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The University of Southern Mississippi

THE EFFECT OF ONLINE DISCUSSION FORUMS ON STUDENT LEARNING AND STUDENT PERCEPTION OF LEARNING IN A SCIENCE COURSE AT THE COMMUNITY COLLEGE LEVEL

by

Rachel Syring Ryan

Abstract of a Dissertation
Submitted to the Graduate School
of the University of Southern Mississippi
in Partial Fulfillment of the Requirements
for the Degree of Doctor of Philosophy

August 2013

ABSTRACT

THE EFFECT OF ONLINE DISCUSSION FORUMS ON STUDENT LEARNING AND STUDENT PERCEPTION OF LEARNING IN A SCIENCE COURSE AT THE COMMUNITY COLLEGE LEVEL

by Rachel Syring Ryan

August 2013

Institutions of higher education are feeling the pressure to offer a greater number of courses through alternative methods of instructional delivery including hybrid and online courses in an attempt to meet the needs of their students. Among institutions of higher education, community colleges have become a forerunner in online education, in many cases incorporating the development of online education into the institution's strategic plan. To some educators, hybrid course offerings provide the best of face-to-face education with electronic transfer of information. One of the greatest challenges which exists in the development of a hybrid course is the development of instructional methodologies which utilize cooperative and active learning.

All learning management systems utilized by institutions of higher education have some form of online discussion forum as a key component. Online discussion forums have been suggested as an effective pedagogical tool which requires both cooperative interaction amongst students while simultaneously requiring individual active reflection of knowledge. However, current studies have focused on the effectiveness of online discussion forums at

the undergraduate and graduate levels. The aim of the current study was to determine the effectiveness of online discussion forums in an upper level science course at the community college level in terms of student satisfaction and student achievement.

Analysis of the data acquired from this study determined that the incorporation of online discussion forums as well as individual written reflections as a post-reflective assignment effectively improved student achievement and understanding of scientific topics and concepts related to Microbiology. In addition, it was determined that the students' attitudes towards the online discussion forum as a cooperative learning experience were somewhat positive. Thus, it can be concluded that the incorporation of online discussion forums into courses at the community college level can be considered as an alternative pedagogical tool which can effectively improve student learning.

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The University of Southern Mississippi

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Rachel Syring Ryan

A Dissertation
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August 2013

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CHAPTER I

INTRODUCTION

For centuries, the focus of instruction in higher education has been through face-to-face interaction between the instructor and the students. The primary source of instruction occurs through dissemination of information from the instructor to the students through lectures in an attempt to generate student understanding. The main disadvantage of this strategy of instruction is that it devotes little or no attention upon the actual process of learning to achieve a true understanding of information through active restructuring of knowledge on the part of the learner which can only be achieved through active learning, in which students are engaged in problem solving, inference making and investigation, and/or resolution of contradiction and reflection (Catherine Fosnot, 1989, as cited in Johnson, Johnson, & Smith, 1991).

The science classroom has been suggested as the most appropriate venue for active, hands-on instruction in research studies (Bilgin, 2006); however, the structure of the science classroom in institutions of higher education is changing in order to accommodate the needs of the growing student population and not necessarily to accommodate the integration of active, hands-on instruction. Over the past seven years, institutions of higher education have reported that online enrollments have been increasing significantly faster than overall higher education enrollments (Allen & Seaman, 2010). Nearly 30% or over 5.6 million students enrolled in institutions of higher education were reported to be enrolled in at least one online course in the Fall 2009 term. In addition, 63% of all reporting institutions declared that “online learning was a critical part of

their institution's long term strategy" (Allen & Seaman, 2010, p. 2). The largest increase in the incorporation of online learning as a part of an institution's long term strategy was most evident among institutions awarding Associates degrees in the southern United States, whom in 2005, 78% agreed it was a part of their long-term strategy (Allen & Seaman, 2006).

The continued growth in online enrollments has resulted in institutions of higher education feeling the pressure to compete for the online student population through growth of existing course offerings (Allen & Seaman, 2010). Community colleges are among the forerunners of online course offerings with more than three-quarters of community colleges now offering the same course in face-to-face and online learning modules (Parsad & Lewis, 2008). In fact, 97% of reporting public two year institutions offered online, hybrid/blended online or other distance education courses and of those institutions, 66% reported offering undergraduate hybrid/blended online courses. The greatest factors affecting the decisions among public two year institutions regarding online course offerings included: seeking to increase student enrollment, making more courses available, meeting student demands for flexible schedules, and providing access to college to those whom otherwise would not have access (Parsad & Lewis, 2008).

