</td>
<td>providing questions structured argumentation</td>
<td>content analysis</td>
<td>discussion quality</td>
<td>negative</td>
</tr>
<tr>
<td>Lu &amp; Jeng 2006</td>
<td>project management tool providing questions</td>
<td>test</td>
<td>learning</td>
<td>no effect</td>
</tr>
<tr>
<td>Makital et al. 2005</td>
<td>scaffold-message label and sentence opener positive role interdependence</td>
<td>content analysis</td>
<td>discussion quality</td>
<td>no effect</td>
</tr>
<tr>
<td>Moore &amp; Marra 2005</td>
<td>providing questions</td>
<td>test</td>
<td>learning</td>
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</tr>
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<td>Ng et al. 2010</td>
<td>providing questions</td>
<td>content analysis</td>
<td>discussion quality</td>
<td>mixed</td>
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<td>Raybon 2004</td>
<td>positive role interdependence project management tool</td>
<td>end-of-semester product</td>
<td>learning</td>
<td>no effect</td>
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<td>van Rooij 2009</td>
<td>providing questions</td>
<td>content analysis</td>
<td>discussion quality</td>
<td>positive</td>
</tr>
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<td>Suh 2005</td>
<td>providing questions</td>
<td>survey</td>
<td>learning</td>
<td>mixed</td>
</tr>
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<td>Sutherland et al. 2010</td>
<td>providing questions</td>
<td>content analysis</td>
<td>discussion quality</td>
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<tr>
<td>Tollison 2009</td>
<td>providing questions</td>
<td>content analysis</td>
<td>discussion quality</td>
<td>positive</td>
</tr>
<tr>
<td>Valcke et al. 2009</td>
<td>providing questions</td>
<td>content analysis</td>
<td>discussion quality</td>
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</tbody>
</table>

Providing Guidance to Students

Providing guidance to students in online discussions refers to the provision of additional information, resources, or requirements on how students are expected to behave in online
discussion. For example, some studies (e.g., Lai, 2006 (dissertation); Makitalo, et al., 2005; Suh, 2005 (dissertation)) provided prompting questions to students to direct students toward reflection and problem solving. Lai reported no difference in the quality of student discussion in the treatment and control groups. Prompting questions were provided to students in Makitalo et al. (2005) study to help them to identify the relevant information and clues on how to solve the given problem. The students indicated better learning outcome with the aid of these questions. Tollison (2009) provided students with worked-examples in the online discussion instruction, and found that students felt better learning in the discussions. Suh (2005) however, reported negative impact of the use of questioning in online discussion. Based on the same theoretical approach of using questions to help student learning, Choi et al. (2005) provided students with guidance on how to ask effective questions aiming at eliciting meaningful peer interaction and found that there was no effect of the peer-questioning tool on learning or quality of questions the students generated.

Other than the questioning approach, some studies provided students with additional knowledge resources. Bai (2009) provided students with the critical inquiry model suggested by Garrison et al. (2001). As a result, more instances of integration and less instances of information sharing were observed in treatment condition than in non-treatment condition (i.e., better quality of discussion). Chung (1999) provided students with a step-by-step direction on how to work on their projects, which were the topic for online discussion. No better quality of online discussion was found while better scores on final group projects were observed as a consequence of providing these directions. Gilbert and Dabbagh (2005) provided students with tips for successful online discourse and instructions on the frequency and pacing for contributing to online discussion but ended up with fewer instances on making inferences and more instances on citing other resources and sharing and clarifying information compared to the control condition, which indicated the decrease in the quality of online discussion.

A third type of guidance is to provide students with special tools. Van Rooij (2009) provided students with project management tool and they found that students did better in their class projects. Buder and Bodemer (2008) and Janssen, Erkens, and Kanselaar (2007) provided students with group consensus awareness tools. The former group found that the students performed better in the discussion and achieved better learning compared to control group and
the latter reported two out of the five groups performed better but other three groups showed no difference compared to those in the controlled condition.

**Imposing Restraints on Student Activity**

Many studies investigate the use of restraints in online discussion. Students in Valcke, de Wever, Zhu, and Deed (2009) study were requested to label their postings with one of the Bloom’s six learning outcome categories. The students showed more instances of synthesis and evaluation in discussion compared to those who did not label their postings. Similarly, Sutherland, Howard, and Markauskaite (2010) requests students to use one of the four types of reflective labels for each of their discussion postings and the students exhibited more cognitive engagement in the discussion compared to their counterparts. Ng, Cheung, and Hew (2010) provided students with three types of labels and multiple options of sentence openers in each type of labels. The content analysis of the discussion transcriptions did not reveal any difference in terms of students’ problem-solving processes. Chen (2005) requested students to contribute to specific issues or topics under certain threads while the control group might post any type of message at any place of their choice. The students did not show any difference in their post-test scores. Jeong and Joung (2007) compared students who used labels in their postings with those who did not. They found that students were less likely to challenge others or respond to others’ challenges when they were to label their postings.

Another group of restrained online discussion strategy is based on Toulmin (1958)’s argumentation model. Cho and Jonassen (2002) requested students to post one of the five types of messages in online discussion: claim, ground, warrant, backing, and rebuttal. The students using the restraints provided increase claims about how to solve the problem and backed them up with more grounds and produced more problem-solving communication than the students who did not use restraints. Moore and Marra (2005) requested students to construct one of the four types of message: thesis, evidence, assumption, and synthesis. They found that the students posted fewer knowledge construction messages than when they were not required to use the constraints. Jeong and Joung (2007) designed five types of constraints for online discussants: argument, evidence, critique, explanation, and others. They compared the quality of the postings of students in the constrained-group and the no-treatment group and no difference was found.
Instructor/Facilitator’s Role

Four studies investigated the effect of different roles an instructor/facilitator might play in online discussion and the influence on student learning. Chang (2005) investigated the effect of employing online facilitator in online discussion. The result was discouraging. No significant difference in cognitive restructuring and learning achievement was found. Choi, Land, and Turgeon (2007) investigated the effect of instructor modeling of effective questioning skills in online discussion. The results showed that the proportion and number of perspective question (higher level) generated by the treatment group was higher than those generated by the control group, which indicated better quality of discussion for the students observing instructor modeling. In Gerber, Scott, Clements, and Sarama (2005) study, instructor challenged the students’ proposition, asked the students to defend their position, and pointed out disagreements and conflicts in their evidence or opinion. The results indicated that student posted more referenced and reasoning messages compared to those in the control group. In Lu and Jeng (2006) study, instructor as both facilitator and co-participant positively affected the new knowledge construction of the group compared to the discussion in which the instructor acted as a facilitator only.

Peers’ Effect

Two studies investigated peers’ effect on student learning in online discussion. Peers’ effect here in this context referred to the impacts on the students that were originated from their peers’ actions toward their online discussion activities, such as commenting on their ideas or grading their contributions. (This was not the peer-effects, which was understood as social interactions among peers). Ertmer et al. (2007) examined the impact of receiving peer feedback. The quality of discussion postings and the scores on posttest were maintained through the use of the peer feedback. In Lai and Law (2005) study, the discussions in the novice class changed from information-centered toward meaning negotiation when the novice learners were joined with experienced learners in online discussion. The novice learners started to link with one other’s notes but they did not seem to learn to ask more questions as experienced learners did.

Characteristics of Discussion Tasks

The discussion task has been regarded as one of the factors that affect the quality of online discussion (Veerman & Veldhuis-Diermanse, 2006). A specially designed discussion task in Jorczak and Bart (2009) study was highly contextual and stated clear specification for a final
group product. The results showed that there was no difference in the levels of information processing in the postings or the quality of group projects. Gerber et al. (2005) provided treatment group with higher order task and control group with lower order task. The results showed that lower order task was associated with greater proportion of reasoned postings. The researcher concluded that the abstractness of the higher order task might have hindered student learning. Ke and Xie (2009) compared student learning engagement across three types of discussion tasks: close ended, open ended, and integrated (close and open ended). The results indicated that student engagement in close ended discussion was significantly lower than in open ended and integrated discussion.

Gao and Putnam (2009)’s study investigated the effect of embedding questions in text in online discussion, compared to providing questions and text separately. Less elaboration but more critique was found in the student postings.

**Notifying Consequence**

The study of Brewer and Klein (2006) provided students with certain amount of points toward their course grade for complying with the discussion requirements. No effect was observed. The Gilbert and Dabbagh (2005) study provided students with rubric based on which their discussion would be evaluated. Negative effect was reported associated with the use of evaluation rubrics.

**Features of Discussion Board**

Chanlin, Chen, and Chan (2009) reported that by assigning each posting a numerical ID, students were able to refer to individual message by its ID, and this improved development of new subjects in the online discussion. Another study conducted by Jin et al. (2009) explored the possible effects of limiting the number of postings displayed on each page (on the screen) and they found that students achieved better quality of in their contributions to the discussion. In the same study, these researchers found that when the students were provided with a simulated situation where the postings to the discussion could be filtered according to their relevance to the topic being discussed (irrelevant messages were not displayed), they were able to experience less cognitive load in the discussion while keeping the same quality of discussion.
Summary of Effects of Online Discussion Strategies

To summarize the effects of online discussion strategies, I consolidated results from independent cases. For example, if a study reported two online discussion strategies and their effects on learning, the two effects were counted separately. Similarly, if a study reported the effects of a discussion strategy on learning and discussion quality, it is reported under each of the two outcomes. However, if a study reported multiple measures on one outcome (i.e., discussion quality) from the same group on the use of one online discussion strategy, only one measure was included in the summary.

In summary, among the studies reviewed in this chapter, twenty-six studies reported the effects of online discussion strategies on discussion quality and fourteen studies reported the effects on learning. About 38.5% of the reported effect is positive on discussion quality and 28.6% of the reported effect is positive on learning (tested in performance tests). Overall, about 35% of the strategies improved the discussion quality or the learning outcomes. It is noticeable that 65% of the results show that there is no improvement on discussion quality or student learning as a result of the use of the online discussions strategies. This indicates a strong needs for strategies that can improve the effectively use of online discussion.

Theories Being Used to Develop Online Discussion Strategies

The theoretical bases for these retrieved studies are diverse. Vygotsky’s (1978) social development theory is the mostly cited framework. The major notion of this theory is that social interaction plays a fundamental role in the process of learning, the more knowledgeable other (MKO) should be available for the learner to interact with, and the learning object should be in the zone of proximal development (ZPD) of the learner. Although MKO may imply a teacher or an adult who has better understanding or higher ability level than the learner, a peer of the learner or some other tools, like an instruction, can play the role of a MKO. MKO and ZPD are the basis for scaffolding and cognitive apprenticeship models of instruction.

The use of guidance in several studies is to provide a MKO to the learners. For example, the Bai (2009) study, students were provided with practical inquiry model, which showed a theory-based posting guide. Gilbert and Dabbagh (2005) posted tips for successful online
discourse to help students be on target in their discussion. Makitalo et al. (2005) also presented
hinds and guiding questions to help students to develop solutions for the problems. Similarly,
Chung (1999) provided students with step-by-step instructions on how to work on their project,
vан Rooij (2009) supported student learning with a project management tool, and Suh (2005) and
Lai (2006) provided students with questions focusing on major points of the learning tasks.

Some other online discussion strategies are built upon the model of cognitive modeling
effect of MKO and scaffolding model that is based on the principle of ZPD. These studies
include the effect of instructor facilitation on learning investigated in Chang (2005) and Lu and
Jeng (2006), the inclusion of instructor modeling in Choi et al. (2007), and the influence of
experienced learners on novice learners (Lai & Law, 2006).

The cluster of study that examined restraint-based online discussion strategies are based
on the similar approach of scaffolding, with the addition of certain types of knowledge inquiry
model. For example, Jeong and Joung (2007), Cho and Jonassen (2002), and Moore and Marra
(2005) applied argumentation model (Toulmin, 1958) in the scaffolding processes, which end up
with pre-defined types of messages that fit in the framework of effective argumentation. Bloom’s
taxonomy of cognitive learning was applied in Valcke et al. (2009)’s study in developing the
restraints for student posting. Sutherland et al. (2010) based constraints on the levels of working
with knowledge schemata suggested by Bereiter and Scardamalia (1998).

The theory supports Gao and Putnam (2009) study is related to how people learn from
text. Learner’s prior knowledge, ability to think about and control the reading process, and the
knowledge of reading strategies are of important for effective learning from text. In order to
promote effective reading, questions were embedded in the text in places where the questions
can help the learner to select appropriate reading skills and meta-cognition skills. This is actually
a combination application of KMO and ZPD.

Other than the studies constructed directly based on Vygotsky’s social development
theory, some studies cited other theories that are related to interaction as a condition of learning.
Jorczak and Bart (2009) argued that in order for higher order learning to occur in online
discussion, the discussion tasks should be realistic and highly contextualized so that learners can
make meaningful connections (Greeno, More, & Smith, 1993; Ormrod, 2008). Ke and Xie
(2009) also emphasized interactivity as a key element in distance learning and therefore, the
online discussion tasks should be designed to elicit application of newly knowledge, reflection on learning process, and development of different perspectives.

The role of positive interdependence of group members was the foundation for Brewer and Klein (2006) study. They argued that online instructors should structure the roles of the students to establish interdependence and the sense of responsibility for learning.

