PROMOTING ACADEMIC READING ENGAGEMENT THROUGH A VIRTUAL TUTEE SYSTEM

by

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(Under the Direction of ChanMin Kim)

ABSTRACT

Reading is fundamental in college learning. College students are often expected to study and learn through readings so that they can develop a deeper understanding of a topic. However, it is frequently reported that college students demonstrate poor engagement in academic readings. Despite the significance of academic reading in a college environment, very few empirical studies have been conducted to improve college students' engagement in academic readings.

This dissertation focuses on the development, implementation, and evaluation of an instructional tool, a Virtual Tutee System (VTS), to promote college students' reading engagement and performance. The VTS is a web-based tutoring environment that allows students to teach a virtual character about what they read and learn from academic texts. The VTS has been developed grounded on the peer tutoring literature and motivation theory. A series of studies were conducted to evaluate and refine the VTS.

This dissertation adopts the alternative format and consists of three journal-style manuscripts. The first manuscript (Chapter 2) describes the theoretical foundations underlying the design of the VTS and introduces its design framework. The design framework of the VTS is composed of four design principles and corresponding guidelines. The second manuscript

(Chapter 3) presents two field trials of the initial VTS prototype. The VTS prototype was developed based on the design framework and implemented in an introductory educational technology class at a large public university in the southeastern United States. The two field trials identified some design errors of the VTS and the VTS prototype was revised accordingly. The third manuscript (Chapter 4) reports on an empirical study that assessed the effects of the revised VTS on reading motivation, engagement, and performance. This study used a mixed methods approach: survey instruments yielded quantitative data, and an open-ended survey and student interviews were used to collect qualitative data. The results of the study indicated that students who used the VTS demonstrated deeper cognitive engagement in reading and higher performance on the reading assignments than those who did not use the VTS. The dissertation concludes with implications of the study and future research directions (Chapter 5).

INDEX WORDS: Engagement, Reading engagement, Academic engagement, Virtual Tutee System, Peer tutoring, Learning by teaching, Motivation, Reading motivation

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A Dissertation Submitted to the Graduate Faculty of the University of Georgia in Partial Fulfillment of the Requirements for the Degree

DOCTOR OF PHILOSOPHY

ATHENS, GEORGIA

2013

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August 2013

DEDICATION

This dissertation is dedicated to my beloved family. Your love, encouragement, and support gave me the strength to overcome every challenge in this journey.

ACKNOWLEDGEMENTS

First and foremost, my sincere gratitude goes to my advisor, Dr. ChanMin Kim, for her wholehearted support and enlightening mentoring throughout my doctoral studies. I would not have been able to reach this level of accomplishment without her guidance and encouragement. I especially thank her for being a great mentor and sharing her experiences as an educator and a scholar.

I would also like to express my deep appreciation to my committee members, Drs. Robert Branch, Lloyd Rieber, and Nicholas Fuhrman. I am grateful for their interest in my research, invaluable feedback on my study, and the support and guidance they provided to assist me in advancing as a researcher.

Additionally, I give special thanks to Ms. Gretchen Thomas and Dr. Gregory Clinton for allowing me to conduct my dissertation study in their classrooms and who helped in the data collection. Their support was critical to my completing this dissertation. In addition, I cannot thank Erkan Er enough for programming a Virtual Tutoring System. His extraordinary work made this dissertation study possible. I am truly grateful for his willingness to help and collaborate with me.

Finally, I would like to acknowledge all the colleagues and friends I have met at the University of Georgia. With their support, caring, and encouragement, I was able to maintain my faith in myself throughout the journey of my doctoral studies.

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CHAPTER 1

INTRODUCTION AND LITERATURE REVIEW

Educational practitioners have long recognized student engagement as essential for student learning (Finn & Zimmer, 2012). Although the definition of engagement varies, it is generally understood as a student's active involvement in a learning activity (Wellborn, 1991). Students who pay attention, complete assigned work, or actively participate in course activities during class are considered to be engaged students who are likely to become high achievers in school. Empirical research has also provided evidence for a positive relationship between student engagement and academic performance. For example, Finn, Pannozzo, and Voelkl (1995) found that students with high effort exertion and attentive behaviors scored higher on final exams than did those with low effort exertion and inattentive behaviors.

In most college classrooms, reading is one of the major vehicles for acquiring knowledge. College students are often expected to build a knowledge base for in-class lectures and discussions through reading course materials because instructors may not cover every detail of the course content in class (Berry, Cook, Hill, & Stevens, 2011). By reading course materials, students can develop a deeper understanding of the course topic. Thus, students' engagement in course readings can be critical for learning in a college classroom.

Studies have reported a positive relationship between students' reading engagement and academic achievement (Blumenfeld & Meece, 1988; Wigfield et al., 2008). For example, college students who completed assigned readings demonstrated a better understanding of in-class lectures and scored higher on class exams (Sappington, Kinsey, & Munsayac, 2002). Similarly,

college students earned a higher grade-point average (GPA) when they read their textbooks (Wandersee, 1988). Other research has also reported that reading completion was a strong predictor of class participation as well as student achievement (Carkenord, 1994; Karp & Yoels, 1976). Even college students themselves acknowledge that course readings are critical for their learning in class (Arquette, 2010; Berry et al., 2011).

Despite the significance of reading engagement, low engagement in academic readings has been commonly observed among college students. Although reading in college often places complex cognitive demands on students, college students rarely use reading strategies that could facilitate a deeper understanding and meaningful learning (Cao & Nietfeld, 2007). College students frequently reported that they had instead skimmed the course reading (Phillips & Phillips, 2007; Tomasek, 2009). Lesley, Watson, and Elliot (2007) also found that college students either read only a part of the assigned readings or chose not to read them at all. Furthermore, when studying for an exam by reading course materials, students rarely made an effort to develop a conceptual understanding but rather relied on simple memorization (Barnett, 2000; Taraban, Rynearson, & Kerr, 2000).

However, very few empirical studies have been conducted to improve college students' engagement in academic readings. A group of researchers have conducted studies focusing specifically on reading engagement (e.g., Guthrie et al., 1996). These researchers recognized the importance of reading motivation and engagement in improving students' reading comprehension and developed an instructional model to enhance reading engagement and comprehension: Concept-Oriented Reading Instruction (CORI). The CORI is a reading comprehension instruction program that focuses on both cognitive strategy instruction and motivational support in reading. Although numerous studies have reported supportive evidence

for the effectiveness of the CORI (e.g., Guthrie et al., 1996; Guthrie, Wigfield, & Perencevich, 2004; Wigfield et al., 2008), it was primarily developed for elementary school students (Guthrie et al., 1996) and more recently used with adolescents (Guthrie, Klauda, & Ho, 2013). The CORI rather covers classroom practices as a whole, which are difficult to apply to the context of a college classroom. There is an apparent lack of research that addresses a distinct intervention to improve reading engagement of college students.

Conceptual Framework of the Study

Peer tutoring refers to practices in which students provide instruction for other students (Topping & Ehly, 1998). It has been widely applied to classroom environments primarily as a successful alternative to individualized instruction (Devin-Sheehan, Feldman, & Allen, 1976). The literature on peer tutoring has consistently reported its effects on the academic gains of students who have received the tutoring. For example, elementary students significantly increased their math performance on a curriculum-based measurement after they were taught by more advanced peers (Menesses & Gresham, 2009). Similar findings are reported in numerous studies (e.g., Cook, Scruggs, Mastropieri, & Casto, 1985; Ginsburg-Block, Rohrbeck, Lavigne, & Fantuzzo, 2008; Stenhoff & Lignugaris/Kraft, 2007).

Not only is peer tutoring beneficial for students who learn from their peers but also for those who provide the tutoring. Such findings have been observed with a wide range of learners from elementary students to adult learners. For example, Wright and Cleary (2006) found that elementary students demonstrated a substantial improvement in reading fluency after teaching younger students. Rae and Baillie (2005) also reported a similar finding that junior-year college students who taught study skills to freshmen improved their own skills. Similarly, senior medical

students improved their knowledge and skills after they had taught junior medical students (Tang, Hernandez, & Adams, 2004).

In addition to enhanced academic achievement, studies have shown that assuming the role of tutor has an impact on student motivation and engagement as well. In a well-publicized meta-analysis study on peer tutoring, Cohen, Kulik, and Kulik (1982) found that peer tutoring had positive effects on improving students' social skills, self-concept, and classroom behaviors. Increases in self-competence or self-efficacy beliefs were especially pronounced in many other studies (Bierman & Furman, 1981; Miller, Topping, & Thurston, 2010; Top & Osguthorpe, 1987; Topping & Bryce, 2004; van Keer & Verhaeghe, 2005). Student tutors also spent more time on task, improved class participation, and developed more positive attitudes toward the subject (Cushing & Kennedy, 1997; Franca & Kerr, 1990; Greer & Polirstok, 1982; Lieberman, Dunn, van der Mars, & McCubbin, 2000). Even when students with disabilities served as tutors, peer tutoring brought about a considerable improvement in their academic attitudes and behaviors (Cook et al., 1985).

Researchers have often referred to the concept of "learning-by-teaching" to explain tutors' gains (Gartner, Kohler, & Riessman, 1971). Roscoe and Chi (2007) suggest that knowledge-building activities in which peer tutors engage as they prepare to teach leads to the observed effects of learning-by-teaching. In fact, several studies have indicated that only expecting to teach can lead to enhanced learning of student tutors. For example, Bargh and Schul (1980) found that college students who studied reading material to teach at a later time performed better on a retention test than did those who studied the same material only for the purpose of learning it themselves. Similarly, Benware and Deci (1984) found that students were more intrinsically motivated and actively engaged with their learning environment when they were expected to

teach others than those who expected to be tested on the learning material. Annis (1983) also reported superior learning gains among college students who read with the expectation of teaching as compared to those who were taught by their peers.

Reflecting on the literature on peer tutoring leads to the conjecture that a computer-based learning environment in which students play the role of tutor may have the capability to enhance students' engagement in reading. In fact, a group of researchers have developed a *teachable agent*, a computer-simulated peer to which students teach the content and concepts they have learned (Brophy, Biswas, Katzlberger, Bransford, & Schwartz, 1999). Studies on a teachable agent were inspired by the concept that people develop deep knowledge and skills when they teach peers. Although the teachable agent has been found to enhance student motivation and engagement (Chase, Chin, Oppezzo, & Schwartz, 2009), the focus of the research has not been on motivation and engagement. This dissertation study highlights the motivational effects of tutoring and aims to apply agent technology to the context of college reading tasks.

Research Purposes

Given the poor reading engagement in college classrooms, this dissertation study focuses on enhancing college students' engagement in academic readings. The purposes of my dissertation study are two fold: 1) to design and develop a tool that can promote student engagement in academic reading and 2) to investigate the effectiveness of the tool developed. To serve the first purpose, a Virtual Tutee System (VTS) was developed to enhance college students' reading engagement. The VTS is a web-based tutoring environment in which students are assigned to teach a virtual tutee about the course materials. The initial design principles and guidelines of the VTS were grounded in the literature on peer tutoring, self-determination theory, and role theory. The VTS is not intended for a specific course; rather, it can be adapted into any

college course that involves assigned reading. Three subsequent studies were conducted in a college classroom to evaluate the VTS with regard to its effect on students' engagement in course readings and to revise the design of the VTS based upon the study results. The ultimate goal of this research is to refine the VTS to improve students' reading engagement and advance the design framework underpinning the VTS so that it can be replicated, applied, and adopted by other researchers and practitioners.

Dissertation Overview

The dissertation encompasses three published or ready to be published manuscripts. The three manuscripts report on a series of research studies conducted since January 2012. The first paper (Chapter 2), *A Design Framework for a Virtual Tutee System to Promote Academic Reading Engagement in a College Classroom*, delineates the foundational work underpinning the VTS development and research. The paper begins with a review of the peer tutoring literature emphasizing the effects of peer tutoring on the tutor. Next, the paper describes the two theoretical foundations of the VTS: role theory and self-determination theory. Based on the theoretical foundations, the paper introduces the design framework of the VTS and provides examples of application in a teacher-education course. Finally, the paper discusses the potential for the VTS and implications for future research. This paper was published in *Journal of Applied Instructional Design* (Park & Kim, 2012).

The second paper (Chapter 3), *Virtual Tutee System: A Potential Tool for Enhancing Academic Reading Engagement*, reports on the first two evaluation studies of the VTS. Based on the design framework presented in Chapter 2, the initial prototype of the VTS was developed through consultations with experts in instructional design and computer programming and with the course instructor. The main purposes of the two field trials were to assess the efficacy of the

VTS and improve its design. During the two field trials, the VTS was implemented in an introductory educational technology class. In the first trial, students who used the VTS were compared to those who completed reading guide questions with regard to their reading engagement. Reading engagement was measured in two ways: 1) the time students spent reading and 2) the degree to which students used reading strategies. Based on the first trial results, the VTS design was modified. The second field trial was conducted to evaluate the modified VTS. In this trial, changes in students' cognitive engagement after using the VTS were assessed. The two field trials yielded minimal evidence for a positive influence of the VTS on students' reading engagement.

Chapter 4, *The Effects of a Virtual Tutee System on Academic Reading Engagement*, presents the empirical research on the VTS. The main purposes of the study were to assess the prolonged use of the VTS and expand the findings of the past field trial studies. In the prior field trials, students completed two reading assignments with the VTS. In this third study, the VTS was implemented with four reading assignments. The study examined the impact of the VTS on reading motivation, reading engagement, and reading performance. Reading motivation was defined as the degree to which students demonstrated either autonomous or controlled motivation for completing the assigned readings. Reading engagement was measured primarily in three ways: 1) behavioral engagement (e.g., overt reading behaviors), 2) cognitive engagement (e.g., use of reading strategies), and 3) emotional engagement (e.g., experience of different emotions with reading assignments). Reading performance was measured by students' performance on the reading assignments. A concurrent triangulation mixed methods design (Creswell, 2009) was used as the primary research design. Survey instruments were administered for quantitative data collection, and an open-ended survey and student interviews were conducted for qualitative data

collection. Study results indicated that students who used the VTS achieved higher reading performance than those who completed the online reading guide.

Finally, Chapter 5 presents a summary of key ideas from the three manuscripts. As the dissertation research has served for the initial development stages of the VTS, further research should follow to refine the VTS and advance its effectiveness on student engagement and learning. Chapter 5 concludes with implications of the dissertation study and future research directions.

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CHAPTER 2

A DESIGN FRAMEWORK FOR A VIRTUAL TUTEE SYSTEM TO PROMOTE ACADEMIC READING ENGAGEMENT IN A COLLEGE CLASSROOM[1]

[1] Park, S. W., & Kim, C. (2012). *Journal of Applied Instructional Design*, *2*(1), 17–33, Reprinted here with permission of publisher.

Abstract

Poor academic reading habits among students in higher education have been commonly acknowledged. Pre-service teachers are not exceptions as they do not always complete assigned course readings and frequently exhibit a shallow level of reading strategies. This paper proposes one approach to improve college students' engagement in academic reading, a Virtual Tutee System (VTS). The VTS presents a Web-based peer-tutoring environment in which students take the role of tutor and teach a virtual avatar character. According to research on peer tutoring, students are likely to develop active engagement in learning when they adopt the role of a tutor. This paper provides an elaboration of the design framework of the VTS with design examples applied to a teacher-education course. The framework consists of four design principles, including component guidelines for each principle, grounded in role theory and self-determination theory. The peer tutoring literature is briefly reviewed along with two theories that provide the foundation of the VTS. The paper concludes with a presentation of the potential for the VTS in college classrooms and directions for future research.

Introduction

In many college classes, students are assigned to read course texts before class (Hilton, Wilcox, Morrison, & Wiley, 2010; Tomasek, 2009). Although college instructors provide lectures to introduce major ideas and concepts in class, they cannot cover every detail of the materials students are supposed to learn, due to limited time and resources. The instructors thus expect students to study and learn through reading textbooks and other materials in order to gain familiarity with, as well as a deeper understanding of, the topic (Bramhall, 2009). As a result, textbooks and other supplementary readings are integral components of college learning (Berry, Cook, Hill, & Stevens, 2011; Dávila & Talanquer, 2010). This is true of most college settings, regardless of how many educators would like to see a different learning paradigm in place.

However, a low level of engagement in course readings is commonly observed in college classrooms. A low completion rate of assigned readings has been reported at all levels of higher education from community college classrooms (e.g., Burgess, 2009) to graduate classes (e.g., Clump & Doll, 2007) as well as across different disciplines including accounting (e.g., Fitzpatrick & McConnell, 2009), psychology (e.g., McMinn, Tabor, Trihub, Taylor, & Dominguez, 2009), education (e.g., Arquette, 2010), and chemistry (e.g., Smith & Jacobs, 2003). Moreover, college students invest minimum effort to complete course readings. For example, they seldom make notes or draw inferences while reading course materials and rely on skimming (Phillips & Phillips, 2007; Taraban, Rynearson, & Kerr, 2000). Even when studying for exams, college students tend to focus on memorizing and retaining information rather than understanding materials (Barnett, 2000).

This issue of poor academic reading engagement has been reported with pre-service teacher-students in teacher education as well. Lesley, Watson, and Elliot (2007) surveyed pre-

service teachers with regard to their behaviors with, and attitudes toward, assigned readings and found strongly reluctant reading behaviors. Pre-service teachers reported that they disliked completing assigned readings; they either read part of them or decided not to read them at all. Furthermore, many pre-service teachers engaged in only a superficial level of reading, such as skimming and scanning, and indeed demonstrated a minimal understanding of the text. Similarly, Akyol and Ulusoy (2010) found that the majority of pre-service teachers not only spent an insufficient amount of time on course-related reading but also exhibited a limited use of reading strategies. Such low reading engagement among pre-service teachers has apparently persisted for years, as Gupta and Saravanan (1995) reported a similar issue more than 15 years ago: "Our (teacher) trainees rarely read, could not cope with their academic readings, and were unaware of effective strategies to manage their own reading" (p. 354).

Given that reading is fundamental to all domains of learning, teachers in any area should serve as good reading models for their students. Teachers' reading habits and attitudes influence those of students. For example, teachers who are enthusiastic about reading are more likely to demonstrate practices that promote students' engagement in reading (Morrison, Jacobs, & Swinyard, 1998). These teachers may encourage students to develop positive attitudes toward reading and use effective reading strategies. Hence, the development of good academic reading habits is critical for every teacher.

Poor academic reading engagement among pre-service teachers should have an adverse influence on their own learning. Numerous studies indicate that academic engagement is closely related to quality learning (see Fredricks, Blumenfeld, & Paris, 2004). For example, Wigfield and colleagues (2008) found that the level of reading engagement positively influenced reading comprehension. Engaged readers usually demonstrate higher reading motivation and better use

of reading strategies (Guthrie et al., 2004; Guthrie & Wigfield, 2000). Considering that college reading often involves extensive academic reading (Smith, Holliday, & Austin, 2010), reading engagement in higher education should have a significant influence on learning. Given the importance of the reading behaviors of pre-service teachers, intervention is needed to help future teachers engage in their own academic reading.

This paper proposes a virtual tutoring approach to improve the poor academic reading behaviors of pre-service teachers or college students through enhancing their engagement in course reading. Our approach to promoting reading engagement involves providing students with an opportunity to teach their peers, that is, *learning-by-teaching*. Learning-by-teaching (Gartner, Kohler, & Riessman, 1971) is a promising technique that can facilitate engagement in academic tasks. Learning-by-teaching refers to a process in which students learn more and better when they teach others. The effects of learning-by-teaching have been commonly reported in the literature on peer tutoring (Robinson, Schofield, & Steers-Wentzell1, 2005; Roscoe & Chi, 2007). Prior research on peer tutoring indicated that students who serve as tutors of their peers not only enhance their own academic achievement but also show improvement in psychological and behavioral outcomes of learning (e.g., motivation and attitudes) (Miller, Topping, & Thurston, 2010; Topping & Bryce, 2004; van Keer & Verhaeghe, 2005). Likewise, an opportunity to teach peers seems to have a positive influence on the quality of students' learning, including academic engagement as well as their performance. Even greater effects of a tutoring opportunity can be expected with pre-service teachers who presumably have high motivation for teaching.

However, learning-by-teaching, or peer tutoring, is seldom applied in a higher education setting. Peer tutoring in higher education is mostly implemented outside the classroom as a part of academic support services for students in need (e.g., Vogel, Fresko, & Wertheim, 2007) or in

a format in which upper-level students provide additional assistance in class (e.g.,Tang, Hernandez, & Adams, 2004). College students rarely have an opportunity to learn course materials by teaching their classmates. The dearth of peer tutoring in college classrooms could be due to the way most college classes are structured. Unlike primary and secondary school classrooms, college students do not necessarily know fellow students, and they meet for only a few hours a week rather than on a daily basis. This arrangement presents a challenge, making it difficult for students to engage in meaningful interactions and build rapport with their classroom peers. Also, many college classrooms are lecture-based and involve a large number of students, which makes it difficult for instructors to create and oversee peer-tutoring or other group activities.

Given these constraints, a Virtual Tutee System (VTS) has been developed, which implements learning by teaching in a college classroom through the affordance of agent technology. The VTS is a Web-based peer-tutoring environment in which students become the tutor of a virtual agent who is represented as a peer student. The VTS introduced in this paper was developed specifically for a teacher-education course. In the VTS, students, or pre-service teachers, are required to teach a virtual peer about what they have learned from their course texts. The main strategy for promoting reading engagement embedded in the VTS is the incorporation of a learning-by-teaching process into reading tasks as described in more detail later in this paper.

The purpose of this paper is to provide the design rationale and framework for the VTS. The framework consists of four design principles, each of which is accompanied by component guidelines. These principles and guidelines are grounded in research on learning by teaching, role theory, and self-determination theory. In the following sections, the peer tutoring literature is briefly reviewed to describe the observed effects of learning by teaching. Next, two theories

underlying the learning by teaching effect (i.e., role theory and self-determination theory) are discussed. Finally, the VTS design framework and its four design principles, along with design examples, are presented within the context of a college course teaching pre-service teachers to integrate technology in the classroom.

Previous Research on Peer Tutoring

Peer tutoring refers to one approach to educational practice in which students provide instruction to their peer students (Topping & Ehly, 1998). Numerous studies examining the effects of peer tutoring have indicated that students who are tutored improved their academic performance (e.g., Cook, Scruggs, Mastropieri, & Casto, 1985; Ginsburg-Block, Rohrbeck, Lavigne, & Fantuzzo, 2008). Although a majority of the studies were conducted with elementary and secondary school students, other studies have also showed the effectiveness of peer tutoring with college students. For example, Lake (1999) reported that students in an advanced physiology class achieved a higher course grade when they received peer tutoring. Researchers note that the individualized instruction and immediate feedback available through peer tutoring are believed to enhance student performance (Dineen, Clark, & Risley, 1977).

Moreover, peer tutoring is not only beneficial for students who are tutored but also for those who provide tutoring. Wright and Cleary (2006) found that advanced elementary students (3^{rd} and 4^{th} grade) showed a substantial improvement in their reading fluency after teaching reading skills to students in the second and third grade. Similar effects were observed with college students. After 4^{th} year medical students facilitated classroom discussions for 2^{nd} year students, they demonstrated significant improvement in their own knowledge and skills (Tang et al., 2004). Rae and Baillie (2005) also reported that junior-year students who taught freshmen about college study skills improved their own study skills.

Furthermore, some studies have indicated that the benefits of peer tutoring are even greater for tutors than for tutees. In an experimental study by Annis (1983), college students were assigned to one of five conditions: (i) read only, (ii) read to teach but not actually teach, (iii) read and teach, (iv) be taught only, and (v) read and be taught, with the students in each group taking approximately 30 minutes to fulfill the given activities. One week later, students in all groups completed a reading comprehension test. The study found that students who had taught peer students outperformed those who had been taught but not served as tutors. More recent studies have also reported a stronger impact of peer tutoring on the performance of tutors than on that of tutees (Robinson et al., 2005; Roscoe & Chi, 2007; van Keer & Verhaeghe, 2005). For example, Knobe and colleagues (2010) compared the effects of peer teaching with those of instructor-led teaching on 3rd and 4th year medical students. Students who had served as student teachers significantly outperformed those who had been taught by either their peers or the instructor.

In addition to enhanced academic achievement, students who serve as tutors also tend to demonstrate high engagement in academic tasks. For example, college students spent time focusing on conceptual understanding of the materials rather than on rote learning as they prepared for tutoring (Galbraith & Winterbottom, 2011). Arco-Tirado, Fernández-Martín, and Fernández-Balboa (2011) similarly reported that students improved their use of cognitive and metacognitive strategies of learning after tutoring their peer students. Student tutors also exhibited an increase in time on task, assignment completion, and class participation (Cushing & Kennedy, 1997; Lieberman, Dunn, van der Mars, & McCubbin, 2000). Furthermore, many studies have reported that students become more confident about themselves as learners and develop positive attitudes toward academic tasks after tutoring their peers (Bierman & Furman,

1981; Cohen, Kulik, & Kulik, 1982; Franca, Kerr, Reitz, & Lambert, 1990; Greer & Polirstok, 1982; Topping, Campbell, Douglas, & Smith, 2003). For example, students reported greater enjoyment with and interest toward a subject that they were to teach as compared to instances when they were not engaged in any tutoring experience (Utay & Utay, 1997). Also, students increased their self-efficacy beliefs about an academic task on which they tutored their peers (Legrain, D'Arripe-Longueville, & Gernigon, 2003; van Keer & Verhaeghe, 2005). These studies imply that a tutoring activity facilitates students' engagement in learning, which may lead to enhanced academic performance.

Several studies have indicated that the expectation of teaching by itself, without actual teaching, can lead to enhanced learning of student tutors. In the Annis (1983) study previously described, superior learning gains were observed with students who read with the expectation of teaching as well as with those who actually taught their peers. Bargh and Schul (1980) also reported a similar finding that college students who prepared to teach yielded a higher performance on a retention test than those who studied the same reading material in order to learn it for themselves. Moreover, Benware and Deci (1984) found improvement in students' academic motivation and engagement following students' expectation of teaching. In Benware and Deci's study, college students in one group were asked to read an article as if they would teach the contents of the article to another student, but they did not actually teach other students. Students in the other group were told that they would have an exam on the same article. Results of the study indicated that students who studied the assigned article in order to teach expressed a higher task interest and enjoyment and a greater willingness to devote additional time to the same task, when compared with those who studied in order to be examined. Also, students with the expectation of teaching perceived themselves to be more engaged with the learning

environment. Benware and Deci (1984) concluded that preparation for teaching promotes more active engagement in learning with students taking the initiative and showing greater commitment to learning.

In short, peer tutoring contributes to the learning of both those students who serve as a tutor and those who are tutored, or are tutees, and the tutor seems to benefit more than the tutee from the tutoring activity. Student tutors tend to develop positive academic self-concepts and favorable learning attitudes and motivation, which should promote active engagement and enhanced learning outcomes. Several studies have indicated that these benefits for tutors could only be achieved with an expectation of future teaching before performing the actual teaching. Recently, some researchers have found that the deeper cognitive engagement of tutors, such as integration of new and prior knowledge and elaboration of knowledge, is the main source of the learning by teaching effect (Roscoe, 2008; Roscoe & Chi, 2007). However, the mechanism by which the learning by teaching environment promoted this deep level of engagement has rarely been discussed in the literature (e.g., Robinson et al., 2005; Roscoe, 2008). In the next section, this paper discusses role theory and self-determination theory (SDT) as two aspects of a theoretical framework to explain how the elements of learning by teaching contribute to a tutor's enhanced engagement and learning.

Theoretical Foundations of the Tutoring Effects

Role Theory

According to role theory, a role is associated with a set of specific behaviors and attitudes generally determined by society (Sarbin & Allen, 1968; Turner, 2002). When individuals assume any particular role, they are likely to behave and hold attitudes consistent with the assigned role and perceive themselves constrained by the expectations of other people (Sarbin & Allen, 1968;

Thomas & Biddle, 1966). In the context of peer tutoring, students who serve as tutors adopt characteristics of the role similar to those of the teacher (Allen & Feldman, 1973; Hogg & Vaughan, 2005). Students with the tutor role thus perceive a responsibility for a tutee's learning and develop a commitment to learning, finding learning materials more useful and important than students without a tutoring role (Robinson et al., 2005). Allen and Feldman (1976) suggested that the role of tutor also implies independence and authority in that the tutor has been recognized as having the capability to help others. Therefore, by taking on the role of a tutor, students perceive a greater competence with and control over a learning situation, as the role of tutor allows for a position wherein students can choose and determine what to learn and what to teach.

Self-Determination Theory

Self-determination theory (SDT), first proposed by Deci and Ryan (1985), further explicates how the adoption of the role of tutor can foster a student tutor's engagement. According to SDT, human motivation can be categorized into different types. These diverse forms of motivation are closely related to the varying levels of engagement and learning outcomes. That is, certain types of motivation can lead to deeper engagement and learning. The two most basic types of motivation are *intrinsic motivation* and *extrinsic motivation* (Deci & Ryan, 1985). Intrinsic motivation refers to behaviors enacted for one's inherent interest and enjoyment (Ryan & Deci, 2000). Such behaviors are thus experienced for the sake of an individual's inner pleasure. On the other hand, extrinsically motivated behaviors are performed because they are instrumental to some outcomes separable from the activity itself (Ryan & Deci, 2000). For example, a student reads a textbook in order to get good grades rather than for the inner pleasure and satisfaction from reading.

It is natural for people to be likely to engage in activities in which they are interested. Thus, intrinsic motivation often results in active engagement and high-quality learning (Deci & Ryan, 2000). However, most learning-related activities are not inherently fun or interesting. For example, reading a textbook is probably not an intrinsically motivating activity for most college students. Rather, it is extrinsically motivating, for students usually read textbooks in order to receive higher scores on a test. Although not intrinsically motivated, students can show differing levels of engagement with an extrinsically motivating activity. According to Ryan and Deci (2000), "students can perform extrinsically motivated actions with resentment, resistance, and disinterest or, alternatively, with an attitude of willingness that reflects an inner acceptance of the value or utility of a task" (p.55). Self-determination theory thus introduces four different types of extrinsic motivation (see Figure 2.1).

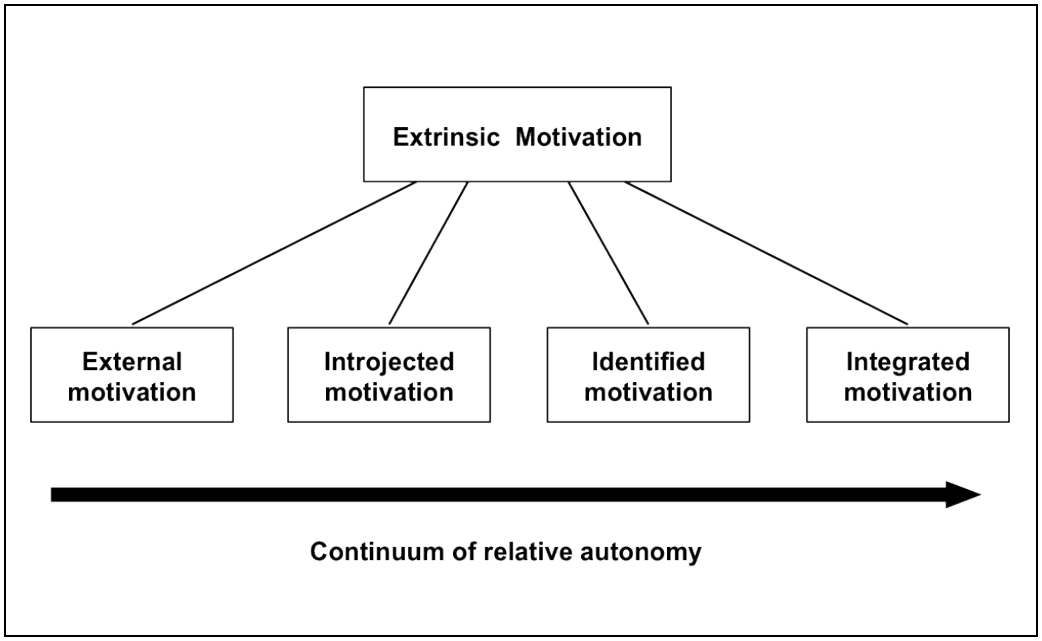

Figure 2.1. Types of extrinsic motivation. Adapted from "Intrinsic and extrinsic motivations: Classic definitions and new directions" by R. M. Ryan and E. L. Deci, 2000, *Contemporary Educational Psychology, 25*, p. 61. Copyright 2000 by Academic Press.