To some educational leaders, hybrid instruction has been touted as offering the *best of both worlds*. The Sloan Consortium defines a blended/hybrid course as any course which combines online and face-to-face delivery with a substantial proportion of content delivered online typically utilizing online discussions and having a reduced number of face-to-face meetings (Allen &

Seaman, 2010). Through the blending of the traditional and web-based models of instructions, hybrid courses offer the accessibility and flexibility of the online course along with the personal face-to-face interaction and sense of community establish within the traditional classroom.

While the perception of the relative quality of online instruction compared to face-to-face instruction has been reported to be favorable, over three-quarters of academic leaders report online education to be as good as or better than face-to-face instruction, the struggle between traditional face-to-face and fully online learning continues (Allen & Seaman, 2010). When resistance is encountered from faculty in regards to online courses, blended/hybrid formats tend to offer a welcomed compromise (Toth, Fougler, & Amrein-Beardsley, 2008). Within the hybrid/blended online courses offered, public two year institutions reported the technology medium utilized to a moderate or large extent within the learning management system was asynchronous internet based technologies (Parsad & Lewis, 2008).

Computer mediated communication (CMC) is a mechanism of asynchronous internet based technology which supports information exchange and group interactions through a variety of electronic tools including electronic mail (email), bulletin boards, class listserves, and online discussion forums (Bodzin & Park, 2000). Computer mediated communication which is based on constructivist learning theory has been described as an important pedagogical tool which is capable of engaging groups of students separated by time and space to engage in the active process of developing shared knowledge (Gunawardena, Lowe, & Anderson, 1997).

Online discussion forums are a form of web-based asynchronous communication which allows the students to electronically post messages in a common line area for participants to read and respond (Huang, 2000). Online discussion forums have become a central element within every online learning management system allowing for the extension of teaching beyond the traditional face-to-face classroom (Levine, 2007). Through online discussion forums, students have the opportunity to interact, construct hypotheses, view knowledge and information from multiple perspectives, and reflect upon this information (Nicaise & Barnes, 1996).

Palloff and Pratt (1999) suggest that it is through the various interactions accommodated through online discussion forums that a constructivist approach is facilitated leading to the successful learning within the individual. As a result, online discussion forums represent a unique opportunity for teaching in a new way capable of stimulating an individualized form of learning at the higher levels of the cognitive domain (Levine, 2007). However, with the rise in popularity and use of such a powerful pedagogical instrument comes the challenge of its effective use to provide a substitute for interactive dimensions found within the traditional face-to-face classroom. Palloff and Pratt (2001) suggest that while each learning environment has its own advantages in the use of dialogue, it is the pedagogy and not the technology which is vital to student success within a classroom.

The comparison between the face-to-face and online discussion forums in the development of higher-order thinking and meaningful learning has been a source of continued interest among educational researchers (Althaus, 1997;

Ernst, 2008; Gilbert & Dabbagh, 2005; Meyer, 2003; Pallofff & Pratt, 2001; Thomas, 2002; Tolmie & Boyle, 2000). A second area of interest in regards to online discussion forums which is equally important to the facilitation of higher-order thinking and has received ample focus within educational research is the overall perception of student learning and attitudes towards online discussion forums (Dietz-Uhler & Bishop-Clark, Meyer, 2003; Rodriguez & Anicete, 2010; Tiene, 2000; 2001; Vonderwell, 2003; Wu & Hiltz, 2004).

While a wealth of research has been conducted on online discussion forums the primary focus of such studies has been upon the utilization of online discussion forums as a pedagogical method in graduate level courses of various subject areas. However, little research has been focused on the utilization of online discussion forums as a pedagogical method at the undergraduate and/or community college level.