The theoretical framework applied in Makitalo et al. (2005) study was uncertainty reduction theory. Uncertainty in learners is due to the lack of feedback on others’ social emotional attitude and the quality of their contributions to the communication. This theory suggests that by reducing the learner’s uncertainty, the amount of interaction should increase and the information seeking behavior should decrease.

Cognitive Load Theory and Its Implication on Discussion Board Design

Based on the literature review, I found that few studies have considered the cognitive capacity limitation of the learners in developing online discussion strategies. The research of cognitive load has suggested that human has limited working memory capacity and comparatively unlimited long-term memory. Effective instructions should manipulate the cognitive load of the learning tasks to the limit of human working memory capacity and should make good use of human long-term memory to facilitate learning.

Cognitive Load Theory

CLT assumes that human cognitive architecture has a limited working memory capacity and an unlimited long-term memory holding schemas of knowledge. Learning occurs in working memory, which is equated with consciousness (Sweller et al., 1998). Working memory is capable of holding about seven elements at one time (Miller, 1956). When used to process rather than merely holding information, human are probably able to deal less number of elements. The number of element working memory can deal with simultaneously also reduces when there is any interaction between elements. In order for instructions to be effective, they should be designed in ways that impose appropriate working memory load on learners.

Human existing knowledge is stored in long-term memory as schemas. Expert learners have good amount of well-structured schemas of domain-specific knowledge as well as general learning skills. A schema categorizes elements of knowledge according to the manner they may
be used (Rumelhart, 1980). A complex schema consists of a number of simpler schemas. When practiced appropriately, schemas can become automatic and be carried out with minimal conscious effort. A skilled reader can read without consciously processing individual words and grammar rules while a younger reader may need to consciously recognize each letter and make sense of each sentence by using grammar knowledge. A schema is treated as one element when brought into working memory regardless of its complexity. Schema and schema automation can reduce working memory load and improve learning when dealing with complex tasks. When new information in instructions is related to learner’s existing knowledge, long-term memory will be involved in processing the new information. This will require less working memory capacity. The other goal of instruction is to help learners to form new, more complex schema, and provide practices to make schemas automatic.

CLT distinguishes three types of cognitive load: intrinsic, extraneous, and germane. Intrinsic load is due to the complexity of the learning material. The number of new elements contained in the learning material and the interactivity of elements can affect intrinsic load level. Extraneous load is due to inappropriate instructional design. Some of the well-recognized instances that can post extraneous load are split-attention effect (Sweller, Chandler, Tierney, & Cooper, 1990), redundancy effect (Chandler & Sweller, 1991), expertise reversal effect (Kalyuga, Ayres, chandler, & Sweller, 2003), and so on. Germane load is caused by learning effort. The construction of new schemas requires sufficient working memory capacity to be allocated, which is regarded as germane load.

The implications of cognitive load theory on instructional design can hardly be overestimated. Any instruction that ignores working memory limitation or fails to utilize long-term memory is deficient. The goal of effective instructional design is to decide appropriate complexity level of the materials, reduce extraneous load to minimum, make good use of long-term memory resource, and direct learners’ attention to schema construction and automation.

Using CLT principles to Improve Online Discussion Instructions

No single theory or framework can address all aspects of the issues in online discussion. Like the theories being used in developing online discussion strategies, CLT is only applicable in solving certain problems. Specifically, CLT principles concern about the ways that new information is presented to the learners, which emphasize the demand for the working memory, the use of existing knowledge (working memory), and the acquisition of new schema. In
reviewing the seven categories of online discussion strategies reported in the literature, it seems that strategies of providing guidance to students, characteristics of the discussion task, and notifying consequence impose great demand on learner’s cognitive system at the front end (before the learners start to participate in the discussion). In this study, they are referred to as online discussion *Instructions* hereafter to be distinguished from the online discussion strategies that were discussed before.

A common characteristic for online discussion instructions is that, they are provided to the online discussants at the beginning of the discussion, which may include description of the discussion topic, participation rules, rubrics for acceptable contributions, rubrics for grading, helping tips, other resources, and so on. The discussants must understand these instructions to successfully complete the discussion task. However, when an instruction presents too much information, or presents the information in the format that distracts the discussants from focusing on the discussion task, the discussants may face heavy cognitive load that may lead to insufficient of cognitive resources. As a result, the discussants may not be able to understand the instruction very well and consequently, may not perform successfully in the discussion task.

Understanding the online discussion instructions and figuring out a good way to complete the discussion task is a complication problem solving process. The literature on the use of worked-example versus practice of mean-end searching problem solving may shed lights on how to improve the design of online discussion instructions.

**Worked-Example Effect**

In the cognitive load literature, worked-example effect refers to the findings that example-based learning is more effective for problem-solving skill acquisition than the traditional problem-solving practicing method (Sweller, et al., 1998). Worked examples are instructional tools that model the process of problem solving. For example, in mathematics or physics, a worked example presents a problem, the steps to solve the problem, and the right answer to the problem (Renkl, Stark, Gruber, & Mandl, 1998). When properly designed, worked examples are sufficient to induce skills and abstract problem representations even when direct instruction is absent (Zhu & Simon, 1987). Empirical studies have showed that compared to learning by solving problems, where students are engaged in means-ends analysis and searching,
learning from worked-examples is more effective for problem-solving skill acquisition (Sweller & Cooper, 1985; Tarmizi & Sweller, 1988, Ward & Sweller, 1990; Mwangi & Sweller, 1998).

In the Sweller and Cooper (1985) study, students were taught on how to solve mathematical problems. And then they were divided into two groups, one group was presented with problems and worked examples on how these problems could be solved, while the other groups was presented with the same set of problems and asked to solve these problems on themselves based on what they had just been taught. After the students finished the practice, they were tested on the same knowledge. The results showed that the students studied from worked examples used less time and made fewer errors on the posttest than the students practiced problem solving on their own. Cooper and Sweller (1987) reported the similar findings when they test the students on transfer problems. Paas (1992) found that when statistical students provided with worked examples, they performed better in transfer tasks than students who used conventional problem solving approach. Paas and van Merrienboer (1994) reported that the use of worked example yielded lower extraneous load scores, better schema construction, and better performance than the conventional problem solving condition. Trafton and Reiser (1993) reported that students benefited more from studying worked examples in learning programming languages compared to solving equivalent problems. Similarly, Darabi, Nelson, Meeker, Liang, and Boulware (2010) reported that the students studied worked-examples showed a greater progression of their mental models compared to those used problem-solving strategy in a troubleshooting test.

The worked example effect has been explained as the result of making efficient use of the learners’ limited cognitive resources. In problem-solving practice, the learners will conduct extensive search to find out the correct solution steps to solve the problem. The learners who are provided with worked examples, however, can focus on studying the steps and logics of solving the problem illustrated in the examples, their cognitive resources are used for the induction of abstracted and generalisable problem-solving schemas that can be used to solve similar problems (Sweller, 1988 & 1994; Sweller, et al. 1998).

Worked examples provide learners with the experts’ problem solving model for the learners to study and emulate (Atkinson, Derry, Renkl, & Wortham, 2000). Research has shown that the performance difference between a novice and an expert is due to the complexity of the schemas they possessed. Experts have complex schemas that enable them to recognize a problem
as a member of a class and retrieve procedures appropriate for that class. Therefore, one very important purpose of worked examples is to model the methods of awareness of the problem structure and the procedures that can be generalized to similar settings. This process of focusing on structural features of the problem and the constructing complex schemas is not supported when the learners are provided merely the problems (in the situation of this study, the instruction of the discussion tasks). As noted by social learning theory (Bandura, 1977), by observing the experts’ problem solving solution (worked examples), the learners may have increased awareness of the expectations on their performance and be reinforced for modeling the behaviors of the experts.

Recent research on the use of worked example focuses on identifying the techniques of using of examples that may prioritize the learning outcome. As pointed by Renkl (1997), merely presenting the worked examples is not enough to promote students’ schema construction. Students may have the illusion of understanding when they study the examples (Renkl, 1999), or they may not identify the relevant information and focus on the irrelevant information in the examples (Ross, 1989). Some students have difficulty solving new problems with the solutions presented in the examples (Catrambone & Holyoak, 1989). Chi and her colleagues recommend that students should be prompted to elaborate on the structure of the examples, the rationale underlying the solution procedures, and the goals accomplished by each step (Chi, Bassok, Lewis, Reimann, & Glaser, 1989). Anderson and colleagues also suggested that it might be desirable to identify the critical features in the worked examples by annotating them with what they are supposed to illustrate (Anderson, Boyle, Corbett, and Lewis, 1990). In order for the use of example postings to be effective in facilitate schema acquisition, researchers also recommended that the worked examples or other sources of information provided to the learners must not require significant cognitive resources for processing (Tarmizi & Sweller, 1988).

**Product-Oriented and Process-Oriented Worked-Examples**

Worked examples typically show a problem state, a goal state, and the procedures to solve the problem. This is further defined as product-oriented worked examples because they show how the final solution is reached (Renkl, 2002; van Merrienboer, 1997). In contrast, process-oriented worked examples include explanations for the purpose of the steps in the examples, which are believed to facilitate understanding and transfer of knowledge (van Gog, Paas, & van Merrienboer, 2004 & 2008).
Figure 2.2 A product-oriented worked example

Figure 2.3 A process-oriented worked example

Note. Figure 2.2 and Figure 2.3 illustrate the difference between a product-oriented and a process-oriented worked example. Reprinted from “Effects of studying sequences of process-
Several studies have reported positive effects of process-oriented worked examples. Van Gog et al. (2008) found a medium effect size of the use of process-oriented worked examples for beginning learners. Catrambone (1996) also reported that labeling the steps by explanatory descriptions enhanced transfer performance. Kiera and Bovair (1984) found that when the students were provided with “how-it-works” information, they learned better and faster and the researchers concluded that the explanatory information provided a meaningful context for the learners to understand and infer the procedures. This notion has been confirmed by Singley and Anderson (1989), who suggested that explanatory knowledge was the basis for transfer. A same explanatory knowledge may support the learners to develop different procedures rather than mimicking the procedures illustrated in the worked examples.

The Use of Examples in Online Discussion

Complex learning tasks impose high cognitive load on learners. The complexity of a learning task is determined by the number of elements that must be processed simultaneously in working memory and the element interactivity (Van Merrienboer & Sweller, 2005). Online discussions are complex tasks that place heavy cognitive load on students. They have to mentally hold the multiple items in the participation rubric, multiple ideas and opinions presented in the learning materials and other discussants’ postings, while they are trying to figure out the relations among these items and searching for appropriate steps to fulfill the task (constructing a posting that aligns with the rubric). When the cognitive load of the discussion task exceeds the students’ cognitive capacity, there will be no capacity available for germane load. Higher level learning is less likely to occur in this situation. One other possible situation is that the complexity of the discussion task and the design of the discussion diverge learners’ attention, limited cognitive capacity is not effectively used for information processing, and the learners fail to achieve higher level learning.
The use of example postings in online discussion is intended to overcome these problems (Jin, et al., 2009). Example postings are postings provided at the beginning of a discussion, demonstrating how to respond to the discussion task properly with highlights and explanations of how to meet the requirements. They will help the discussants to understand new concepts and relationships embedded in the discussion task and discussion rubric by connecting to a specific situation. This process involves the knowledge stored in long-term memory, and is believed to require less working memory capacity in understanding the task. The explanations of the example postings can also foster understanding of the abstract rubric items, such as analysis, synthesis, critique, and justification. Consequently, the learners will experience less cognitive load to understand the discussion task and requirements and therefore will be able to have mental capacity to construct new schemas on how to participate in discussions complying with the rubric.

The inclusion of the highlights and the explanations in the example-postings is based on the notion that students may not be able to identify the relevant information (Ross, 1989) and may suffer from illusions of understanding (Renkl, 1999). The highlights are expected to clarify the structure of the examples and make the abstraction and generalization of the solutions illustrated in new problems easier. As a result, the example-postings should facilitate new schema construction and the students should be able to transfer the knowledge and skills they learn in these example-postings to new discussion tasks that have similar participation rubric but different discussion topics.

The Possible Effect Size

In the study of Jin et al. (2009), the authors investigated the effect of example-postings on cognitive load and quality of online discussion. Two groups in the study resembled the comparison of providing students with example-postings versus non-treatment conditions in the online discussions. The participants were 20 undergraduate students enrolled in an online course of Stress and Resilience in Families and Children in fall of 2008. The effect size of the treatment on cognitive load was (cohen’s d) .61, which indicated a medium effect (Cohen, 1988), while the independent-sample t test was not significant at .05, \( t (18) = 1.28, p \) (one-tailed) = 0.10. The inconclusive findings of this study were very likely due to the larger standard error of the
difference (0.47) and the low power of the study (0.35), which might have originated from the small sample size and great diversity in the participants.

In current study, the sample size is larger and therefore the power is increased. Also I could examine the within-subject difference which would possibly have a smaller error of difference. I am hoping to be able to compare the findings in the current study with the results in the Jin et al. (2009) study to get a better understanding of the possible effect of example-postings.