The four forms of extrinsic motivation in SDT do not represent distinct categories but rather exist in a continuum (Ryan & Deci, 2000). They differ in the degree to which the motivation for one's behavior arises from one's self or the motivation is self-determined. For example, *external motivation*, located at the far left in Figure 2.1, refers to behaviors performed in order to achieve a reward or avoid a punishment. An incentive of the externally motivated behavior thus lies outside the self, representing the least self-determined motivation. Another type of extrinsic motivation is *introjection*. *Introjected motivation* involves behaviors performed to avoid guilt or to attain a feeling of self-worth. This type of motivation is still not considered to be self-determined because the behaviors are instead initiated and controlled by internal pressure. On the other hand, *identified motivation* is signified when an individual recognizes the value of an activity and accepts it as personally important. For example, a college student might complete a textbook reading because he believes that it will help him master the course content, which is important for competence in more advanced courses. Finally, *integrated motivation,* at the far right of the continuum, is the most autonomous, self-determined form of extrinsic motivation. It occurs when the identified value of an activity is fully integrated with a part of the self. For example, a college student might apply for a study-abroad program because she can learn and appreciate the cultures of other countries, which is consistent with her deep-rooted values and interests.

Many studies have reported that greater autonomous and self-determined motivation, although extrinsic, yields deeper engagement and enhanced learning. Ryan and Connell (1989), for example, reported that the more students were externally motivated, the less they exhibited interest, endorsed the task's value, and/or exerted effort. Furthermore, identified motivation was correlated with enjoyment of school and adaptive coping styles, whereas introjected motivation

was related to anxiety and negative coping strategies. Connell and Wellborn (1991) also found that elementary students with a greater autonomous motivation were rated as paying more attention, demonstrating on-task behavior, and being active in class. Black and Deci (2000) reported similar results - namely, college students who had a greater autonomous motivation for learning organic chemistry demonstrated a higher perceived competence, more enjoyment in class, and less anxiety. All of these studies indicate that the more autonomous, self-determined forms of extrinsic motivation are crucial for facilitating constructive and high-quality learning experiences.

Given these advantages of autonomous types of extrinsic motivation, SDT is concerned with how non-intrinsically motivated behaviors can become internalized and self-determined. SDT introduces three basic psychological human needs that play a fundamental role in the development of autonomous motivation: the needs for autonomy, competence, and relatedness. In essence, greater autonomous motivation is facilitated if the learning environment is structured in a way that satisfies these innate human needs.

The need for competence refers to the need to feel efficacious. Individuals are more likely to sustain their motivation for a certain task when the task is structured in contexts that lead them toward feelings of competence. Optimal challenges and positive feedback, for example, contribute to the experience of perceived competence (Ryan & Deci, 2000). SDT further suggests that perceived competence alone does not promote internalization of extrinsic motivation; people must experience a sense of autonomy in addition to feelings of competence. A need for autonomy refers to a desire to experience one's behaviors as volitional and self-endorsed. Autonomy is closely related to a feeling of freedom to choose and determine one's own actions. Human autonomy can be supported by a provision of choices and

acknowledgement of feelings but undermined by external rewards, threats, and evaluation pressure (Ryan & Deci, 2000). Lastly, the need for relatedness refers to the desire to experience a sense of belongingness and connectedness to others. People tend to engage in activities that are valued by their significant others or those to whom they want to feel connected (Deci, Vallerand, Pelletier, & Ryan, 1991). The need for relatedness can be supported when people feel respected and cared for during the activity.

Numerous studies have reported that students show more internalized extrinsic motivation and productive learning behaviors when the psychological needs for autonomy, competence, and relatedness are satisfied. For example, Chirkov and Ryan (2001) found that students who perceived autonomy support from their teachers and parents were more likely to show self-determined types of motivation. Reeve, Jang, Carrell, Jeon, and Barch (2004) also reported that high-school teachers who were trained to support students' autonomy demonstrated more autonomy-supportive behaviors and that students of these trained teachers showed a higher engagement in class. Moreover, Miserandino's (1996) study indicated the importance of support for competence. In this study, students with low perceived competence exhibited more negative affect and lower engagement, even though they were academically high achievers in class. Furthermore, Furrer and Skinner (2003) studied feelings of relatedness among elementary-school students and their relation to academic engagement and performance. Results indicated that students who were more connected to their teachers and parents demonstrated greater engagement and higher performance. In sum, a classroom environment that supports the needs for autonomy, competence, and relatedness promotes more internalized, autonomous forms of extrinsic motivation, and accordingly, enhances student engagement and learning.

Returning to role theory, peer tutoring enables students who serve in the role of tutor to experience control over learning activities, or autonomy, as well as enhanced competence. Thus, peer tutoring seems to inherently support the needs for competence and autonomy. Benware and Deci (1984) found that when undergraduate students were expected to teach others, they were more intrinsically motivated and actively engaged with the learning environment. In addition, results of several studies have also supported that peer tutoring increases tutors' self-confidence (e.g., Cochran, Feng, Cartledge, & Hamilton, 1993; Miller et al., 2010; Top & Osguthorpe, 1987; Topping et al., 2003). For example, students rated themselves to be smarter and more competent after tutoring another student (Allen & Feldman, 1976; Bierman & Furman, 1981). These findings indicate that adopting the role of tutor promotes a sense of autonomy and competence. Furthermore, peer tutoring naturally addresses the need for relatedness. As student tutors engage in tutoring activities, they interact with their peers. Serving in the role of tutor, students may also feel respected and important. Indeed, several studies reported that students acting as tutors increased their feelings of belonging and social acceptance, a condition that fulfills the need for relatedness (Fantuzzo, Davis, & Ginsburg, 1995; Nazzal, 2002). In short, peer tutoring provides an environment that satisfies the basic psychological needs for autonomy, competence, and relatedness of students who serve as tutors. Thus, the high quality engagement and learning associated with student tutors may have resulted from the satisfaction of their basic psychological needs as suggested in SDT.

Virtual Tutee System

Given the deep level of engagement of tutors reported in the peer tutoring literature, a Virtual Tutee System (VTS) was developed to improve the academic reading experiences of college students by placing them in the role of a tutor through the application of agent

technology. The VTS is a Web-based peer-tutoring environment in which students take the role of tutor and teach a virtual character, or a virtual tutee, about what they read in their course texts. A *Teachable Agent* (TA) is the specific inspiration for the VTS. A group of researchers have developed the TA, which is a computer-simulated peer that students are asked to tutor (Brophy, Biswas, Katzlberger, Bransford, & Schwartz, 1999). For example, middle-school students draw a concept map about river ecology on a computer program to teach a TA named Betty (Biswas, Leelawong, Schwartz, Vye, & TAG-V, 2005). Based on whether students have correctly provided the concept map, Betty can or cannot answer quiz questions. Consistent with the peer tutoring literature, TA studies reported that students demonstrated a significant improvement in learning after teaching the TA (Chase, Chin, Oppezzo, & Schwartz, 2009; Leelawong & Biswas, 2008). However, most TA research has focused on supporting knowledge and skill acquisition of students. Although the TA has been found to enhance student motivation and engagement (e.g., Chase et al., 2009), the design of a TA did not explicitly address this aspect of learning. Furthermore, a TA has been applied mostly to K-12 settings but rarely to college environments. Accordingly, the VTS is designed to capitalize on a tutor's active engagement in learning, reported in the peer tutoring literature, and to replicate such effects in the context of college reading tasks.

Based on role theory and self-determination theory, the VTS employs specific design strategies that augment support for the basic psychological needs for autonomy, competence, and relatedness of peer tutors. Some studies indicated that a peer tutoring environment with restricted support for these psychological needs yielded no learning gains with student tutors. For example, when the student tutors' autonomy was diminished, only a minimal effect for peer tutoring was observed. Rohrbeck, Ginsburg-Block, Fantuzzo, and Miller (2003) found that student tutors did

not show significant improvement in learning when they were not allowed to set their own goals for the tutoring lessons. Similarly, student tutors who were frequently interrupted with regard to their use of resources and feedback failed to show significant learning gains (Biswas et al., 2005; Chan & Chou, 1997). Therefore, the VTS is carefully designed to fulfill each psychological need, as summarized in the four design principles and subsequent guidelines (see Table 2.1). The following section introduces each of the design principles and guidelines of the VTS and elaborates them with examples developed for a teacher-education course in which students, that is, pre-service teachers, learn how to integrate technology in the classroom.

A Design Framework for the Virtual Tutee System

Principle 1: Identification with the Role of Tutor

The first design principle of the VTS concerns identification with the role of tutor. According to role theory, involvement in a role is one factor that contributes to the degree of role commitment and enactment (Sarbin & Allen, 1968; Allen & Feldman, 1976). College students must be involved in the role of tutor so that they can adopt the characteristics of the role and experience a sense of autonomy and competence. To facilitate involvement in the role of tutor, first of all, the *responsibilities of the role of a tutor should be clearly communicated to students*. In the beginning of the VTS, students (pre-service teachers) are provided with a guide video that explains what their task is (i.e., to teach their virtual tutees) and what virtual tutees are expected to achieve. To establish a more authentic peer-tutoring environment, secondly, *virtual tutees' performances should be evaluated*. During the tutoring session, the virtual tutee asks several questions regarding the tutored materials (see Figure 2.2). The accuracy of students' responses to the questions is then used as an indication of the virtual tutees' performance. Further, *the progress of the virtual tutees' performances should be monitored throughout the entire learning*

course, which serves as feedback about students' tutoring. Although the current version of the VTS has not yet included this feature, the future VTS will record tutees' performance, assessed through students' responses to the tutees' questions, on each lesson and present the information graphically so that students can keep track of it.

Table 2.1. *Design principles and guidelines for the VTS*

Design Principles	**Component guidelines**
1. In order to support perceived competence and autonomy, the VTS should enhance students' identification with the role of tutor.	• Responsibilities of the tutor are clearly communicated to students. • A virtual tutee's performances are evaluated. • Students are able to view the progress of virtual tutees' performances.
2. In order to enhance student autonomy, the VTS should provide students with choices regarding tutoring activities.	• Students set their own instructional goals and objectives. • Students determine how to deliver a lesson. • Students choose whom they want to teach.
3. In order to support the need for relatedness, the VTS should emulate social interactions between tutor and tutee	• Virtual tutees ask students questions related to the lesson. • Virtual tutees express positive attitudes toward learning. • Interactions between students and virtual tutees continue throughout the entire semester.
4. In order to support individual students' motivational problems, the VTS should address the respective needs of individual students.	• Goal orientation: virtual tutees express their own aspirations for learning. • Task value: virtual tutees acknowledge the utility value and importance of the learning materials.

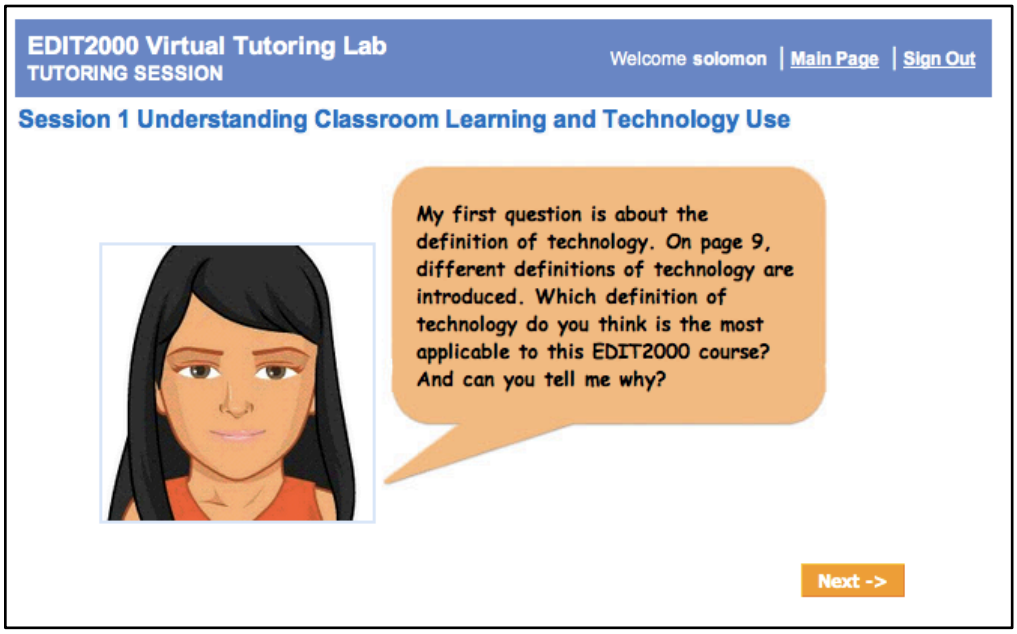

Figure 2.2. An example screen of a virtual tutee asking a question.

Principle 2: Choices in Tutoring Activities

The second principle concerns the strategies that further support students' autonomy as a tutor. According to self-determination theory, providing choices enhances a sense of autonomy (Deci & Ryan, 2000). The VTS presents three different choices that students need to make for their tutoring. First, *students should set goals and objectives for tutoring*. As shown in Figure 2.3, students are given a list of instructional goals pertinent to the assigned part of the course text and asked to choose one or more goals for their tutoring lesson. In addition, *VTS provides a choice about how to deliver a lesson to their virtual tutees*. For example, students may choose to create a concept map, write a summary, or provide definitions of key terms. Lastly, *students can choose whom they want to teach*. The VTS provides a list of available tutees along with their profile information. This strategy not only engages students' interest but also enhances their ownership, which in turn promotes involvement in the tutor role.

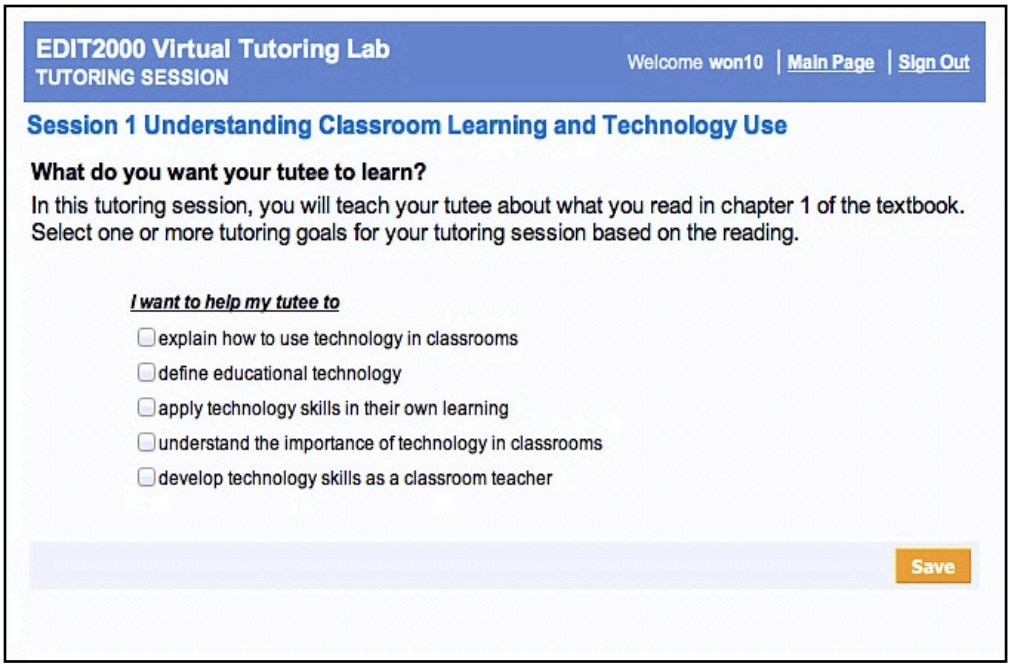

Figure 2.3. An example screen of instructional goal selection.

Principle 3: Social Interactions between Tutor and Tutee

The third principle is proposed to facilitate social interactions between tutor and tutee. Although virtual tutees are not identical to human peers, several studies indicated that people respond to computers as if they are social actors (e.g., Bracken & Lombard, 2004; Nass, Fogg, & Moon, 1996; Nass, Moon, & Green, 1997). For example, college students showed more favorable responses to computers that generated voice cues matching with their own personalities (Nass & Lee, 2001). Thus, the VTS is designed to simulate the experience of a human tutor-tutee interaction with the goal of satisfying the need for relatedness. Three strategies are employed to augment social interaction in the VTS. First, as shown in Figure 2.2, *virtual tutees ask student tutors questions*. Asking questions is a typical behavior of tutees. By responding to tutees' questions, students realize their role of tutor and become more involved. Second, *virtual tutees express positive attitudes toward learning*. For example, virtual tutees occasionally send a message expressing their interest in the tutored materials (see Figure 2.4).

Positive attitudes may serve as positive feedback for tutoring, which can enhance student tutors' feelings of being respected and important. Student tutors may model a virtual tutee's positive attitudes as well. Finally, *interactions between students and virtual tutees should continue throughout the entire semester*. The VTS should be designed for an entire learning course rather than for a one-time intervention. Students develop relationships with their tutee for a longer period of time so that they can increase their commitment, as well as sustain their motivation.

Figure 2.4. An example screen of a virtual tutee's positive attitude toward tutoring.

Principle 4: Needs of Individual Students

The three design principles discussed above focus on creating a learning environment that promotes active engagement. However, even if a learning environment is arranged to support basic psychological needs, the motivational beliefs of individual students could have an adverse effect on their engagement. Deci and Ryan (2000) pointed out that individuals' goals also influence the internalization of motivation (the autonomous types of extrinsic motivation). They argued that pursuing a certain type of goal may be conducive to the satisfaction of the basic

psychological needs. That is, people who pursue intrinsic goals (e.g., personal growth, health, and affiliation) are more likely to demonstrate self-determined motivation, whereas people with extrinsic goals (e.g., wealth, image, and fame) tend to exhibit less autonomous motivation. In support of this, Vansteenkiste, Simons, Lens, Sheldon, and Deci (2004) reported that undergraduate students who were given intrinsic goals (contribution to community, personal growth, and health) showed autonomous motivation, which in turn yielded deep processing, high test performance, and persistence. Similarly, Standage, Duda, and Ntoumanis (2003) examined secondary students' motivation in physical education and found that students in a mastery-oriented classroom were more likely to experience self-determined motivation and more leisure-time physical intentions. Thus, promoting intrinsic goal orientations may lead to more autonomous types of motivation.

In addition, another motivational belief that contributes to the development of autonomous motivation is perceived task value. One distinct element that differentiates between autonomous motivation (e.g., identified motivation) and less autonomous motivation (e.g., introjected motivation) is identification with the value of a learning activity. As described above, when students find a learning task to be important and personally meaningful, they exhibit self-determined motivation (Deci & Ryan, 2000). That is, students should recognize and understand the value of the activity. In fact, task value has long been recognized among motivation researchers as a critical factor in student motivation and learning (e.g., Eccles, 1984; Pintrich & De Groot, 1990; Pintrich & Schunk, 1996; Wigfield & Eccles, 2000). All these studies support that students show active engagement, invest more effort, and achieve more when they acknowledge the value of learning activities. Several self-determination theorists have also examined the relationship between task value and the internalization of academic motivation and

performance. For example, Reeve, Jang, Hardre, and Omura (2002) provided students with a rationale for why putting in an effort is worthwhile and useful during an uninteresting activity and tested the effects of the provision of a rationale on student achievement. Results showed that students provided with the rationale reported a higher task value (i.e., the importance of the activity), more internalized or autonomous motivation, and greater effort as compared with students who were not given the rationale. Therefore, it is critical that students understand the importance and usefulness of learning activities and truly value them in order to experience self-determined motivation and active engagement.

Given the critical role of goal orientation and perceived task value in promoting active engagement, the VTS will provide support to promote these two motivational beliefs, which relates to the fourth design principle of the VTS. In the beginning of each tutoring session, as shown in Figure 2.5, the VTS assesses student tutors' perceived value of course reading and their academic goal orientation. For students who demonstrate an extrinsic goal orientation, *virtual tutees will express their own aspirations for learning in this course* so that students can model them. If students recognize little value for the course readings or course materials, the VTS may foster perceived task value by having *virtual tutees acknowledge the importance of textbook reading and course materials*.

Conclusion

Although it is important that pre-service teachers develop and demonstrate exemplary academic reading behaviors for their future teaching, a majority of them have exhibited poor engagement in their own academic readings. They often do not complete the assigned readings, or they only skim the course texts. In response to this particular problem, this paper proposed a Virtual Tutee System (VTS) that aims to facilitate pre-service teachers' engagement in their own

course readings. The VTS is grounded on findings reported in the peer tutoring literature that peer tutors demonstrated active engagement and enhanced performance with the expectation of teaching. Thus, the VTS is designed to capitalize on the mechanism of these learning by teaching effects as suggested in role theory and self-determination theory.

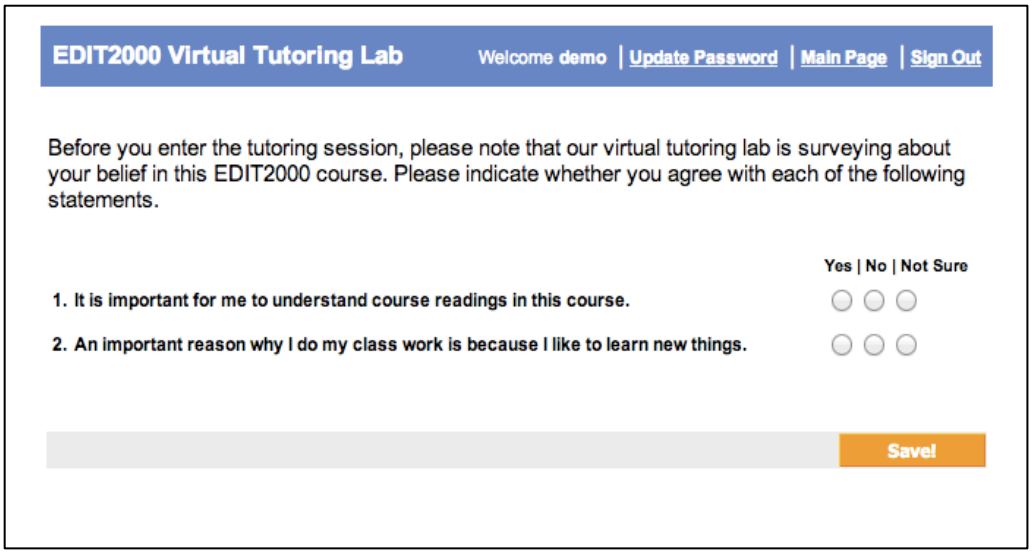

Figure 2.5. Individual needs assessment screen.

The major activity in the VTS involves teaching the virtual tutees about what the student tutors (pre-service teachers) have read in their course texts. The role of tutor allows students to experience a sense of competence and feeling of autonomy as well as to engage in social interactions with their virtual tutee. The specific design strategies employed in the VTS are arranged to augment support for the basic psychological needs for autonomy, competence, and relatedness of tutors. This paper summarized these strategies in the four design principles and guidelines of the VTS. With fulfillment of the three basic human needs, it is expected that the VTS will enable pre-service teachers to develop a more active engagement toward their own course readings.

Although the VTS is proposed with a strong theoretical groundwork, it has not yet been validated through empirical research studies. Future studies should examine the effects (or effectiveness) of the VTS as well as to refine its design framework according to study findings. For example, here we have suggested using the VTS throughout the semester so that students can establish a stronger commitment to their virtual tutee. However, it could transpire that students may become frustrated with the repetitive structure of the VTS after interacting with it for some period of time. In this case, the tutoring activities in the VTS should be varied or an intermittent use of the VTS should be considered.

The VTS is a distinctive application of peer tutoring as it employs a virtual character as an object who receives tutoring. One of the significant limitations of the VTS concerns the degree to which a virtual tutee can simulate an actual human tutee. It would strongly contribute to the success of the VTS to facilitate more authentic-like interactions between students and their virtual peers. Future studies should investigate how much simulated tutor-tutee interaction is desirable. The VTS can be further improved if it incorporates recent advances in virtual agents that are designed to have appropriate social competencies and to express and respond to emotions (e.g., Bickmore & Cassell, 2005).

The VTS offers much potential to resolve the problem of poor reading engagement among pre-service teachers, as well as to promote their academic performance. Research on the VTS has only taken the first step and there are several further studies to be completed. It is expected that future studies will not only refine the design of the VTS but also contribute to the existing literature of peer tutoring and extend the application of peer tutoring into different contexts.

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CHAPTER 3

VIRTUAL TUTEE SYSTEM: A POTENTIAL TOOL FOR ENHANCING ACADEMIC READING ENGAGEMENT[2]

[2] Park, S. W., & Kim, C. Submitted to *Educational Technology Research and Development*, 03/13/2013.

Abstract

This article reports on evaluation studies of the Virtual Tutee System (VTS) designed to enhance students' engagement in academic reading. The VTS is a web-based peer-tutoring environment in which students teach a virtual tutee about the content in course readings that students have been assigned to learn. With the VTS, students interact with virtual tutees by providing lecture notes and answering questions from these tutees. The initial prototype of the VTS was implemented and evaluated through two field trials in a college classroom. The purposes of the two field trials were to assess the efficacy of the VTS and improve its design. In the first trial, students successfully completed the VTS and suggested a deeper engagement in reading with the use of the VTS, but reported several design issues. Based on findings from the first field trial, two modifications in the VTS design were made. In the second field trial, students used the revised VTS. They expressed enjoyment in teaching their virtual tutees and appreciated the value of the VTS. They also demonstrated a significant increase in their reading strategy use. The article concludes with design considerations for the VTS and implications for future research.

Introduction

Reading is an integral component in college learning. Most college-level courses involve reading assignments designed to augment the lessons in class. Instructors expect students to study and learn through reading course materials because, as a result of limited time and resources, class lectures cannot include all the details that students are supposed to learn (Dickson, Miller, & Devoley, 2005; Hilton, Wilcox, Morrison, & Wiley, 2010). Course readings enable students to gain familiarity with a topic before class and develop a deeper understanding of it after class (Bramhall, 2009; Tomasek, 2009). Some studies have indeed indicated that students who complete assigned readings perform better on exams (Sappington, Kinsey, & Munsayac, 2002; Smith & Jacobs, 2003).

Nevertheless, low engagement in academic readings has been frequently reported among college students. One example is a low completion rate of assigned readings. Berry, Cook, Hill, and Stevens (2011) reported that only 18% of the students in college finance courses read their textbooks prior to class. Even if college students read, many of them demonstrate only a superficial level of reading engagement. For example, college students engage in a limited use of cognitive strategies that facilitate a deeper understanding and meaningful learning despite the fact that college-level textbooks are often conceptually dense and sophisticated (Cao & Nietfeld, 2007). They also tend to rely on literal comprehension and rote memorization rather than on developing a conceptual understanding of the materials when they prepare for upcoming exams (Barnett, 2000; Taraban, Rynearson, & Kerr, 2000). Moreover, many college students exhibit negative attitudes toward academic reading. In Lesley, Watson, and Elliot's (2007) study, most college students reported displeasure and boredom with reading assignments.

In response to college students' poor reading engagement, we developed a Virtual Tutee System (VTS) within a design framework grounded in the literature on peer tutoring, self-

determination theory, and role theory (Park & Kim, 2012). The VTS is a web-based tutoring environment in which students teach a virtual avatar character about the course materials they have been assigned to read in the class. The VTS is designed to promote student engagement in reading by placing students in the role of tutor. Although the VTS can be incorporated into any college course that involves assigned readings, the initial prototype of the VTS has been implemented in a teacher-education course.

Two field trials were carried out in order to evaluate the VTS prototype. The purpose of this paper is to describe these field trial studies and report their results. First, we discuss the background of the VTS by describing the relationship between learner engagement and peer tutoring through a brief review of the relevant literature and theories. Next, we describe the prototype design of the VTS. Finally, we discuss the processes of the two field trials and report the study findings.

Learner Engagement and Peer Tutoring

Engagement has been long considered to be essential to learning. Nevertheless, defining engagement is not a straightforward matter. The most recent conceptualization of engagement introduces three types of engagement: behavioral, emotional, and cognitive (Finn & Zimmer, 2012; Fredricks, Blumenfeld, & Paris, 2004). *Behavioral engagement* refers to observable behaviors that exhibit participation in academic and extracurricular activities or demonstrate positive conduct. Examples of behavioral engagement include time on task, completion of homework, attendance, and absence of disruptive behaviors. In the case of a reading task, time spent paying attention to text corresponds to behavioral engagement in reading. In comparison to overtness in behavioral engagement, *cognitive engagement* refers to a psychological investment in learning or an inner quality of learning. An expenditure of effort to understand complex ideas

and master ‘difficult’ tasks would be one indicator of cognitive engagement. For example, Guthrie and colleagues (2004) specified that using complex strategies and conceptual thinking (or deep processing) should be considered as cognitively engaged reading. Lastly, *emotional engagement* is concerned with learners’ affective reactions to any object in the learning environment. Students can experience various emotions toward learning-related activities. For example, college students tend to report boredom when listening to lectures (Mann & Robinson, 2009). A positive affect such as enjoyment is generally regarded as an indicator of high quality emotional engagement, whereas a negative affect such as boredom or helplessness is indicative of low engagement.

Researchers have studied engagement by looking at various indicators because it is not directly observable (Fredricks et al., 2004). For this reason, a majority of studies have focused on behavioral engagement that is relatively easy to measure. In the case of cognitive and emotional engagement, researchers have operationalized engagement differently across studies and heavily relied on the use of self-report survey measures (Fredricks & McColskey, 2012). The most common method that has been used to assess cognitive engagement is to measure students’ use of learning strategies that require cognitive exertion. For example, Miller, Greene, Montalvo, Ravindran, and Nichols (1996) used a self-report survey of self-regulation and strategy use as task engagement measures. Similarly, Pintrich and DeGroot (1990) referred to use of cognitive and metacognitive strategies as cognitive engagement. Other researchers also frequently used a questionnaire of learning strategies to measure students’ cognitive engagement (Meece, Blumenfeld, & Hoyle, 1988).

The majority of these previous studies on engagement have consistently reported a finding that engagement is strongly related to learning. For example, based on the results of data

obtained from the National Survey of Student Engagement (NSSE), a global measure of engagement assessing college students' participation in curricular and co-curricular activities and their perceptions about college environments, Carini, Kuh, and Klein (2006) found a positive association between student engagement and grade point average (GPA). They also found links between student engagement and specific academic skills such as critical thinking and problem solving. Similarly, studies have reported that students with a higher engagement in reading demonstrated better reading comprehension and academic performance (Blumenfeld & Meece, 1988; Wigfield et al., 2008). For example, Taraban, Rynearson, and Kerr (2000) examined college students' use of reading strategies and found that students who used deep strategies (i.e., high cognitive engagement) achieved higher GPAs.

Given the significance of engagement in student learning, many researchers have proposed different theories and models that can be used to promote learner engagement (Finn & Zimmer, 2012). Self-determination theory (SDT) provides one perspective on engagement. SDT views engagement as a manifestation of motivation and focuses on identifying and supporting the sources of engagement and motivation (Deci & Ryan, 1985, 2000). According to SDT, three basic psychological needs of human are the most influential sources of human engagement. Engagement is enhanced when the environment supports the three innate psychological needs for *autonomy*, *competence*, and *relatedness* (Ryan & Deci, 2000). That said, under conditions in which people perceive the capability to determine their own behaviors (autonomy), feel efficacious (competence), and/or experience a sense of belongingness to others (relatedness), they are likely to demonstrate deep engagement.