Statement of the Problem

Online discussion forums have been demonstrated to be an effective and powerful pedagogical tool for the support and construction of knowledge and meaningful learning. The success of online discussion forums is due in large part to the implementation of research supported models which assist instructors in the design of effective online discussion protocols within higher education settings; however, the current research focuses primarily upon the utilization of online discussion forums at the graduate student level. Few studies have been conducted to examine the effectiveness of structured online discussion forums at an undergraduate student level including at the community college level. If community colleges are going to continue to focus their attention upon the

delivery of education through an online learning environment, it is essential that the effectiveness of such pedagogical methods including online discussion forums be evaluated at this level of the higher education system. The problem to be investigated in this study is to determine whether structured online discussion forums are an appropriate and effective pedagogical tool for the development of an engaging learning environment which results in meaningful discourse among students enrolled in a science course at the community college level.

Purpose of the Study

The purpose of this study was to determine students' level of satisfaction with the use of online discussion forums in a traditional face-to-face classroom and their level of learning through meaningful discourse utilizing four types of reflective assignments: (1) no reflection, (2) written reflection submitted to instructor, (3) written reflection submitted to threaded online discussion forum with small group discussion, or (4) written reflection submitted to threaded online discussion forum with large group discussion. The study included one independent variable, type of reflection. The design included two dependent variables. The first dependent variable was the students' level of satisfaction with the use of online discussion forums as measured by a survey. The second dependent variable was the level of student learning achieved. The second dependent variable was measured using a pre-test and post-test design and a content analysis of the transcripts of the reflections and responses of the online discussions from various sections of the course *Microbiology* a sophomore-level science course. The general goal of this research was to determine if online discussion forums are an appropriate and effective pedagogical tool at the

community college level and to offer guidance to instructors who utilize online discussion forums on how to structure online discussions which engage students to develop meaningful discourse.

Theoretical Framework

The success of the integration of asynchronous online discussion forums into the classroom is based on the theories of constructivism. The foundation of constructivism is rooted in the ideas of educators and psychologists including John Dewey, Jean Piaget, and Lev Vygostky (Kivinen & Ristela, 2003). Constructivism is one interpretation of the complex process of learning from which a number of diverse educational theories have emerged. Duffy and Cunningham (1996) state that all theories with a constructivist base are grounded in two common beliefs: a) learning is a process of actively constructing knowledge rather than acquiring it; and b) instruction is a supportive process which assists in the construction of knowledge rather than communication of knowledge.

Through the theory of constructivism, the process of learning is thus shifted from a teacher-centered to learner-centered and collaborative approach in which the students are responsible for constructing their own understanding by actively constructing knowledge rather than passively absorbing it. The student builds upon existing knowledge with foundations in personal ideas and experiences by assimilating and constructing new knowledge through social interactions with their peers. Online communication tools allow for the establishment of a unique collaborative learning environment.

Research Questions

The following questions were investigated through this research:

1. What is the level of student learning for each of the four different types of reflective assignments?

2. Is there a statistical relationship between the level of student learning for the four different types of reflective assignments?

3. What are the students' perceived levels of collaborative learning, social presence, and overall satisfaction with the online learning environment?

4. Is there a relationship between the level of student learning and the students' perceived levels of collaborative learning, social presence, and overall satisfaction with the online learning environment?

Research Hypotheses

The above research questions were investigated through the statistical evaluation of the following research hypotheses:

Research Hypothesis 1: There will be a statistical difference in the pre-test and post-test scores for each of the reflective assignments: a) no reflection, b) written reflection, c) small group discussion forum, and d) large group discussion forum.

Research Hypothesis 2: There will be a statistical relationship in the level of student learning between the different types of reflective assignments.

Research Hypothesis 3: There will be a statistical relationship among students' perceptions of collaborative learning, social presence, and satisfaction.

Limitations

The research was conducted under the following limitations:

- Participants in the research were limited to those students enrolled in Microbiology, a sophomore-level course, taught by myself and two other instructors at a community college in South Mississippi during the fall semester of 2012.
- The study was limited by the adult (18->45 years of age) learner population selected:
    - The adult learners' understanding of the terminology of the instrument utilized to measure their satisfaction with the online learning environment as well as pre-test and post-test instruments utilized to measure meaningful discourse.
    - The adult learners' prior experience with the Desire2Learn (D2L) interface and utilization of asynchronous online discussions.
- The study was limited by the honesty and clarity with which the adult learners provided responses to the instrument of measure and asynchronous online discussions.
- The format of the asynchronous online discussion forums was limited by the applications available through the Learning Management System, D2L.