Furthermore, the examples implemented in this study have been improved compared to those used in the Jin et al. (2009) study. Based on the recommendations of researchers in the field of worked-example effect (Anderson, et al., 1990; Chi, et al., 1989), highlights on the structures of the example and explanations are included in the example-postings used in this study. Therefore, a higher effect size is expected to be detected in this study.
CHAPTER 3

METHOD

Participants

Approximately 100 students enrolled in a undergraduate online course of New Communication Technology at spring 2012 were invited to participate in this study. The students were required to participate in online discussions every week. The discussions on Week 7 and Week 8 were used in this study. The invitation for participation was sent to the class by the course instructor. Sixty-six students consented to participate. The participants were randomly assigned to Group 1 and Group 2 and then they were randomly assigned to discussion-groups of 3-5 persons. Six of them completed only one of the two online discussions and two did not post to either discussion therefore these eight students were excluded from the study. There were 28 participants in Group 1 and 30 participants in Group 2. Each group had eight discussion-groups (referred to as disGroups hereafter).

Most of the participants were first year (20 students) and second year (36 students) students. The majors of the participants are reported in Table 3.1.

<table>
<thead>
<tr>
<th>Major</th>
<th>Number of participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communications</td>
<td>36</td>
</tr>
<tr>
<td>Social Sciences</td>
<td>6</td>
</tr>
<tr>
<td>English</td>
<td>5</td>
</tr>
<tr>
<td>Business</td>
<td>5</td>
</tr>
<tr>
<td>Computer Sciences</td>
<td>2</td>
</tr>
<tr>
<td>Hospitality</td>
<td>1</td>
</tr>
<tr>
<td>Humanities</td>
<td>1</td>
</tr>
<tr>
<td>Art</td>
<td>1</td>
</tr>
<tr>
<td>Exploratory</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>58</strong></td>
</tr>
</tbody>
</table>

All the participants reported that they had used online discussions in at least two courses before this course. Fifty-six students had used online discussion in more than two courses before. Participants’ prior experiences of using online discussion are reported in Table 3.2.
Table 3.2
*Participants’ prior experience of using online discussion*

<table>
<thead>
<tr>
<th>Question</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neither agree nor disagree</th>
<th>Disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>I know very well about how to participate in online discussions.</td>
<td>31</td>
<td>25</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>I never had difficulties in participating in online discussions.</td>
<td>13</td>
<td>20</td>
<td>9</td>
<td>15</td>
<td>1</td>
</tr>
<tr>
<td>I always had good grades in online discussions.</td>
<td>25</td>
<td>26</td>
<td>5</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

**Treatments**

Two treatments were provided to the participants in this study. Treatment A was the condition where the participants were provided with example-postings and Treatment B was the condition with no examples. Online discussion instructions for Treatment A and Treatment B for the two discussions that were observed in this study are illustrated in Appendix D, E, F, and G.

**Materials**

The study was conducted in Week 7 and Week 8 of the semester. On Wednesday of Week 6 the students were provided with a list of readings on Media and Funding Resources. They could ask the instructor or the TAs questions regarding the readings via twitter or email. They would get responses no later than one day. The online discussion for Week 7 was available to the students on the midnight of Sunday of Week 7 (a week starts at Sunday and ends at Saturday). A list of readings were provided to the student on the Wednesday of Week 7 on Media and Public Policy and the discussion for Week 8 was available to the students on the midnight of the following Sunday. The students were expected to complete the reading assignments before they participate in the online discussions. The instructions for the Treatment A condition (shown in Appendix D and F) included the discussion question, the rubric for participation, and an example-posting. The instructions for Treatment B condition (shown in Appendix E and G) presented the discussion question and the rubric for participation.
The purpose of the weekly discussion was to engage students in articulating and sharing their opinions on the course readings for the corresponding week, to become aware of diverse perspectives, and to reflect upon similarities and controversies. The following participation rubric was provided to all the students.

Active participation in the online discussions helps create a learning community and gives you opportunities to work with other students on developing deep understanding of the contents we learn in the course. You contributions to the online discussion will enrich your learning experience and those of your classmates. You will earn up to 7 points for each discussion. You are expected to:

1. (1 point) Post to each of the discussion in a timely manner, i.e., post one initial response to the discussion topic within two days after the discussion topic is posted and respond to at least two classmates’ postings before the due date of the discussion.

2. (1 point) Indicate originality in your postings. Give us a refreshing and new take on the subject at hand.

3. (1 point) Provide clear descriptions on the defining characteristics of the subject to enable others to understand the bases of your opinion.

4. (1 point) Provide thoughtful analysis of the course materials and the media you have chosen. Shallow sharing of information or describing your experience may be necessary in your postings but should not be the major theme of any of your postings. You may identify commons or differences between contents of the course materials or media you selected, or compare, relate, or distinguish opinions.

5. (1 point) Indicate carefully reflection upon peers’ and your postings. You may make connections between the ideas of your posting and others, and/or point out the difference between your points and others’.

6. (1 point) Indicate insight for considering other possibilities and consequential results, challenge others’ ideas or opinions with supporting materials, or construct new ideas. You should demonstrate at least one of the above thoughtful processes in your postings.
Study Design and Power Analysis

Study Design

A 2X2 crossover design was used in this study (shown in Table 3.3).

Table 3.3
2X2 cross-over design of the study

<table>
<thead>
<tr>
<th>Discussion</th>
<th>Group 1</th>
<th>Group 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Treatment B</td>
<td>Treatment A</td>
</tr>
<tr>
<td>2</td>
<td>Treatment A</td>
<td>Treatment B</td>
</tr>
</tbody>
</table>

Both groups got both treatments but in different order. Group 1 was provided with no example (Treatment B) in Discussion 1 and was provided with example-posting (Treatment A) in Discussion 2 whereas Group 2 was provided with an example (Treatment A) in Discussion 1 and was provided with no example in Discussion 2 (Treatment B).

Power Analysis

A power analysis was conducted at the planning stage to determine the proper sample size that would enable accurate and reliable statistical judgments regarding the effects. I used G-Power, F-test MANOVA: Repeated measures, within-between interaction (two groups and measured for two times). Two types of power analysis were conducted: priori and sensitivity.

The result of priori power analysis provided information on required sample size for given $\alpha$ (.05), power (.95), and effect size. I expected a medium effect size based on the results of my previous study, which was .61. The power analysis estimated that the required sample size was 37.

Because I was expecting to have around 80 participants in my study, I conducted a sensitivity power analysis, which predicts the smallest possible effect size my study may get for given $\alpha$ (.05), power (.95) and sample size (80). The result was .41. This indicates that my study can detect a medium level effect size around .41 for the effect of my treatment.

The comparison between the 2X2 cross-over design and two-independent-group design: If I use a two-independent-group one-time measurement design, the power analysis result for the priori power analysis was that 70 participants were needed to achieve the given $\alpha$ (.05), power...
(.95), and effect size (.80). This required about three times more participants than the crossover design. The sensitivity analysis showed that the smallest possible effect size the study can detect when there were 80 participants would be .74, which was much less sensitive than what the crossover design could detect (.41).

**Overall Study Design and Analysis Methods for Individual Outcome**

The power analysis at planning stage was based on the overall design of this study, a multivariate repeated measure comparing means among groups. However, as recommended by some researchers (Jones & Kenward, 1989, Senn, 2002), the analysis methods used to examine individual outcomes of interest, including the grouping effect, carry-over effect, discussion task effect, and treatment effect, were t tests (paired-sample t test or independent sample t test). This was because, first, I would compare two means for each analysis (but the two means would be of different combinations of the treatment groups); second, I would compare different combination of the measured variables that would reflect either the repeated measure or the cross-over treatment of the design (which were the within-factors in the MANOVA design). Therefore, appropriate t-tests would be able to serve the purpose for individual analysis.
Procedures

The procedures of the study are illustrated in Table 3.3.

Table 3.4
Procedures of the Study

<table>
<thead>
<tr>
<th>Task</th>
<th>Group 1</th>
<th>Group 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respond to Prior-Skills Survey</td>
<td>y</td>
<td>y</td>
</tr>
<tr>
<td><strong>Week 7</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Study the content* of Week 7</td>
<td>y</td>
<td>y</td>
</tr>
<tr>
<td>2. Study the discussion instruction for Week 7</td>
<td>Treatment B</td>
<td>Treatment A</td>
</tr>
<tr>
<td>3. Report cognitive load</td>
<td>y</td>
<td>y</td>
</tr>
<tr>
<td>4. Participate in online discussion</td>
<td>y</td>
<td>y</td>
</tr>
<tr>
<td><strong>Week 8</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Study the content* of Week 8</td>
<td>y</td>
<td>y</td>
</tr>
<tr>
<td>2. Study the discussion instruction for Week 8</td>
<td>Treatment A</td>
<td>Treatment B</td>
</tr>
<tr>
<td>3. Report cognitive load</td>
<td>y</td>
<td>y</td>
</tr>
<tr>
<td>4. Participate in online discussion</td>
<td>y</td>
<td>y</td>
</tr>
</tbody>
</table>

*Study the content includes conducting the assigned readings, communicating with instructor and TAs for questions regarding the content.

y in the table indicates that the task is required for the corresponding group.

Note. Students’ performances in online discussions were graded after the experiment was complete.

The participants were requested to conduct the following tasks:

1. Respond to Prior Skills Survey to report their academic background, prior knowledge and prior skill, and indicate their consent to participate in this study during Week 5 and 6;

2. Conduct the assigned readings for Week 7 and communicate with the instructor and the TAs if they have questions regarding the readings and related contents;

3. Read the instruction for the Week 7 discussion carefully and report their cognitive load; (the instruction was available to the students on Sunday midnight)
4. Post initial response to the discussion question by midnight of Wednesday and post two more responses by Sunday midnight;

5. Conduct the assigned readings for Week 8 and communicate with the instructor and the TAs if they have questions regarding the readings and related contents;

6. Read the instruction for the Week 8 discussion carefully and report their cognitive load; (the instruction was available to the students on Sunday midnight)

7. Post initial response to the discussion question by midnight of Wednesday and post two more responses by Sunday midnight;

Each student’s discussion postings for each week were graded at a later time.

**Variables and Measures**

**Independent Variable**

**Type of treatment.** For each discussion, one group was provided with a discussion instruction with an example (treatment A) while the other group was provided with a discussion instruction without examples (treatment B). The treatments were switched between the two groups in the second discussion that were observed in this study.

**DisGroup.** There were eight disGroups in each of the treatment groups. And the participants were randomly assigned to each of these disGroups. I compared the means among these small groups for Group 1 and Group 2 to detect whether there was difference in the outcome scores across the eight disGroups.

**Dependent Variables**

**Cognitive load of the discussion instruction.** The cognitive load of the discussion instruction was measured by the 9-level self-report instrument developed by Paas, Van Merrienboer, and Adam (1994, see Appendix I for detail). This instrument has been reported to have reliability between .80-.95 in previous studies (Paas & van Merrienboer, 1994; de Croock & van Merrienboer, 2007; de Croock, van Merrienboer, & Paas, 1998).

The participants were asked to rate the mental effort that they had invested in understanding the discussion instruction right after they had finished reading it and felt that they had understood the task. The participants were prompted to choose one of the nine levels, from very very low, very low, rather low, low, neither low nor high, high, rather high, very high, to very very high (illustrated in Appendix I).
**Student’s performance in discussion.** Students’ performance in online discussion was measured as a latent construct consisting of seven indicators that were stated in the discussion rubric. This measure was developed based on construct measure approach (Wilson, 2005) and item response theory (Osterlind, 2006). Each of the seven requirements specified in the rubric was treated as an indicator of student performance and was measured as a score from 0 to 1.

The students’ performances in each of the discussions were first graded by the instructor of the course based on the rubric provided to all students. The scores given by the instructor were used as the grades for each student toward their final assessment of the course. (Note: There were four teaching assistants who worked for the instructor with the grading. The actual procedure was the teaching assistants graded the discussions and submitted the scores to the instructor and the instructor would assign the score to each student. I did not have the information on which teaching assistant graded which student, therefore I treated the scores on the discussion performance as being rated by the instructor.)

Based on the same set of rubric, two other raters graded the students’ discussion postings. The two raters were graduate students majored in education. They were briefly trained before the rating. The training included presenting them with the rubric and allowing them to practice and discuss on how to scale the quality of individual student’s discussion on each of the seven items in the rubric. The raters then rated the students’ discussion individually.

As a result, each student was graded by three raters for each of the two discussions and the average of the three scores was used as the measure of the student’s performance in each of the two discussions.

**Data Analysis**

**Inter-Rater Reliability**

An inter-rater reliability study provides evidence on the quality of the data generated by multiple human observers. It evaluates whether a coding instrument could yield the same judgment among different observers within a tolerable rate of error (Hayes & Krippendorff, 2007). There are many types of inter-rater reliability measures and many of the popularly used indexes, such as percent agreement, Cohen’s Kappa (Cohen, 1960), Scott’s Pi (Scott, 1955), Bennett et al.’s S (Bennett, Alpert, & Goldstein, 1954), and Fleiss’s K (Fleiss, 1971), are applicable for two-rater situations or nominal data. In this study, each participant was graded by
three raters and the scores were continuous. Therefore, the applicable index for inter-rater reliability used was intraclass correlation coefficient (ICC; Shrout and Fleiss, 1979). Shrout and Fleiss discussed several models of reliability studies accounting for the effects of the raters and the subjects: one-way random effect model when only participants are treated as a random effect, two-way random effect model when raters and participants are treated as random effects, and two-way mixed effect model when raters as fix-effect and participants as random effect. They also specified ICC calculations for situations when multiple raters were used and the means of the multiple ratings were of interest, which was the situation in this study.