Human autonomy is supported when people are given choices or other opportunities to determine their own actions, but it is undermined when people perceive their behaviors are

controlled by external rewards, threats, or evaluation pressure (Grolnick & Ryan, 1989; Tsai, Kunter, Ludtke, Trautwein, & Ryan, 2008). Feelings of competence can be experienced with optimal challenges or positive/constructive feedback (Vallerand & Reid, 1984). The need for relatedness is supported when people perceive that they are respected and cared for (Ryan & Grolnick, 1986).

Previous studies have demonstrated how support of these psychological needs enhances student engagement. For example, when teachers increased their autonomy-supportive behaviors such as using informational language, providing choices, and acknowledging student affect, students demonstrated greater task involvement (e.g., verbal participation, persistence, and effort) (Reeve, Jang, Carrell, Jeon, & Barch, 2004). Jang, Reeve, and Deci (2010) also reported that constructive feedback and explicit guidance (i.e., competence-supportive behaviors) promoted students' behavioral engagement. Furthermore, Vansteenkiste, Simons, Lens, Soenens, and Matos (2005) showed that autonomous motivation promoted deep rather than superficial learning (i.e., cognitive engagement). These findings together illustrate, as SDT argues, that when the learning environment encompasses the elements that satisfy the three innate human needs, students demonstrate active engagement in learning.

Serving as a peer tutor sets up a condition supportive of the needs for autonomy, competence, and relatedness. According to role theory, students who serve as tutors tend to behave and hold attitudes in a way similar to what a teacher would do (Allen & Feldman, 1973; Hogg & Vaughan, 2005). In other words, students with the tutor role assume a responsibility for a tutee's learning and develop a commitment to learning (Robinson, Schofield, & Steers-Wentzell1, 2005). Also, the role of tutor implies independence and authority as it allows for a position wherein students can select and determine what to learn and what to teach (Allen &

Feldman, 1976). This suggests that students in a tutor role are likely to perceive a greater competence in and control over a learning situation (i.e., autonomy). In fact, students have exhibited an increase in their autonomy and self-confidence as learners after tutoring their peers (Allen & Feldman, 1976; Benware & Deci, 1984; Bierman & Furman, 1981; Cochran, Feng, Cartledge, & Hamilton, 1993; Miller, Topping, & Thurston, 2010; Top & Osguthorpe, 1987; Topping, Campbell, Douglas, & Smith, 2003). In addition, peer tutoring provides a means to interact with peers. Serving as tutors, students may feel respected and important (i.e., feelings of relatedness). Several studies have reported that students experience enhanced feelings of belonging and social acceptance while tutoring their peers (Fantuzzo, Davis, & Ginsburg, 1995; Nazzal, 2002).

With fulfillment of these basic psychological needs, students serving as tutors are likely to experience high quality engagement. Moreover, the literature on peer tutoring has frequently reported study results that indicated an enhanced engagement of peer tutors. For example, students used deep strategies for learning as opposed to rote learning as they prepared for tutoring (Arco-Tirado, Fernández-Martín, & Fernández-Balboa, 2011; Galbraith & Winterbottom, 2011). Furthermore, after tutoring their peers, students improved their classroom behaviors such as assignment completion and class participation and developed positive attitudes toward academic tasks (Bierman & Furman, 1981; Cochran et al., 1993; Cushing & Kennedy, 1997; Franca, Kerr, Reitz, & Lambert, 1990; Lieberman, Dunn, van der Mars, & McCubbin, 2000). The expectation of teaching in and of itself, without actually teaching, has also been observed to promote student engagement. In one study, college students were asked to read an article as if they would teach the contents of the article to another student; following this assignment, they exhibited higher task interest and enjoyment and a greater willingness to devote

additional time to the same task when compared with those who studied in order to be examined (Benware & Deci, 1984). In sum, many studies indicate that students are more engaged in academic tasks when they are placed in the role of tutoring their peers; this effect can be attributable to the fulfillment of the three basic psychological needs in student tutors.

Based on the high engagement of student tutors and the theoretical underpinnings of this tutoring effect, we have come to believe that tutoring can be adopted in a college classroom to enhance students' reading engagement. However, there appear to be various limitations on implementing peer tutoring in the college class environment. Not only would instructors have difficulty in overseeing a number of peer tutoring groups but also students might struggle to engage in meaningful interactions with peers within the very limited class time. Given these constraints, we proposed a Virtual Tutee System (VTS) that included peer-tutoring elements situated in an environment in which students could tutor their tutees at their own pace (Park & Kim, 2012).

Computers Are Social Actors

The *Computers-Are-Social-Actors* (CASA) paradigm proposes that people react socially to computers (Nass, Steuer, & Tauber, 1994). Many human-computer interaction studies have reported that people apply the same social rules and expectations to computers as those they employ in interactions with other individuals (e.g., Bracken & Lombard, 2004; Nass, Fogg, & Moon, 1996; Nass, Moon, & Green, 1997). For example, people who were asked by a computer to evaluate its performance were more likely to provide feedback than those asked by a different, independent source to evaluate the computer (Nass et al., 1994). This finding indicates that people apply the politeness norms to computers. Similarly, college students disclosed more

intimate information to a computer that displayed its own vulnerability than to a computer that did not (Moon, 2000).

Lombard and Ditton (1997) conceptualized CASA as a computer embodying social presence. According to the CASA paradigm, a computer's social presence is created primarily by the interactivity built into computers. In other words, people perceive a social presence in a computer only when the computer's activities are dependent on their inputs (Nass & Sundar, 1996). Further, a limited set of human characteristics is enough to elicit social presence (Nass et al., 1994). For example, assigning a gender to a computer or including a voice is one of the powerful cues for social presence and interactions (Nass & Lee, 2001; Nass et al., 1997). Although there is still a debate about whether people perceive a computer as an imagined human being or as an independent entity (see Lee, 2010), most agree that social interactions between humans and computers involve a natural and unconscious process invoked by human-like characteristics.

CASA studies have further suggested that a computer's social presence influences human attitudes, motivation, and engagement. For example, in the online learning environment, the quality of the social interactions with a computer influenced students' perceptions about their learning experience (Tu, 2001). Lester and colleagues (1997) found this effect with pedagogical agents and referred it as *persona effect*: the presence of an agent positively affects students' perception of their learning experience. Later studies on pedagogical agents also reported similar findings (Dirkin, Mishra, & Altermatt, 2005; Kim, Baylor, & Shen, 2007).

In short, people perceive computers with embedded interactivity as social actors and respond accordingly to the computers. People's perceptions of a social presence of computers can be elicited by simple social cues. Based on these findings from the CASA studies, we

presuppose the capability of a VTS to create a social learning environment that emulates human-human tutoring. Also, the CASA paradigm suggests that with appropriate designs, virtual tutees can be perceived as social entities. It may be argued that a virtual tutoring environment could be created without employing agent technology (e.g., Clark & Choi, 2005). However, given the nature of a tutoring setting in which at least two individuals interact, we believe that the presentation of a virtual tutee enables a virtual tutoring environment to be perceived closer to a natural one than without the virtual tutee. In the next section, we introduce the overall design of the VTS and discuss the design decisions we made.

Design of the Virtual Tutee System

The VTS aims to promote student engagement in reading by incorporating the reading task within a peer-tutoring scheme. The VTS presents a Web-based peer-tutoring environment in which students take the role of tutor and teach a virtual character represented as a peer student. Students as tutors are asked to teach their virtual tutee about what they have read in the course materials. This line of research is not new. In fact, a *Teachable Agent* is the specific inspiration for the development of the VTS. The teachable agent is a computer-simulated peer to which students are asked to teach the content and concepts they have learned (Brophy, Biswas, Katzlberger, Bransford, & Schwartz, 1999). For example, after reading an assigned text about river ecology, middle-school students taught a teachable agent named Betty by drawing a concept map on a computer program (Biswas, Leelawong, Schwartz, Vye, & TAG-V, 2005). Most research on a teachable agent is based on the idea that students acquire deep knowledge and skills when they teach peers. These researchers are interested in how performance improves with the experience of teaching. Although the teachable agent has been found to enhance student motivation and engagement (Chase, Chin, Oppezzo, & Schwartz, 2009), the focus of the research

on the design has not been on this aspect of learning. Furthermore, the teachable agent has been employed mostly in K-12 settings but rarely in college environments. In contrast, the VTS is designed to achieve a tutor's active engagement in the context of college reading tasks.

The design of the VTS is drawn from the engagement and peer tutoring literature and is grounded in particular in two theoretical foundations: role theory and self-determination theory. Accordingly, four design principles of the VTS have been proposed, and each principle is accompanied by specific design guidelines. These four design principles and design guidelines of the VTS are geared toward augmenting students' feelings of autonomy, competence, and relatedness in a virtual tutoring environment to promote students' engagement in a reading activity. Although a detailed discussion on the design principles of the VTS is beyond the scope of this paper and has been described elsewhere (see Park & Kim, 2012), in the following we briefly explain the design features included in the first prototype of the VTS so that readers may gain a clear idea about the VTS.

The first design principle of the VTS is concerned with enhancing students' perceived competence and autonomy by facilitating their identification with the role of tutor. In order to experience the sense of autonomy and competence that the role of tutor engenders, according to role theory, students must commit themselves to the tutor role and adopt the characteristics of that role (Allen & Feldman, 1976). One strategy to facilitate students' commitment to or identification with the tutor role is *to clearly communicate to students the responsibilities of the role of a tutor*. To help implement this guideline, we included a guide video in the VTS at the beginning. The guide video provides an overview of the entire tutoring process so that students can understand what their task as a tutor is and what virtual tutees are expected to achieve. An understanding of the assigned tasks and expectations involves navigating the new web

environment, the VTS, with a series of steps and procedures. We decided to use a video instead of text-based instruction primarily for two reasons. First, according to the multimedia principle, people learn better with the presentation of both words and pictures (Mayer, 2009). In addition, although images are a powerful medium to convey information, animations have been found to be more effective than static images especially when procedural knowledge is to be taught (Höffler & Leutner, 2007).

The second principle refers to providing choices as a strategy to further enhance students' autonomy as tutors. The VTS presents three different options related to the tutoring. First, *students are allowed to set their own goals and objectives for tutoring*. Before each tutoring session, student tutors are presented with a list of instructional goals pertinent to the assigned part of the course text and asked to choose one or more goals that they would like to focus on in their tutoring lesson (see Figure 3.1). The list of instructional goals was composed based on the learning objectives provided by the authors of the textbook chapter. If objectives were not available in a particular course reading, the goals were determined in consultation with the course instructor. In addition, *students could select the delivery method for a tutoring lesson*. In the first prototype of the VTS, students could either choose to write a summary of the assigned chapter or provide definitions of key concepts. The purpose of embedding this feature in the VTS was to simulate a tutor delivering some form of instruction to a tutee so that students could develop a sense of teaching in themselves. The two options for a tutoring delivery method are referred as lecture notes in the VTS. Lastly, *students are allowed to choose whom they want to teach*. When students first log into the VTS, they are asked to choose their tutee from a list of six different avatar characters (see Figure 3.2). These characters were developed using a free web-based avatar creation application (Pickaface.net). We intentionally created an equal number of

male and female characters, and each of the three males or females was designed with a different skin color so that each one could represent a different group. The tutees have their own names and unique appearances and are accompanied by profile information (students can look up the profile of each tutee character by clicking on his or her image). The tutee profiles include information about hometowns, majors, years in college, and hobbies, which are reflective of our target user information.

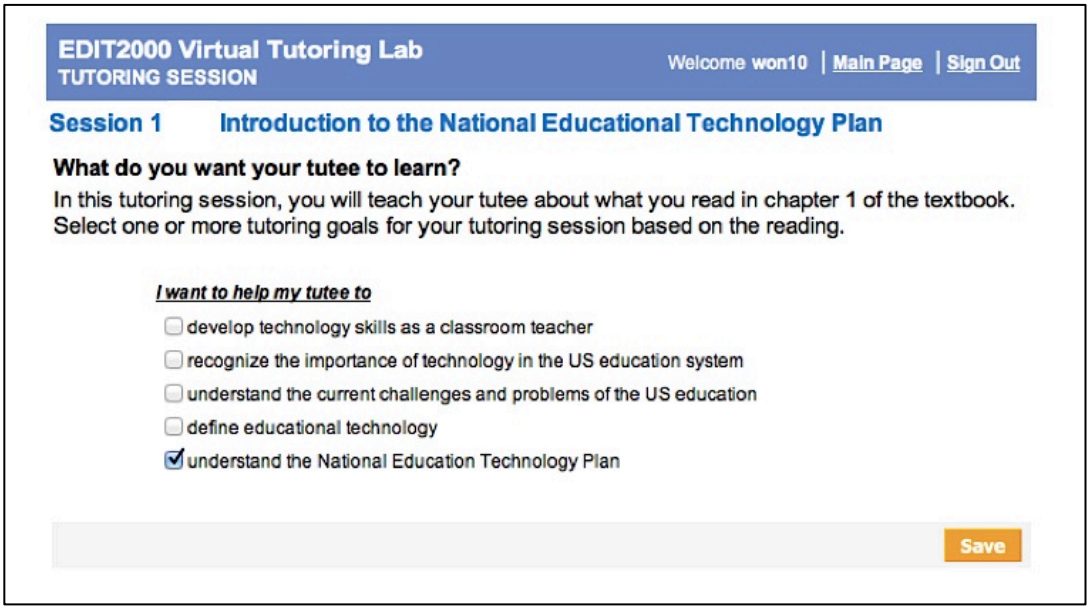


Figure 3.1. Tutoring goal selection in the VTS

The third design principle of the VTS suggests that the VTS emulate social interactions between tutor and tutee in order to support the need for relatedness. As indicated previously, peer interaction during tutoring promotes students' sense of belonging, which influences their engagement. Thus, it is important to enable students to feel that they are interacting with virtual tutees. In other words, students should perceive virtual tutees as social entities. In order to augment students' perceptions of the virtual tutees as social characters, the VTS is designed to simulate the human tutor-tutee interaction with the goal of satisfying the need for relatedness. For example, *the virtual tutee asks several questions regarding the tutored materials*. Also,

virtual tutees express positive attitudes toward learning because such positive feedback can enable students to feel respected and important. In the prototype of the VTS, virtual tutees send a message expressing their interest in the tutored materials during the tutoring session (see Figure 3.3). According to the CASA paradigm, as discussed earlier, the social presence of virtual tutees can be created with simple human-like characteristics. Thus, we expect that the simulation of the human tutor-tutee interaction employing the two strategies described above can elicit students' social interaction with virtual tutees.

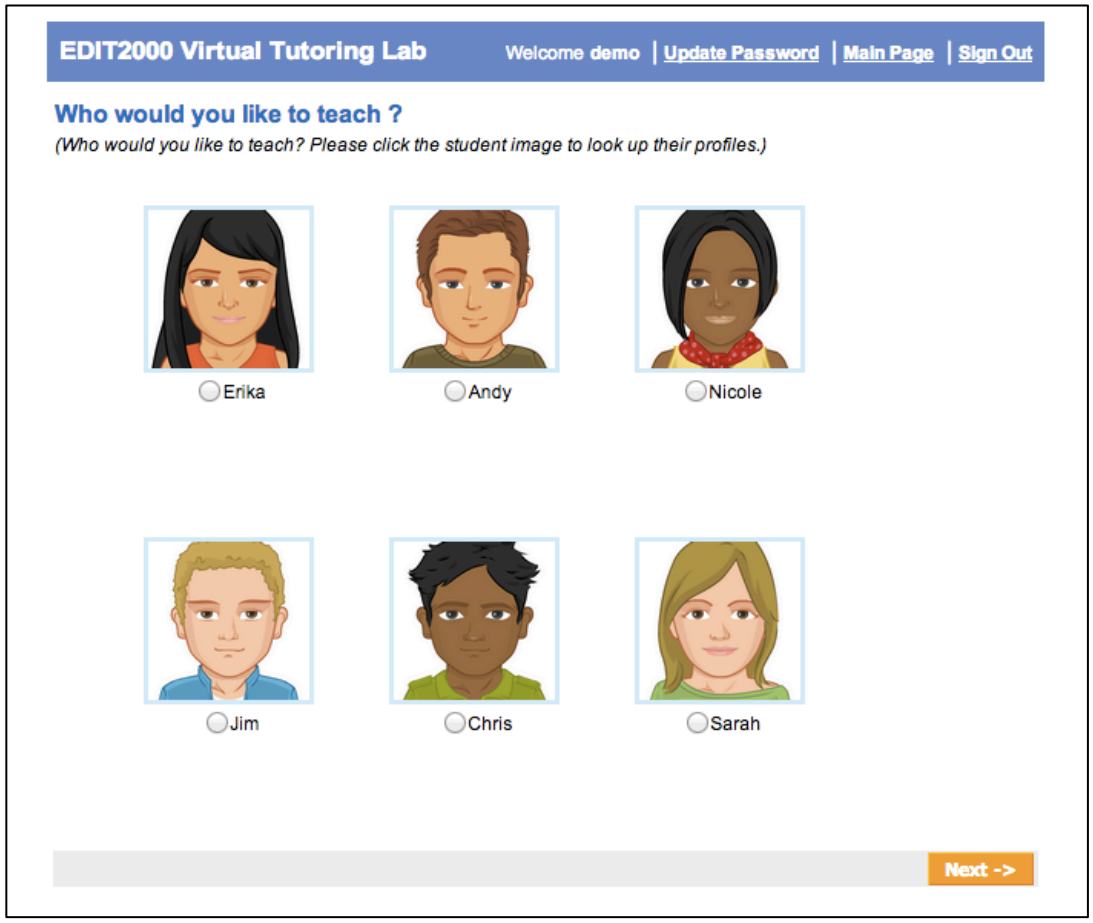


Figure 3.2. A virtual tutee selection page

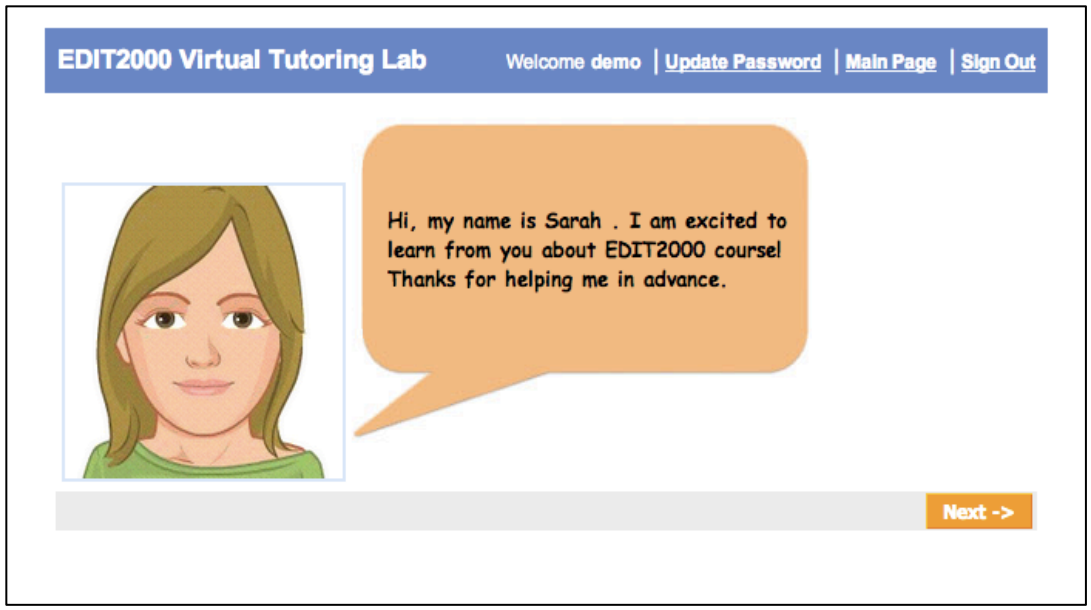


Figure 3.3. A virtual tutee expressing positive attitudes toward learning

The three design principles previously discussed focus on ensuring that a virtual tutoring environment provides support for the three psychological needs (i.e., autonomy, competence, and relatedness) in a manner similar to that of a human tutoring one. Although a learning environment has been established to fulfill these three needs, the motivational beliefs of individual students can hinder their engagement (Kim & Keller, 2008, 2010). One common motivational belief is an individual's goal orientation. According to self-determination theory, a certain type of goal is conducive to the satisfaction of the basic psychological needs. For example, students with intrinsic goals (e.g., personal growth, health, and affiliation) as opposed to extrinsic goals (e.g., wealth, image, and fame) are more likely to benefit from satisfaction of the basic psychological needs and demonstrate an active engagement (Deci & Ryan, 2000). Also, task value is another critical motivational belief. If students do not perceive any value in a task, they are less likely to appreciate its support for the psychological needs; thus, students may not be engaged in the task (Eccles, 1984; Pintrich & DeGroot, 1990; Pintrich & Schunk, 1996; Wigfield & Eccles, 2000). Therefore, it is critical that students adopt an intrinsic goal orientation

as well as understand the value of the learning activities in order to develop a high-quality engagement.

The last design principle is related to providing tailored support based on student needs regarding their goal orientation and perceived task value. At the beginning of each tutoring session, the VTS assesses student tutors' perceived value of the course reading and their academic goal orientation. If students demonstrate a poor goal orientation or low perceived value, a support message is delivered by virtual tutees (see Figure 3.4). For example, if students are found to have an extrinsic goal orientation, *virtual tutees express their own aspirations for learning in this course or reading course materials*. If students are found to perceive little value in the course materials, *virtual tutees acknowledge the importance of textbook reading and course materials*. By so doing, we intended that students model their virtual tutees' positive motivation for reading.

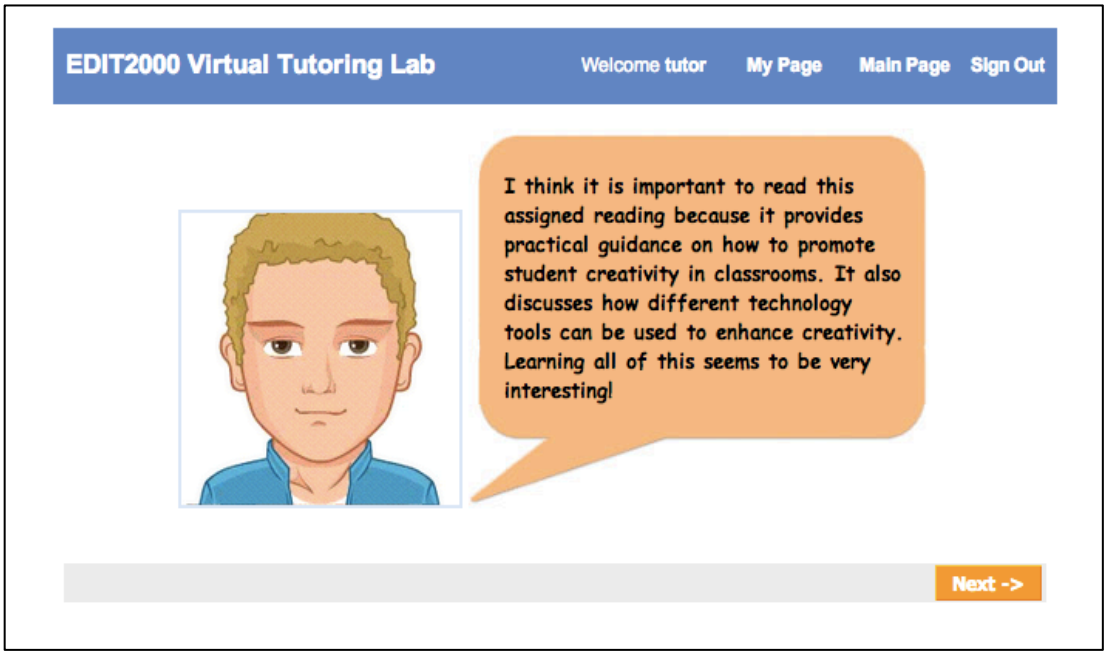


Figure 3.4. An example message to support a tutor's perceived task value and intrinsic goal orientation

Research Questions

Based on the four design principles and guidelines, the initial prototype of the VTS was developed for implementation in a teacher-education course. The architecture and interface design of the VTS was modified and completed through constant consultations with experts in instructional design and computer programming and the course instructor. In order to evaluate the first prototype of the VTS, two field trials were conducted in the target class during two different semesters. The major goals of the field trials were to 1) explore students' perceptions about the VTS, 2) improve the design of the VTS, and 3) assess the efficacy of the VTS. Specifically, we focused on the following research questions:

1. What design errors were reported by the target users?
2. What is the target users' perceived value of and satisfaction with the VTS?
3. What is the effect of the VTS on students' reading engagement?

Field Trial I

Setting and Participants

Study participants were 27 undergraduate students recruited from two sections of a teacher-education course at a large public university in the southeastern United States. The course introduced and explored the different ways in which teachers can integrate technology into their classrooms. Although the course was designed primarily for pre-service teachers, the students enrolled in this course represented various majors including communication sciences, child and family development, psychology, management information systems, occupational therapy, advertising, and journalism. Only 10 % of the participants were education majors (e.g., science education and middle school education). Approximately 80% of the participants were

female, with an average age of 20.63 for all participants. The majority of the participants were senior (52.6%) and sophomore students (36.8%).

Independent Variables

Students in one section of the course (n=15) were assigned to a VTS group and students in the other section (n=12) were assigned to a control group. Both groups were required to complete two reading assignments as homework during the course of the study. For each reading assignment, students read a chapter from their textbook. After students read the assigned chapter of the textbook, those in the VTS group completed the activities provided in the VTS. In contrast, students in the control group responded to paper-based reading guide questions after reading the textbook chapter. From the beginning, students in both groups were aware that they would be required to complete either a VTS or a reading guide for their reading assignment.

VTS

When students first accessed the VTS, they were required to open an account. After logging into the VTS, they were asked to watch a guide video instructing them how to use the VTS. Next, students selected the tutee they wanted to teach from the six tutee options. After choosing their individual tutees, students entered a tutoring session. Each tutoring session was designed to correspond to specific assigned readings. Every time students entered a tutoring session, they were asked to complete a brief questionnaire that assessed their goal orientation and perceived value of the reading assignment. Depending on student responses to this questionnaire, a support message would or would not have appeared. Then, the VTS presented the option to choose tutoring goals followed by an option to choose the lecture-note format (i.e., summary or key concepts). With their selections, students were asked to either provide a written summary of the assigned reading or describe definitions of key concepts. After providing their lecture note,

students answered a series of three questions asked by their virtual tutees that were related to the assigned reading. We intentionally chose to have three questions so that the amount of time and effort students would spend to complete the assignment was equivalent between the VTS and the reading guide group. These virtual tutees' questions were extracted directly from the questions used in the reading guide.

Reading Guide

Each reading guide included an average of 10 open-ended questions related to the assigned reading. These queries were composed of different types of reading comprehension questions such as reorganization, inference, evaluation, and personal response (for details of each question type, see Day & Park, 2005). For example, one question asked students to describe the most important characteristic of effective technology-supported content learning tasks after reading about supporting content learning through technology. On each paper-based reading guide, only the 10 reading questions were listed and no other instructions were provided. Students in the reading guide group completed the reading guide as homework by answering the reading questions and returning it to the instructor in class.

Instruments

In order to explore students' perception about the VTS, we employed an open-ended questionnaire and student interviews. The open-ended questionnaire was composed of four main questions and two follow-up questions that asked about the perceived design, appeal, and content of the VTS. Sample questions were: "How helpful was the tutorial?" and "In what ways do you think the VTS influenced your understanding of the textbook?" The student interviews were prepared to complement data obtained from the open-ended questionnaire. The partially structured interview protocol focused on an in-depth exploration of students' experiences with

and perceptions of the VTS. Example interview questions included: "Would you tell me what it was like to use the VTS?" and "Tell me what appeals to you about the VTS."

Two types of reading engagement were assessed in the first trial study: behavioral engagement and cognitive engagement. A single question asking about the time students spent reading the assigned materials was used to measure students' behavioral engagement in the course readings. We drew students' attention to reporting the actual time they spent reading the textbook rather than to the time they spent completing the entire assignment to obtain a more accurate estimate of their behavioral engagement in reading. The self-reported reading time was compared between the VTS and the reading guide groups using an independent *t*-test.

In order to assess cognitive engagement, we relied on three data sources, the first being the Metacognitive Awareness of Reading Strategies Inventory (Mokhtari & Reichard, 2002). The Metacognitive Awareness of Reading Strategies Inventory (MARSI) is composed of 30 items that assess students' perceived use of various reading strategies when reading *school-related materials*. Sample items include "I take notes while reading to help me understand what I read" and "I use context clues to help me better understand what I'm reading." Students rated each item on a five point Likert scale ranging from 1 (*I never or almost never do this*) to 5 (*I always or almost always do this*). The MARSI was administered twice: in the beginning of the semester (i.e., pre-survey) and after students' completion of the second reading assignment (i.e., post-survey). On the post-survey, students were asked to recall reading strategies they had used when they were completing the reading assignment of the course. An analysis of covariance (ANCOVA) was used to test for a difference in students' use of reading strategies between two groups, with the pre-survey scores on MARSI as a covariate. In this study, Cronbach's α of the MARSI ranged from .74 to .86, indicating an acceptable internal consistency.

Although MARSI items covered various reading strategies that were indicators of students' reading engagement, some empirical reports have questioned the validity of the MARSI (e.g., Cromley & Azevedo, 2006; Guan, Roehrig, Mason, & Meng, 2011). In order to compensate for this limitation of the prospective/retrospective measure of reading strategy use, student reports from the open-ended questionnaire and the interviews were also used as additional data sources to examine students' cognitive engagement in reading. The data from the open-ended survey and the student interviews were initially analyzed through open-coding and the codes were classified into pre-determined categories of engagement.

Procedure

On the first week of the class, students in both the VTS and reading guide groups completed the MARSI to determine their baseline level of engagement when reading academic materials (i.e., a pre-survey). During the second week of the class, students completed the first reading assignment; they completed the second reading assignment during the fourth week. Both groups completed two reading assignments outside the classroom at their convenience (i.e., take-home assignments). After students had finished two reading assignments using either the VTS or the reading guide, they again completed the MARSI (i.e., post-survey) and the reading time survey. Additionally, students in the VTS group responded to the open-ended questionnaire on the same day. Those in the VTS group were also recruited for a follow-up interview and three students agreed to participate. The interviews were conducted individually in a small conference room. When participants came to the interview sessions, the researcher obtained their consent and briefly explained the purpose of the interview. Each interview lasted approximately 30 minutes.

Results

First, students in the VTS group successfully completed the reading assignments with the VTS. They did not report any major difficulties with using the VTS. On the open-ended questionnaire, most students (*n*=14) reported that the VTS was straightforward to use, and seven of them said that the guide video provided in the beginning of the VTS helped them better understand its structure. Students also described different design features embedded in the VTS as appealing. For example, one student reported, "I liked thinking of it [reading assignment] as tutoring a student." Another student said presentation of the tutee profiles made his tutoring more believable. Other students (*n*=3) made favorable comments about the different options that they were given as tutors: they enjoyed choosing the lesson goals they wanted to focus on, selecting which tutoring format they preferred (i.e., summary or definitions of key concepts), and picking the tutee he or she wanted to tutor. Similar comments were made during the interviews. All interviewees acknowledged that the VTS was simple enough to use without additional help. One student commented in particular about the guide video by saying, "I did like watching because then I knew what was coming . . . . I knew what to prepare for." In addition, all the interviewees made favorable comments about virtual tutoring as follow:

> I felt like I was teaching when she was asking a real question.
>
> That was kind of cool because I've never tutored other people. So it was kind of cool to think about "Oh, I am teaching this little." So it was more interactive, which I liked.
>
> I think that [selecting her own tutee] makes me fun. It makes you more believable . . . .
>
> Um, it was fun reading profiles and looking at different faces. That was fun.

In addition to the students' impressions and perceived usability of the VTS, students' reports on the open-ended questionnaire indicated the impact of the VTS on their engagement in

reading. The most apparent influence of the VTS was found on their behavioral engagement in reading. Eight students in the VTS group commented that the VTS made them actually read the textbook; otherwise, they would have skimmed or not even read it. Furthermore, students' reports on the questionnaire indicated that the VTS promoted their cognitive engagement in reading as well. In particular, four students reported that the VTS encouraged them to construct a deeper understanding of the readings. For example, one student commented, "It [VTS] made me think more critically while reading the textbook. I took the reading more seriously rather than just skimming over the pages." Another student also remarked, "Well . . . it [VTS] made me really read the textbook and understand the material for me . . . . VTS really made the concepts stick in my head."

The interview data included similar comments implying that the VTS prompted students to engage in a deep level of reading and learning. During the interview, all three students mentioned that the VTS had prompted them to "actually read and comprehend" the assigned textbook chapter. They specifically mentioned that the VTS had enabled them to become aware of what they were reading and look for key concepts in the material. When probed further, one student reported that teaching the virtual tutees had somewhat forced them to construct a clear understanding of the materials. For example, one student reported, "Because you are teaching them, you have to know it [the reading material] pretty well . . . You have to type it in your own words. So it was a different learning process." The following remarks illustrate how the VTS influenced students' engagement in reading:

> It [VTS] did help me actually realize what I was reading about. Like made me think of what I was reading versus just doing the summary that would have been what I do with other textbooks; just like memorizing a lot of information.

> It forces you to actually comprehend and make sure, while you are answering the question, understand them. So I think it [VTS] is beneficial to learn the material.
>
> You have to understand it . . . . I was more aware of looking at key concepts. . . . I think it kind of help me focus on key concepts as opposed to other information.
>
> So I do read first and then of course, I took notes, highlighted, and underlined the key words so just make sure what pages they are on. And then when I started the tutoring . . . I didn't remember all the concepts in there, so I went back to see what I can write . . . I also tried to pick at least one topic every page to cover and to make sure to include in the summary. . . . And then with tutee questions, I just made a point looking back at the pages where it specifically talked about that. And then I re-read some of the areas just to really understand for me so I can answer those questions and tried to think of other outside examples to answer questions.

In order to examine whether students in the VTS group were different from those in the RG group with regard to their use of reading strategies, the MARSI scores of the two groups were compared. Although the interview data indicated a deep engagement in reading with students in the VTS group, we did not find any significant difference between the VTS and the reading guide groups, $F(1, 24) = .20$, $p = .65$.

When comparing the average time between the two groups students spent reading the assigned course materials to examine any differences in their behavioral engagement in reading, we did not find any significant results ($p > .05$). Table 3.1 presents the mean total MARSI scores on the pre- and post-surveys and the average time students spent reading in both the VTS and reading-guide groups.

Table 3.1. *Descriptive statistics for two engagement variables in field trial I*

	MARSI Pre-survey		MARSI Post-survey		Reading time (*h*)	
	M	*SD*	*M*	*SD*	*M*	*SD*
VTS	103.11	15.47	95.05	15.56	1.09	.51
Reading Guide	99.94	13.09	96.75	13.45	.98	.56

Although most students were satisfied with the overall structure of the VTS, several problems with its design were reported in the open-ended survey and interviews. The most common complaint concerned ambiguity about how students were to write a summary or explain key concepts to their tutees. One student reported on the open-ended questionnaire, "When it came to the summary, it had no clear direction." Another student also commented during the interview, "When it [VTS] gave an [option of] an overall summary or key concepts, I wasn't sure what their difference was. I wasn't sure what I was supposed to write." Partially due to the lack of direction on how to write a summary or explain key concepts, many students also reported that what they wrote in the summary was repeated in their answers to their tutees' questions, and they seemed to have been frustrated by that. For example, one student reported during the interview, "It [VTS] was asking you to give a summary and asking things that you already said in the summary so you had to type the same thing two or three times." Another problem frequently reported by students was related to the virtual tutee's mouth movement. On the screen on which students were asked to either type a summary of the material or definitions of key concepts, the virtual tutee's comments were presented in a speech bubble to provide feedback on students' selection of the type of lecture note (see Figure 3.5). In order to make it clear that the virtual tutee was "talking," the mouth of the tutee was programmed to repeatedly open and close.

However, several students noted that they were annoyed and distracted by this motion as they were typing their lecture note.

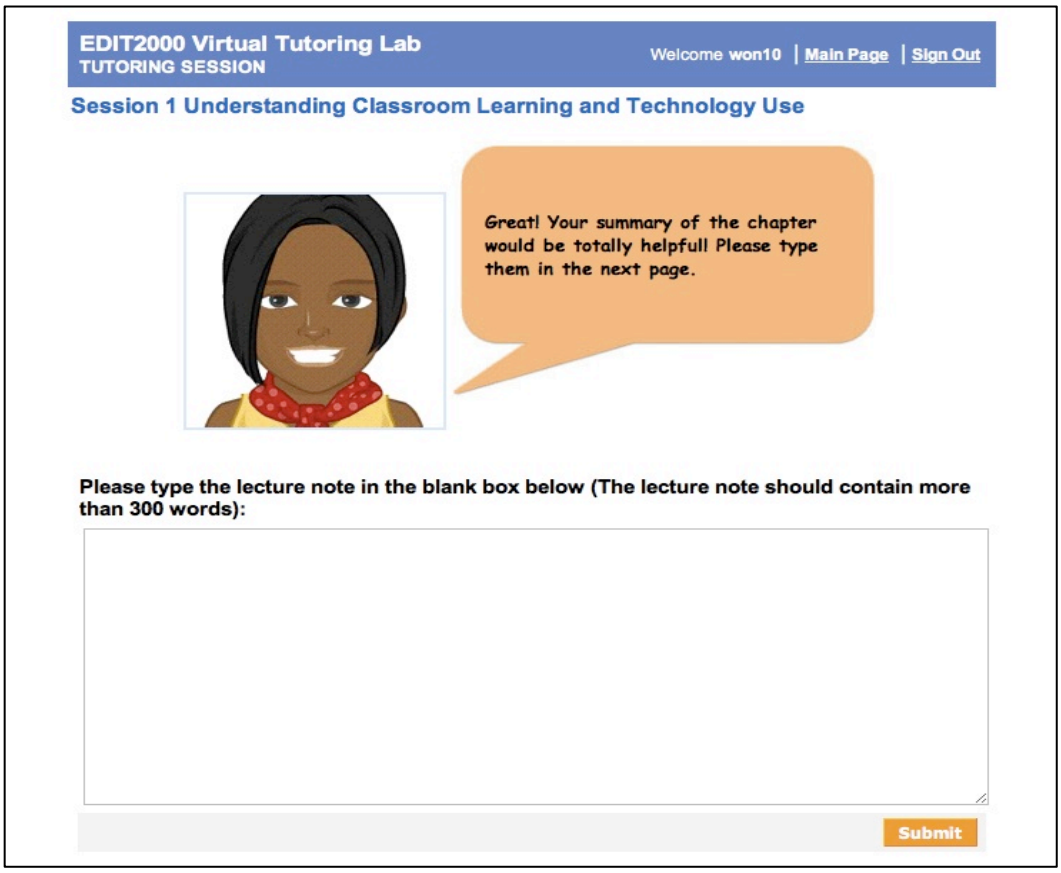


Figure 3.5. A lecture note page in the initial VTS prototype

Discussion

Overall, students reported positive experiences with the VTS. They did not encounter any major difficulty in completing it, and the guide video of the VTS eased the actual virtual tutoring process. Most students were pleased with the idea of teaching their virtual tutees and were content with the different design features of the VTS.

We also found some evidence to support students' improvement in reading engagement with the use of the VTS. First, the VTS seemed to have promoted students' behavioral engagement in reading. One frequent comment students made was that tutoring made them

actually read the text; otherwise, they would have skimmed it. Furthermore, students' remarks hinted that the VTS enhanced their cognitive engagement in reading as well. For example, students reported that the VTS prompted them to look for main ideas, critically evaluate the text, and monitor their understanding. Although there was no significant difference in reading strategy use between the VTS and the reading guide groups, these remarks from the open-ended questionnaire and interview data implied that students in the VTS group exhibited a deep processing of the text that corresponds to high cognitive engagement in reading.

Two major design errors were identified in the initial prototype of the VTS. In the VTS, students were asked to provide either a brief summary of the assigned reading or identify key concepts of the reading and give a brief definition of each as a way to teach their virtual tutees. However, a majority of students reported discomfort with this activity due to the absence of clear instructions on how to write a summary or identify key concepts. In particular, students were dissatisfied with presenting the same information in the latter part of the tutoring when they answered their tutee's questions. The second error was related to the animated mouth of the virtual tutee. Students were irritated by the persistent, repetitive animation that was presented when they were to type their tutoring note (e.g., a summary of reading).

Accordingly, two modifications were made in the VTS design based on the results of the first pilot test. First, directions on how to write a lecture note were added in which the VTS specified the information that students should include in a summary or in key concepts for their tutees (see Figure 3.6). We ensured that this catalog of information was distinct from what students would provide as answers to the virtual tutees' questions. The other modification was that we separated the page on which the virtual tutee acknowledged the student's choice of

lecture note type from the page on which students typed the lecture note. In this way, students would not see the virtual tutees' constant mouth movement when writing their lecture note.

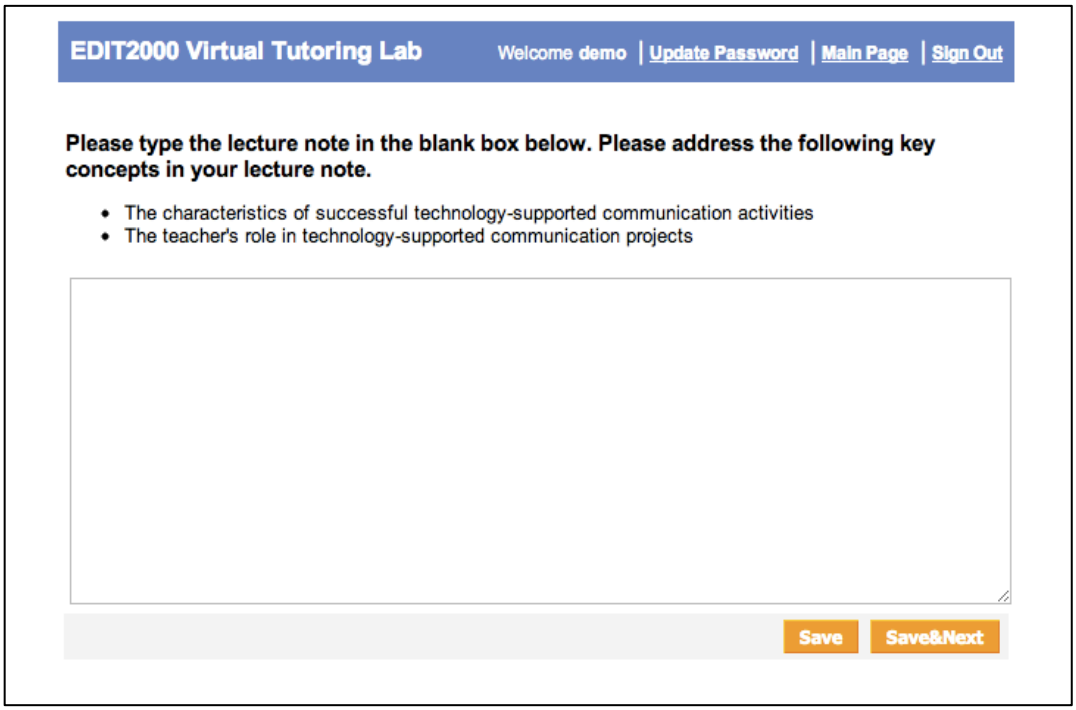


Figure 3.6. A lecture note page in the revised VTS prototype

Field Trial II

The second field trial was conducted during the semester following the first field trial. The purpose of this field trial was to evaluate the second prototype of the VTS that had been modified based on the first field trial and to identify any remaining errors in the design.

Setting and Participants

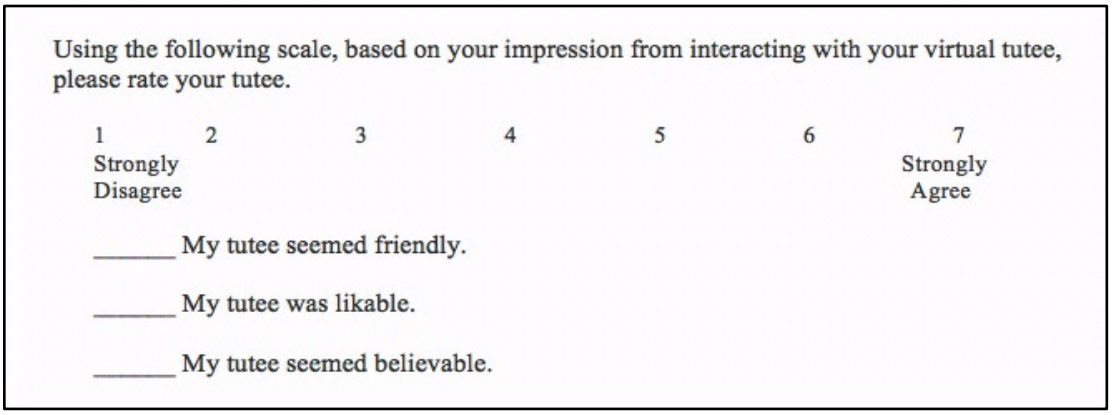
Participants in the second field trial were recruited from the same course taken by the participants in the first trial. Ten undergraduate students took part in the second field trial, including eight female and two male students. The majority of the participants (40%) were sophomores, 30% juniors, and the remaining 30% seniors. As in the first trial, the participants represented various majors including education (n =3), communication sciences (n =2), child and

family development (n =1), psychology (n =1), statistics (n =1), criminal justice (n =1), and finance (n =1). The average age of the participants was 22.6 years old. Eight were Caucasian and two were African-American.

Instruments

As in the first field trial, the MARSI was used to measure students' cognitive engagement in reading. On the post-survey, students were directed to refer to reading strategies they had used when they were completing the reading assignment of the course. Cronbach's α of the MARSI ranged from .90 to .93 with the data collected from the second field trial. Additionally, an open-ended questionnaire was administered to further explore students' engagement in reading as well as their perceptions about the VTS. The questionnaire was similar to the one used in the first field trial but a question was added: "How did you enjoy completing the VTS overall?" This query allowed students to discuss their overall experiences with the VTS.

In addition, we implemented a survey about students' social judgment of the virtual tutee's persona. This survey was prepared to examine whether students indeed perceived the virtual tutee as a social being as we had designed it to model a human peer (i.e., social presence). Because social presence of a computer has an impact on human perceptions and attitudes (Kim et al., 2007; Nass & Lee, 2001; Tu, 2001), the perceived persona of the virtual tutee should have a significant influence on students' satisfaction with the VTS. The survey included three items assessing the social attractiveness (i.e., friendly and likable) and believability of the virtual tutee (see Figure 3.7). These items were extracted from the questionnaire used by Lee (2009) and modified for this study. Students rated each item on a seven point Likert scale ranging from 1 (*Strongly Disagree*) to 7 (*Strongly Agree*).


Using the following scale, based on your impression from interacting with your virtual tutee, please rate your tutee.

1 Strongly Disagree 2 3 4 5 6 7 Strongly Agree

_____ My tutee seemed friendly.

_____ My tutee was likable.

_____ My tutee seemed believable.

Figure 3.7. A questionnaire about the virtual tutee's social presence

Procedure

The procedures in the second field trial were similar to those in the first. Differing from the first trial, however, there was only the VTS group as all the participants were recruited from one class. Participants completed two reading assignments using the VTS throughout the study. In the beginning of the semester, students completed a demographic survey and the MARSI to determine their baseline level of reading engagement (i.e., a pre-survey). As in the first field trial, before they began the first reading assignment, students were informed that they were going to teach a virtual tutee about what they had read in the textbook chapter. After students had completed two reading assignments, they again completed the MARSI (i.e., post-survey) and the open-ended questionnaire.

Results

As in the first field trial, most students reported positive experiences with the VTS on the open-ended questionnaire. No students reported any difficulty using the VTS. Those who watched the guide video (n = 6) indicated that it helped them in utilizing the VTS; those who did not watch the guide video (n = 4) also mentioned that the structure of the VTS was very clear. Two students commented that the VTS presented the reading assignment in a more enjoyable

way, and three students indicated pleasure in working from a teacher perspective. For example, one student commented, “I enjoyed it [VTS] because I was able to take the role of the teacher.” Another student remarked, “It has been nice to switch to thinking out of just being the student to being a teacher and teaching what you learned.” Similar to the first trial, several students made approving comments about specific design features of the VTS such as the online format, a choice of the virtual tutees, and an option to select a tutoring format.

Student reports on the open-ended survey also indicated that the VTS supported their reading and facilitated cognitive engagement. Seven students explicitly stated that the VTS encouraged thorough, critical reading and thus enhanced their understanding. For example, one student stated, “It [VTS] provided a format that made you reflect on your reading, so you felt like you learned the information.” Another student wrote, “It [VTS] influenced me reading because I knew I actually had to read it and take it in and not just read it because it was assigned.” Four students mentioned that serving in the role of tutor in particular enabled them to engage in a deeper level of reading. For example, one student commented, “I think reteaching what you've learned is a useful study tool because it required me to recall my learning and pull out the important facts.” The following excerpt from the open-ended survey illustrates how the role of tutor influenced students’ engagement in reading:

> VTS made me look at the text in two different views: student and teacher. VTS increased my understanding because I had to ‘teach’ the main points of the text and answer questions about the text.

When we compared students’ MARSI scores on the pre- and post-surveys using a paired *t*-test, we found a significant difference, $t(9) = -2.28$, $p < .05$, $d = .757$. This finding indicates that

students significantly increased their use of reading strategies after using the VTS. Table 3.2 presents the mean total MARSI scores on the pre- and post-surveys.

Table 3.2. *Descriptive statistics for MARSI scores in field trial II*

	Pre-survey		Post-survey			
	M	*SD*	*M*	*SD*	*t*	*p*
MARSI	107.30	18.50	115.10	15.09	-2.28	.048

Finally, students indicated a moderate degree of social presence with their virtual tutees. Students rated a mean of 5.7 (out of 7) on two social attractiveness items (i.e., "my virtual tutee seemed friendly" and "my virtual tutee was likable") and a mean of 4.8 (out of 7) on the virtual tutee's believability item. In fact, one student mentioned on the open-ended survey that she enjoyed having some social interactions while completing the reading assignment.

Discussion

The primary purpose of the second field trial was to examine students' perceptions about the second prototype of the VTS and find any remaining design flaws. The results of the second field trial indicated that students were satisfied with the VTS. Students demonstrated enjoyment in being a tutor and teaching their tutees and approved of the design features of the VTS. Furthermore, students rated their tutees as moderate on social attractiveness and believability. This finding suggests that the design of the virtual tutees is adequate for them to be perceived as social actors rather than simply imaginary objects and that students may have experienced social interaction with their virtual tutees.

In addition to students' positive perception about the revised VTS, we also found it had an effect on their cognitive engagement in reading. Students not only enjoyed teaching their tutees but also acknowledged the advantages to their learning. On the open-ended survey, most

students explicitly stated that the VTS helped their understanding of the text by providing an environment that enabled them to engage in thorough and critical reading. Student reports further implied that serving in the role of tutor encouraged students to demonstrate deep engagement in reading. In support of the findings from the open-ended questionnaire, students also showed a significant increase in the use of reading strategies (i.e., MARSI score) after completing the VTS.

In summary, students successfully completed the VTS without any serious difficulties. A majority agreed that the VTS presented a more pleasurable way of completing the reading assignments. They also acknowledged that the VTS improved their understanding of the readings as they engaged in deep, critical reading. Indeed, students demonstrated an enhanced use of reading strategies when they completed the reading assignments with the VTS.

General Discussion

The design and development of instructional materials is an iterative process. It involves a constant looping of evaluation and revision. This process of feedback loop refers to formative evaluation (Branch, 2009). Formative evaluation is the process of collecting data about the effectiveness of instructional materials with the purpose of improving and refining (Dick, Carey, & Carey, 2011). Formative evaluation enables designers to detect problems in a design, understand the causes of the problems detected, and modify the design in order to resolve the problems and minimize errors. A field trial is one form of formative evaluation. During the field trial, the instructional materials are implemented in an authentic learning environment and evaluated with representative target learners. The field trial allows instructional designers to determine the feasibility of the materials, identify problems in the materials as reported by the target learners, and establish the potential effectiveness of the materials (Branch, 2009).

This article has reported the processes and results of two field trials that evaluated the VTS, a web-based peer-tutoring environment designed to promote college students' engagement in course reading. We developed the first prototype of the VTS based on the design principles drawn from the relevant literature and theories and through peer and expert reviews. In both field trials, we looked for the design errors perceived by the target learners and assessed the preliminary effect of the VTS on student engagement in reading.

The students' overall impressions of the VTS were positive in both field trials. Students were fond of the format of the VTS in which students took the role of tutor and taught their tutees. They seemed to have favored such a distinctive way of completing the reading assignments. Students were also pleased with the specific design features embedded in the VTS such as the tutees' profile information, option of choosing tutoring goals and lecture format, and questioning-answering interactions.

Most interestingly, students appreciated the impact of the VTS on their reading engagement. A majority acknowledged that the VTS made them read, suggesting its effect on behavioral engagement in reading. Moreover, the VTS enabled them to engage in a deeper understanding of the reading materials (i.e., cognitive engagement) when using the VTS. Students carefully read the assigned textbook, focused on main ideas, and reflected on their understanding in part because they were to teach their tutees and they had to ensure that they themselves comprehended the materials. After completing the VTS, students demonstrated a significant improvement in their reading strategy use in the second field trial as well. All together, these findings support the potential of the VTS for promoting student engagement in reading.

Finally, based on the two field trials, we extracted four considerations in the design of a VTS or other similar virtual tutoring environments. First, given students' unfamiliarity with a

new virtual environment, a guide video of the VTS should be available to the users. In both field trials, the majority of the participants acknowledged that the guide video was useful for understanding the workings of the system and preparing themselves for the activities that followed. This consideration is consistent with reports in the literature that students showed a higher performance with video-enhanced instructions (Boster et al., 2007; Boster, Meyer, Roberto, Inge, & Strom, 2006). Although it was not a focus of the study to empirically test the effect of the guide video, based on our findings, we reasonably conclude that a video is an effective medium for helping students' understanding of the new web-based learning environment.

Second, the question and answer feature seems to be the critical element in the VTS. In both field trials, a frequent student comment was that he or she had enjoyed "teaching" his or her tutee. Students indicated that responding to their tutee's questions fostered a perceived interactivity in the VTS and a state of teaching in them. That is, the question and answer feature facilitated students' involvement in the role of tutor and contributed to their perceived believability in the VTS. Even students who expressed disapproval of writing a summary favored answering their tutee's questions. Therefore, in order to aid in students' identification with the role of tutor, the question-answer element should be embodied in the design of a virtual tutoring environment.

Third, the animated virtual character should be exclusively presented without other information. Although previous studies have suggested that an animated pedagogical agent has a stronger impact on student performance than a static image (e.g., Craig, Gholson, & Driscoll, 2002; Baylor & Ryu, 2003), students seemed annoyed and distracted when the animated agent was presented along with other information that was not related directly to the animation. In the

first trial, students reported displeasure with the repeated movement of a virtual tutee's mouth while writing their lecture note. In response to this issue, we separated the pages so that students do not see the mouth movement when they are directed to type the lecture note.

Last, it is necessary to provide explicit guidance on how to write a summary of the reading materials or explain definitions of the key concepts. Many participants in the first trial reported that they had no idea what they were supposed to do when they were simply asked to write a summary of the textbook chapter. Although college students apparently understood the concept of a summary, they seemed confused about what should be included in it to be presented to their tutees. Another reason for students' frustration in writing a summary was that they had to repeat what they had already stated when they answered their tutees' questions. Accordingly, in the second prototype of the VTS, we added explicit directions for writing a summary and explaining key concepts. It was important to ensure that the information required for the summary or the key concepts did not overlap with the information students needed to provide later when answering tutees' questions.

Limitations and Suggestions for Future Research

There are several limitations in this study. First, we did not embody spoken narration in the design of a virtual tutee. Previous studies have indicated that a pedagogical agent with narrated speech yielded a stronger effect on students' learning and performance (Craig et al., 2002; Moreno, Mayer, Spires, & Lester, 2001). This finding is consistent with the modality principle of multimedia learning that people learn better from graphics with narration than graphics with text (Mayer, 2009). With narration, it is likely that students perceive their virtual tutees as more authentic, believable, and interactive (Lee & Nass, 2005; Nass et al., 1994). Thus,

it is suggested that the next prototype of the VTS include a spoken narration feature in the design of the virtual tutee.

Moreover, the implementation of the VTS in the two field trials was relatively short in length. It is possible that the observed effects of the VTS may have been a novelty effect. That said, students may have actively engaged in the VTS simply because it was not something that they used to do. However, it is also possible that students would gradually increase their engagement in reading with a longer use of the VTS as Schwartz and others (2009) reported an increasing effect of a teachable agent on students' performance over time. In the future, it is recommended that researchers administer the VTS for a longer period and examine how students change in their level of reading engagement over time.

Another study limitation resides in the use of the MARSI as a measure of students' cognitive engagement in reading. Despite its good scale reliability, Guan, Roehrig, Mason, and Meng (2011) indicated a weak construct validity of the MARSI. This problem may be attributable to the fact that the MARSI is a *prospective* or *retrospective* self-report measure (see Veenman, 2005). Veenman (2005) pointed out that the problem of using a prospective or retrospective self-report measure of reading strategy use is that students are not good at accurately recalling their previous use of reading strategies. If so, findings from such self-report measures can be questionable in assessing students' actual strategy use. Instead, concurrent measures such as think-aloud or log files are suggested as alternatives (Cromley & Azevedo, 2006). However, our intention in this study was to avoid any possibility that the concurrent measures of reading strategy use could disrupt the natural process of reading and interrupt their willingness to complete the assignment, which might also elicit negative emotions toward reading and decrease their engagement in reading. In the current study, we examined the data

from the open-ended questionnaire and interviews to compensate for the limitation of the self-report measure of reading strategy use. In future research, multiple methods to measure cognitive engagement in reading should be considered to enhance the validity of study findings. For example, in addition to reading strategy use, assessment of conceptual thinking and critical reasoning can be done through analyzing students' responses to the open-ended reading comprehension questions.

In addition, the field trials managed to examine only a limited aspect of student engagement in reading. The first trial focused on behavioral and cognitive engagement whereas the second trial assessed only cognitive engagement in reading. Given that engagement manifests in various modes, future studies should investigate the effect of the VTS on other types of student engagement (e.g., emotional engagement) as well.

Finally, the current studies had a small number of participants. In the first trial, there were fewer than 20 participants in each group; the second field trial had only 10 participants. Thus, the findings could not be generalized. However, the primary purpose of the field trials was to test the newly developed tool in the target environment and to identify any errors. That said, the field trials served the very initial step of refining and validating the VTS. As a result of the field trials, we found potential for the VTS in promoting students' engagement in reading. Future research should follow to examine and warrant the effectiveness of the VTS with a large number of participants.

In conclusion, based on the results of the two field trials, we were convinced of the potential effect of the VTS to enhance student engagement in course reading. As previously mentioned, peer tutoring has been commonly used in many classrooms, and its effect has been extensively reported in the literature (Robinson et al., 2005; Roscoe & Chi, 2007; Tang,

Hernandez, & Adams, 2004; Wright & Cleary, 2006). Other researchers have developed the computer-based tutoring system, *Teachable Agent*, and shown its extensive effects on students' cognition and metacognition (Biswas et al., 2005; Chase et al., 2009). However, most of these studies focused on K-12 students and gave little attention to peer tutoring effects on *engagement* in particular. The use of the VTS is promising in that it is targeted for a college population and based in an online environment that allows for greater accessibility. Furthermore, the VTS can be readily incorporated into college classrooms without spending much additional instruction time. Given that the current study presented the field trials of the VTS, further studies should follow to examine and validate the effectiveness of the VTS.

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CHAPTER 4

THE EFFECTS OF A VIRTUAL TUTEE SYSTEM ON ACADEMIC READING ENGAGEMENT IN A COLLEGE CLASSROOM[3]

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Abstract

This research examined the effects of the Virtual Tutee System (VTS) on academic reading motivation, engagement, and performance. The VTS presents a Web-based virtual tutoring environment that embodies the sources of motivation and engagement suggested in self-determination theory. In this study, students who used the VTS were compared to those who used an online reading guide (RG) with regard to their motivation, engagement, and performance. The study used a concurrent triangulation mixed methods design. Participants in the study were 70 college students enrolled in an introductory educational technology course. Findings indicated that students in the VTS group achieved a higher reading performance implying deeper engagement in reading activities as compared to those in the RG group. No difference was found in motivation between the two groups. The paper presents results from both quantitative and qualitative data analyses and discusses the integrated findings. Limitations and implications for future research are also provided.

Introduction

Poor student engagement has been recognized as a major problem observed in college classrooms (Martin, 2009). Poor class attendance and a low level of commitment to academic tasks have been reported in studies with college students (Sheard, Carbone, & Hurst, 2010). Many college students procrastinate on academic tasks, miss assignments, and put minimum effort into learning (Lay & Schouwenburg, 1993; Tice & Baumeister, 1997). Instructors are often concerned about the low in-class participation of students as well (Rocca, 2010). Furthermore, many college students have shown a low interest in class and reported boredom (Mann & Robinson, 2009; Miller & Sundre, 2008).

Another indicator of low engagement among college students is poor academic reading completion. Reading in college often involves conceptually complex and sophisticated texts, which demand deep-level processing by students. However, college students do not seem to apply much effort in reading their course materials. A majority of them would rather skim the assigned readings, or they choose not to read them at all (Lesley, Watson, & Elliot, 2007; Phillips & Phillips, 2007; Tomasek, 2009). They also tend to rely on simple rote memorization or rehearsal instead of focusing on developing a conceptual understanding when studying for an exam (Barnett, 2000; Taraban, Rynearson, & Kerr, 2000).

In previous studies (Park & Kim, 2012, 2013), a Virtual Tutee System (VTS) was developed to mitigate the poor engagement in academic reading observed with college students. The VTS is a web-based tutoring environment in which students teach a virtual avatar character about the course materials they have been assigned to read. In essence, the VTS is designed to enhance students' reading engagement by placing them in the role of tutor. The literature on peer tutoring has consistently reported that student tutors demonstrate an increased engagement in

their own learning as a result of tutoring activities (Arco-Tirado, Fernández-Martín, & Fernández-Balboa, 2011; Benware & Deci, 1984; Cushing & Kennedy, 1997). However, implementation of peer tutoring in a college class environment appears to be constrained in many ways. Many college courses are lecture-based with a large number of students enrolled. Students meet a class twice or three times a week at most for a very limited time. This arrangement of college courses hinders instructors from creating and overseeing a number of peer tutoring groups and also inhibits students from building rapport and meaningful interactions within the groups. Thus, the Virtual Tutee System (VTS) has been proposed to enable peer tutoring in a college classroom and reproduce the increased engagement among tutors observed in the peer-tutoring research (Park & Kim, 2012, 2013).

The initial design framework of the VTS was grounded mainly in self-determination theory and role theory, which proposed four design principles with specific design strategies (Park & Kim, 2012). Based on this design framework, the first prototype of the VTS was developed and implemented in a teacher-education course. Several design elements of the first prototype were improved based on two field trials (Park & Kim, 2013). Although limited, evidence emerged in the field trials indicating that the VTS improved students' reading engagement. For example, students engaged in thorough reading and increased their use of reading strategies after using the VTS. The current study aimed to examine the effects of the revised VTS on students' reading motivation, engagement, and performance.

College Reading and Engagement

Reading is an important part of college learning. Most college courses involve reading materials that students are required to read (Lei, Bartlett, Gorney, & Herschbach, 2010). College instructors often emphasize the importance of course readings because they cannot provide all

the details of the course content in class. They expect students to develop a deeper understanding of a topic through studying the course readings (Berry, Cook, Hill, & Stevens, 2011). Also, course readings enable students to build a knowledge base for in-class discussions and lectures (Bramhall, 2009; Brost & Bradley, 2006; Tomasek, 2009). Not only instructors but also college students recognize that reading course materials is critical for their learning and performance in class (Arquette, 2010; Berry et al., 2011). Indeed, studies have shown that students who completed assigned readings developed a better understanding of in-class lectures and exhibited a higher performance on class exams (Sappington, Kinsey, & Munsayac, 2002; Wandersee, 1988). Other research has also reported that reading completion was a strong predictor of class participation as well as student achievement (Carkenord, 1994; Karp & Yoels, 1976).