The following formula suggested in Shrout and Fleiss (1979) was used to calculate ICC:

\[
\text{ICC} = \frac{(BMS - EMS)}{BMS}
\]

Where BMS is the between person mean square and EMS is the residual. The BMS and EMS are calculated as (Saito, Sozu, Hamada, & Yoshimura, 2005):

\[
BMS = \frac{\sum_{i=1}^{I} \sum_{j=1}^{J} (Y_{ij} - \bar{Y}_j)^2}{(J-1)(J-1)}
\]

\[
EMS = \frac{\sum_{i=1}^{I} \sum_{j=1}^{J} (Y_{ij} - \bar{Y}_{ij} + \bar{Y}_i - \bar{Y}_j)^2}{(I-1)(J-1)}
\]

Where I is the number of raters, J is the number of participants, \( Y_{ij} \) is the score for participant j given by rater I, \( \bar{Y}_i \) is the mean of scores given by rater i, \( \bar{Y}_j \) is the mean of the scores of participant j, and \( \bar{Y}_- \) is the mean of all the scores.

Model of Example-postings’ Effect on Cognitive Load

To model the effect of the treatments on cognitive load, I used a four-factor (discussion task effect, treatment effect, grouping effect, and carry-over effect) model. The following equations model the relationships of the factors and measures of cognitive load.

For Group 1

Treatment A: \( ME_{1A1} = ME_0 + D + T + \text{Grouping}_1 + e_{1A1} \) \hspace{1cm} (3.3)

Treatment B: \( ME_{1B1} = ME_0 + 0D + 0T + \text{Grouping}_1 + e_{1B1} \) \hspace{1cm} (3.4)

For Group 2

Treatment A: \( ME_{2A1} = ME_0 + 0D + T + \text{Grouping}_2 + e_{2A1} \) \hspace{1cm} (3.5)

Treatment B: \( ME_{2B1} = ME_0 + D + 0T + \text{Grouping}_2 + L + e_{2B1} \) \hspace{1cm} (3.6)

Where Treatment A is the condition that provides participants with examples and Treatment B is the condition without examples. ME is the cognitive load measured, the subscript 1 or 2 indicates the group membership, the subscript A or B indicates the Treatment conditions. ME_0 is the
estimated mean cognitive load for non-treatment condition (Treatment B) in discussion 1. D is the Discussion task effect of Discussion 2. T is the Treatment (worked-example) effect. Grouping\(_1\) and Grouping\(_2\) are the possible grouping effects in Group 1 and Group 2, correspondingly. L is the carry-over effect for cognitive load.

**Model of Example-postings’ Effect on Students’ Performance in Online Discussion**

The students’ performance in online discussion was modeled using the similar four-factor structure as that used to model cognitive load in the previous section. The following equations were used in the model:

For Group 1

For Treatment A: \[ P_{1Ai} = P_0 + D' + T' + \text{Grouping}'_1 + e'_{1Ai} \]  \hfill (3.7)

For Treatment B: \[ P_{1Bi} = P_0 + 0D' + 0T' + \text{Grouping}'_1 + e'_{1Bi} \]  \hfill (3.8)

For Group 2

For Treatment A: \[ P_{2Ai} = P_0 + 0D' + T' + \text{Grouping}'_2 + e'_{2Ai} \]  \hfill (3.9)

For Treatment B: \[ P_{2Bi} = P_0 + D' + 0T' + \text{Grouping}'_2 + L' + e'_{2Bi} \]  \hfill (3.10)

Where Treatment A is the condition that provides participants with examples and Treatment B is the condition without examples. \(P\) is the student's discussion performance score, the subscript 1 or 2 indicates group membership, and the subscript A or B indicates the treatment condition. \(P_0\) is the estimated mean performance level for non-treatment condition (Treatment B) in discussion 1. \(D'\) is the Discussion task effect. \(T'\) is the Treatment (worked-example) effect, Grouping’\(_1\) and Grouping’\(_2\) are the possible grouping effects in Group 1 and Group 2, and \(L'\) is the carry-over effect for performance.

**Individual Total Scores**

An individual total score was calculated by adding up the scores of the participant in the two treatment conditions. Individual totals were calculated for discussion performance and for cognitive load.

For Group 1

\[ \text{MEtotal}_{1i} = \text{ME}_{1Ai} + \text{ME}_{1Bi} \]
\[ = 2\text{ME}_0 + D + T + 2\text{Grouping}_1 + e_{1Ai} + e_{1Bi} \]  \hfill (3.11)

\[ \text{Ptotal}_{1i} = P_{1Ai} + P_{1Bi} \]
\[ = 2P_0 + D' + T' + 2\text{Grouping}'_1 + e'_{1Ai} + e'_{1Bi} \]  \hfill (3.12)

For Group 2
\[
\text{ME}_{\text{total}2i} = \text{ME}_{2Ai} + \text{ME}_{2Bi}
\]
\[
= 2\text{ME}_0 + \text{D} + \text{T} + 2\text{Grouping}_2 + L + e_{2Ai} + e_{2Bi} \quad (3.13)
\]
\[
\text{P}_{\text{total}2i} = P_{2Ai} + P_{2Bi}
\]
\[
= 2P_0 + D' + T' + 2\text{Grouping}'_2 + L' + e'_{2Ai} + e'_{2Bi} \quad (3.14)
\]

Where ME\text{otal} is the individual total score of cognitive load, P\text{otal} is the individual total score of discussion performance. ME is the individual’s score on cognitive load, P is the individual’s score on discussion performance. P is the student’s performance in an online discussion, the subscript 1 or 2 indicates the group membership, and the subscript A or B indicates the treatment conditions. ME_0 is the estimated mean of cognitive load for non-treatment condition. P_0 is the estimated mean performance level for non-treatment condition. D is the discussion task effect for cognitive load and D’ is the Discussion task effect on discussion performance. T is the treatment effect of cognitive load and T’ was the treatment effect on performance, Grouping_1 and Grouping_2 are the possible grouping effects in Group 1 and Group 2 on cognitive load, and Grouping’_1 and Grouping’_2 are the possible grouping effects in Group 1 and Group 2 on performance, and L is the carry-over effect on cognitive load and L’ is the carry-over effect on performance.

**Grouping Effect**

Grouping effect referred to the possible effects of group dynamic on outcomes (discussion performance and cognitive load). After randomly assigning students to Group 1 (Treatment BA) and Group 2 (Treatment AB), three to five students in each sequence group were randomly assigned to a small disGroup and they stayed together for the two discussions. The characteristics of the group members and the way the members in the disGroups participated might have impacted others in the group.

To detect this effect, a one-way ANOVA test on individual totals of cognitive load and performance by disGroups was conducted for each sequence group. The significant F test results would indicate the existence of grouping effect. If the grouping effect would have been detected, I would conduct further analysis on the means of disGroups to identify which group or participant might have caused the effect. Two sets of analysis would be conducted thereafter, one would be based on the complete data and one would be based on the data eliminating the outlier disGroup(s).

**Carry-Over Effect**
To identify whether there was a carry-over effect for Group 2 in Treatment B (Discussion 2), the individual totals were compared for the two groups (Jones & Kenward, 1989; Senn, 2002). The rationale for the carry-over effect test was that (as illustrated in equations 3.11-3.14), when the grouping effects were eliminated or ignored, the individual totals represented the effects of both the Treatment A (with examples) and the Treatment B (without examples) conditions. Participants in different sequence groups (Treatment BA or Treatment BA) cannot differ in individual totals by treatment effect because they all have both treatments and they cannot differ due to the discussion task effect because they all participated in both discussions. The difference between the two groups on the means of individual totals should reflect the carry-over effect that might exist in Group 2 Treatment B.

An independent-sample t test was conducted for the two groups. A significant t test result would indicate that there was carry-over effect. The carry-over effects were analyzed before other analysis because the carry-over effects would be adjusted for in the outcome scores before further analysis would be conducted. The analysis of carry-over effects would answer the Research Question 4, “Do the effects of the example-postings (change in cognitive load and improvement in performance) sustain when the examples are removed?”

It should be noted that the difference in the means of individual totals for the two groups might reflect the intrinsic differences between the participants in the two groups (the error terms in the equations). However, this should not be an issue in this test because the participants were randomly assigned to Group1 and Group 2.

**Discussion Task Effect**

If the two discussion tasks were equivalent in terms of difficulty level and the ability to test the students’ performance, the students’ mean scores in the two discussions would indicate no statistical difference. Since the possible existence of carry-over effects in Group 2 Treatment B, test on discussion task effect was conducted after adjusting the scores for Group 2 Treatment B by carry-over effects. The paired-sample t test of the means for the two discussions was used to detect the discussion task effect.

**Treatment Effect**

Treatment effect was analyzed via paired-sample t test after adjusting for the carry-over effect (if existed). The comparison was conducted for the mean differences between the participants’ scores on Treatment A and Treatment B.
The analysis of treatment effects would answer Research Questions 1 and 2.

**Correlation between Changes in Cognitive Load and Changes in Online Discussion Performance**

To answer Research Question 3, the bivariate correlation coefficient between the changes in cognitive load and the changes in discussion performance for individuals in the two treatment conditions was calculated to examine how these two changes were associated. To decide an appropriate type of correlation coefficient, the data should be checked on normality. If the data would show no serious violation on normality, Pearson’s $r$ would be reported. Otherwise, a nonparametric correlation (Spearman’s rho) would be reported.
CHAPTER 4

RESULTS

The sequence of the results in this chapter is organized as consistent with the sequence of
the analysis, which is Descriptive of the Outcomes, Reliability, Grouping Effect, Carry-over
Effect, Discussion-task Effect, Treatment effect, and Correlation between Changes in Cognitive
Load and Discussion Performance. The reason the main effects (treatment effect and correlation)
are reported after all other results is because the analysis of the main effects utilized the results of
other effects.

Descriptive Statistics for the Outcomes

Cognitive load scores ranged from 2 to 8 (possible scores were 1 to 9). The descriptive
statistics of group by discussion are shown in Table 4.1. The distribution histogram of cognitive
load scores is shown in Figure 4.1.

<table>
<thead>
<tr>
<th>Group/Treatment*</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Skewness</th>
<th>Std Err of Skewness</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/A</td>
<td>28</td>
<td>5.88</td>
<td>1.00</td>
<td>0.072</td>
<td>0.441</td>
</tr>
<tr>
<td>1/B</td>
<td>28</td>
<td>5.53</td>
<td>1.17</td>
<td>0.281</td>
<td>0.441</td>
</tr>
<tr>
<td>2/A</td>
<td>30</td>
<td>5.87</td>
<td>1.46</td>
<td>-0.327</td>
<td>0.427</td>
</tr>
<tr>
<td>2/B</td>
<td>30</td>
<td>5.83</td>
<td>1.26</td>
<td>0.225</td>
<td>0.427</td>
</tr>
<tr>
<td>Total</td>
<td>116</td>
<td>5.78</td>
<td>1.23</td>
<td>-0.011</td>
<td>0.225</td>
</tr>
</tbody>
</table>

*1 or 2 indicates group membership; Treatment A is the condition when example-postings are
provided and Treatment B is the condition when no example-postings are provided.
Students’ performance scores on discussions ranged from 3 to 7 (possible scores were 0 to 7). The descriptive statistics are shown in Table 4.2.

Table 4.2
Descriptive statistics of discussion performance scores

<table>
<thead>
<tr>
<th>Group/Treatment*</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Skewness</th>
<th>Std Err of Skewness</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/A</td>
<td>28</td>
<td>6.12</td>
<td>0.69</td>
<td>-1.402</td>
<td>0.441</td>
</tr>
<tr>
<td>1/B</td>
<td>28</td>
<td>5.15</td>
<td>0.69</td>
<td>-1.261</td>
<td>0.441</td>
</tr>
<tr>
<td>2/A</td>
<td>30</td>
<td>6.10</td>
<td>0.64</td>
<td>-0.056</td>
<td>0.427</td>
</tr>
<tr>
<td>2/B</td>
<td>30</td>
<td>6.18</td>
<td>0.64</td>
<td>-1.217</td>
<td>0.427</td>
</tr>
<tr>
<td>Total</td>
<td>116</td>
<td>5.90</td>
<td>0.78</td>
<td>-0.816</td>
<td>0.225</td>
</tr>
</tbody>
</table>

*1 or 2 indicates group membership; Treatment A is the condition when example-postings are provided and Treatment B is the condition when no example-postings are provided.
Inter-Rater Reliability

Each student was graded by three raters and the average of these three scores was used as the student’s score of his performance in the discussions. A one-way random model ICC was calculated as the indicator of the inter-rater reliability of the average of the three raters’ scores. The ICC for the average scores of the three raters was 0.70, with the 95% confidence interval of 0.60 to 0.79.