However, many studies have reported that college students avoid completing their assigned readings. For example, Arquette (2010) found that a majority of college students with education majors invested an insufficient amount of time in reading their course texts. Similarly, Phillips and Phillips (2007) reported that over 80% of introductory accounting college students attended the class without having read their textbooks. Even among students who read the course texts, many demonstrated a superficial level of reading such as skimming the texts (Phillips & Phillips, 2007). Also, several studies have reported that college students rely on rehearsing when studying for an exam and showed a limited use of reading strategies (Elias, 2005; Lesley et al., 2007; Taraban et al., 2000). These adverse reading behaviors imply that many college students do not enjoy reading course materials. College students often report negative affects toward academic reading such as displeasure and boredom (Brost & Bradley, 2006; Fitzpatrick & McConnell, 2009; Lesley et al., 2007).

These various facets of college students' reluctance to complete assigned readings indicate a low engagement in academic reading. College students' low completion rate of assigned readings is an indicator of poor *behavioral engagement* in reading. A limited use of reading strategies observed in college students represents a low *cognitive engagement* in reading. Another example of poor cognitive engagement in reading is when students demonstrate a superficial rather than a conceptual understanding of information. With regard to *emotional engagemen*t, a negative affect such as boredom is indicative of low engagement.

Engagement is critical to learning. Previous empirical studies have consistently reported that student engagement is strongly related to their achievement (e.g., Marks, 2000; Pintrich & DeGroot, 1990; Vansteenkiste, Simons, Lens, Soenens, & Matos, 2005). These studies have been conducted in various learning contexts, and some of them have indicated that active engagement with reading leads to higher performance on reading comprehension as well (Blumenfeld & Meece, 1988; Wigfield et al., 2008). For example, Taraban, Rynearson, and Kerr (2000) examined college students' use of reading strategies and found a positive relationship between students' deep strategy use and their GPAs.

Because engagement is not directly observable, researchers have studied engagement, especially cognitive and emotional engagement, mostly by examining its various indicators (Fredricks & McColskey, 2012). Thus, different approaches have been applied to assess student engagement. The common indicators of behavioral engagement include student conduct, task involvement, and participation (Fredricks, Blumenfeld, & Paris, 2004). Although limited studies have examined emotional engagement, self-report surveys about various academic emotions are frequently used to measure emotional engagement (e.g., Appleton, Christenson, Kim, & Reschly, 2006; Skinner, Kindermann, & Furrer, 2009). In the case of cognitive engagement, many

researchers have examined students' strategy use. For example, Pintrich and DeGroot (1990) used a self-report questionnaire of cognitive and metacognitive strategy use to measure students' cognitive engagement. Some researchers further differentiated between deep and surface-level strategies (Meece, Blumenfeld, & Hoyle, 1988; Miller, Greene, Montalvo, Ravindran, & Nichols, 1996). Similarly, Helme and Clarke (2001) examined students' self-regulatory behaviors (e.g., self-monitoring and volitional strategies) as indicators of cognitive engagement.

Although reading engagement is critical for student learning, there is a lack of research on college students' academic reading and engagement. Although Guthrie and colleagues (2004) have proposed an effective instructional model to promote students' reading engagement and achievement, the model covers classroom practices as a whole. The current study focuses on a specific intervention (i.e., VTS) to improve college students' engagement in academic reading. The specific design features and strategies of the VTS are discussed later in the paper.

Theoretical Framework

Self-determination theory (SDT) provides a distinctive framework that informs the practice of enhancing engagement. SDT explains the development of engagement and identifies its sources from a motivational perspective (Deci & Ryan, 1985, 2000). As illustrated in Figure 4.1, three basic psychological needs of human, intrinsic goal, and self-endorsed value are introduced as the most influential sources of autonomous motivation and engagement. According to SDT, the environment should be arranged in a way that supports these sources in order to promote high quality engagement. The design of the VTS enlisted this theoretical framework to create a learning environment that can improve students' engagement in academic reading.

SDT assumes that engagement is a manifestation of motivation, and the quality of motivation determines the quality of engagement. According to SDT, there are different types of

motivation; the two most basic forms are intrinsic and extrinsic motivation. Intrinsic motivation refers to enactment of behaviors for one's inherent interest and enjoyment, whereas extrinsic motivation applies to doing an activity to obtain separable outcomes (Ryan & Deci, 2000). Extrinsic motivation is further differentiated into four categories: external, introjected, identified, and integrated. In essence, all the different forms of motivation differ in their respective degree of autonomous motivation. If students sense a greater degree of autonomy and ownership in performing learning behaviors, they will demonstrate greater autonomous motivation such as identified and integrated, or even intrinsic motivation. These autonomous types of motivation then manifest as active, high-quality engagement, which in turn results in higher performance.

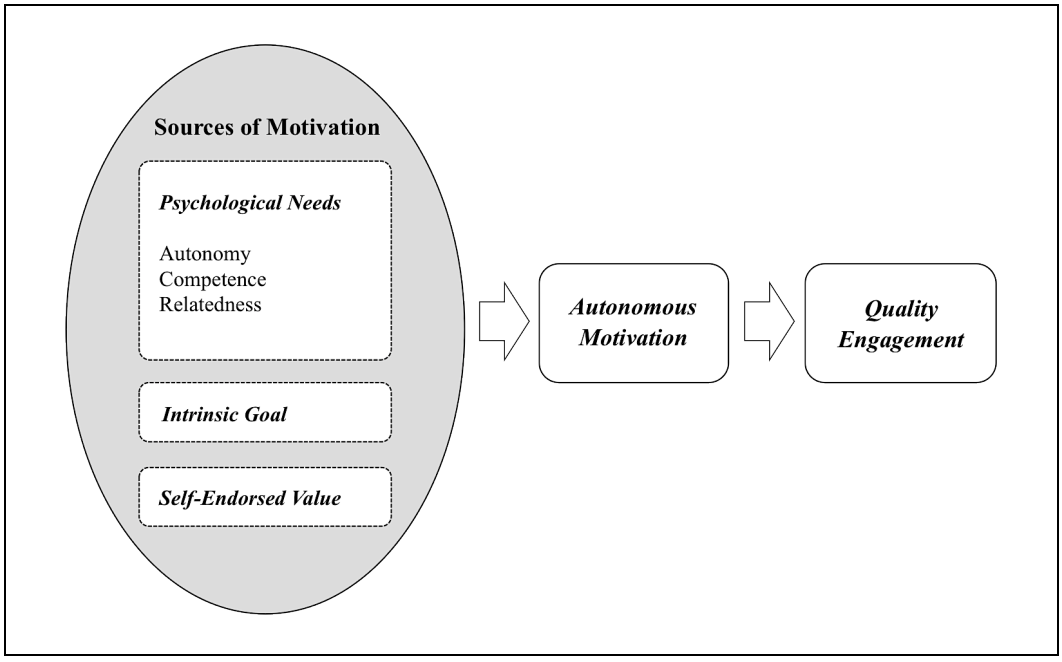

Figure 4.1. Theoretical framework guiding design of the VTS

SDT proposes three basic needs as the essential sources of intrinsic motivation: the needs for autonomy, competence, and relatedness (Ryan & Deci, 2000). When students experience a sense of psychological freedom (autonomy), a feeling of being competent (competence), and emotional bonds with others (relatedness), their inherent, proactive motivation is sustained and

reinforced. Previous research has shown that choice, encouragement, opportunities for self-direction, and positive feedback support student autonomy and competence (Katz & Assor, 2007; Reeve & Jang, 2006; Ryan & Deci, 2000) whereas, surveillance, deadlines, commands, and competition thwart autonomy in the classroom (Amabile, DeJong, & Lepper, 1976; Deci, Betley, Kahle, Abrams, & Porac, 1981; Lepper & Greene, 1975; Reeve & Jang, 2006). These studies have commonly reported a positive relationship between the three basic needs and intrinsic motivation (e.g., Jang, Reeve, Ryan, & Kim, 2009; Vallerand & Reid, 1984).

However, in the case of activities with which students do not have inherent, intrinsic motivation, support for these three basic needs is not sufficient for them to develop an autonomous motivation. SDT asserts that the degree to which students personally endorse the value and significance of an activity is a key element for extrinsic motivation to be autonomous (i.e., identified or integrated motivation) (Deci & Ryan, 1985). According to the theory, when students accept the value of an activity as personally important, they experience autonomy because their motivation for engaging in the activity arises from inside rather than from outside themselves (e.g., guilt, punishment, and rewards).

In addition to a self-endorsed value, a personal goal is also an important factor for experiencing autonomous motivation. Specifically, pursuit of intrinsic goals such as personal growth, health, and affiliation allows for basic needs satisfaction, whereas pursuit of extrinsic goals such as wealth and fame undermines basic needs satisfaction. In sum, autonomous motivation emerges with self-endorsed value and intrinsic goal aspirations on the basis of the three basic needs satisfaction.

As the sources of motivation and engagement are identified, SDT asserts that the quality of motivation and engagement is enhanced when the environment is structured in a way that

supports these sources. For example, when teachers were more likely to incorporate students' interests into the lesson, provide choices, and acknowledge an increased students' affect, students demonstrated greater task involvement (e.g., verbal participation, persistence, and effort) (Reeve, Jang, Carrell, Jeon, & Barch, 2004). Teachers' constructive feedback and explicit guidance were also found to promote student engagement (Jang, Reeve, & Deci, 2010). Similarly, Vansteenkiste and colleagues (2005) showed how autonomy support leads to deep rather than superficial learning (i.e., cognitive engagement). Furthermore, when students were provided with a meaningful rationale for learning tasks (facilitation of self-endorsed value), they demonstrated higher autonomous motivation and engagement (Jang, 2008; Reeve, Jang, Hardre, & Omura, 2002). Along this line, the quality of a teacher's motivating style is suggested as a crucial factor for students to develop autonomous motivation (Reeve, 2009).

In short, SDT identified the sources and conditions that could promote autonomous motivation and engagement. Support for three psychological needs, a self-endorsed value for a task, and pursuit of intrinsic personal goals are the major elements that lead to active engagement. This theoretical framework guided the development of the VTS, and the strategies of enhancing engagement were applied in the VTS so that the VTS was designed to enhance students' engagement in reading. The following section describes how the VTS was designed to support the sources of motivation and engagement.

Design of the Virtual Tutee System

The Virtual Tutee System (VTS) is a Web-based tutoring environment in which students are to teach virtual characters about what they read. Four design principles were proposed to create the environmental condition that stimulates students' autonomous motivation and engagement (for more details, see Park & Kim, 2012). In essence, the VTS was designed to

afford students' experience of autonomy, competence, and relatedness and provides support for an intrinsic goal adoption and a self-endorsement of value in academic reading. By incorporating the VTS with course readings in a college classroom, it is expected that students will develop an autonomous motivation for reading course materials and improve their engagement in the readings. Figure 4.2 summarizes the expected workings of the VTS.

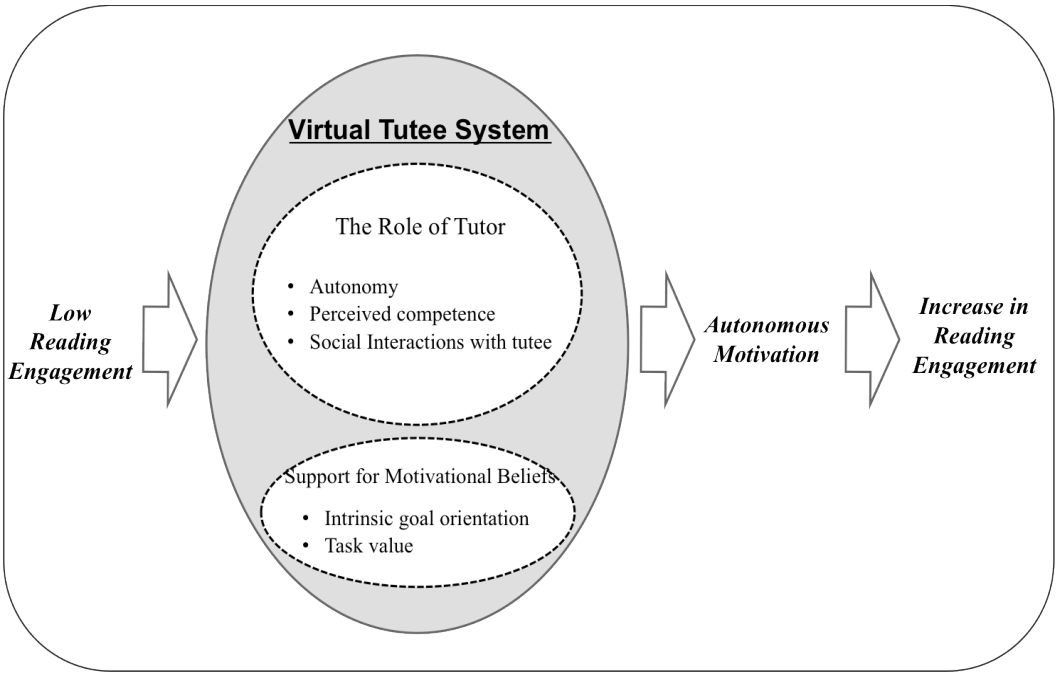

Figure 4.2. The expected workings of the VTS

Serving as a peer tutor creates a condition that affords satisfaction of basic needs for autonomy, competence, and relatedness. According to role theory, students who take the role of tutors tend to adopt characteristics of a teacher (Allen & Feldman, 1973; Hogg & Vaughan, 2005). For example, student tutors perceive the independence and authority that teachers would have and develop a commitment to learning (Allen & Feldman, 1976). This suggests that students in a tutor role are likely to experience autonomy and competence. Further, peer tutoring involves interaction with other students, and student tutors may perceive respect from their peers,

which can support the need for relatedness. Thus, the design of the VTS focused on reproducing the human tutoring environment in which the three needs are inherently supported.

The first design principle of the VTS refers to facilitating students' identification with the role of tutor to support their perceived competence and autonomy. To achieve this principle, the VTS is designed to clearly communicate the responsibilities of students as tutors and provide a clear direction on how to teach the virtual tutees. For example, the VTS provides a guide video that explains the entire tutoring process so that students can readily understand their tasks.

The second principle is concerned with provision of choices that are affordable to tutors. This design principle is arranged to further enhance students' perceived autonomy as tutors. There are three different options in the current VTS. First, student tutors can determine the tutoring goals that they would like to focus on in their tutoring lesson. Also, student tutors choose the format of the lesson delivery. For example, they can either write a summary of the assigned reading or explain its key concepts. The last option is that students choose whom they want to teach. When students open an account with the VTS, they are asked to choose one tutee from a list of six different avatar characters.

The third principle focuses on simulating social interactions between a human tutor and his or her tutee in order to support the need for relatedness. In particular, three design strategies are implemented to augment the social presence of virtual tutees. One strategy is to have the virtual tutee ask questions. Answering the tutee's questions is in fact an essential element of virtual tutoring. Also, the virtual tutees communicate positive attitudes toward learning so that the students may feel respected and important as tutors. For example, virtual tutees send a message indicating their interest in the lesson. Finally, the last strategy is to design the virtual tutoring to

take place over a longer period of time. The prolonged interaction with the tutees enables students to enhance their involvement in the role of tutor and develop their commitment as tutors.

In addition to satisfying basic needs by putting students in the role of tutor, the VTS is also designed to foster an intrinsic goal and perceive a meaningful value for reading as a strategy to further support student engagement, which is the fourth design principle of the VTS. Before students start tutoring, virtual tutees express their intrinsic aspirations for learning in the course and acknowledge the importance of reading course materials. This is done so that students may model their virtual tutees' positive motivation for reading.

Research Questions

Based on the four design principles, the VTS prototype was developed and revised through two iterations of pilot testing. In these two pilot studies, college students completed two reading assignments using the VTS and demonstrated a minimal improvement in their reading engagement. In the current study, the modified VTS was implemented throughout the entire semester (i.e., four times) in the same teacher-education course taken by the participants in the previous pilot studies. The goal of the study was to examine the effects of the prolonged use of the modified VTS on students' reading motivation, engagement, and performance. In this study, the following five research questions were addressed:

1. What is the effect of the VTS on students' motivation for completing the reading assignments?
2. What is the effect of the VTS on behavioral engagement in academic reading?
3. What is the effect of the VTS on cognitive engagement in academic reading?
4. What is the effect of the VTS on emotional engagement in academic reading?
5. What is the effect of the VTS on students' reading performance?

Hypotheses

The main hypothesis of the study was that students who used the VTS would develop a greater autonomous motivation for reading, deeper reading engagement, and higher reading performance than would those who did not use the VTS (i.e., comparison group). In accordance with the research questions, the complete list of the hypotheses tested in this study are provided below:

1. Students in the VTS group would demonstrate higher autonomous motivation than those in the comparison group.
    1.1. Students in the VTS group would demonstrate lower controlled motivation than those in the comparison group.
2. Students in the VTS group would demonstrate deeper behavioral engagement than those in the comparison group.
    2.1. The assignment completion rate of the VTS group would be higher than that of the comparison group.
    2.2. Students in the VTS group would spend more time completing the reading assignments than those in the comparison group.
    2.3. Students in the VTS group would engage in less skimming when completing the assignment than those in the comparison group.
3. Students in the VTS group would exhibit higher cognitive engagement than those in the comparison group.
    3.1. Students in the VTS group would use the higher rate of reading strategies when completing the assignments than those in the comparison group.

4. Students in the VTS group would demonstrate higher emotional engagement than those in the comparison group.
    4.1. Students in the VTS group would report higher enjoyment with the reading assignments than those in the comparison group.
    4.2. Students in the VTS group would report lower boredom with the reading assignments than those in the comparison group.
    4.3. Students in the VTS group would report lower anger with the reading assignments than those in the comparison group.
5. Students in the VTS group would score higher on the reading assignments than those in the comparison group.

Methods

Research Design

This study incorporated a concurrent triangulation mixed methods design to converge two different sources of data on student engagement in reading and provide rich evidence-based accounts on the study findings (Creswell, 2009). In a concurrent triangulation design, both quantitative and qualitative data are gathered to address the same or similar research problems. In particular, the research question five were mainly addressed through the quantitative data, and the research questions one, two, three, and four were addressed using both data sources. Table 4.1 summarizes the alignment of research questions with data collection methods and analysis strategies. On each research question, the group who used the VTS was compared to the group who did not use the VTS (i.e., comparison group) following the quasi-experimental pre-and posttest design (Pedhazur & Schmelkin, 1991).

Table 4.1. *Alignment of research questions with data collection methods and analysis strategies*

Research Questions	Data Collection Methods	Analysis Strategies
What is the effect of the VTS on students' motivation for completing the reading assignments?	– Learning Self-Regulation Questionnaire (SRQ-L) – Reading experience open-ended survey – Student interviews	MANCOVA Theme generation
What is the effect of the VTS on behavioral engagement in academic reading?	– Behavioral reading engagement survey – Reading experience open-ended survey – Student interviews	MANOVA Theme generation
What is the effect of the VTS on cognitive engagement in academic reading?	– Metacognitive Awareness of Reading Strategies Inventory (MARSI) – Reading experience open-ended survey – Student interviews	MANCOVA Theme generation
What is the effect of the VTS on emotional engagement in academic reading?	– Achievement Emotions Questionnaire (AEQ) – Reading experience open-ended survey – Student interviews	MANCOVA Theme generation
What is the effect of the VTS on students' reading performance?	– Reading assignment score	ANCOVA

Settings and Participants

This study was conducted in an introductory educational technology course at a large public university in the southeastern United States. Participants were recruited from four sections of the course. There were two different instructors teaching the four sections: the first instructor was in charge of three sections and the other instructor taught the fourth. Individual sections were based on the same curriculum and lesson plans. The course was designed primarily to teach pre-service teachers about how to integrate technology in their classrooms; however, students in this course represented various majors including communication sciences, recreational studies, mass media, public relations, psychology, and education. The majority of the course work involved participating in a series of hands-on activities to learn how various technologies could be used for teaching and learning. Periodically, students were instructed to read assigned course

materials, and the reading assignments formed 15 % of the course grade. There were a total of four reading assignments throughout the semester. The reading materials were compiled from various sources including a textbook chapter, magazine article, and blog posts. Students spent about 10 to 40 minutes reading each of the readings.

Seventy-one students initially participated in the study, but one student failed to complete the post surveys. Thus, the total number of participants analyzed in the study was 70. Of the 70 participants, 75.7 % were female (n = 43). The majority of students (78.6 %) were Caucasian (n = 55) with 12.9 % African American (n = 9), 4.3 % Asian (n = 3), 2.9 % Hispanic (n = 2), and 1.4 % other (n = 1). Participants of the study were at various academic levels; 32.9 % were sophomores (n = 21), 30 % seniors (n = 23), 25.7 % juniors (n = 18), and 11.4% freshmen (n = 8). The average participant age was 20.11 years.

Of the 70 participants, 21 students failed to complete all four reading assignments. Only participants who completed *more than two* reading assignments (out of four) were included because the focus of the study was to examine the prolonged use of the VTS as compared to the previous studies in which the VTS was used with *only two* reading assignments. Inclusion of these students yielded 63 participants in total.

Independent variables

The four sections of the course were randomly assigned to either the treatment or comparison group. Both groups received the same materials to read as take-home assignments. However, students in the treatment group were asked to complete the Virtual Tutoring System (VTS) while students in the comparison group completed the online reading guide (RG). The total number of participants in the VTS group was 34, and the RG group included 36 participants (see Figure 4.3). After excluding students who did not complete the assignments, 31 participants were retained in the VTS group and 32 in the RG group.

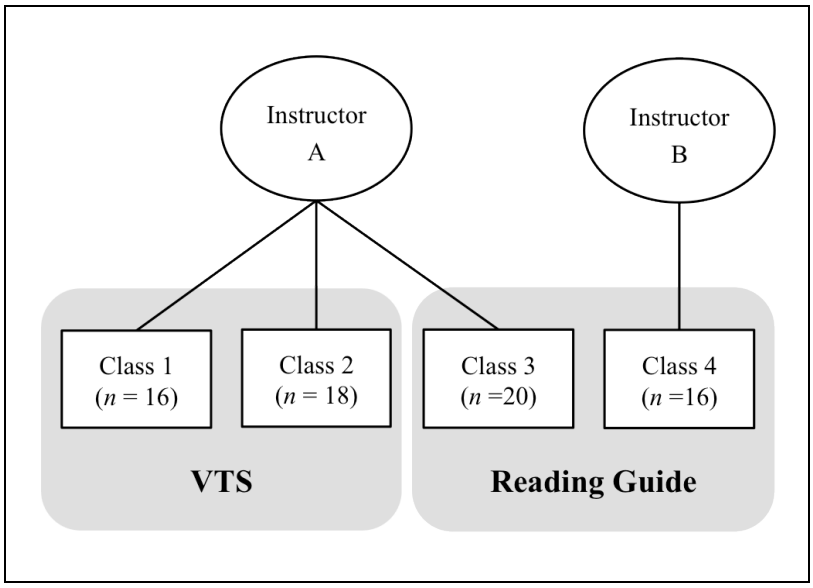

Figure 4.3. Experimental group assignment of the study

Treatment Group. Students in the treatment group taught their virtual tutees about the content covered in the reading material for each reading assignment. When students signed up for the VTS, they were required to select their virtual tutee from a list of six options. The available virtual tutees were represented as human-like characters, each of which had a different appearance. Each virtual tutee character was provided with a profile that contained information about hometown, major, year in college, and hobbies. After choosing their tutee, students were directed to watch a guide video on how to use and navigate the VTS. The VTS in this study presented four tutoring sessions, and an individual tutoring session corresponded to each of the four reading assignments.

Once students entered a tutoring session, they determined lesson objectives, provided a lecture note, and answered tutee questions. First, students were given an option to decide their lesson objectives for the selected tutoring session. Then, they provided a lecture note by either writing a summary or explaining the key concepts. No matter which lecture note type students chose, they were asked to address the same list of reading questions in their lecture note. After

completing the lecture note, students answered a series of three questions from their virtual tutees about the reading, which was the last part of the tutoring session (see Figure 4.4). Tutee questions were provided through written text and were not vocalized. The questions used in the lecture note and the tutees' questions were essentially identical to questions used in the reading guide of the control group. They were only reworded differently to appear as if the tutees were asking the questions (see Table 4.2). Students repeated the same process for every tutoring session: lesson objective selection, lecture note, and tutee questions and answers. Appendix D provides screen shots of the VTS in the sequence of events in the first tutoring.

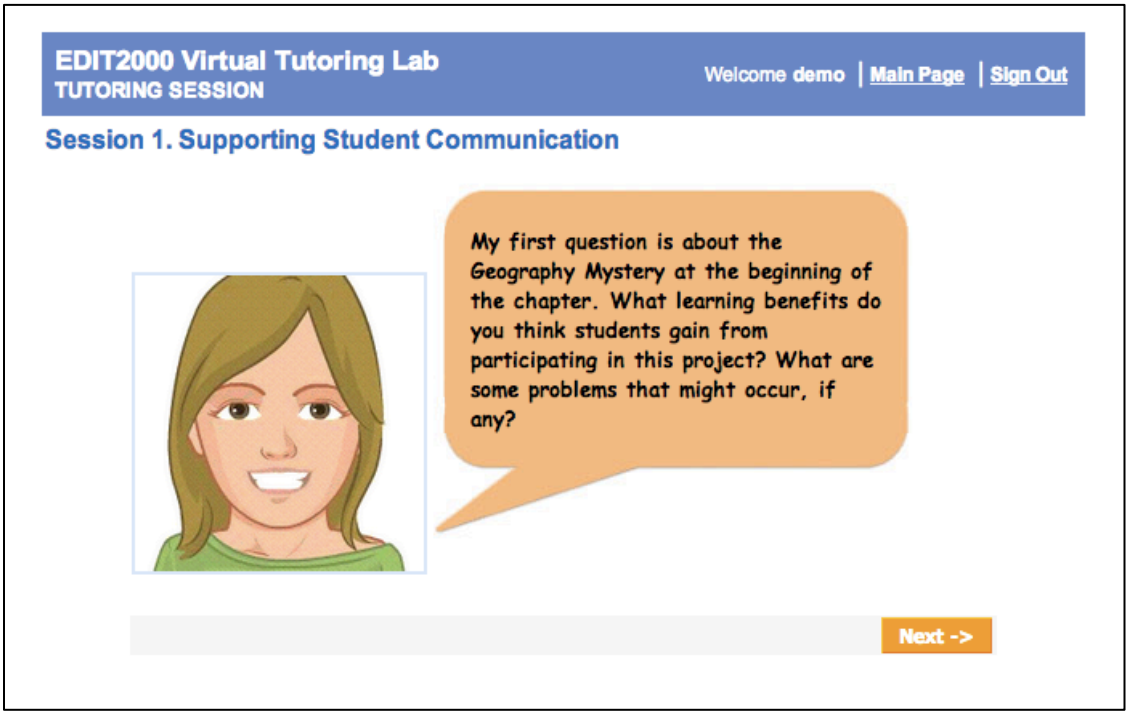

Figure 4.4. Screenshot of a virtual tutee asking a question in the VTS

Table 4.2. *Examples of modification of reading questions*

Virtual Tutee System (VTS) Questions	Reading Guide (RG) Questions
I have another question. Think about all of the tools we've learned about in this class. I would like to envision how those tools could support student creativity. Would you please select one tool and provide explanation about how the tool might help with the four dimensions of creativity?	Think about all of the tools we've learned about in class so far. Select a tool and describe how it might help with two or more of the four dimensions of creativity.
I have difficulty differentiating collaboration and cooperation. Could you explain the difference between collaboration and cooperation? Which one do you think seems to happen most frequently in classrooms?	What is the difference between collaboration and cooperation? Which one seems to happen most frequently in classrooms?
I have one last question. Among the four areas, it seems that I have a hard time maintaining effective attitudes and dispositions. How about you? Which one of these areas of focus (idea generation, reflective judgment, self-regulation, or attitudes and dispositions) is most difficult for you as a learner and why?	Which one of these areas of focus: idea generation, reflective judgment, self-regulation, or attitudes and dispositions is most difficult for you as a learner and why?
According to the reading, project-based learning isn't more prevalent in K12 schools and in post-secondary classrooms. Why do you think this is? What changes do you think need to be made if a teacher wanted to use project based learning in his classroom?	Using evidence from the reading, explain why project-based learning isn't more prevalent in K12 schools and in post-secondary classrooms. What changes need to be made if a teacher wanted to use project based learning in his classroom?

Comparison Group. Students in the comparison group completed a Web-based reading guide for each reading assignment. The reading guide was composed of a series of four to five questions that students were to answer. Students were provided with a URL to each reading guide that was arranged in a survey-creation website (see Figure 4.5). To complete the reading guide, students typed their answers to each question in a given field and clicked the submission button at the end of the reading guide.

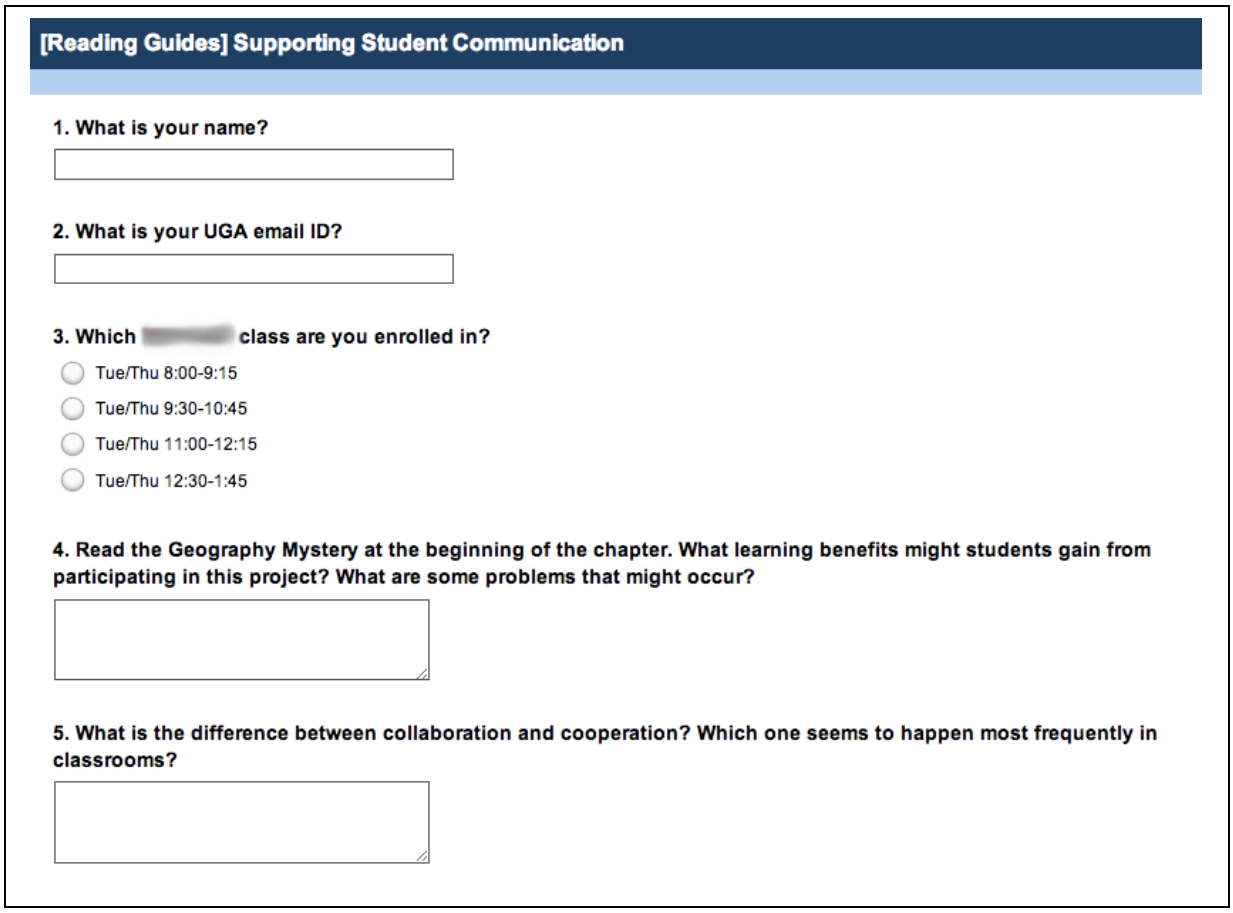

Figure 4.5. Screenshot of a reading guide

Measures and Instruments

The Learning Self-Regulation Questionnaire (SRQ-L) (Black & Deci, 2000) was administered to measure the degree to which students demonstrated autonomous or controlled motivation for reading. Each item in the SRQ-L provides different reasons for why people engage in learning activities that represent either autonomous or controlled motivation. To match the context of the current study, the SRQ-L was slightly modified. The modified version of SRQ-L asked students to rate different reasons for completing the assigned readings on a seven-point Likert scale ranging from 1 (*not at all true*) to 7 = (*very true*) (see Appendix E). An example item of the controlled motivation scale is, "I read the assigned readings because the instructor would have thought badly of me if I didn't do the assignments"; an example item of the

autonomous motivation is “I read the assigned readings because I felt like it was a good way to improve my understanding of the course material.” Subscale scores of this questionnaire were calculated by averaging the items on each subscale. In the previous studies, the alpha reliabilities for these two subscales were .80 for autonomous regulation and .75 for controlled regulation (Black & Deci, 2000; Williams & Deci, 1996). In the current study, the SRQ-L had the alpha coefficients of .90 and .72 for autonomous motivation and controlled motivation, respectively.

Behavioral reading engagement was assessed with three survey items (see Appendix F). The first question asked students to indicate the reading behavior that they were engaged in while completing the reading assignments. Students were to choose the statement that best described their reading behavior among four options ranging from 1 (*I mostly skimmed the text in order to get just the main ideas*) to 4 (*I read the entire text very thoroughly*). The second question of the behavioral engagement survey asked about the average time students spent reading, and the last item asked them to report the average time they spent completing each of the reading assignments.

The Metacognitive Awareness of Reading Strategies Inventory (MARSI) (Mokhtari & Reichard, 2002; see also Appendix C) was used to measure students’ use of reading strategies while completing assigned readings, as one indicator of cognitive engagement. The MARSI is composed of three subscales with a total of 30 items: global reading strategies, problem-solving strategies, and support reading strategies. The global reading strategies subscale consists of 13 items that relate to a global analysis of the text. Example items include “I have a purpose in mind when I read”; “I try to guess what the material is about when I read”; and “I decide what to read closely and what to ignore.” The problem-solving strategies subscale contains eight items focusing on fix-up strategies in instances in which text becomes difficult to read. Examples

include “I read slowly but carefully to be sure I understand what I’m reading”; “When text becomes difficult, I reread to increase my understanding”; and “I adjust my reading speed according to what I read.” The last subscale, support reading strategies, is composed of nine items referring to practical strategies for reading comprehension. Example items are “I underline or circle information in the text to help me remember it”; “I go back and forth in the text to find relationships among ideas in it”; and “I ask myself questions I like to have answered in the text.”

In this study, the MARSI was administered twice: before (i.e., pre-survey) and after the intervention (i.e., post-survey). In both instances, students were asked to recall reading strategies they had used when they were completing the reading assignments for the course. They rated each item on a five point Likert scale ranging from 1 (*I never or almost never do this*) to 5 (*I always or almost always do this*). Scale scores were calculated by summing up the items on each subscale. In the previous research, scores on each subscale of the MARSI yielded an acceptable reliability with Cronbach’s alphas ranging from .79 to .92 (Mokhtari & Reichard, 2002). The alpha reliabilities in the current study were .81 (.77)[4], .86 (.81), and .81 (.75) for global, problem-solving, and support reading strategies, respectively. Evidence for the validity of the scale was provided through a factor analysis in the previous research (Mokhtari & Reichard, 2002).

Part of the Achievement Emotions Questionnaire-Mathematics (AEQ-M) (Pekrun, Goetz, & Perry, 2005) was used to measure students’ emotional engagement in readings. The AEQ-M is a multidimensional self-report survey that assesses students’ achievement emotions (i.e., boredom, anxiety, enjoyment, anger, shame, pride, and hopelessness) experienced with mathematics in three different situations: attending class (class-related), studying and doing homework (learning-related), and taking tests and exams (test-related). For the purpose of the current study, the learning-related part of the AEQ-M was modified to assess students’ emotional

[4] The value in parenthesis indicates an alpha coefficient observed with the pre-survey scores.

experiences, specifically boredom, enjoyment, and anger, with reading assignments. In the original AEQ-M, an example item of boredom is "Just thinking of my math homework assignments makes me feel bored." In the current study, this item was modified to "Just thinking of *reading assignments in this class* makes me feel bored." An example item of enjoyment in the original instrument, "When doing my math homework, I am in a good mood," was modified to "When doing my *reading assignment in this class*, I am in a good mood." An example item of anger in the original instrument, "I get angry because my math homework occupies so much of my time," was reworded to "I get angry because reading assignments in this class occupy so much of my time"

The modified AEQ-M was administered before and after the intervention, and students were directed to recall their emotional experiences with reading assignments completed in the course. Students responded to each item on a five-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Each subscale of boredom, enjoyment, and anger contained three items, making nine items in total. Scale scores were calculated by summing up the items on each subscale. The reliability of scores on the three subscales of the original AEQ-M was adequate in the past study as alpha coefficients ranged from .88 to .90 (Pekrun et al., 2005). The Cronbach's alphas of three subscales in the current study were .86 (.77)[5], .75 (.67), and .84 (.78) for boredom, enjoyment, and anger, respectively.

The Learning Climate Questionnaire (LCQ) (Williams & Deci, 1996) is a self-report survey that assesses the degree to which the instructor supports students' autonomy. According to self-determination theory, the teacher's motivating style is one of the critical factors affecting students' motivation and engagement (Reeve, 2012). Thus, students' perceived autonomy support from their instructors was considered as an important covariate of the study. The LCQ

[5] The value in parenthesis indicates an alpha coefficient observed with the pre-survey scores.

was used to assess possible differences in instructors' autonomy support and understand their effect on student engagement in reading. The original LCQ is composed of 15 items; however, the survey developers also provided an abbreviated version with six items. In this study, the short form of the LCQ was used (see Appendix G). Example items include, "My instructor listens to how I would like to do things" and "I feel that my instructor provides me choices and options." Students rated each item on a seven-point Likert scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). Scale scores were calculated by summing up all the items. The past study reported Cronbach's alpha of .96 (Williams & Deci, 1996). The current study found a high internal consistency of the LCQ as well with an alpha coefficient of .93.

Student performance scores were obtained through evaluation of students' responses provided in the reading assignments. Each reading assignment contained four to five open-ended questions about the reading. These queries were composed of different types of reading comprehension questions such as reorganization, inference, evaluation, and personal response (for details of each question type, see Day & Park, 2005). In order to evaluate students' answers to these reading questions, rubrics (see Appendix H) were developed by two researchers in consultation with the course instructors as well as an instructional design research expert. The rubrics were concerned with whether students provided accurate and adequate answers to the questions (scale: 0-5 points).

Students' scores on four reading assignments were summed to calculate the total reading performance score. The maximum performance score was 90. To enhance the validity of the performance scores, two researchers independently reviewed and rated students' answers on the reading assignments. Neither rater had access to group assignment information while evaluating the data (i.e., blind data). In the first independent evaluation, 66.4 % of all the items yielded the

same scores between the two raters. The two raters then discussed and refined the scoring criteria on the rubric and independently reevaluated the items on which the two raters' scores did not match in the first evaluation. After the second independent evaluation, the proportion of the agreed scores was 95.4%. The two raters further discussed and reviewed each item with dissimilar scores until they reached agreement on them.

An open-ended survey (see Appendix I) was developed to explore students' experiences with the reading assignments. The survey contained five questions asking students to describe different aspects of the reading assignment. The sample questions were, "How did you like completing reading assignments in this course?" and "Do you think the VTS (or reading guides) influenced your understanding of the reading materials?" Additionally, student interviews were conducted to explore in greater depth students' experiences with the reading assignments. A semi-structured interview protocol (see Appendix J) was developed with a series of open-ended questions similar to the ones used in the open-ended survey. The protocol was used primarily as a guide, and the interviewer was allowed to change and add questions (Roulston, 2010). The interview questions focused on acquiring detailed descriptions about the behaviors, emotions, and thinking processes that students experienced while completing the reading assignments. All the interviews were audio-recorded and transcribed verbatim.

The main purpose of implementing the open-ended survey and the interviews was to explore students' cognitive and emotional engagement in reading and complement the Likert-scale instruments (MARSI and AEQ). The use of reading strategies represents only one aspect of cognitive engagement. Similarly, students may engage in emotional experiences other than those assessed by the AEQ in this study. Thus, the open-ended survey and student interviews were

used to explore other aspects of reading engagement that could not be measured by the Likert-scale questionnaires.

Procedures

Participants for the treatment and comparison groups were recruited at the beginning of the semester to complete the surveys twice during the semester (i.e., pre- and post-surveys). Those who volunteered to participate completed a consent form, a demographic survey (see Appendix K), the Metacognitive Awareness of Reading Strategies Inventory (MARSI), and the Achievement Emotions Questionnaire (AEQ) as pre-surveys on the same day they were recruited. From the third week of the semester, students in the VTS group completed the reading assignments with the VTS whereas students in the RG group carried out the assignments by completing the web-based reading guide. Students received the second reading assignment two weeks after the first assignment; the third reading was assigned six weeks after the second one; the fourth reading assignment was completed two weeks after the third assignment.

After students completed the fourth reading assignment, they completed the behavioral engagement survey, MARSI, AEQ, SRQ-L, LCQ, and open-ended questionnaire as the post-surveys. On the same day, students were recruited for participation in follow-up interviews. Those who agreed to participate in the interviews received an incentive of an extended due date for their course assignment. A total of 11 students participated in the interviews: six from the VTS group and five from the RG group. All the interviews were conducted face-to-face in a small-sized conference room, and each interview lasted approximately 30 minutes.

Data Analysis

Quantitative data analysis. Five separate quantitative data analyses were performed with SAS 9.3 and IBM SPSS Statistics 20. First, a multivariate analysis of variance (MANOVA)

was used to test for differences between the VTS and RG groups on students' scores on two dependent variables of behavioral engagement: reading behavior and average time students spent completing each reading assignment. The average time students spent reading the assigned material was excluded from the analyses due to violation of an assumption of unequal covariance matrices. While multivariate analysis is typically robust to multivariate non-normality, violating the assumption of equality of covariance matrices can yield biased results (Huberty & Olejnik, 2006). With two behavioral engagement variables, results of the Box's M Test of Equality Covariance Matrices indicated that the population variance-covariance matrices of two groups were equal at $\alpha = .05$ ($p = .577$). Perceived autonomy support (i.e., instructor influence) was not used as a covariate because it did not significantly correlate with any of the behavioral engagement measures.

The three subscale scores on MARSI were compared between the two groups using a multivariate analysis of covariance (MANCOVA), with the pre-survey scores on MARSI as covariate. Without a significant relationship with any of the post-MARSI scores, perceived autonomy support was not included as a covariate. The correlations between the pre-MARSI scores and post-MARSI scores ranged between .27 and .51. As in MANOVA, the assumption of equal covariance matrices were tested, and results of the Box's M Test indicated the homogeneous covariance matrices between the two groups ($p = .70$). In addition to the assumptions of multivariate normality and equal covariance matrices, there are two more assumptions to be met before MANCOVA can be conducted. One assumption is independence of the covariates and the independent variable. That is, the covariates should not be different between the two treatment groups. Results of Hotelling's T^2 showed that the pre-survey scores on the three MARSI subscales were not significantly different between the VTS and RG groups (p

= .13). The last important assumption of MANCOVA is that the regression slope of the outcome variable on the covariate is the same for all groups of participants (i.e., homogeneity of regression slopes). There was no significant interaction between the covariates (i.e., the pre-survey scores on the three MARSI subscales) and the independent variable (VTS vs. RG); thus, the assumption of homogeneity of the regression slopes was also met.

Another MANCOVA was performed to test for differences between the VTS and RG group on the three emotions (boredom, enjoyment, and anger), with the pre-survey scores on AEQ and perceived autonomy support as covariates. Results of the Box's M Test yielded evidence for equal covariance matrices of the dependent measures between the two groups (p = .18). Both the initial emotional engagement and perceived autonomy support (i.e., covariates) were not significantly different between the two groups, indicating the independence of the covariates and the independent variable (p = .71). Moreover, none of the interactions between the covariates and the groups were significant, so the assumption of equal regression slopes was also upheld.

In order to examine differences between the two groups on autonomous and controlled motivation for reading assignments, a MANCOVA was also performed, with perceived autonomy support as a covariate. Initial analyses indicated homogeneous covariance matrices (p = .75) and the independence of the covariate and two groups (p = .84). Also, the analyses revealed that the assumption of equal regression slopes was met (p = .88).

Lastly, student performance scores were compared between the VTS and RG groups using an analysis of covariance (ANCOVA) with GPA as a covariate. The Levene's test indicated that the two groups had an equal covariance (p = .20). The two groups were not significantly different on GPA (p = .30) as well, indicating that the assumption of the

independence of the covariate and independent variable was upheld. Also, regression slopes of performance scores on GPA for the two groups were equal (p = .98).

Qualitative data analysis. The data from the open-ended survey and the student interviews were initially analyzed through open-coding (Strauss & Corbin, 1990). The coded data were constantly compared to and classified into pre-determined categories of engagement and motivation (e.g., behavioral engagement, cognitive engagement, emotional engagement, autonomous motivation, and controlled motivation) (Crabtree & Miller, 2005). Additional categories were also developed for the codes that did not fit into the existing categories. The reading guide and VTS groups were then compared within each category to generate key patterns and themes that best represented the data. The development of the patterns and themes were refined through an iterative process, as suggested by Patton (2002).

Missing data treatment for quantitative data analyses. Two missing values were found in the survey data. One student did not complete one item of the pre-survey MARSI; another student did not report his or her GPA. The Little's MCAR test indicated that these cases were missing completely at random (MCAR), p = 1.00. Considering that these two missing values are a relatively small portion of the entire sample (1.4 % for each missing) and that they were MCAR, pairwise deletion was used as a missing data treatment for the quantitative analyses in this study.

Results

Quantitative Data Results

First, the reading completion rate was calculated for each group. The number of students who failed to complete at least one reading assignment was 12 for the RG group (33.3 %) and nine for the VTS group (26.4%). The number of students who missed more than one assignment

was four for the RG group (11.1 %) and three for the VTS group (8.8 %). These seven students were eliminated in the subsequent data analyses examining students' engagement in reading.

Comparing the levels of students' autonomous and controlled motivation for reading between the two groups, the MANCOVA failed to find a significant difference, $\Lambda = 0.95$, $F(2, 59) = 1.48$, $p > .05$. Both groups demonstrated a moderate degree of autonomous and controlled motivation for reading although controlled motivation was slightly higher than autonomous motivation overall. The descriptive statistics are summarized in Table 4.3.

On the analysis of the MANOVA to examine the differences in reading behavior and reading time between the two groups, the data did not show any significant result, $\Lambda = 0.98$, $F(2, 60) = 0.40$, $p > .05$. The means of the reading behavior were 2.42 and 2.53 for the VTS group and the RG group respectively, indicating that both groups were engaged in a moderate level of skimming (see Table 4.3). The means of the assignment completion time were approximately 43 minutes and 40 minutes for the VTS group and the RG group (see Table 4.3).

Students in the two groups also demonstrated a similar pattern of reading strategy use. The results of the MANCOVA indicated that the scale scores on all three types of reading strategies were not significantly different between the RG and VTS groups, $\Lambda = 0.87$, $F(3, 55) = 2.59$, $p > .05$.

With the scores on the three emotion scales, the MANCOVA yielded a statistically significant difference between the two groups, $\Lambda = 0.59$, $F(3, 55) = 12.33$, $p < .001$, partial $\eta_p^2 = .40$[6]. To further examine the significant effect on the multivariate analysis, follow-up univariate ANCOVAs were conducted on each of the three emotions with a Bonferroni correction. According to the ANCOVA results, the two groups were significantly different in

[6] partial eta- squared (η_{p2}) is used to calculate effect size: Small: $.01 \leq \eta_{p2} < .06$; Medium: $.06 \leq \eta_{p2} < .14$; Large: $\eta_{p2} \geq .14$

enjoyment, $F(1, 57) = 23.67$, $p < .001$, partial $\eta_p^2 = .29$. No significant difference was found in two other emotions (anger and boredom).

Table 4.3. *Mean pre-survey scores and mean and adjusted mean post-survey scores for dependent variables*

Dependent variables	Group	*n*	Pretest		Posttest obtained		Posttest adjusted
			M	*SD*	*M*	*SD*	*M*
Reading behavior	RG	32	–	–	39.98	24.58	–
	VTS	31	–	–	43.55	23.10	–
Completion time	RG	32	–	–	2.53	.84	–
	VTS	31	–	–	2.42	.84	–
Global strategies[a]	RG	31	41.61	8.93	44.70	6.80	45.07
	VTS	31	42.77	7.00	42.16	9.07	41.79
Problem-solving strategies[b]	RG	31	29.59	5.65	28.12	5.75	28.03
	VTS	31	28.54	5.67	26.64	6.62	26.74
Support strategies[c]	RG	31	24.12	6.44	20.64	6.37	21.17
	VTS	31	26.38	6.74	22.38	7.48	21.85
Enjoyment[d]**	RG	32	9.03	2.20	8.90	2.54	8.86
	VTS	31	8.51	2.06	6.41	1.96	6.45
Anger[e]	RG	32	5.81	2.34	4.90	2.21	5.02
	VTS	31	6.67	2.90	5.74	2.65	5.6
Boredom[f]	RG	32	8.73	3.12	7.96	3.12	7.9
	VTS	31	8.96	3.41	8.38	2.81	8.3
Autonomous motivation	RG	32	–	–	4.82	1.49	4.82
	VTS	31	–	–	4.83	1.58	4.82
Controlled motivation	RG	32	–	–	5.21	1.26	5.22
	VTS	31	–	–	5.70	1.13	5.69
Performance[g]*	RG	31	–	–	64.64	14.40	63.80
	VTS	31	–	–	71.25	12.80	72.09

[a] Possible range of Global Reading Strategies score: 13 – 65
[b] Possible range of Problem Solving Strategies score: 8 – 40
[c] Possible range of Support Reading Strategies score: 9 – 45
[d] Possible range of Enjoyment scale score: 3 – 15
[e] Possible range of Anger scale score: 2 – 10
[f] Possible range of Boredom scale score: 3 – 15
[g] Maximum performance score: 90
* $p < .05$. ** $p < .01$

Lastly, after controlling for students' GPA, a significant difference was found on students' performance scores, $F(1, 59) = 7.09$, $p = .01$, partial $\eta_p^2 = .10$. The adjusted mean scores of reading performance were 72.09 for the VTS group and 63.80 for the RG group.

Qualitative Data Results

Findings obtained from the open-ended survey are reported here in conjunction with those obtained from the interviews because the same questions were used in both data collection methods. The number of students included in the open-ended survey data analyses is 31 for the VTS group and 32 for the RG group. The number of students participating in the interviews was six for the VTS group and five for the RG group.

First, it was found that both the RG and VTS groups appreciated the reading assignments. In the open-ended survey, the majority of students in the VTS group ($n = 20$) reported that the readings were interesting and relevant to what they learned in the class. Students in the RG group ($n = 22$) also reported that the readings were informative and helpful to understanding the course. Many students in the RG group commented that they particularly liked that the readings were brief and easy to understand ($n = 10$). When students were asked how they enjoyed completing the reading assignments, in particular, 17 students in the VTS group made positive responses as compared to 13 students in the RG group.

Students also acknowledged the support of the reading guides or the VTS for their understanding of the reading materials. Some of them made comments indicating that the reading guides or the VTS prompted behavioral engagement in reading. For example, a student from the VTS group said, "It [VTS] forced me to sit down and learn even on days when I wasn't feeling particularly motivated." A student in the RG group similarly commented, "I probably wouldn't have read the readings at all if it were not for the reading guide questions."

In addition to behavioral engagement, students reported about the cognitive benefits of the reading guides or the VTS. The majority of students in the RG group (n = 17) and the VTS group (n = 20) reported that the reading guides or the VTS helped identify the main ideas of the readings and explain them in their own words. In particular, students in the VTS group referred to this cognitive benefit of using the VTS as the most appealing aspect of the reading assignments (n =14). For example, a student in the VTS group commented, "The Virtual Tutoring Lab helped me reinforce my understanding of what I'd read in asking me to elaborate on certain points and summarize certain ideas." Another student in the VTS group said, "I like how it [VTS] really asked about the main ideas so it allowed me to focus on what was important." A student from the RG group similarly said, "They helped me focus on which parts of the reading I needed to gather information most from." Other students made comparable comments during the interviews to the effect that the reading guides or the VTS helped their understanding of the readings:

> Usually I just read, what I would have thought was important would be different from what a teacher would have thought was important so…when I had the [reading] guides I kind of knew what I needed to focus on more and like pay more attention the other parts so I did think they were helpful. [RG group]
>
> If I didn't have those [VTS], I probably wouldn't have read them . . . . Because it [VTS] gave me a purpose for my readings . . . if I just [did] mindless reading, I don't think I would have gotten anything out of it. I think it [VTS] really helped me focus on the key concepts of the reading. [VTS group]

When questioned further, some students reported that the RG or the VTS prompted them to engage in deep processing of the texts and deep, critical thinking as they answered the

questions. One student from the RG group said, “Oh, yes, because otherwise it [readings] was just words on the page that I’ve got to read; if you’re making me answer a question, I have to think about it.” A student from the VTS group also put it:

> Well, it [VTS] forced me to like think about the material again and to kind of apply it and I think applying new understanding, like it should help the information to stick to my memory .... I guess in a way it’s like taking notes after reading and it helps me take mental notes. So I guess it’s just good for the reinforcement and remembering the material.

Furthermore, several students in the VTS group made comments specifically about the benefits of tutoring (n = 4). For example one student commented in the open-ended survey, “I thought that the Virtual Tutoring Lab was a great way to test my understanding of the reading. By having to teach someone else the material, you had to understand it yourself first, so that was good motivation.” Another student said, “The fact that I had to turn the subject around and teach it to someone else really helped me.” The following interview excerpt also indicates the benefits of being a tutor:

> The virtual tutoring was pretty interesting. It gives you a chance to kind of be a teacher I guess you’d say … and so in doing that I was able to reinforce the topics for myself as well so I think it was beneficial.

Others also recognized the VTS as a novel way of completing reading assignments with at least a degree of entertainment. For example, a student stated in the open-ended survey, “I thought it was interesting that we could choose whom we wanted to tutor. I also liked that we were given choices in what we wanted to discuss in our reading assignments.” Similar comments

were reported during the interviews. The following interview excerpts are example remarks that students made about the appeal of the VTS:

> Yeah. I think it was interesting, like pick a person. I remember reading the descriptions of each person and picking the one that I think I most liked or something. Yeah, so that was interesting, it was different. And then when they'd ask me questions ... I mean, that was a lot better than just like filling out a worksheet or something like that. Overall, I liked it.
>
> I liked having a little person talk to me. I thought that was cool. It is just different, you know? I liked how you could choose like summary or key concepts because it personalized it.
>
> It feels somewhat interactive because you get to choose the person you tutor and the way they present the questions is like they are speaking to you in a conversation. So, it was unique, I think.

Although students were mostly content with the reading assignments, a few in both groups also mentioned their downsides. The most common complaints reported were that the assigned readings were boring and some of the topics were uninteresting. As compared to the RG group, students in the VTS group reported several problems about the VTS. One of them was related to faulty design in the VTS. In order to answer the tutee's questions, students had to proceed to the next page on which a blank field was presented to type the answers (see Figure 4.6). However, once students moved to the next page, the tutee's question was no longer visible. This issue seemed to have significantly bothered students. For example, one student said, "I wish the questions would not disappear when I clicked next to answer the question. I had to open a document, paste the question, write my answer, and copy the answer, then paste the answer in the answer box."

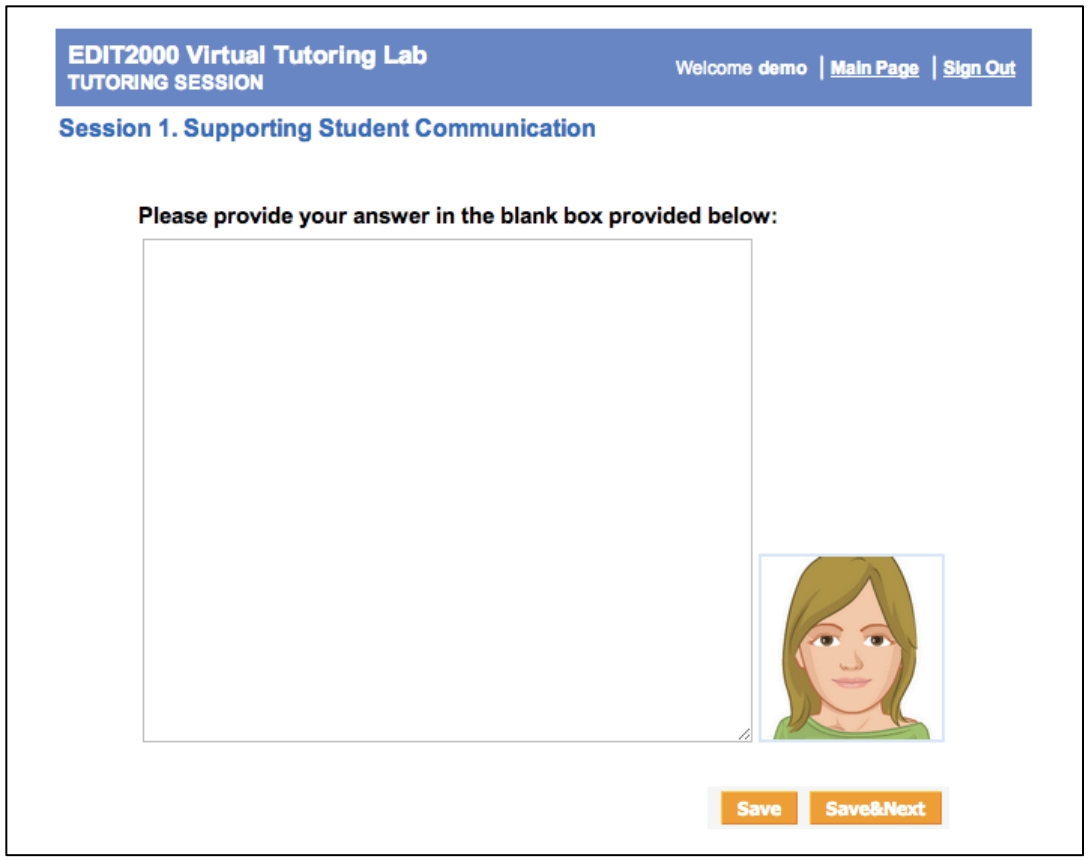

Figure 4.6. Screenshot of providing answers to a tutee question in the VTS

Another recurring issue that the VTS group reported about the reading assignment was the type of questions asked by their tutees. Students in the VTS complained about answering open-ended questions. Some of them mentioned in particular that the type of questions were not the kind of questions that tutees would ask. One interviewee said, "I guess the questions that were asked … didn't seem like a real person would ask. So, the questions were … I think they were kind of vague." He added that a tutee's asking an open-ended question created confusion. Several students also complained about spending too much of their time on answering the open-ended questions. One student explained during the interview that providing answers to the broad, open-ended questions as a tutor somewhat forced her to elaborate on her answers in great detail.

The following excerpt from the interview illustrates how she responded to the questions in the VTS:

> I think it would help like that and maybe if the question was more specific so that I wouldn't have to write so much because I felt like some of them had very open-ended, broad answers and I didn't feel comfortable just talking a little bit so I'd write a lot and then. I think at first the concept of having to teach made me feel like I had to talk about it as much as I can .... I felt like I had to cover all the aspects of the material, like especially if I chose the summarizing one, then I would summarize it. But then I'd also take the time to expand on each point that I wrote about. I just wasn't sure how much would be okay to write or enough.

Discussion

Summary of the Findings and Interpretations

The purpose of the study was to examine the effects of the VTS on students' reading motivation, engagement, and performance. Students who used the VTS were compared to those who used the reading guide. With regard to the effect of the VTS on students' motivation for completing the assigned readings, it was expected that students in the VTS group would show a higher autonomous motivation than students in the RG group because the VTS was designed to provide different sources of autonomous motivation (Reeve, 2012). However, the two groups did not differ in either autonomous or controlled motivation. Rather, both groups demonstrated a higher controlled motivation than an autonomous motivation. In other words, students completed reading assignments to get grades rather than to pursue their personal interests. Two students also reported in the open-ended survey that they completed the assignments for the grades associated with them.

This finding may be related to the fact that many students were not education majors although the course was primarily designed for pre-service teachers. In fact, two students mentioned during the interviews that the reading topics were not of interest to them because they were not related to their majors. In addition, the limited impact of the VTS on autonomous motivation may be attributable to the nature of the reading assignments in this study. The importance of the reading assignments in this course was relatively low compared to other college courses because it was not a typical lecture-based course and did not involve a formal examination. Also, the reading materials did not necessarily introduce technical vocabularies or complex concepts that students needed to learn. Together, these circumstances may have lowered the perceived value of the readings in this particular course. Given that self-endorsed value is one of the essential elements for autonomous motivation according to self-determination theory (Deci & Ryan, 1985), it is possible that students in the current study may have not fully capitalized on what the VTS could offer and have not developed an autonomous motivation for reading.

There was also limited evidence to support the effect of the VTS on students' behavioral engagement in reading. It was expected that students in the VTS group would demonstrate greater behavioral engagement with a higher rate of assignment completion and a greater amount of time spent on reading. Although more students in the VTS group (73.6 %) completed all four reading assignments as compared to those in the RG group (66.7 %), they spent an equivalent amount of time in completing each assignment as students in the RG group spent. According to the qualitative data, both the reading guides and the VTS definitely made students complete the assigned readings they otherwise would not have read. Furthermore, both groups engaged in a similar degree of skimming when carrying out the assignments. During the interviews, several

students stated that they read thoroughly only the parts of the readings that were relevant to the reading questions.

As one indicator of cognitive engagement in reading, students' use of reading strategies was examined and the two groups did not differ in their use of reading strategies as well; both showed a moderate degree of reading strategy use. This finding is somewhat inconsistent with the previous pilot studies. In the previous study, students improved their use of reading strategies after completing two reading assignments using the VTS as compared to four assignments in this study (Park & Kim, 2013). The observed effect of the VTS in the earlier study could have been a novelty effect. However, it could also be attributable to the low level of difficulty of the texts that students read. The readings used in the study were more akin to informal reading materials such as a magazine article, a blog post, and an overview of a research summary. Students spent approximately 10 to 40 minutes reading each of the selections. Unlike traditional textbooks, these readings were relatively short and written with simple, plain language and vocabulary. Thus, it is possible that students did not need to use sophisticated reading strategies to understand them. Indeed, many students indicated in the open-ended questionnaire that they liked the readings of the course because they were short and easy to understand. Additionally, it is also possible that students failed to recall their reading strategy use. Previous research has indicated that a self-report questionnaire might not accurately measure students' actual use of reading strategies because it relies on their retrospection (Veenman, 2005).

On the open-ended survey, students acknowledged that both the reading guides and the VTS promoted their understanding of the texts. They reported that answering the reading questions of the reading guides or the VTS helped them better identify and understand the main ideas of the texts. In particular, students in the VTS group indicated that serving as a tutor

prompted a thorough understanding of the texts so that they could accurately answer questions from the tutees.