Grouping Effect

To detect grouping effect, I compared the means of cognitive load totals and the performance totals of disGroups in each treatment sequence group, Group 1 and Group 2. To determine what type of test would be appropriate, I first checked the normality and homogeneity of variance of the data. The results are presented in Table 4.3.
Table 4.3
The results of normality tests and Homogeneity of variance tests for the two groups

<table>
<thead>
<tr>
<th>Group</th>
<th>Variable</th>
<th>Normality (Skewness)</th>
<th>Homogeneity of Variance (Levene’s test)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Statistic</td>
<td>Std. Err</td>
</tr>
<tr>
<td>1</td>
<td>ME Total</td>
<td>0.13</td>
<td>0.44</td>
</tr>
<tr>
<td></td>
<td>P Total</td>
<td>-1.59</td>
<td>0.44</td>
</tr>
<tr>
<td>2</td>
<td>ME Total</td>
<td>0.23</td>
<td>0.43</td>
</tr>
<tr>
<td></td>
<td>P Total</td>
<td>-0.38</td>
<td>0.43</td>
</tr>
</tbody>
</table>

For Group 1, the Levene’s homogeneity of variance tests results were significant for both outcomes, which indicated the violation for the homogeneous variance assumption of ANOVA test. For Cognitive load scores, the normality assumption was not violated therefore the Welch test was appropriate. The test results were \( F = 0.74, p = 0.74 \), which indicated no grouping effect existed on cognitive scores in Group 1. For performance scores, because both the normality and the homogeneity of variance assumptions were violated, a non-parametric test, independent-samples Kruskal-Wallis test was appropriate. The test result results was \( p = 0.008 \), which was significant at 0.05 level therefore there was grouping effect existed in Group 1 on discussion performance scores.

Since the normality tests and the homogeneity tests results for Group 2 indicated that the means of Group 2 were normally distributed and homogeneous, ANOVA tests should be appropriate. The ANOVA test results for cognitive load were \( F(7, 22) = 1.43, p = 0.24 \), and the test results for performance were \( F(7,22) = 0.73, p = 0.65 \). These results indicated that there were no grouping effects in Group 2 because the means of the disGroups in Group 2 were statistically equal.

**Further Analysis on Grouping Effect**

Further analysis on the grouping effect of discussion performance was conducted for Group 1 because of the statistical significance of the disGroup difference. First, the disGroup means in Group 1 and their corresponding ranges of scores (as shown in Figure 4.4) were examined to detect possible outliers.
Figure 4.3 The means and ranges of disGroups on Performance total scores in Group 1

Figure 4.3 showed that disGroup 5 might have caused the heterogeneity in Group 1 because the mean of this small group was the highest and the variance in the discussion group was comparatively smaller than the rest. To test whether this observation was statistically supported, I conducted a nonparametric test (independent-samples Kruskal-Wallis test) because the normality assumption of ANOVA or Welch tests was not met (skewness statistic was -1.73, standard error of skewness was 0.48). The test result was 0.80, not significant at 0.05 level. This indicated that the grouping effect in Group 1 was not significant when eliminating disGroup 5 from the data.

To further investigate grouping effect originated from disGroup 5 in Group 1, I examined the scores of the participants in disGroup 5 and their discussion transcripts. The scores are shown in Table 4.9. Further discussion on the grouping effect was presented in Discussion and Conclusion chapter in this manuscript.

Table 4.4

<table>
<thead>
<tr>
<th>Participant</th>
<th>Treatment B (Discussion 1)</th>
<th>Treatment A (Discussion 2)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6.17</td>
<td>6.50</td>
<td>12.67</td>
</tr>
<tr>
<td>2</td>
<td>5.67</td>
<td>6.83</td>
<td>12.50</td>
</tr>
<tr>
<td>3</td>
<td>5.83</td>
<td>6.50</td>
<td>12.33</td>
</tr>
<tr>
<td>4</td>
<td>5.83</td>
<td>7.00</td>
<td>12.83</td>
</tr>
</tbody>
</table>
Note: The possible range of total score is 0—14.

To examine how the grouping effect might impact the results of other analysis, I firstly conducted all the rest of the analysis based on the complete data that included disGroup 5. Then I re-ran the same set of analysis based on the data that excluded disGroup 5. And finally, I compared the results from the two data sets and examined the impacts of disGroup 5.

**Carry-Over Effect (Complete Data)**

The carry-over effect was investigated by comparing the two groups on individual totals. The Levene’s test for equality of variance showed that equal variances existed in the two group, $F = 0.472, p = 0.50$ for performance total scores and $F = 1.651, p = 0.204$ for cognitive load scores. Therefore, the t test results for equal variances were appropriate for the analysis. The results are reported in Table 4.5.

<table>
<thead>
<tr>
<th>Variable</th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
<th>Mean Difference</th>
<th>95% Confidence Interval of the Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME Total</td>
<td>-0.55</td>
<td>56</td>
<td>0.58</td>
<td>-0.31</td>
<td>-1.42, 0.81</td>
</tr>
<tr>
<td>P Total</td>
<td>3.35</td>
<td>56</td>
<td>&lt;0.05</td>
<td>1.02</td>
<td>0.41, 1.62</td>
</tr>
</tbody>
</table>

Because significant carry-over effect was detected for discussion performance scores, the performance scores of Group 2 in treatment B should be adjusted by carry-over effect. The estimation of the carry-over effect was calculated as the mean difference between the individual totals between Group 1 and Group 2, which was 1.02, with 95% CI of (0.41, 1.62). Table 4.6 shows the descriptive statistics for performance scores adjusted by carry-over effect.

<table>
<thead>
<tr>
<th>Group/Treatment*</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/A</td>
<td>28</td>
<td>6.12</td>
<td>0.69</td>
</tr>
<tr>
<td>1/B</td>
<td>28</td>
<td>5.15</td>
<td>0.69</td>
</tr>
<tr>
<td>2/A</td>
<td>30</td>
<td>6.10</td>
<td>0.64</td>
</tr>
</tbody>
</table>
Discussion Task Effect (Complete Data)

The discussion task effects were investigated after adjusting the performance scores for Group 2 discussion 2 by the carry-over effect (1.02). No adjustment was done to the cognitive load scores because the test for carry-over effect for cognitive load was not significant.

First, the normality of the paired-differences was checked for cognitive load scores and discussion performance scores. The results showed that the normality requirement of paired t test was met for both outcomes, with the skewness statistic for cognitive load as -0.09, standard error of 0.31, and for performance scores as 0.45, standard error of 0.31.

The paired-sample t test was conducted to compare the mean differences between the participants’ scores in Discussion 1 and Discussion 2. Results are shown in Table 4.7.

Table 4.7
Discussion task effect tests (paired-sample t test comparing means in Discussion 1 to Discussion 2) based on complete data

<table>
<thead>
<tr>
<th>Variable</th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>95% Confidence Interval of the Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME</td>
<td>-0.81</td>
<td>57</td>
<td>0.42</td>
<td>-0.14</td>
<td>1.29</td>
<td>-0.47 to 0.20</td>
</tr>
<tr>
<td>Performance</td>
<td>-0.10</td>
<td>57</td>
<td>0.99</td>
<td>0.01</td>
<td>1.16</td>
<td>-0.29 to 0.32</td>
</tr>
</tbody>
</table>

Because no significant effect of the discussion tasks was indicated by this analysis, the two discussion tasks were regarded as equivalent in terms of difficulty level and the capability to test the students’ performance.
Treatment Effect (Complete Data)

Treatment effect was tested by comparing the means of the outcome scores in Treatment A and Treatment B after adjusting Group 2 Treatment B scores by the estimated carry-over effect. The normality of paired difference was met in cognitive load scores, skewness as 0.13 with standard error of skewness of 0.31. The normality requirement was marginally met in discussion performance scores, skewness as 0.64 with standard error of skewness of 0.31. The paired-sample t test results are reported in Table 4.8.

Table 4.8
Treatment effect test results (paired-sample t test comparing means in Treatment A to Treatment B) based on complete data

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean difference</th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
<th>95% Confidence Interval of the Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME</td>
<td>0.17</td>
<td>1.02</td>
<td>57</td>
<td>.31</td>
<td>-0.16 to 0.51</td>
</tr>
<tr>
<td>Performance</td>
<td>0.95</td>
<td>11.10</td>
<td>57</td>
<td>&lt;.05</td>
<td>0.78 to 1.12</td>
</tr>
</tbody>
</table>

Effect-sizes

The mean of performance scores in Treatment A was 6.11, SD= 0.66 and it was 5.15 for Treatment B, with SD= 0.66. The Paired samples correlation for performance scores was 0.51. Therefore, the Cohen’s \( d \) was calculated as 1.47 after adjusting for the paired-sample correlation (Morris & DeShon, 2002, equation 8, using online calculator http://www.cognitiveflexibility.org/effectsize/effectsizecalculator.php)

\[
d = \frac{\mu}{\sigma \sqrt{2(1-\rho)}} \tag{4.1}
\]

Where \( d \) is the effect size, \( \mu \) is the mean difference, \( \sigma \) is the standard deviation, and \( \rho \) is the paired-sample correlation.

Using the same equation, the effect size of cognitive load was 0.13, based on mean of Treatment A as 5.86, SD= 1.25, the mean of Treatment B as 5.69, SD= 1.22. The paired samples correlation was 0.46.
Correlation Between Changes (Complete Data)

Before conducting the correlation analysis of the changes in cognitive load and discussion performance, I checked the normality of the data. As shown in Table 4.9 and Figure 4.4 and 4.5, Changes in cognitive load had a skewness of 0.13, and standard error of 0.31, which indicated the satisfaction of normality. The changes in discussion performance had a skewness of 0.65, with standard error of 0.3. Although the skewness was larger than 2SD but it was less than 3SD, therefore the normality assumption of data was not severely violated. The scatterplot of changes in cognitive load by changes in discussion performance (as shown in Figure 4.6) does not show much violation of the bivariate normality.

The correlation coefficient between changes in cognitive load and changes in discussion performance was -0.049 with p value (2-tailed) as 0.71.

Table 4.9
Descriptive Statistics of Changes in Cognitive load and Performance based on complete data

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>SD</th>
<th>Skewness</th>
<th>Std. Err of Skewness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change in ME</td>
<td>0.17</td>
<td>1.29</td>
<td>0.13</td>
<td>0.31</td>
</tr>
<tr>
<td>Change in Performance</td>
<td>0.95</td>
<td>0.65</td>
<td>0.65</td>
<td>0.31</td>
</tr>
</tbody>
</table>

Figure 4.4 Histogram of changes in cognitive load based on complete data
Carry-Over Effect (Without disGroup 5)

The carry-over effect was investigated by comparing the two groups on individual totals. The Levene’s test for equality of variance showed that equal variances existed in the two group, $F = 0.22, p = 0.64$ for performance total scores and $F = 2.63, p = 0.11$ for cognitive load scores. Therefore, the $t$ test results for equal variances were appropriate for the analysis. The results were reported in Table 4. 10.
Because significant carry-over effect was detected for discussion performance scores, the performance scores of Group 2 in Discussion 2 (treatment B) should be adjusted by carry-over effect. The estimation of the carry-over effect was calculated as the mean difference between the individual totals between Group 1 and Group 2, which was 1.24, with 95% CI of (0.61, 1.86). Table 4.11 shows the descriptive statistics for performance scores adjusted by carry-over effect.

Table 4.11
Descriptive statistics of discussion performance scores after adjusting for carry-over effect without disGroup 5

<table>
<thead>
<tr>
<th>Group/Treatment*</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Skewness</th>
<th>Std Err of skewness</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/A</td>
<td>24</td>
<td>6.02</td>
<td>0.69</td>
<td>-1.35</td>
<td>0.47</td>
</tr>
<tr>
<td>1/B</td>
<td>24</td>
<td>5.03</td>
<td>0.67</td>
<td>-1.35</td>
<td>0.47</td>
</tr>
<tr>
<td>2/A</td>
<td>30</td>
<td>6.10</td>
<td>0.64</td>
<td>-0.06</td>
<td>0.43</td>
</tr>
<tr>
<td>2/B</td>
<td>30</td>
<td>4.94</td>
<td>0.64</td>
<td>-1.22</td>
<td>0.43</td>
</tr>
<tr>
<td>Total</td>
<td>108</td>
<td>5.52</td>
<td>0.85</td>
<td>-0.40</td>
<td>0.23</td>
</tr>
</tbody>
</table>

*1 or 2 indicates group membership; Treatment A is the condition when example-postings are provided and Treatment B is the condition when no example-postings are provided.

Discussion Task Effect (Without disGroup 5)

The discussion task effects were investigated after adjusting the performance scores for Group 2 discussion 2 by the carry-over effect (1.24). No adjustment was done to the cognitive load scores because the test for carry-over effect for cognitive load was not significant. A paired-sample t test was conducted between the means of cognitive load and performance of the two discussions. Results are shown in Table 4.12.
Table 4.12
Discussion task effect tests without disGroup 5

<table>
<thead>
<tr>
<th>Variable</th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>95% Confidence Interval of the Difference</th>
<th>Lower</th>
<th>Upper</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME</td>
<td>-0.54</td>
<td>53</td>
<td>.59</td>
<td>-0.09</td>
<td>1.26</td>
<td>-0.43, 0.25</td>
<td>-0.43</td>
<td>0.25</td>
</tr>
<tr>
<td>Performance</td>
<td>1.16</td>
<td>53</td>
<td>.25</td>
<td>0.20</td>
<td>1.27</td>
<td>-0.15, 0.55</td>
<td>-0.15</td>
<td>0.55</td>
</tr>
</tbody>
</table>

Because no significant effect of the discussion tasks was indicated by this analysis, the two discussion tasks were regarded as equivalent in terms of difficulty level and the capability to test the students’ performance.