With regard to emotional engagement in reading, about half of the students in both groups reported that they enjoyed completing the reading assignments. When two groups were compared with regard to their emotional experiences with the reading assignments, a significant difference in enjoyment between the VTS and RG groups was reported: students in the RG group reported a higher enjoyment of the readings than those in the VTS group. According to the general definition of emotional engagement (Fredricks et al., 2004), the low enjoyment found in the VTS group suggests a low emotional engagement in reading.

However, such displeasure with the reading assignments may be instead a result of deep cognitive processing. A seminal study by Zeidner (1987) found that people tend to experience negative emotions when working on a task with high demand for a cognitive process (e.g., working memory, information retrieval). In fact, as compared to the RG group, which liked the brevity of the assignment, some students in the VTS group expressed discomfort with spending more time on the reading assignments than they had expected and such distress may have marred their enjoyment in reading. Furthermore, although they complained about the extended time they spent completing the assignment, students in the two groups reported an equivalent amount of assignment completion time on the behavioral engagement survey. This implies that students in the VTS group may have expended greater mental effort than those in the reading guide group. That is, the more intense cognitive load among students in the VTS group (i.e., deep processing) may have contributed to the perception of greater time consumption, which may have also caused low enjoyment in reading. Thus, the low enjoyment observed with the VTS group may instead indicate deep cognitive engagement in reading.

Finally, students in the VTS group performed better on the reading assignments than did those in the reading guide group. This finding also adds to the evidence for greater cognitive exertion among students in the VTS group as the higher reading performance represents superiority in conceptual understanding of the reading materials. That said, the VTS seems to have facilitated students' deep, critical thinking when answering the reading questions, which led to the higher performance. Although students acknowledged that either the reading guides or the VTS helped their understanding, the VTS may have promoted deeper-level processing and thinking when completing the reading assignments, in particular answering the reading questions. As hinted in students' reports on the open-ended survey and interviews, the act of teaching their tutees may have fostered a deeper engagement in and greater effort on the reading and question-answering activities.

Implications of the Study

The current study indicated the utility of the VTS in a college classroom. The majority of students in the VTS group were satisfied with the VTS, and many of them favored the activities in the VTS. Further, they reported enjoyment in interacting with their tutees. The students not only acknowledged the benefits of the VTS but also showed high performance with the VTS.

In addition, the study found evidence, albeit limited, suggesting the effects of the VTS on students' engagement in reading. The study findings imply that the VTS facilitated students' deep cognitive processing of a text and critical thinking. In particular, the VTS seemed to influence students' engagement in question-answering rather than in reading itself. Although students in the VTS group did not show a greater autonomous motivation for reading nor any improvement in their reading strategy use, they still achieved a higher performance on their reading assignments than did those in the RG group. In other words, students in the VTS group

may have read the assigned course materials as those in the RG group read, but when they were answering their tutees' questions, they may have exerted greater cognitive effort than the RG group answering the reading guide questions. As frequently reported in the open-ended survey and interview, serving as a tutor may have encouraged students to take the question-answering activity more seriously and engage in deep, critical thinking. Thus, the study findings demonstrated the potential of the VTS as a learning tool that promotes students' deep-level thinking.

Additional implication of the study is related to the measure of emotional engagement in reading. According to most engagement researchers (e.g., Skinner, Furrer, Marchand, & Kindermann, 2008), positive emotions are regarded as emotional engagement in contrast to emotional disaffection. However, the findings of the study imply that deep cognitive engagement might not always result in positive emotions. Although students in the VTS groups seemed to exert a greater cognitive, mental effort, they reported lower enjoyment than students in the RG group. As noted above, when students engage in tasks with high cognitive demands, they tend to experience negative affects temporarily until the cognitive discrepancies are resolved (Zeidner, 1987). Thus, the measure of emotional engagement based solely on valence (positive versus negative) might not be applicable to some contexts, in particular, a circumstance in which students are involved in complex cognitive tasks (Pekrun, 2006). Researchers may consider using multiple measures to accurately assess students' emotional engagement in learning, as suggested by Fredericks and McColskey (2012).

Limitations of the Study and Directions for Future Research and Development

One limitation of the study lies in the use of a self-report survey to measure the reading time. Students were asked to think back and recall the average times they spent reading after all four reading assignments were completed. However, it is possible that students were not able to remember the accurate time they spent reading. In fact, although students were asked to report both the time they spent reading and the time they spent completing each assignment, many of them did not differentiate these two. Future studies may consider using web-based reading texts and measuring the actual reading time while students working online. This will allow for a more accurate measure of behavioral engagement in reading.

Another limitation of the study is related to the low value of the readings. The main reason for using the VTS in a college class is to help students acquire knowledge from the readings, given that the readings are critical to learning in the course. However, the readings used in the study were supplementary resources rather than the main sources of knowledge acquisition in the course. As previously mentioned, participants were not formally evaluated on their learning from the readings, and the readings were not the traditional academic texts containing complex concepts and technical vocabulary. Also, the readings may have had less to do with topics of interest to study participants because many of them were not education majors. Although the VTS was designed to support the intrinsic value of reading, its low attainment value may have hampered students' engagement in the reading assignments and the VTS. Given the significance of task value in engagement, it is possible that such a low value of the readings may have interfered with the effects of the VTS on reading engagement. The capability of the VTS might be enhanced in learning environments in which a deep understanding of course readings is essential for students' performance in the course.

In addition, the nature of the reading questions used in the VTS may also have restricted the study findings. The reading questions used in the study were generated based on the reading guide questions that the course instructor had been using in the course. In order to promote students' deep processing, the instructor had created questions asking for application, evaluation, or personal response (Day & Park, 2005). However, several students indicated that the broad, open-ended questions were not reflective of authentic tutee questions. It appeared that these types of questions are unsuitable in a tutoring environment because they ask for personal opinions and experiences. Within the arrangement of virtual tutoring, it may be more natural for a virtual tutee to ask questions requiring students to explain and clarify complex concepts and constructs. In order to develop the effective virtual tutoring environment, future studies may explore whether the types of tutee questions can have an impact on students' engagement and learning with the VTS.

Moreover, students in the VTS group encountered technical problems with the VTS. Several students reported that they had difficulty logging in because they had forgotten their password but the password resetting function in the VTS did not work properly. Also, the VTS failed to save students' answers on two occasions. In future studies, these technical issues should be resolved so that students do not experience any discomfort using the tool.

The recruitment of interview participants is another limitation. In the current study, the interview participants were recruited toward the end of the semester. In order to encourage participation, interview participants were given an incentive of an extended due date for their course assignment. Thus, it is possible that students with lower performance in the course tended to participate in the interviews, which might have yielded the biased data. In future studies, purposeful sample interviews are recommended instead. For example, after reviewing students'

open-ended survey data, researchers may decide to select those who clearly demonstrate either a deep or shallow level of engagement.

Finally, it is necessary to test whether or not the effects of the VTS are due to its novelty. One of the purposes of the current study was to examine the prolonged use of the VTS. However, the study failed to replicate the findings reported in the previous studies. As noted earlier, the effects of the VTS found in the past studies may have been a novelty effect. Although Schwartz and colleagues (2009) found an incremental increase in student performance with a prolonged interaction with a teachable agent, there is an apparent lack of research comparing the short-term and long-term effects of a virtual character. Further studies are necessary to examine the impact of the length of a VTS use on learner engagement and performance.

Conclusion

Although the current study did not find significant effects of the VTS on autonomous motivation, behavioral engagement, and the use of reading strategies, it provided the evidence that the VTS influenced students' cognitive engagement in reading: students in the VTS group engaged in deep-level, critical thinking and demonstrated a greater conceptual understanding of the reading materials. This study is also meaningful in that it showed the potential of the VTS as a learning tool for college students and also yielded several critical implications for future research that were not indicated in the previous pilot studies. Future studies should be pursued that reflect on these suggestions to further evaluate and refine the VTS.

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CHAPTER 5

CONCLUSION

This dissertation reported research studies aimed at improving poor reading engagement commonly observed in the college classrooms. The main intervention used in the dissertation studies was a Virtual Tutee System (VTS). The concept of the VTS was initiated based on the tutoring effect reported extensively in the peer tutoring literature. Role theory and self-determination theory provided the theoretical framework and guided the design of the VTS. Chapter 2 discussed how the design framework of the VTS was developed to promote reading engagement. Based on the design framework, the VTS prototype was developed and implemented in an educational technology course.

Three studies were conducted to evaluate and refine the VTS. The first two evaluation studies were reported in Chapter 3. The major focus of these two studies was to test the basic functions of the VTS and identify design errors. Also, the impact of the VTS on reading engagement was evaluated. In both studies, students did not report serious problems with the VTS; only minor design errors were found and the VTS was revised accordingly. Most students were satisfied with tutoring a virtual character and with the design features of the VTS. As a measure of reading engagement, students' use of reading strategies was assessed and a statistically significant improvement was found in the second study. The qualitative data also implied a positive influence of the VTS on students' engagement in course readings. Students in both studies acknowledged that the VTS helped them engage in deeper understanding of the texts.

The third study, described in Chapter 4, was conducted to replicate and extend the findings of the previous studies. This study focused on the effects of the prolonged use of the VTS on reading motivation, engagement and performance. Based on the self-determination theory (SDT), it was expected that students who used the VTS (the VTS group) would demonstrate greater autonomous motivation, deeper reading engagement, and higher performance than those who did not use the VTS (the online reading guide group). According to the quantitative data analyses, most of the variables, with the exceptions of emotion and performance, did not yield significant differences between two groups. Students in the VTS group reported lower enjoyment toward reading assignments but achieved higher performance as compared to those who were in the reading guide (RG) group. In the open-ended survey and interviews, the majority of the students expressed satisfaction with the VTS and acknowledged its benefits in that it allowed for a deeper understanding of readings; however, some of them reported discomfort with spending an extended amount of time in answering open-ended tutee questions.

In short, the dissertation study demonstrated the potential of the VTS for promoting students' academic reading engagement and their performance in a college classroom. In particular, students seemed to exhibit greater cognitive engagement with the use of the VTS. Students demonstrated an increased use of reading strategies (field trial II) and higher reading performance and greater conceptual understanding (study 3) after working with the VTS. Their experience of discomfort with the reading assignments also implied greater cognitive exertion. This dissertation study is an initial step towards a long-term goal of validating the VTS and its design principles. More studies are necessary to further refine the design of the VTS and examine its effectiveness on engagement in reading. In the next section, recommendations for the design of the VTS are provided based on the current study findings.

Implications for Design of the VTS

One of the purposes of the dissertation study was to assess the functionality of the VTS and identify its design errors. Through a series of studies, the VTS has been revised and improved. Based on the findings from the three studies, the following five specific design considerations were extracted:

1. *Provide a guide video that introduces the procedure of the VTS.*

   In the beginning of the VTS, the guide video of the VTS was provided primarily to communicate to students their assignments as a tutor. Participants in the studies recognized that this video helped them understand the VTS and navigate the websites. On the other hand, several students who did not watch the video reported that they were confused about some functions of the VTS. According to the pre-training principle of multimedia learning design, people learn better when they are familiar with the key components in the learning materials (Mayer & Moreno, 2003). Without an understanding of the basic information, people's cognitive capacity can be greatly restricted for higher-level processing. Considering that the VTS is an unusual environment that puts students into the role of tutor, a guide video that provides an overview of the VTS seems necessary for new users to successfully teach a virtual tutee.

2. *Provide an explicit direction on how to write a lecture note.*

   In the first prototype of the VTS, student tutors were asked to provide a summary or explain the key terms from the reading as a lecture note without any specific directions. Students repeatedly reported frustration due to ambiguity about writing the lecture note. Although summarization is considered to be a fundamental skill for

college students, it seemed to present a high cognitive load when guidelines are not made specific. Thus, it is suggested that the expectations for a lecture note in the VTS be explicitly stated. For example, the revised VTS provides a list of key ideas that should be addressed in the lecture note. Such guidelines can also promote students' clear understanding about their assignments as a tutor.

3. *Embody natural interaction*.

   In the VTS, when a virtual tutee made a comment in a speech bubble, the mouth of the tutee was programmed to repeatedly open and close. In the first prototype, this animation was presented along with a field in which students entered their lecture note; however, the opening and closing motion of the tutee's mouth annoyed the students. It is likely that the constant mouth movement even after the end of interaction may have pronounced the pseudo interaction with the tutee. This issue could be readily addressed by employing spoken narration. In fact, several empirical studies have indicated a stronger effect on students' learning of a vocalized pedagogical agent over simple on-screen text (Craig, Gholson, & Driscoll, 2002; Moreno, Mayer, Spires, & Lester, 2001).

4. *Present the fields for the tutee questioning and the tutor answering on the same page*.

   In the third evaluation study, students frequently reported frustration at the tutee question not being visible on the same page as the one on which students were to type their answers. The reason for this arrangement was to sequence the conversational dialogue between the tutee and the student tutor. However, this design produced inconvenience instead: because the question posed by a virtual tutee was not brief, students had difficulty remembering the question or went through an extra step of

copying and pasting the question. It is recommended that the tutee question be visible on the page with the tutor answering field.

5. *Construct natural tutee questions*.

   Many of the questions asked by the virtual tutees in the study were those soliciting personal opinions and experiences. Several students commented that a human tutee would ask them to teach difficult concepts rather than relate personal stories. Given the nature of tutoring, it may be more authentic to add tutee questions asking the tutors to explain and/or clarify complex concepts and constructs. Further studies are needed to test the effects of question types and find appropriate questions to be used in the VTS.

Future Research Directions

Given that this dissertation study is an initial step of refining and validating the tool, a further evaluation of the VTS is necessary. First, future studies should examine the impact of the VTS that incorporates design features that were initially proposed but not embodied in the current prototype. For example, one of the design guidelines of the VTS is to evaluate the virtual tutee's performance and make it available to student tutors (for additional details, see Park & Kim, 2012). This guideline was proposed to increase the believability of the tutoring environment and support students' autonomy and competence. Future studies may assess whether this feature adds to the effect of the VTS. In addition, the initial guideline suggested the long-term use of the VTS to promote students' interaction with their virtual tutees and support the need for relevance. However, the current dissertation study did not find a result that confirms this guideline. More studies should be conducted to further examine the long-term effects of the VTS.

In extension of an evaluation of tutee performance, future studies could also explore the influence of competition among the virtual tutees on students' engagement. If the VTS generates tutees' performance scores, students may be driven to improve their tutees' performance and surpass other virtual tutees. Although previous studies have indicated an adverse effect of competition (Chan & Lam, 2008; Deci, Betley, Kahle, Abrams, & Porac, 1981; Johnson, Maruyama, Johnson, Nelson, & Skon, 1981), the competitive structure in the VTS may instead have had a positive impact on students' engagement because students compete against other *virtual tutees* rather than other *students*.

Another possible consideration for future research is related to the influence of students' motivational beliefs on reading engagement. Self-determination theory indicates that self-endorsed value of task and intrinsic goal aspirations are the critical factors of engagement (Deci & Ryan, 2000). The study's qualitative data hinted that students were low in these two motivational beliefs. Although the VTS was designed to support students' perceived value and intrinsic goal orientations (e.g., support messages delivered from a virtual tutee), it may have not been enough to promote these two beliefs in students. It is necessary that future studies investigate a better understanding of the influence of students' perceived task value (i.e., both intrinsic and instrumental values) and their goal orientations toward their learning with the VTS and explore effective ways to promote students' motivational beliefs in the VTS.

Moreover, future studies may consider adding spoken narration to the VTS. Narrated speech may be a critical element in the interface design of the VTS given the nature of the virtual tutoring environment in which real human interaction is sacrificed. According to the modality principle of multimedia learning, people learn better from graphic representation with narration than with text (Low & Sweller, 2005; Moreno & Mayer, 1999). As mentioned above, the

narrated pedagogical agent also had a greater effect on student learning than text-based instruction (Craig et al., 2002; Moreno et al., 2001). It is possible that narrated speech further promotes students' perceived interaction with their virtual tutees and stimulates interest (e.g., "persona effect"; Lester et al., 1997; Moreno et al., 2001). Thus, future studies may embody spoken narration in the design of a virtual tutee to create a more authentic tutoring environment.

In the long run, continuous evaluation of the VTS will lead to its validation and yield a refinement in the design framework of the VTS. Future studies will also contribute to the advancement of the theory of motivation and engagement and generate the principles of promoting reading engagement by testing the theoretical framework that underlies the expected workings of the VTS. Finally, future studies may consider testing the generalizability of the VTS and its design framework as well. The VTS should be applied in different settings such as K-12 learning environments to test its effectiveness in new contexts.

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APPENDIX A

OPEN-ENDED QUESTIONNAIRE USED IN FIELD TRIAL I

1. Have you watched the tutorial video on the VTS?
   1.1. If so, was the video helpful?
      1.1.1. If the video was helpful, in what ways do you think it helped you?
      1.1.2. If not, why not?

   1.2. If you have NOT watched the video, why not? For example, you didn't know there was a tutorial video; you were too busy to watch the video; you were confident that you knew what you were supposed to do in the tutoring activity; etc.

2. In what ways do you think the VTS influenced your understanding of the textbook?

3. What was the MOST appealing thing about the VTS?

4. What was NOT appealing to you about the VTS?

APPENDIX B

INTERVIEW PROTOCOL USED IN FIELD TRIAL I

1. Please tell me about your overall experiences with the Virtual Tutee System (VTS) in this class.
2. Please walk me through the first time you used the VTS.
3. Think of the most recent time you used the VTS. Would you tell me what it was like?
4. In a typical week, how much time did you spend completing the VTS?
5. Tell me what appeals to you about the VTS.
6. Tell me about the things that do not appeal to you about the VTS.
7. Tell me how the VTS helped your studying in this course, if any.
8. How did you like reading the textbook in this class?
9. Tell me how you enjoyed this class.
10. Would you recommend to your friends that they use the VTS? Why or why not?
11. Is there anything that I have not asked that you want to share about your experience with the VTS?

APPENDIX C

METACOGNITIVE AWARENESS OF READING STRATEGIES INVENTORY[7]

Directions [Pre-survey]: Listed below are statements about what people do when they read *academic or school-related materials* such as textbooks or library books. Before answering the following questions, **recall some typical situations of reading school-related materials** and circle the number (1, 2, 3, 4, or 5) that applies to you using the scale provided. Please note that there are **no right or wrong answers** to the statements in this inventory.

Directions[8] **[Post-survey]**: The following statements list what you may have done when completing the reading assignments **IN THIS CLASS**. After reading each statement, please circle the number (1, 2, 3, 4, or 5) that applies to you. Please note that there are no right or wrong answers to the statements.

Five numbers follow each statement (1, 2, 3, 4, 5), and each number means the following:

- **1** means "I **never or almost never** do this."
- **2** means "I do this **only occasionally**."
- **3** means "I **sometimes** do this" (about **50%** of the time).
- **4** means "I **usually** do this."
- **5** means "I **always or almost always** do this."

1.	I have a purpose in mind when I read.	1 2 3 4 5
2.	I take notes while reading to help me understand what I read.	1 2 3 4 5
3.	I think about what I know to help me understand what I read.	1 2 3 4 5
4.	I preview the text to see what it's about before reading it.	1 2 3 4 5
5.	When text becomes difficult, I read aloud to help me understand what I read.	1 2 3 4 5
6.	I summarize what I read to reflect on important information in the text.	1 2 3 4 5
7.	I think about whether the content of the text fits my reading purpose.	1 2 3 4 5
8.	I read slowly but carefully to be sure I understand what I'm reading.	1 2 3 4 5
9.	I discuss what I read with others to check my understanding.	1 2 3 4 5
10.	I skim the text first by noting characteristics like length and organization.	1 2 3 4 5
11.	I try to get back on track when I lose concentration.	1 2 3 4 5
12.	I underline or circle information in the text to help me remember it.	1 2 3 4 5
13.	I adjust my reading speed according to what I'm reading.	1 2 3 4 5
14.	I decide what to read closely and what to ignore.	1 2 3 4 5
15.	I use reference materials such as dictionaries to help me understand what I read.	1 2 3 4 5
16.	When text becomes difficult, I pay closer attention to what I'm reading.	1 2 3 4 5
17.	I use tables, figures, and pictures in text to increase my understanding.	1 2 3 4 5
18.	I stop from time to time and think about what I'm reading.	1 2 3 4 5
19.	I use context clues to help me better understand what I'm reading.	1 2 3 4 5

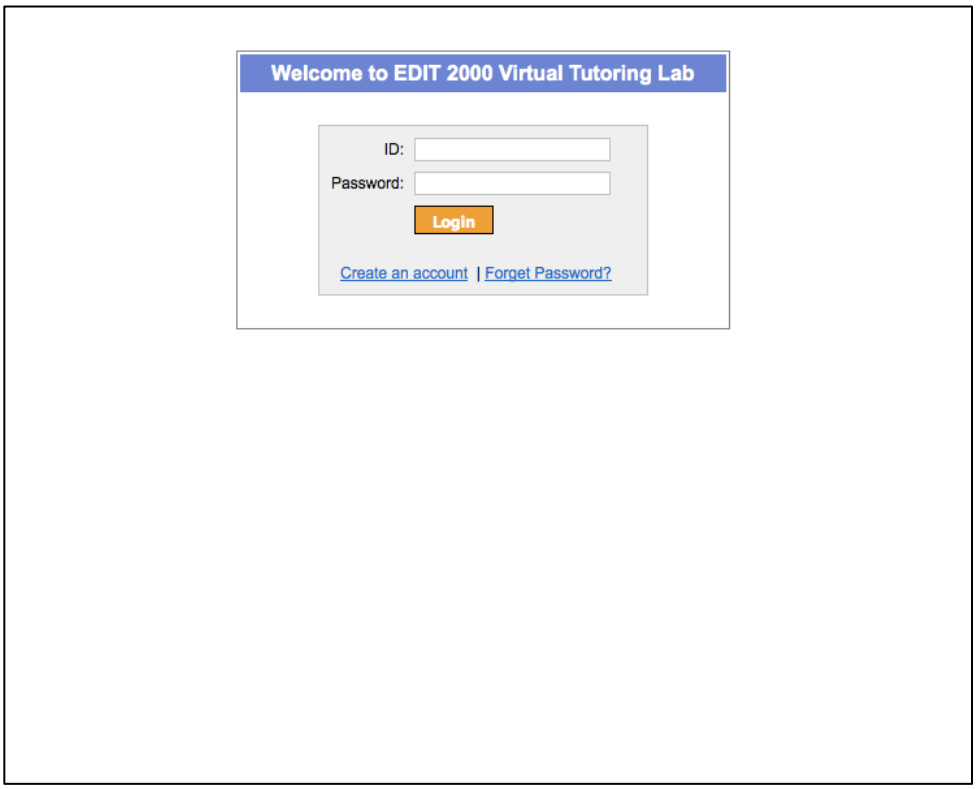
[7]

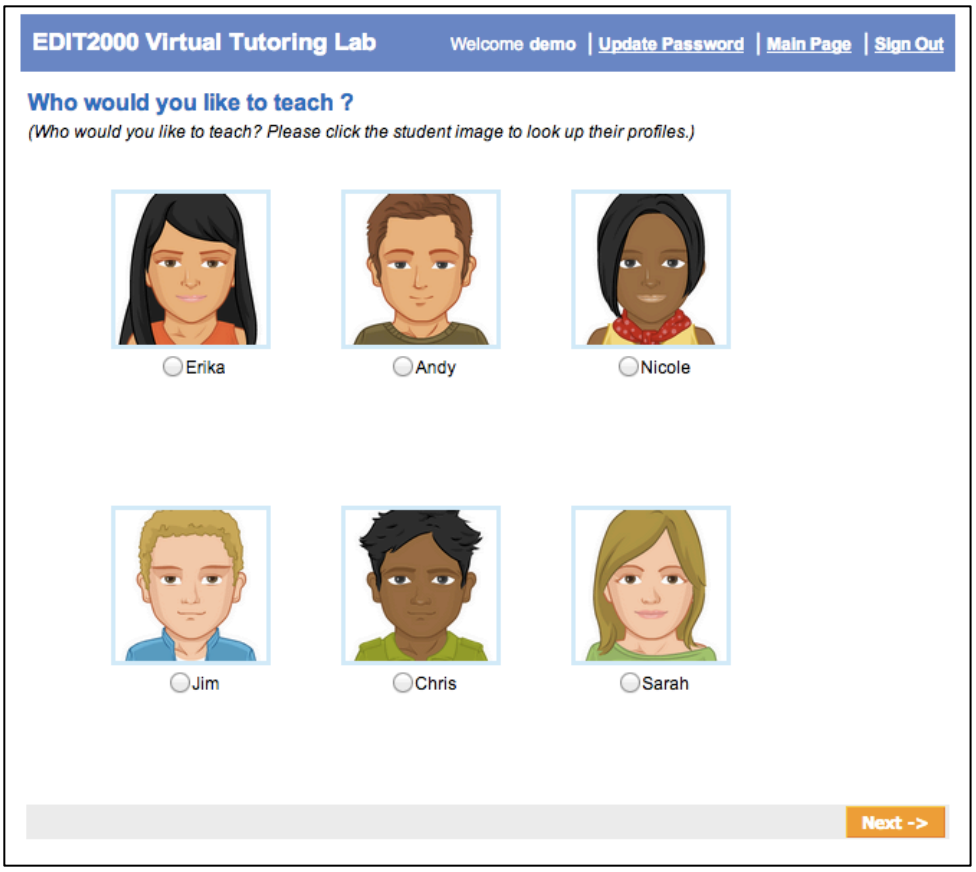
[8] These directions were used for the third study (Chapter 4).

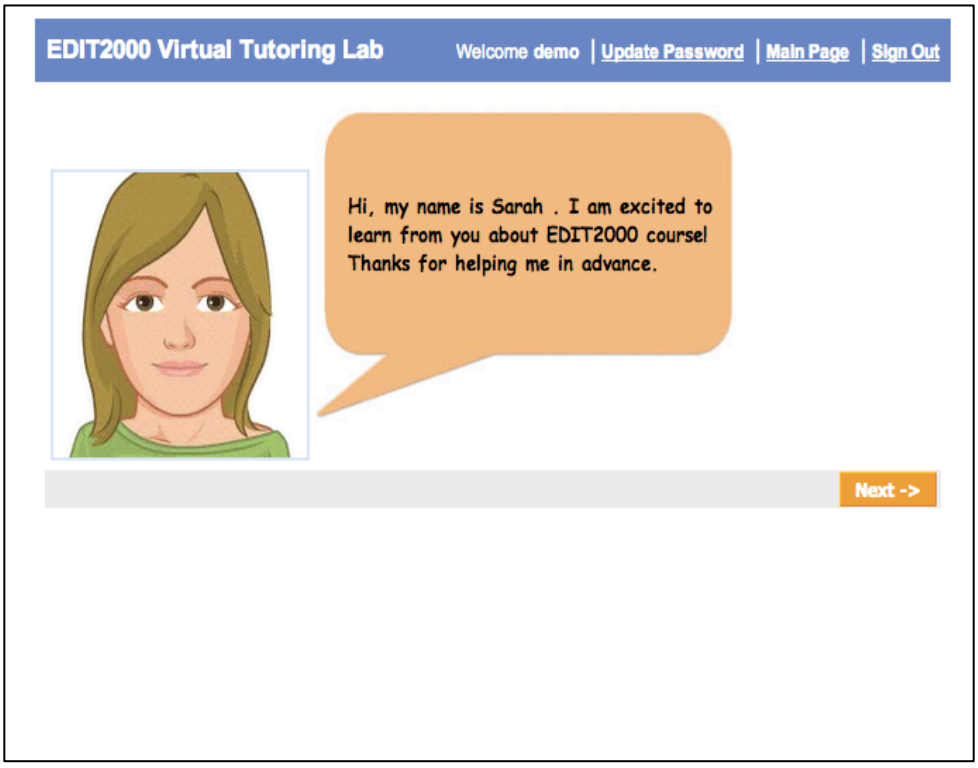
20.	I paraphrase (restate ideas in my own words) to better understand what I read.	1	2	3	4	5
21.	I try to picture or visualize information to help remember what I read.	1	2	3	4	5
22.	I use typographical aids like boldface and italics to identify key information.	1	2	3	4	5
23.	I critically analyze and evaluate the information presented in the text.	1	2	3	4	5
24.	I go back and forth in the text to find relationships among ideas in it.	1	2	3	4	5
25.	I check my understanding when I come across conflicting information.	1	2	3	4	5
26.	I try to guess what the material is about when I read.	1	2	3	4	5
27.	When text becomes difficult, I reread to increase my understanding.	1	2	3	4	5
28.	I ask myself questions I like to have answered in the text.	1	2	3	4	5
29.	I check to see if my guesses about the text are right or wrong.	1	2	3	4	5
30.	I try to guess the meaning of unknown words or phrases.	1	2	3	4	5