**Treatment Effect (Without disGroup 5)**

Treatment effect was tested by comparing the means of the Treatment A and Treatment B after adjusting Group 2 Treatment B scores by the estimated carry-over effect. The test results are reported in Table 4.13.

Table 4.13
Treatment effect test results without disGroup 5

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
<th>95% Confidence Interval of the Difference</th>
<th>Lower</th>
<th>Upper</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME</td>
<td>0.13</td>
<td>0.76</td>
<td>53</td>
<td>0.45</td>
<td>-0.21, 0.47</td>
<td>-0.21</td>
<td>0.47</td>
</tr>
<tr>
<td>Performance</td>
<td>1.08</td>
<td>11.81</td>
<td>53</td>
<td>&lt;.05</td>
<td>0.90, 1.27</td>
<td>0.90</td>
<td>1.27</td>
</tr>
</tbody>
</table>

**Effect-sizes**

The mean of performance scores in Treatment A was 6.06, SD= 0.66 and it was 4.98 for Treatment B, with SD= 0.65. The Paired samples correlation for performance scores was 0.47. Therefore, the Cohen’s $d$ was calculated as 1.60 after adjusting for the paired-sample correlation (equation 4.1).
Using the same equation, the effect size of cognitive load was 0.11, based on mean of Treatment A as 5.83, SD= 1.27, the mean of Treatment B as 5.70, SD= 1.16. The paired samples correlation was 0.47.

**Correlation Between Changes (Without disGroup 5)**

Before conducting the correlation analysis of the changes in cognitive load and discussion performance, I checked the normality of the data (as shown in Figure 4.7 and 4.8). Changes in cognitive load had a skewness of 0.041, and SD of 0.33, which indicated the satisfaction of normality. The changes in discussion performance had a skewness of 0.80, with SD of 0.33. Although the skewness is larger than 2SD but it was less than 3SD, therefore the normality assumption of data was not severally violated. The scatterplot of changes in cognitive load by changes in discussion performance (as shown in Figure 4.9) does not show much violation of the bivariate normality.

*Figure 4.7 Histogram of changes in cognitive load without disGroup5*
Based on the normality analysis results, the correlation coefficient index used in this analysis was Pearson’s r. The correlation between changes in cognitive load and changes in discussion performance was -0.05 with p value (2-tailed) as 0.72.

**The Impact of disGroup 5 on Analysis Results**

As shown in Table 4.13, the grouping effect that possibly caused by disGroup 5 did not affect the analysis results very much. The significant results in the analysis that included disGroup 5 remained significant in the analysis that excluded disGroup 5 and the non-significant results in the analysis that included disGroup 5 remained non-significant in the analysis that
excluded this small group. However, the magnitudes of the effects changed, especially for carry-over effect and treatment effect. The carry-over effect changed from 1.02 to 1.24, and the treatment effect changed from 0.95 to 1.08.

Table 4.14
*The impact of disGroup 5 on analysis results*

<table>
<thead>
<tr>
<th>Effect</th>
<th>Complete Data</th>
<th></th>
<th>Without disGroup 5</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean difference</td>
<td>t (p)</td>
<td>Mean difference</td>
<td>t (p)</td>
</tr>
<tr>
<td></td>
<td>(95% CI)</td>
<td></td>
<td>(95% CI)</td>
<td></td>
</tr>
<tr>
<td>Carry-over effect</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ME</td>
<td>-0.31(-1.42, 0.81)</td>
<td>-0.55(0.58)</td>
<td>-0.37(-1.52, 0.78)</td>
<td>-0.64(0.53)</td>
</tr>
<tr>
<td>Performance</td>
<td>1.02(0.41, 1.62)</td>
<td>3.35(&lt;0.05)</td>
<td>1.24(0.61, 1.86)</td>
<td>4.0(&lt;0.05)</td>
</tr>
<tr>
<td>Discussion effect</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ME</td>
<td>-0.14(-0.47, 0.20)</td>
<td>-0.81(0.42)</td>
<td>-0.09(-0.43, 0.25)</td>
<td>-0.54(0.59)</td>
</tr>
<tr>
<td>Performance</td>
<td>0.01(-0.29, 0.32)</td>
<td>-0.10(0.99)</td>
<td>0.20(-0.15, 0.55)</td>
<td>1.16(0.20)</td>
</tr>
<tr>
<td>Treatment effect</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ME</td>
<td>0.17(-0.16, 0.51)</td>
<td>1.02(0.31)</td>
<td>0.13(-0.21, 0.47)</td>
<td>0.76(0.45)</td>
</tr>
<tr>
<td>Performance</td>
<td>0.95(0.78, 1.12)</td>
<td>11.10(&lt;0.05)</td>
<td>1.08(0.90, 1.27)</td>
<td>11.81(&lt;0.05)</td>
</tr>
<tr>
<td>Correlation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>( r = -0.05, p = 0.71 )</td>
<td></td>
<td>( r = -0.05, p = 0.72 )</td>
<td></td>
</tr>
</tbody>
</table>
CHAPTER 5

DISCUSSION AND CONCLUSION

This study was to investigate the effect of example-postings on students’ cognitive load and performance in online discussions. Two groups of participants were provided with two treatment conditions but in different sequence. Treatment A provided participants with online discussion instructions and example-postings whereas Treatment B provided participants with online discussion instructions and no example-postings. The scores on cognitive load of the discussion instruction and students’ performance in the discussions were measured and modeled via a set of linear equations. Grouping effect, carry-over effect, discussion task effect, and treatment effect were analyzed separately.

A significant grouping effect was detected in one group on discussion performance scores. The follow-up analysis revealed that the possible cause for the grouping effect was the relatively high and homogeneity of the participants’ scores on discussion performance totals in this disGroup. The grouping effect was further investigated in the next section of this chapter. Grouping effect was handled in two ways, with or without the outlier disGroup in the analysis. Two sets of analysis were conducted and the results were compared.

A significant carry-over effect in discussion performance scores was detected in both conditions (with or without the outlier disGroup). Therefore the scores of treatment A-B group in Treatment B condition were adjusted for the carry-over effect before further analysis was conducted. No carry-over effect was identified for cognitive load.

No discussion task effect was detected in either condition (with or without outlier disGroup) which indicated that the two discussion tasks were equivalent in difficulty level and the ability to test students’ performance.

Treatment effect was significant for performance scores in both conditions and with a slightly difference effect sizes (1.47 for the complete data and 1.60 when eliminating outlier disGroup) but not significant for cognitive load scores.

No significant correlation between the changes in cognitive load and changes in performance scores was detected.
Grouping Effects

A significant grouping effect was detected in Group 1 (treatment BA) on discussion performance scores. Analysis showed that the grouping effect was due to the homogeneity of disGroup 5 - the four members in this group had relatively high scores on discussion performance totals and the variance of their scores was relatively small (As shown in Figure 4.4). Further investigation showed that the four participants had relatively high scores in their first treatment condition (Discussion 1) -- the no-example condition (shown in Figure 5.1).

Figure 5.1 Illustrations of the means of disGroup5 and others in Group 1

The left figure shows the mean of disGroup 5 (red solid line) and the mean of others in Group 1 (blue dotted line) in the discussion condition where no examples were provided. The right figure shows the mean of disGroup 5 (red line) and the mean of others in Group 1 (blue line) in the discussion condition where examples were provided.

As shown in Figure 5.1, the mean of disGroup 5 in Discussion 1 (shown as a red solid line) was much higher than the mean of the other participants (shown as a blue dotted line). And this difference was smaller in the example-posting condition when all the disGroups’ mean scores were increased. This indicated that: first, disGroup 5 had a relatively high performance when no examples were provided to them; second, the outlier condition of disGroup 5 was not due to the example-treatment.

Two possible factors might have contributed to the relatively high performance in Discussion 1 (no-example condition) of this group. First, they might have had high prior-skill level. Second, the first one or two posts in this group might have been at very good quality and this might have affected the subsequent interactions. An examination of the prior skills level on the use of online discussion showed that all of the four students in this group had taken more
than 4 online courses that used online discussions. Their responses to the prior skill survey (Table 5.1) showed that they had averagely higher prior skill level than the class.

<table>
<thead>
<tr>
<th>Question</th>
<th>Strongly Agree &amp; Agree</th>
<th>Other Responses*</th>
</tr>
</thead>
<tbody>
<tr>
<td>disGroup5</td>
<td>Class</td>
<td>disGroup5</td>
</tr>
<tr>
<td>I know very well about how to participate in online discussions.</td>
<td>100%</td>
<td>97%</td>
</tr>
<tr>
<td>I never had difficulties in participating in online discussions.</td>
<td>75%</td>
<td>57%</td>
</tr>
<tr>
<td>I always had good grades in online discussions.</td>
<td>100%</td>
<td>88%</td>
</tr>
</tbody>
</table>

*Other Responses include Neither agree nor disagree, Disagree, Strongly disagree.

To examine the possible modeling effect of the early contributors in this disGroup, I check the score for the first contributor in Discussion 1, which was 5.67, the lowest among the four. This showed that modeling effect probably was not a major factor in this situation.

**Results Regarding Research Questions**

*Research Question 1. Do the students feel less cognitive load of the discussion instructions when they are provided with example-postings compared to when they are not provided with worked-examples?*

The results of this study indicated that the students did not feel any difference on the cognitive load imposed by the discussion instructions when they were provided with example postings compared to when they were not provided with examples. Hypothesis A was not supported by the results of this study. There are several possible explanations for this finding. First, the means of the cognitive load (of each treatment group in each treatment condition, as shown in Table 4.1) reported by the participants was around 5.5-6.0 on a 1-9 scale, which was between Neither High Nor Low and Rather High. This indicated that the students felt medium level of cognitive load to understand the discussion instructions. This might be due to the fact that the students in this study were used to this type of activities (majority of them had more than three previous courses that used online discussion) and they had good understanding of the
contents for the discussions (the discussion used for this study occurred on week 7 and week 8 of the semester and students may have learned a lot about the contents). Therefore, the inclusion of the examples did not cause significant changes in cognitive load on the students.

The second possible explanation for the no-difference in cognitive load results might be that the students did not pay close attention to the examples. They may have glanced at the instructions, relied on their prior experience, and rushed into the discussions without carefully examination of the examples. However, this explanation is not supported in this context because if this was the case the students’ performance in the discussions should not have exhibited improvement in the conditions that examples were provided. As a conclusion, I think the first explanation, the high level of prior skills of using online discussion, may have played a key role in this situation.

At the same time, a third possible explanation to the no-change in cognitive load might be due to the lack of sensitivity of the instrument used to measure cognitive load. The cognitive load of the discussion instruction was measured by the 9-level self-report instrument developed by Paas et al. (1994). Many researchers have reported relatively good internal consistency of this instrument (Paas & van Merrienboer, 1994; de Croock & van Merrienboer, 2007; de Croock, et al., 1998) based on participants’ ratings on multiple tasks, the Cronbach’s coefficient alpha ranged from .82 to .98 in these studies. However, from the methodological perspective, the validity of the inference made from a one-item instrument is questionable (Osterlind, 2006). Furthermore, how mental effort is related to cognitive load remains unclear (Brunken, Plass, & Leutner, 2003). Other methods for measuring cognitive load, such as the computational procedure (Sweller, 1988), but this method is concerned with the nature of the learning task and does not consider the problem solver’s strategy and knowledge that impacted the cognitive resources used for processing that learning task. Other techniques such as dual-task measure (Brunken, et al., 2003), heart-rate measure (Paas & van Merrienboer, 1994), and brain functional magnetic resonance imaging (Smith & Jonides, 1997) have proven to be complex and to some extent impractical for conducting research in educational settings where authentic learning situations are preferred. This raises the call for more reliable and easily implementable methods for empirical applications (Brunken, et al., 2003).
Research Question 2. Does the students’ performance in online discussion improve when the students are provided with example-postings compared to when they are not provided with example-postings?

Hypothesis B of this study is supported by the findings. The results of this study showed that the students’ performance in online discussion improved by about 1.47 – 1.60 of its standard deviation when they were provided with example postings. This is a very larger effect size based on Cohen’s rule. The relatively large effect size revealed in this study is probably due to the cross-over design where the between-subject variance is eliminated, which indicated the possible advantages of using a cross-over design instead of a simple two-group control-experimental design.

The results indicated that the examples may have helped the students better organize their thoughts and as a result the students presented in-depth processing of the contents in their postings. Also consider the finding of Research Question 1, the students’ rich prior experience of using online discussion and their content knowledge of the discussion topics were good enough so that the discussion tasks were not difficult for them.

Other than being a reasonable explanation for the findings on improved student performance in online discussions and no-difference in cognitive load, the high prior skills level of the students in the use of online discussion may also explain the different results between this study and the Jin et al. (2009) study. In the current study, all the participants used online discussion in at least two courses before they took this course. However, the situation was reversed in the Jin et al. (2009) study where 24 out of the 28 participants had used online discussion in less than two courses prior to the experiment.

Research Question 3. Does the improvement of the performance in online discussion relate to the change in the cognitive load of the discussion task?