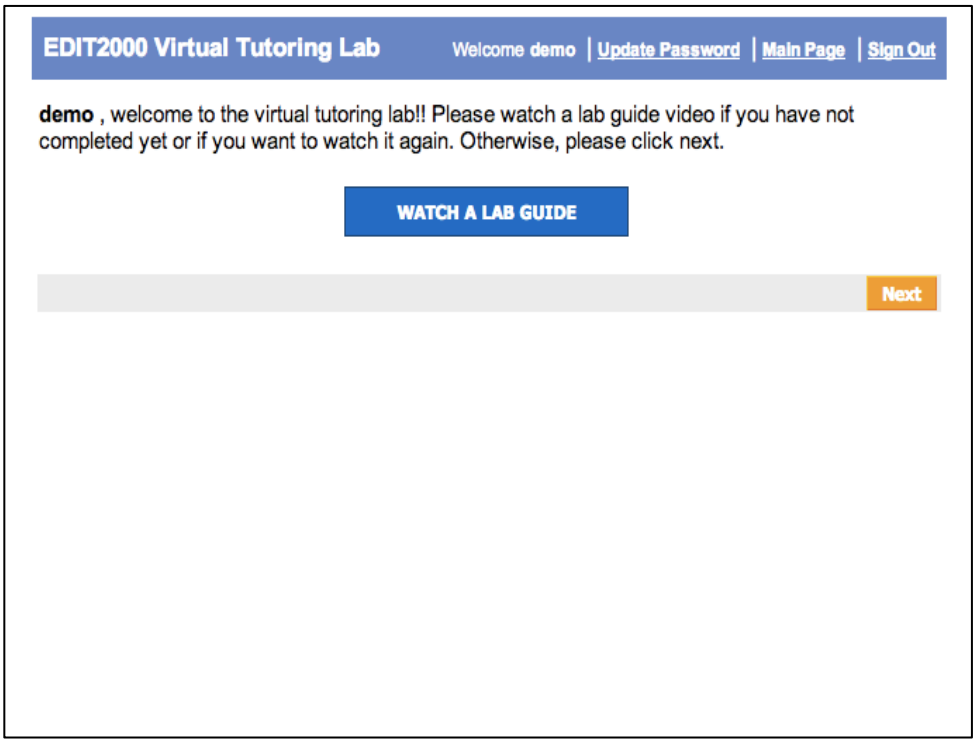
APPENDIX D

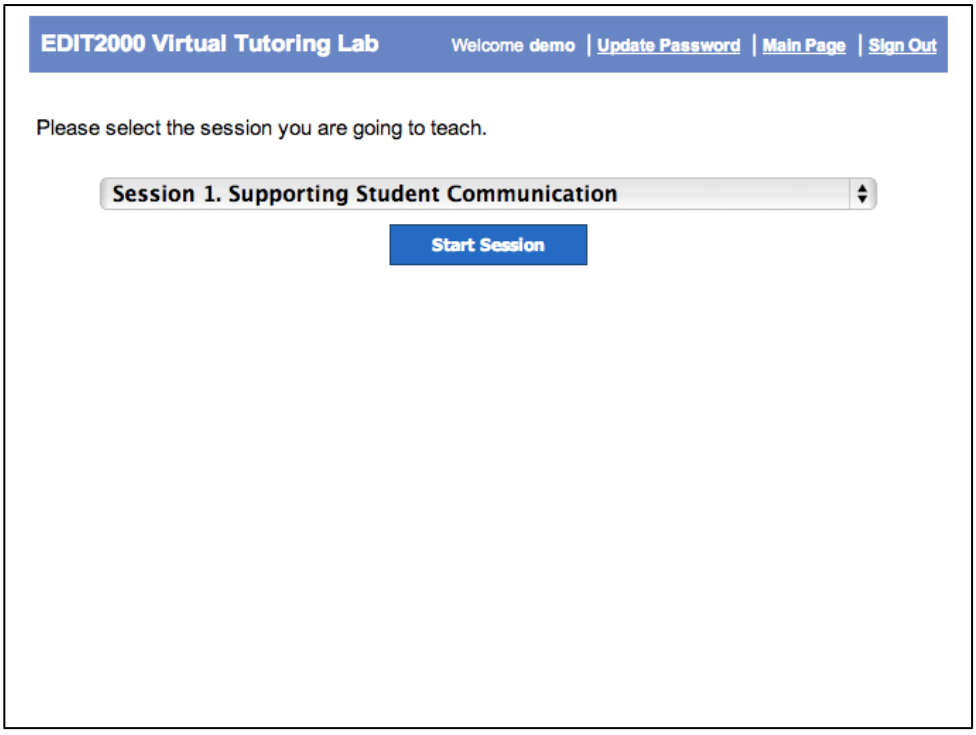
A SEQUENCE OF EVENTS IN THE VIRTUAL TUTEE SYSTEM

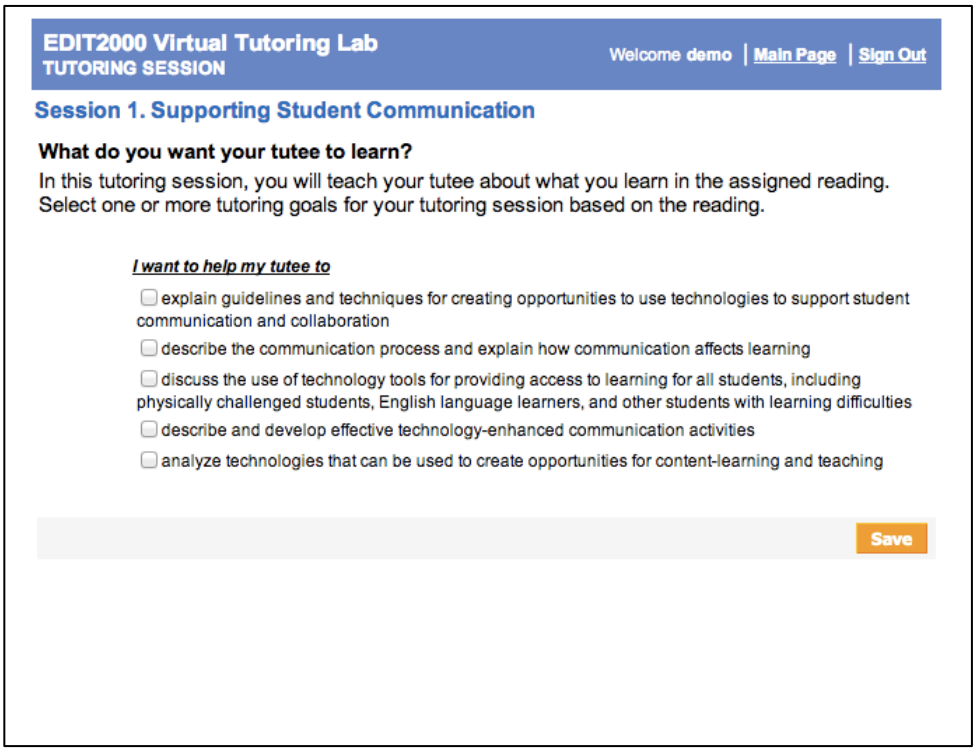


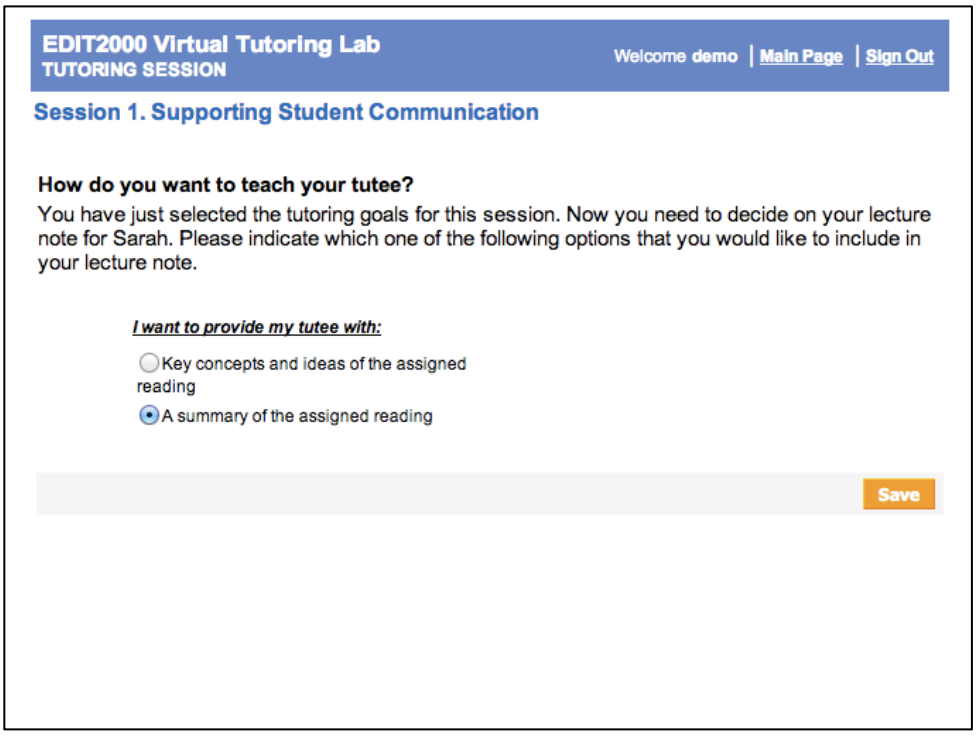

EDIT2000 Virtual Tutoring Lab
Welcome demo | Update Password | Main Page | Sign Out
Who would you like to teach ?
(Who would you like to teach? Please click the student image to look up their profiles.)
Erika
Andy
Nicole
Jim
Chris
Sarah
Next ->


EDIT2000 Virtual Tutoring Lab
Welcome demo | Update Password | Main Page | Sign Out
Hi, my name is Sarah . I am excited to learn from you about EDIT2000 course! Thanks for helping me in advance.
Next ->


EDIT2000 Virtual Tutoring Lab
Welcome demo | Update Password | Main Page | Sign Out
demo , welcome to the virtual tutoring lab!! Please watch a lab guide video if you have not completed yet or if you want to watch it again. Otherwise, please click next.
WATCH A LAB GUIDE
Next

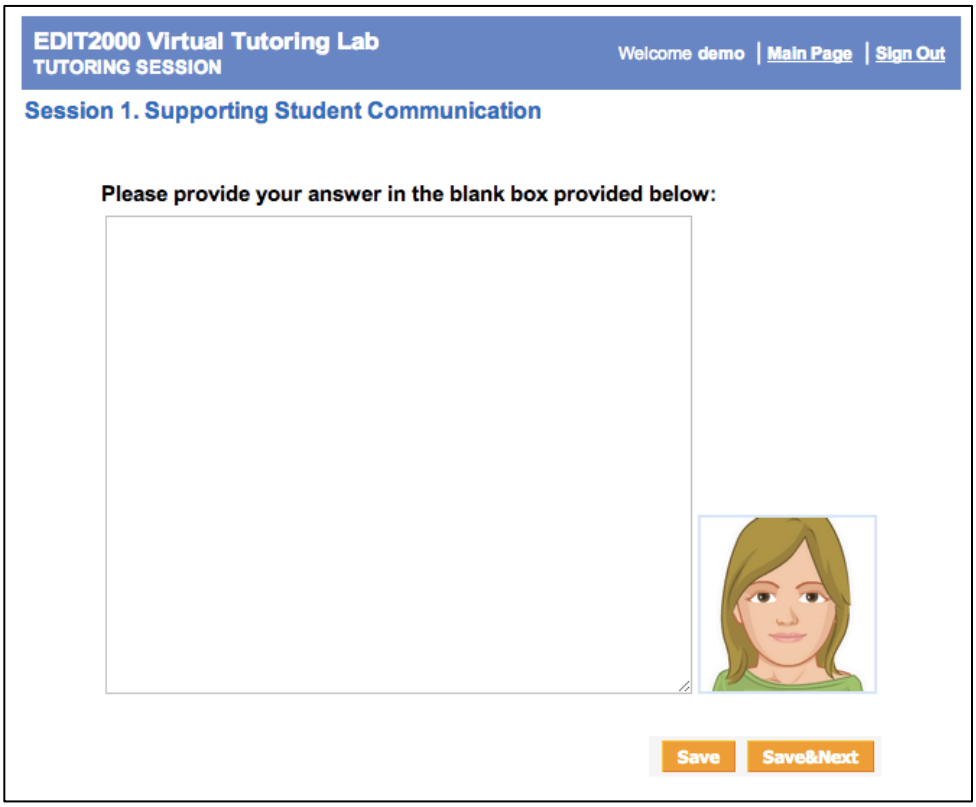

EDIT2000 Virtual Tutoring Lab
Welcome demo | Update Password | Main Page | Sign Out
Please select the session you are going to teach.
Session 1. Supporting Student Communication
Start Session

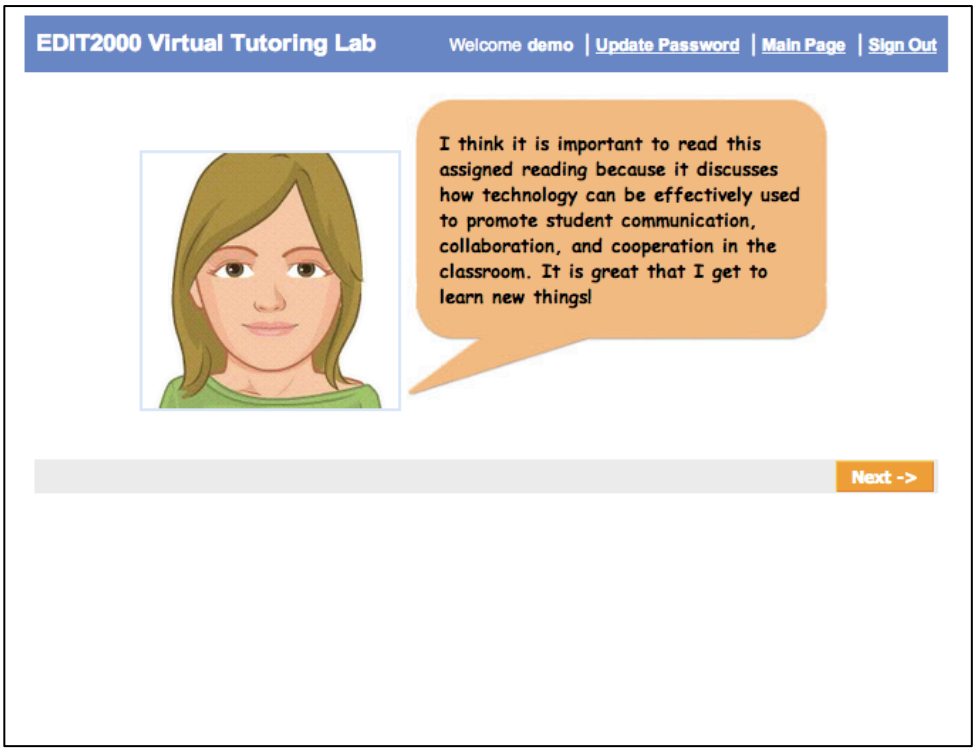

EDIT2000 Virtual Tutoring Lab
TUTORING SESSION
Welcome demo | Main Page | Sign Out
Session 1. Supporting Student Communication
What do you want your tutee to learn?
In this tutoring session, you will teach your tutee about what you learn in the assigned reading. Select one or more tutoring goals for your tutoring session based on the reading.
I want to help my tutee to
explain guidelines and techniques for creating opportunities to use technologies to support student communication and collaboration
describe the communication process and explain how communication affects learning
discuss the use of technology tools for providing access to learning for all students, including physically challenged students, English language learners, and other students with learning difficulties
describe and develop effective technology-enhanced communication activities
analyze technologies that can be used to create opportunities for content-learning and teaching
Save


EDIT2000 Virtual Tutoring Lab
TUTORING SESSION
Welcome demo | Main Page | Sign Out
Session 1. Supporting Student Communication
How do you want to teach your tutee?
You have just selected the tutoring goals for this session. Now you need to decide on your lecture note for Sarah. Please indicate which one of the following options that you would like to include in your lecture note.
I want to provide my tutee with:
Key concepts and ideas of the assigned reading
A summary of the assigned reading
Save


EDIT2000 Virtual Tutoring Lab
TUTORING SESSION
Welcome demo | Main Page | Sign Out
Session 1. Supporting Student Communication
Great! You will explain key concepts and ideas of the assigned reading. That would be very helpful. Please type them in the next page.
Next ->
EDIT2000 Virtual Tutoring Lab
Welcome demo | Update Password | Main Page | Sign Out
Please type the lecture note in the blank box below. Please address the following key concepts in your lecture note.
The characteristics of successful technology-supported communication activities
The teacher's role in technology-supported communication projects
Save
Save&Next


EDIT2000 Virtual Tutoring Lab
TUTORING SESSION
Welcome demo | Main Page | Sign Out
Session 1. Supporting Student Communication
Thank you. I will study these key concepts thoroughly. By the way, I have some questions related to the assigned reading. Would you please answer them for me?
Next ->
EDIT2000 Virtual Tutoring Lab
TUTORING SESSION
Welcome demo | Main Page | Sign Out
Session 1. Supporting Student Communication
My first question is about the Geography Mystery at the beginning of the chapter. What learning benefits do you think students gain from participating in this project? What are some problems that might occur, if any?
Next ->


EDIT2000 Virtual Tutoring Lab
TUTORING SESSION
Welcome demo | Main Page | Sign Out
Session 1. Supporting Student Communication
Please provide your answer in the blank box provided below:
Save
Save&Next


EDIT2000 Virtual Tutoring Lab
Welcome demo | Update Password | Main Page | Sign Out
I think it is important to read this assigned reading because it discusses how technology can be effectively used to promote student communication, collaboration, and cooperation in the classroom. It is great that I get to learn new things!
Next ->

APPENDIX E

LEARNING SELF-REGULATION QUESTIONNAIRE[9]

The following questions relate to your reasons for completing the assigned readings in this class. Different people have different reasons for their engagement in the course readings, and we want to know how true each of the reasons is for you. Please use the following scale to indicate how true each reason is for you.

Not At All True			**Somewhat True**			**Very True**
1	2	3	4	5	6	7

I read the assigned readings in this class because…

1.	I would feel bad about myself if I didn't do the assignments.	1	2	3	4	5	6	7
2.	I felt like it was a good way to improve my understanding of the course material.	1	2	3	4	5	6	7
3.	The instructor would have thought badly of me if I didn't do the assignments.	1	2	3	4	5	6	7
4.	A solid understanding of the readings was important to my intellectual growth.	1	2	3	4	5	6	7
5.	I was worried that I would not get a good grade in this course if I didn't do the assignments.	1	2	3	4	5	6	7
6.	It was interesting to learn more about the use of technology for teaching.	1	2	3	4	5	6	7

[9] Adapted with Permission. The original Learning Self-Regulation Questionnaire available in http://selfdeterminationtheory.org/questionnaires/10-questionnaires/48

APPENDIX F

BEHAVIORAL ENGAGEMENT MEASURE

1. Have you complete all four of the reading assignments?

2. In general, which statement best describes your reading in this class?
   - ☐ I mostly skimmed the text in order to get just the main ideas.
   - ☐ I read only part of the text well and skimmed the rest.
   - ☐ I read most of the text thoroughly and skimmed just a small amount.
   - ☐ I read the entire text very thoroughly.

3. On average, how much time did you spend reading EACH of the four reading assignments? (i.e., the time you spent reading each assigned text)

   _____ hr(s) _____ min(s)

4. [VTS group] On average, how much time did you spend "completing" EACH of the four reading assignments including the time you spent reading the material and completing the Virtual Tutoring Lab?

   [Reading Guide group] On average, how much time did you spend "completing" EACH of the four reading assignments including the time you spent reading the material and completing the reading guide?

   _____ hr(s) _____ min(s)

APPENDIX G

LEARNING CLIMATE QUESTIONNAIRE[10]

This questionnaire contains items that are related to your experience with your instructor IN THIS CLASS. Instructors have different styles in dealing with students, and we would like to know more about how you have felt about your encounters with your instructor. Your responses are confidential.

	Strongly Disagree						**Strongly Agree**
1. I feel that my instructor provides me choices and options.	1	2	3	4	5	6	7
2. I feel understood by my instructor.	1	2	3	4	5	6	7
3. My instructor conveys confidence in my ability to do well in the course.	1	2	3	4	5	6	7
4. My instructor encourages me to ask questions.	1	2	3	4	5	6	7
5. My instructor listens to how I would like to do things.	1	2	3	4	5	6	7
6. My instructor tries to understand how I see things before suggesting a new way to do things.	1	2	3	4	5	6	7

[10] Reproduced with Permission. The questionnaire is available in http://selfdeterminationtheory.org/questionnaires/10-questionnaires/82.

APPENDIX H

READING PERFORMANCE RUBRICS

Reading Assignment 1 Rubric

Reading Questions (that students are supposed to answer)	**5**	**4**	**3**	**2**	**1**	**0**	**Maximum possible points**
1. Read the Geography Mystery at the beginning of the chapter. What learning benefits might students gain from participating in this project? What are some problems that might occur?	▪ Description of possible learning benefits of students in the scenario is provided. ▪ Description of possible problems in the scenario is provided. ▪ The description is complete and thorough.	▪ Description of possible learning benefits of students in the scenario is provided. ▪ Description of possible problems in the scenario is provided. ▪ One of the descriptions is incomplete or too brief.	▪ Description of possible learning benefits of students in the scenario is provided. ▪ Description of possible problems in the scenario is provided. ▪ Both descriptions are incomplete or too brief.	▪ Description of either learning benefits or problems is missing. ▪ The description is complete.	▪ Description of either learning benefits or problems is missing. ▪ The description is incomplete or too brief.	▪ Student response does not adequately address the questions. ▪ No answer is provided.	**5**
2. What is the difference between collaboration and cooperation? Which one seems to happen most frequently in classrooms?	▪ Explanation of the difference between collaboration and cooperation is provided. ▪ Explanation of the most frequent type of	▪ Explanation of the difference between collaboration and cooperation is provided. ▪ Explanation of the most frequent type of	▪ Explanation of the difference between collaboration and cooperation is provided. ▪ Explanation of the most frequent type of	▪ Explanation of the difference between collaboration and cooperation is provided. ▪ Explanation of the most frequent type of	N/A	▪ Explanation of the difference between collaboration and cooperation is NOT adequate/correct ▪ No answer is provided.	**5**

	group work in classroom is provided. ▪ Both explanations are complete and thorough.	group work in classroom is provided. ▪ One of the explanations is incomplete or too brief. (e.g., Rationale for the most frequent type of group work in the classroom is not provided.)	group work in classroom is provided. ▪ Both descriptions are incomplete or too brief.	group work in classroom is NOT provided.			
3. What are the six characteristics of successful technology-supported communication activities? (i.e., content, time, roles, participation, communication technologies, and intentional focus on learning)	▪ The correct six characteristics of successful technology-supported communication activities are provided. ▪ Each characteristic is elaborated AND the description is complete and thorough.	▪ The correct six characteristics of successful technology-supported communication activities are provided. ▪ The description of each characteristic is incomplete or inadequate. OR Each characteristic is NOT elaborated.	N/A	▪ Some of the characteristics of successful technology-supported communication activities are missing. ▪ Each characteristic is elaborated AND the description is complete and thorough.	▪ Some of the characteristics of successful technology-supported communication activities are missing. ▪ The description of each characteristic is incomplete or inadequate. OR Each characteristic is NOT elaborated.	▪ Student response does not adequately address the questions. ▪ No answer is provided.	**5**
4. What is the teacher's role in technology-supported communication projects?	▪ Explanation of teacher's role in technology-supported communication projects is provided. ▪ The explanation is complete and thorough.	N/A	▪ Explanation of teacher's role in technology-supported communication projects is provided. ▪ The explanation is incomplete or too brief.	N/A	N/A	▪ Student response does not adequately address the question. ▪ No answer is provided.	**5**

5. What is the most important thing you have learned from this chapter that will guide your work as you develop communication activities for EDIT 2000 in the upcoming weeks?	▪ Student response provides the most important thing they learned from the reading. ▪ Student response is elaborated (e.g., explained how it is related to communication activities in EDIT2000) AND the description is complete and thorough.	N/A	▪ Student response provides the most important thing they learned from the reading. ▪ Student response is incomplete or too brief.	N/A	N/A	▪ Student response does not adequately address the question. ▪ No answer is provided.	**5**
Total Points							**25**

Reading Assignment 2 Rubric

Reading Questions (that students are supposed to answer)	**5**	**4**	**3**	**2**	**1**	**0**	**Maximum possible points**
1. What are the four dimensions that J.P. Guilford used to describe creativity? (i.e., Fluency, Flexibility, Originality, and Elaboration)	▪ The four dimensions of creativity are provided. ▪ Each dimension is elaborated AND the description is complete and thorough.	▪ The four dimensions of creativity are provided. ▪ The description of each dimension is inadequate or incomplete. OR Each dimension is NOT elaborated.	N/A	▪ Some of the creativity dimensions are missing. ▪ The description of each dimension is complete and thorough.	▪ Some of the creativity dimensions are missing. ▪ The description of each dimension is inadequate, incomplete or too brief.	▪ Student response does not adequately address the questions. ▪ No answer is provided.	**5**

2. With which of the four dimensions do you struggle the most? Provide details as to why/how this dimension is difficult for you.	▪ The most challenging creativity dimension is provided. ▪ Explanation of why/how one of the creativity dimensions is difficult is provided. ▪ The explanation is complete and thorough.	▪	▪ The most challenging creativity dimension is provided. Explanation of why/how one of the creativity dimensions is difficult is provided; but the explanation is incomplete or too brief.	N/A	▪ The most challenging creativity dimension is provided. ▪ Explanation of why/how one of the creativity dimensions is difficult is NOT provided.	▪ Student response does not adequately address the questions. ▪ No answer is provided.	**5**
3. Think about all of the tools we've learned about in class so far. Select a tool and describe how it might help with two or more of the four dimensions of creativity.	▪ Description of how the chosen tool might help with four dimensions of creativity is provided. ▪ The description is complete and thorough.	N/A	▪ Description of how the chosen tool might help with four dimensions of creativity is provided. ▪ The description is incomplete, or too brief.	N/A	N/A	▪ Student response does not adequately address the questions. ▪ No answer is provided.	**5**
4. Explore one of the creativity tools listed in the chart on p. 14 in the article. How could that tool be used to support creativity in your chosen grade/subject area?	▪ Description of how the tool could be used to support creativity in students' grade/subject area is provided. ▪ The explanation is complete and thorough.	N/A	▪ Description of how the tool could be used to support creativity in students' grade/subject area is provided. ▪ The explanation is incomplete or too brief.	N/A	N/A	▪ Student response does not adequately address the question. ▪ No answer is provided.	**5**

5. The article's author, Candace Hackett Shively, has a blog where she posts her thoughts on teaching and learning. She has recently made an interesting post on the following blog page: http://blog.teachersfirst.com/thinkteach/2012/08/31/sourdough-brain-culture-for-our-classrooms. Please visit and read this blog post and describe how this post relates to the article?	▪ Description of how this blog post relates to the article is provided. ▪ Student response is complete and thorough.	N/A	▪ Description of how this blog post relates to the article is provided. ▪ Student response is incomplete or too brief. ▪	N/A	N/A	▪ Student response does not adequately address the question. ▪ No answer is provided.	**5**
Total Points							**25**

Reading Assignment 3 Rubric

Reading Questions (that students are supposed to answer)	**5**	**4**	**3**	**2**	**1**	**0**	**Maximum possible points**
1. Please define critical thinking. Why do you think it is important to K12 learners?	▪ Description of critical thinking is provided. ▪ The reason why critical thinking is important to K12 learners is provided. ▪ The description is complete and thorough.	▪ Description of critical thinking is provided. ▪ The reason why critical thinking is important to K12 learners is provided. One of the descriptions is incomplete or too brief.	▪ Description of critical thinking is provided. ▪ The reason why critical thinking is important to K12 learners is provided. Both descriptions are incomplete or too brief.	▪ Description of critical thinking is provided. ▪ The reason why critical thinking is important to K12 learners is NOT provided. ▪ The description of critical thinking is complete.	▪ Description of critical thinking is provided. ▪ The reason why critical thinking is important to K12 learners is NOT provided. ▪ The description of critical thinking is incomplete or too brief.	▪ The answer does not address the concept of critical thinking. ▪ No answer is provided.	**5**

2. Using the Processes of Critical Thinking and Creative Thinking" handout, explain the model (graphic) shown at the top of the first page. Make sure to use your own words, not those listed below the model.	▪ Explanation of the model is provided. ▪ The explanation is complete and thorough.	▪ N/A	▪ Explanation of the model is provided. ▪ The explanation is incomplete or too brief.	N/A	N/A	▪ Student response does not adequately address the questions. ▪ No answer is provided.	**5**
3. To answer this question, select an area of focus from the handout: idea generation, reflective judgment, self-regulation, or attitudes and dispositions. Within the selected area of focus, look over the "Hints for Instruction" section: identify two technologies you've used this semester and describe how they would be beneficial for this type of instruction.	▪ Description of how two technologies could be beneficial for instruction in the selected area is provided. ▪ The description is complete and thorough.	▪ Description of how two technologies could be beneficial for instruction in the selected area is provided. ▪ One of the two example descriptions is incomplete or too brief.	▪ Description of how two technologies could be beneficial for instruction in the selected area is provided. ▪ Both example descriptions are incomplete or too brief.	▪ Only one technology example is provided. ▪ The description is complete and thorough.	▪ Only one technology example is provided. ▪ The description is incomplete or too brief.	▪ Student response does not adequately address the questions. ▪ No answer is provided.	**5**
4. Which one of these areas of focus: idea generation, reflective judgment, self-regulation, or attitudes and dispositions is most difficult for you as a learner and why?	▪ The most difficult area is described. ▪ The reason why it is difficult is provided. ▪ The explanation is complete and thorough.	▪ The most difficult area is described. ▪ The reason why it is difficult is provided. ▪ The explanation is incomplete or too brief.	▪ N/A	N/A	▪ The most difficult area is described. ▪ The reason why the selected area is difficult is NOT provided.	▪ Student response does not adequately address the question. ▪ No answer is provided.	**5**
Total Points							**20**

Reading Assignment 4 Rubric

Reading Questions (that students are supposed to answer)	**5**	**4**	**3**	**2**	**1**	**0**	**Maximum possible points**
1. What is problem solving? What is project-based learning? Why do these two things go together?	▪ Description of problem solving is provided. ▪ Description of project-based learning is provided. ▪ Explanation of why problem solving and project-based learning go together is provided. ▪ The description is complete and thorough.	▪ Description of problem solving is provided. ▪ Description of project-based learning is provided. ▪ Explanation of why problem solving and project-based learning go together is provided. One of the descriptions is incomplete or too brief.	▪ Description of problem solving is provided. ▪ Description of project-based learning is provided. ▪ Explanation of why problem solving and project-based learning go together is provided. ▪ At least two of the descriptions are incomplete or too brief.	▪ One of the questions is NOT addressed in the response. OR One of the questions is NOT adequately addressed in the response. (e.g., Answers do not address the concept of problem solving OR project-based learning.)	▪ More than one of the questions is NOT addressed in the response. OR More than one of the questions is NOT adequately addressed in the response. ▪ (e.g., Answers do not address the concept of problem solving AND project-based learning.)	▪ Student response does not adequately address any of the questions. ▪ No answer is provided.	**5**
2. Describe a personal experience with project-based learning? What was the grade level, the subject area? What was the project you completed?	▪ Description of a personal experience with project-based learning is provided. ▪ The description is complete and thorough with information about the grade level, the subject area and the project.	▪ N/A	▪ Description of a personal experience with project-based learning is provided. ▪ The explanation is incomplete or too brief.	N/A	N/A	▪ No answer is provided.	**5**

3. The article lists New Technology High School's 8 strategies, such as: "To learn written communication, write." Think of 3 strategies that would suit your major and explain why those strategies would help you prepare to contribute in your future profession.	▪ A list of 3 strategies is provided. ▪ Description of why those strategies would contribute in future profession is provided. ▪ The descriptions about all 3 strategies are complete and thorough.	▪ A list of 3 strategies is provided. ▪ Description of why those strategies would contribute in future profession is incomplete or too brief. ▪	▪ Only two strategies are provided. ▪ Description of why those strategies would contribute in future profession is complete and through. ▪	▪ A list of 3 strategies is provided WITHOUT description of why those strategies would contribute in future. ▪	▪ Only one strategy is provided ▪	▪ Student response does not adequately address the questions. ▪ No answer is provided.	**5**
4. Using evidence from the reading, explain why project-based learning isn't more prevalent in K12 schools and in post-secondary classrooms. What changes need to be made if a teacher wanted to use project based learning in his classroom?	▪ Explanation of why PBL isn't more prevalent in classrooms is provided. ▪ Changes need to be made if a teacher wanted to use PBL are provided. ▪ Both explanations are complete and thorough.	▪ N/A	▪ Explanation of why PBL isn't more prevalent in classrooms is provided. ▪ Changes need to be made if a teacher wanted to use PBL are provided. ▪ Answers are incomplete or too brief.	▪ One of the questions is not addressed in the response. ▪ The description is complete.	▪ One of the questions is not addressed in the response. ▪ The description is incomplete or too brief.	▪ Student response does not adequately address the question. ▪ No answer is provided. ▪	**5**
Total Points							**20**

APPENDIX I

OPEN-ENDED QUESTIONNAIRE USED IN STUDY 3

1. What is your overall experience with reading assignments in this course?

2. How did you like/enjoy completing reading assignments in this course?

3. [VTS group] Do you think the Virtual Tutoring Lab influenced your understanding of the materials? If so, in what ways? If not, how could they have been improved to help your comprehension?

   [RG group] Do you think the reading guides influenced your understanding of the materials? If so, in what ways? If not, how could they have been improved to help your comprehension?

4. What appealed to you when you completing reading assignments in this course? [For VTS group only] What, if anything, was special about the Virtual Tutoring Lab?

5. What, if anything, did not appeal to you when completing reading assignments?

APPENDIX J

INTERVIEW PROTOCOL USED IN STUDY 3

1. Could you tell me about your overall experience about reading assignments in this course?

2. How much time did you typically spend when completing each reading assignment?

3. Could you describe how you completed the reading assignment in general?

4. How did you like the assigned readings in this class?

5. How did you like or enjoy completing [the virtual tutoring lab or the reading guide]?

6. Do you think [virtual tutoring lab or reading guides] influenced your understanding of the reading materials?
    - If so, in what ways?
    - If not, how could it have been improved to help your comprehension?

6. What were things that appeal to you when doing reading assignments in this course? [For VTS group only] What, if anything, was special about the Virtual Tutoring Lab?

7. What were things that did NOT appeal to you when completing reading assignments in this course?

8. Is there anything that I have not asked that you want to share about your experience with the reading assignment in this class?

APPENDIX K

DEMOGRAPHIC SURVEY

1. What is your gender?

   ☐ male
   ☐ female

2. What is your age in years?

   ☐ years

3. What is your race/ethnicity?

   ☐ Asian
   ☐ Black
   ☐ Hispanic
   ☐ White
   ☐ Other

4. What is your academic major? If you haven't decided, what is your intended academic major?

5. What is your current GPA?

6. What is your academic level in college?

   ☐ Freshman

   ☐ Sophomore

   ☐ Junior

   ☐ Senior