The non-significant correlation coefficient between the changes of cognitive load and changes on discussion performance indicated that in this particular study the improvement of online discussion was not related to the change in the cognitive load of the discussion instructions. Therefore, Hypothesis C is not supported in this study. This result again confirmed the findings of Research question 2. The experienced learners in this study needed less working memory capacity in processing the discussion tasks and the example-postings did not make
significant changes in their cognitive load. However, this result might also be due to the insensitivity of the cognitive load measure. The failure to detect the changes in cognitive load may have led to the failure to detect the correlation between the changes in cognitive load and discussion performance.

Research Question 4. Do the effects of the example-postings (changes in cognitive load and improvement in performance) sustain when the examples are removed?

The significant carry-over effect on discussion performance indicated that the effects of example-postings sustained when they were removed. And the non-significant carry-over effect on cognitive load and non-significant treatment effect of cognitive load indicated that there was no treatment effect on cognitive load. Hypothesis D is supported for discussion performance but not supported for cognitive load. This indicates that the use of example-postings may have successfully facilitated the students to construct new schemas on how to effectively participate in online discussions and they are able to retain these new schemas in their long-term memory and use them in new tasks.

According to Senn (2002) and Jones and Kenward (1989), the carry-over effect is equivalent to treatment effect in cross-over designs. Carry-over effect is not the same value as treatment effect in current study probably is because the existence of grouping effect. When grouping effect was ignored in the analysis, the treatment effect was 0.95 and the carry-over effect was 1.02. These values both increased a little when the grouping effect was eliminated, which were 1.08 and 1.24 respectively.

Other Possible Explanations on Improvement in Performance with No Increase in Cognitive Load

Recent development in CLT recognizes the importance of learners’ prior experience to the effectiveness of instructional design (Kalyuga, et al., 2003). On one hand, novice learners lack the schemas necessary to process complex tasks therefore they may feel heavy cognitive load and need more working memory capacity to process the learning tasks. Appropriate instructions like worked-examples could direct learners’ attention to important contents to be learned and could promote schema construction. On the other hand, experienced learners have already acquired relevant schemas in their long-term memory. The instructions provided to the
experienced learners may be redundant and increase the learners’ cognitive load because they could not avoid attending to the information (Kalyuga et al., 2003). As a result, possible increase in cognitive load may occur in experienced learners and this is called expertise reversal effect.

In current study, experienced learners were provided with instructions which might have caused expertise reversal effect but the participants did not report any increase in cognitive load while exhibiting improvement in discussion performance. Other than questioning the sensitivity of the measurement instrument, one other possible way to interpret these results could be looking into the literature to find other theories that may be able to explain the situation.

The use of examples in teaching has long been appraised as one of the best practices. Deyck (1994) argues that examples are “instructional workhorses” that can help “dig into ideas and plow the land of abstract” (p. 40). On one hand, good examples can help the learners experience the ideas that abstract concepts cannot (communicate difficulty concepts). On the other hand, good example can build the connections between the ideas and the learners’ prior experience (existing knowledge). As a result, examples are easy to follow by the learners and well retained in their long-term memory (as schemas). In the context of this study, the rubric was abstract and did not provide the bridge between the instruction and implementation. When the rubric was illustrated by the example-postings, it was better perceived and retained by the students and successfully helped them to improve their performance.

**Suggestions for Future Studies and Conclusions**

With the prevalence use of online discussion, students are getting more and more experience with this instructional tool. Cognitive overload is less likely to be considered a problem in online discussions as it was years ago. Therefore, the assumption of this study, the cognitive overload has caused the lack of reflective and thoughtful contributions to online discussions, is not supported in this study. When online learners are getting more experience of using this instructional tool, the instructional activities that intended to improve students’ performance should look into other barriers that may have hindered students from learning.

The findings of this study may have revealed one type of these barriers—the lack of clear expectations on how to participate. In responding to the Prior Skills of Using Online Discussion Survey, sixteen participants (out of 58) in this study reported that they had difficulties in participating in online discussions, albeit that most of them (56 out of 58) had used online
discussions in at least two other courses and felt they knew very well about how to participate in online discussions and 51 out of the 58 participants reported had good grades in online discussions. This raises the question of what have made the online students feel difficult about online discussions. The results of this study, the use of example-postings improved the students’ performance in online discussions, may have revealed one difficulty the online learners have: the lack of connection between what they are expected to do and how they actually do to satisfy the requirements. The students may feel that they know what the expectations (requirements) are while they are not sure how to demonstrate that they understand the expectations. As a result, they may feel difficulty to participate in the discussions. When provided with the examples, which illustrated the “how-to” process that was missing, the students achieved significant improvement in their discussion performance.

Another issue to be pointed out is the medium-level cognitive load reported in this study is for the discussion instructions. I did not measure the discussants’ cognitive load of constructing postings for the discussions. It is very possible that the diversity of the opinions presented in participants’ postings and the rich interaction might have created information overload and consequently cognitive overload for the discussants. Future studies may investigate the cognitive load from this perspective.

This study also raises the call for more sensible measurement instrument for cognitive load. No change in cognitive load resulting from the treatment conditions may be due to a real situation or to the insufficient sensitivity of the instrument.

To better understand the relations among concepts of cognitive load, student performance, discussion task, and treatment effect, the use of concept mapping may be helpful. As recommended by Jeong (2010), concept maps can be used to improve understanding of complex relationships and causal mechanism. Considering the concept mapping approach may involve other concepts that are related to cognitive load but not investigated in this study, I won’t present a concept map in this manuscript.

In conclusion, the results of this study rejected the assumption of cognitive overload of online discussion instructions but shed some lights on how to improve reflection and thoughtfulness for online learners.
APPENDIX A

INVITATION FOR PARTICIPATION

Figure A. 1 Invitation for participation sent to the class
APPENDIX B

IRB APPROVAL MEMO

Office of the Vice President For Research Human Subjects Committee Tallahassee, Florida
32306-2742
(850) 644-8673 · FAX (850) 644-4392

APPROVAL MEMORANDUM

Date: 4/22/2011

To: Li Jin

Address: 184-06, Moore Dr. 32310
Dept.: EDUCATIONAL PSYCHOLOGY AND LEARNING SYSTEMS

From: Thomas L. Jacobson, Chair

Re: Use of Human Subjects in Research
A study of the effect of online discussion strategies on learning

The application that you submitted to this office in regard to the use of human subjects in the
proposal referenced above have been reviewed by the Secretary, the Chair, and one member of
the Human Subjects Committee. Your project is determined to be Expedited per per 45 CFR §
46.110(7) and has been approved by an expedited review process.

The Human Subjects Committee has not evaluated your proposal for scientific merit, except to
weigh the risk to the human participants and the aspects of the proposal related to potential
risk and benefit. This approval does not replace any departmental or other approvals, which
may be required.

If you submitted a proposed consent form with your application, the approved stamped
consent form is attached to this approval notice. Only the stamped version of the consent form
may be used in recruiting research subjects.

If the project has not been completed by 4/17/2012 you must request a renewal of approval for
continuation of the project. As a courtesy, a renewal notice will be sent to you prior to your
expiration date; however, it is your responsibility as the Principal Investigator to timely request
renewal of your approval from the Committee.

You are advised that any change in protocol for this project must be reviewed and approved by
the Committee prior to implementation of the proposed change in the protocol. A protocol
change/amendment form is required to be submitted for approval by the Committee. In addition, federal regulations require that the Principal Investigator promptly report, in writing any unanticipated problems or adverse events involving risks to research subjects or others.

By copy of this memorandum, the Chair of your department and/or your major professor is reminded that he/she is responsible for being informed concerning research projects involving human subjects in the department, and should review protocols as often as needed to insure that the project is being conducted in compliance with our institution and with DHHS regulations.

This institution has an Assurance on file with the Office for Human Research Protection. The Assurance Number is FWA00000168/IRB number IRB00000446.

Cc: Aubteen Darabi, Advisor
HSC No. 2011.6261
APPENDIX C

APPROVED CONSENT FORM

Florida State University

Consent form

A Study of the Effect of Online Discussion Strategies On Learning

You are invited to participate in a research that investigates the effect of online discussion strategies on learning. I, Li Jun, am conducting this study under the direction of Dr. Annette Darabi. I am a graduate student in Department of Educational Psychology and Learning Systems, College of Education. I am asking you to read this consent form and ask me any questions before you agreeing to participate in this study.

The objectives of the study

The purpose of this study is to investigate the impact of online discussion strategies on learning outcome.

Procedure:

To participate in this study, you will be asked to do the following: First, you will be asked to fill up a survey, which will ask for your demographic information, including your name, major, status in your program, and you knowledge and experience about online discussion. Second, you will participate in three online discussions on some given topics that are relative to the course you are enrolled. You will be requested to post at least one posting for each discussion. Third, you will be asked to fill up a survey right after you post each posting in online discussion. This survey will ask you about your experience in constructing the message you just posted and the topic being discussed. Fourth, you will be asked to grade some other students’ participation in the discussion.

I will collect data on your responses to the surveys, your postings to the online discussions, and the scores you give to your peer students. The peer rating scores will not be use for assessing you or your peer students’ grade for the course you are enrolled.

No other personal information of you will be collected and used for conducting this study. You will need to sign on the consent form and send it back to me via mail or email.

Risk and benefits of being in the study:

The study has no anticipated risks for you.

You may be able to share resources, knowledge, opinions, and aspects with others regarding to some specific topics being discussed. There is no other direct benefit to you in participating in the study. But this study will provide data for the field of instructional design of online discussion, which will benefit future learners and contribute to the knowledge of this field.

No compensation will be provided for participating.

Confidentiality

The participants’ data is confidential to the extent allowed by law. Each participant

FSU Human Subjects Committee Approved 4/19/11. Void after 4/17/12 H5C# 2011.6261
will not be identifiable in any reports we might publish. Research records will be stored securely in UCC3.530 and only researchers of this study have access to the records. The records will be destroyed two years after this study is completed.

Voluntary nature of the study

Participation in this study is voluntary. Your decision on participating or not will not affect you current or future relations with the university. You can withdraw from the study at any time during the research with no effects on your participation in other program or courses.

Any concerns and questions can be directed to any of the following at anytime during the research:

FSU Human Subjects Committee:
2010 Levy Street, Research Building B, Suite 276
Tallahassee, FL 32306-2742
Tel. 850-644-8633
Email: humansubjects@magnet.fsu.edu

Advisor: Aubteen Darabi
305 Stone Building,
FSU, Tallahassee, FL 32306
Tel. 850-644-8633
Email: (Redacted)

Researcher: Li Jin
3530 University Center C
FSU, Tallahassee, FL 32306
Tel. 850-644-8633
E-mail: (Redacted)

Your participation is highly appreciated.

Statement of Consent
I have read the above information; I consent to participate in the study.

Printed Name: ________________________________

Signature ___________________________ Date ___________
APPENDIX D

WEEK 7 DISCUSSION INSTRUCTION (TREATMENT A)

Think about two specific media/communications services you use on a daily basis: a particular newspaper, a favorite website, or a specific cable channel, radio station, and so on. Now consider how the two selected services obtain their funding. What is their source of support (e.g., subscriptions, advertising, pay-per-view)?

Do you think that funding patterns make any difference in terms of the information they make available, the areas they cover, or the audience they reach? (In other words, how does the political economy of various media determine their effect?)

You will be graded a little differently in this week’s discussion. Please read carefully the following explanations.

You will:

a. Make an initial posting to the discussion question by preparing a 200-300-word posting. Make use of online research or course readings where appropriate.

b. Make at least two more contributions to the discussion by compare your case with those of others in your group, and comment on how well others have described the event. Provide constructive suggestions on how they can improve.

You will earn up to 7 points based on your participation in this discussion (which will be 5% toward your final grade). You are expected to:

1. Post to the discussion in a timely manner, i.e., post the initial response to the discussion question by midnight on Wednesday (15th) and two more contributions before Sunday midnight deadline (19th). (1 point)

2. Indicate originality in your postings. Give us a refreshing and new take on the subject at hand. (1 point)

3. Provide clear descriptions on the defining characteristics of the subject to enable others to understand the bases of your opinion. (1 point)

4. Provide thoughtful analysis of the course materials and the media you have chosen. Shallow sharing of information or describing your experience may be necessary in your postings but should not be the major theme of any of your postings. You may identify commons or differences between contents of the
course materials or media you selected, or compare, relate, or distinguish opinions. (1 point)

5. Indicate carefully reflection upon peers’ and your postings. You may make connections between the ideas of your posting and others, and/or point out the difference between your points and others’. (1 point)

6. Indicate insight for considering other possibilities and consequential results, challenge others’ ideas or opinions with supporting materials, or construct new ideas. You should demonstrate at least one of the above thoughtful processes in your postings. (1 point)

7. Clear writing. Make sure your writing clearly articulates what you want to say to prevent any misunderstandings. (1 point)

Please read the following example posting carefully before you start constructing your response to the question. This example illustrates good ways to fulfill the requirements 2-7 of the discussion and how to organize your thoughts.

<table>
<thead>
<tr>
<th>Example Posting</th>
<th>Requirements Met</th>
</tr>
</thead>
<tbody>
<tr>
<td>I like to stay up to date on any breaking news both locally and around the world. The main media service I use for local news is Jacksonville.com, the internet site for the Florida Times Union. For my national and world news I go to drudgreport.com, which is a portal for all types of stories from around the world. Both sites definitely rely heavily on advertising to make a profit or possibly just to stay afloat. But, both would rely on different advertisers and this does show in the type of news on the site. The Florida Times Union is the local paper for the Jacksonville, Florida area. There advertisers are likely to be located in the area along with most of the people who read it on a daily basis. Therefore, the paper will concentrate on local stories and events to keep these people happy and buying advertising both in the print edition and online. The Drudge Report is very different from the Times Union in the type of advertisers and readers. Drudge Report is considered a conservative site that will push the republican angle of a story. This helps them draw advertisers who are like minded in the political arena. But, to keep the advertisers on board they have to continue to slant to the right on issues. In the messages posted by others in this group, Jonathan relies on his Iphone for everything and NBC for news, and some other folks like local radio stations because they drive a lot! In general, I think there are two types of funding resources, ads and subscriptions. Websites rely on ads and Cell phones and TV cables get money from both. I definitely agree with Cathy about how content lean toward the audience and that affects the types of ads the media gets, but I am surprised that Tammy thinks that ads may influence the content on a website but this makes much sense after a second thought because the media may be biased to get more funding and this is what we don’t want to see.</td>
<td>Briefly describe the two media services. (2,3,7)</td>
</tr>
<tr>
<td></td>
<td>State the funding resources. (2,4,7)</td>
</tr>
<tr>
<td></td>
<td>Analysis of how the funding patterns affect content or audience for media. (4,7)</td>
</tr>
<tr>
<td></td>
<td>Draw common characteristics of funding resources stated by others and self. (5,6)</td>
</tr>
<tr>
<td></td>
<td>Surprises and why. (5,6)</td>
</tr>
</tbody>
</table>

Please respond to this Survey after you read all the explanations and feel that you have understood the discussion question and the requirements. You’ll get .5 extra credit for
completing this survey.
APPENDIX E

WEEK 7 DISCUSSION INSTRUCTION (TREATMENT B)

Think about two specific media/communications services you use on a daily basis: a particular newspaper, a favorite website, or a specific cable channel, radio station, and so on. Now consider how the two selected services obtain their funding. What is their source of support (e.g., subscriptions, advertising, pay-per-view)?

Do you think that funding patterns make any difference in terms of the information they make available, the areas they cover, or the audience they reach? (In other words, how does the political economy of various media determine their effect?)

You will be graded a little differently in this week’s discussion. Please read carefully the following explanations.

You will:

a. Make an initial posting to the discussion question by preparing a 200-300-word posting. Make use of online research or course readings where appropriate.

b. Make at least two more contributions to the discussion by compare your case with those of others in your group, and comment on how well others have described the event. Provide constructive suggestions on how they can improve.

You will earn up to 7 points based on your participation in this discussion (which will be 5% toward your final grade). You are expected to:

1. Post to the discussion in a timely manner, i.e., post the initial response to the discussion question by midnight on Wednesday (15th) and two more contributions before Sunday midnight deadline (19th). (1 point)

2. Indicate originality in your postings. Give us a refreshing and new take on the subject at hand. (1 point)

3. Provide clear descriptions on the defining characteristics of the subject to enable others to understand the bases of your opinion. (1 point)

4. Provide thoughtful analysis of the course materials and the media you have chosen. Shallow sharing of information or describing your experience may be necessary in your postings but should not be the major theme of any of your postings. You may identify
commons or differences between contents of the course materials or media you selected, or compare, relate, or distinguish opinions. (1 point)

5. Indicate carefully reflection upon peers’ and your postings. You may make connections between the ideas of your posting and others, and/or point out the difference between your points and others’. (1 point)

6. Indicate insight for considering other possibilities and consequential results, challenge others’ ideas or opinions with supporting materials, or construct new ideas. You should demonstrate at least one of the above thoughtful processes in your postings. (1 point)

7. Clear writing. Make sure your writing clearly articulates what you want to say to prevent any misunderstandings. (1 point)

Please respond to this Survey after you read all the explanations and feel that you have understood the discussion question and the requirements. You’ll get .5 extra credit for completing this survey.
APPENDIX F

WEEK 8 DISCUSSION INSTRUCTION (TREATMENT A)

A number of events relating to media policy have occurred in recent years, such as:

- Arizona State University’s blocking of the website Change.org (http://www.statepress.com/2012/02/02/asu-blocks-petition-website-on-campus-network/)
- Investigation of News Corp. on charges of phone hacking: http://www.capitalnewyork.com/article/media/2012/02/5267941/us-litigation-against-rupert-murdochs-news-corp-may-not-be-imminent-it

Please:

a. Make an initial posting to the discussion by selecting one of these topics, or another comparable national/international media policy issue, and prepare a 200 - 300 word summary of the issues and actors involved, as well as a justification of why it should or should not be considered a public policy question. Make use of online research or course readings where appropriate.

b. Make at least two more contributions to the discussion by compare your case with those of others in your group, and comment on how well others have described the event. Provide constructive suggestions on how they can improve.

You will earn up to 7 points based on your participation in this discussion (which will be 5% toward your final grade). You are expected to:

1. Post to the discussion in a timely manner, i.e., post the initial response to the discussion question by midnight on Wednesday (22nd) and two more contributions before Sunday midnight deadline (26th). (1 point)
2. Indicate originality in your postings. Give us a refreshing and new take on the subject at hand. (1 point)

3. Provide clear descriptions on the defining characteristics of the subject to enable others to understand the bases of your opinion. (1 point)

4. Provide thoughtful analysis of the course materials and the media you have chosen. Shallow sharing of information or describing your experience may be necessary in your postings but should not be the major theme of any of your postings. You may identify commons or differences between contents of the course materials or media you selected, or compare, relate, or distinguish opinions. (1 point)

5. Indicate carefully reflection upon peers’ and your postings. You may make connections between the ideas of your posting and others, and/or point out the difference between your points and others’. (1 point)

6. Indicate insight for considering other possibilities and consequential results, challenge others’ ideas or opinions with supporting materials, or construct new ideas. You should demonstrate at least one of the above thoughtful processes in your postings. (1 point)

7. Clear writing. Make sure your writing clearly articulates what you want to say to prevent any misunderstandings. (1 point)

Please read the following example posting carefully before you start constructing your response to the question. This example illustrates good ways to fulfill the requirements 2-7 of the discussion and how to organize your thoughts.

<table>
<thead>
<tr>
<th>Example</th>
<th>Requirements Met</th>
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<tbody>
<tr>
<td>Net Neutrality is a very heated subject. The major issues regarding to Net neutrality are the concept of it, whether it should be put into laws, and who has the authority for legislation. The concept of net neutrality is mainly being developed by some legal scholars like Tim Wu and Lawrence Lessig, and FCC. It seems that the core of net neutrality is that all legal content on the internet should be treated equally, i.e., be delivered at the same rate and quality. But the idea of tiered internet which allows the service providers to create “fast lanes” for prioritized” content has been advocated as part of the net neutrality. Proposals for net neutrality laws are generally opposed by major cable providers. The opponents argue that regulations could deny network providers’ ability to differentiate their service, confuse the internet with highly regulated telecom lines (such as telephones), and threaten of more intrusive regulations of internet. However, the net neutrality regulations were included in several congressional draft bills but failed to pass eventually. FCC’s net neutrality order finally passed at the end of 2010 and the Republicans have started planning its repeal. It is not even clear that FCC has the authority to enforce the new laws because the U. S. appeals court ruled that the FCC lacks the authority to force Comcast regarding to its service. The FCC net neutrality Order raises the concern from small businesses that can’t afford the extra charges but rely on the internet to provide information or services to consumers. This left a lot of holes open and questions unanswered. Proponents of Net</td>
<td>Clearly state the major issues of your topic.(3,7)</td>
</tr>
<tr>
<td></td>
<td>Identify the comment ideas and differences of multiple opinions regarding the issue.(2,3,4)</td>
</tr>
<tr>
<td></td>
<td>Indicate your insight: why it should not be a public</td>
</tr>
</tbody>
</table>
Neutrality are not sure if the proposal is a step in the right direction or a step in the wrong direction. As a lesson, I think there should not be laws on net neutrality because there is no common agreement on what net neutrality is and who has the authority to enforce it.

John, you argued in your posting that net neutrality is not a pressing issue because he thought internet service providers, like Comcast, should be responsible for blocking illegal content, like that on BitTorrent, therefore they should not have any settlement with BitTorrent on continuing service for an extra charge. For me, this is exactly why there needs to be legislations on net neutrality. Industries are for profits, laws will make them carry the responsibilities for the society.

John, I think you may restate your point from a different perspective, such as the concept of net neutrality is not well developed. And any ambiguous terms or broad definitions of this concept are not as useful compared with clear expectations of the public, such as stopping plagiarism. Hope this is helpful to you.

Please respond to this Survey after you read all the explanations and feel that you have understood the discussion question and the requirements. You’ll get .5 extra credit for completing this survey.
A number of events relating to media policy have occurred in recent years, such as:


Please:

a. Make an initial posting to the discussion by selecting one of these topics, or another comparable national/international media policy issue, and prepare a 200 - 300 word summary of the issues and actors involved, as well as a justification of why it should or should not be considered a public policy question. Make use of online research or course readings where appropriate.

b. Make at least two more contributions to the discussion by compare your case with those of others in your group, and comment on how well others have described the event. Provide constructive suggestions on how they can improve.

You will earn up to 7 points based on your participation in this discussion (which will be 5% toward your final grade). You are expected to:

1. Post to the discussion in a timely manner, i.e., post the initial response to the discussion question by midnight on Wednesday (22nd) and two more contributions before Sunday midnight deadline (26th). (1 point)
2. Indicate originality in your postings. Give us a refreshing and new take on the subject at hand. (1 point)

3. Provide clear descriptions on the defining characteristics of the subject to enable others to understand the bases of your opinion. (1 point)

4. Provide thoughtful analysis of the course materials and the media you have chosen. Shallow sharing of information or describing your experience may be necessary in your postings but should not be the major theme of any of your postings. You may identify commons or differences between contents of the course materials or media you selected, or compare, relate, or distinguish opinions. (1 point)

5. Indicate carefully reflection upon peers’ and your postings. You may make connections between the ideas of your posting and others, and/or point out the difference between your points and others’. (1 point)

6. Indicate insight for considering other possibilities and consequential results, challenge others’ ideas or opinions with supporting materials, or construct new ideas. You should demonstrate at least one of the above thoughtful processes in your postings. (1 point)

7. Clear writing. Make sure your writing clearly articulates what you want to say to prevent any misunderstandings. (1 point)

Please respond to this Survey after you read all the explanations and feel that you have understood the discussion question and the requirements. You’ll get .5 extra credit for completing this survey.
APPENDIX H

PRIOR SKILLS OF ONLINE DISCUSSION SURVEY

Your name:

Major:

How many courses you have taken so far used online discussion?________________

Choose the one that best describe your status:

1. First semester in my program
2. Second semester in my program
3. Third semester in my program
4. Fourth semester in my program
5. Others, please specify_____________

Choose one from the follow five scales for each of the four statements:

(a) strongly agree (b) agree (c) neutral (d) disagree (e) strongly disagree

1. I know very well about how to participate in online discussion
2. I never had difficulty in participating in online discussion
3. I always had good grade in online discussion.
Figure G.1 Screenshot of online survey
APPENDIX I

MENTAL EFFORT SURVEY

Choose the one that best describes the mental effort you invested in understanding the instruction of this discussion:

(a) very very high
(b) very high
(c) high
(d) rather high
(e) neither high nor low
(f) rather low
(g) low
(h) very low
(i) very very low
REFERENCES


Senn, S. (2002). *Cross-over trials in clinical research*. Chichester, Eng: J. Wiley,


BIOGRAPHICAL SKETCH

Li Jin joined the program of Instructional Systems at The Florida State University in fall 2008 as a doctoral student after she got her master’s in Instructional Technology from Kent State University in May 2008. She got her bachelor’s degree on Physics from Beijing Normal University. Li is interested in instructional design especially for online courses, learning outcome measurement methods, and program evaluation. She is enthusiastic about utilizing state of art statistical methods in the research of instructional design. She combines quantitative and qualitative methods and pursues the approaches that may examine the research questions of interest from multiple aspects.

Li Jin has been very active in academic activities such as presenting at international and national conferences, conducting research, writing research articles, and serving as a reviewer for journals in the field of instructional design and technology. She has won a number of awards during the period when she was at Kent State University and at Florida State University for her excellent performance in academic and community services. Some of these awards are: Student Leadership awards (2007 & 2008 at Kent State University), Outstanding Academic Achievement Award (2007 & 2008 at Kent State University), and Excellent International Student Award (2011, The Florida State University). She was the finalist of several other awards including being nominated for the Graduate Student Research and Creativity Award at the Florida State University by the Department of Educational Psychology and Learning Systems.

Li has worked as the assistant for the teaching assistant training program (Program for Instructional Excellence) at FSU since she came to Tallahassee. She worked on development and management of teaching improvement programs and demonstrated excellent skills and abilities in training program development, project management, and collaboration with units in- and outside of the university.

Li is a student at excellent academic standing, a self-motivated researcher, a responsible employee, a talented instructional designer and instructor, and a caring mom of three.