Definition of Terms

Key terms and their definitions used throughout this study are provided below.

Articulation: Methods which force students to explain and reflect upon what they are doing; in other words making their tacit knowledge explicit (Collins, 1991).

Asynchronous Communication: Place and time independent instructional method that allows for multiple sequential communications which support collaborative learning and reflective commentary (Harasim, 1990). Written communications are grouped in threads which allow learners to track the sequence of messages exchanged within several discussions held in parallel (Klobas & Renzin, 2000).

Attitude: The emotional response or overall feeling (positive, negative, neutral) developed within students towards a particular instructional method (asynchronous online discussion forums).

Cognitive Quality: In this study, cognitive quality was defined as the level of meaningful discourse achieved through the utilization of asynchronous online discussions. Attributes of cognitive quality include demonstrations of critical thinking, reflection, articulation, and social and internal negotiation. A coding system was developed to detect and evaluate these instances and measure through qualitative analysis.

Computer-Mediated Communication: A generic term used to describe a variety of electronic systems which enable people to communicate by means of computers and networks (Mason, 1992). Examples of electronic systems include electronic mail (email), discussion listserves, bulletin boards, chat rooms, and asynchronous online threaded discussion forums.

Constructivism: The term constructivism refers to the emphasis upon students *constructing* their own knowledge and perspectives through interpretations of the world based upon past experiences and interactions with the world (Tiene & Ingram, 2001).

Critical Thinking: The ability of a student to analyze, synthesize, and evaluate new information (Driscoll, 2000).

Desire2Learn: An example of a web-based learning management system. Features within the system allow the instructor to manage course content and student assignments. Other features provide students with the opportunity for both synchronous and asynchronous communications.

Distance Education: Process of extending resource-sharing opportunities including learning and/or delivering instruction to locations away from a traditional college campus classroom. This includes both online or hybrid instruction.

Face-to-Face Interaction: Student-instructor or student-student interaction which occurs in a traditional college campus classroom. The primary purpose of the interaction is to facilitate understanding of course and/or content.

Hybrid Instruction: Type of distance education which blends online and face-to-face delivery. A substantial portion of the course content is delivered online and is usually associated with a reduced number of face-to-face meetings (Allen & Seaman, 2010).

Interpersonal Social Dialogue: "Discursive relationship in which participants project themselves socially and emotionally" (Gorsky & Caspi, 2005, p. 139).

Interpersonal Subject-matter Oriented Dialogue: Subset of interpersonal social dialogue. "Discursive relationship between two participants characterized by thought-provoking activities, such as hypothesizing, questioning, interpreting, explaining, evaluating, and rethinking issues or problems at hand" (Gorsky & Caspi, 2005, p. 139).

Intrapersonal Dialogue: Type of dialogue which encompasses all the mental processes occurring with students engaged as they purposefully try to learn (Gorsky & Caspi, 2005, p. 140). The mental processes include ideas of assimilation, accommodation, accretion, and structuring.

Internet: A network of networks which connect millions of computers and people globally (Coorough, 1998).

Learning Management System: Set of software tools used to create web-based courses, including home pages, electronic bulletin boards, email systems, test generators, chat areas, and multimedia features (Picciano, 2001). Synonymous with course management systems and virtual learning environments.

Meaningful Discourse: Ability of students to demonstrate skills associated with critical thinking including making inferences, relating course content to prior knowledge and experience, and interpretation of course content through the analysis, synthesis, and evaluation of others' perspectives (Gilbert, 2002).

Online Course: Course in which most or all of the content is delivered online with no face-to-face meetings (Allen & Seaman, 2010).

Online Discussion Evaluation Rubric: A tool used to assess the quality of postings within an asynchronous online discussion forum. Assessment is based upon a prescribed discussion protocol and takes the form of a scale or set of scales (Branon & Essex, 2001).

Online Discussion Facilitators: Participants within an online discussion whom are responsible for moderating it and helping it to evolve (Poole, 2000). In the current study, the online discussion facilitator is the instructor.

Online Discussion Forums: Common areas where students participate in an asynchronous dialogue. Messages within the forums are organized in a hierarchial structure and threaded based on the time of posting (Branon & Essex, 2001).

Online Discussion Protocols: Set of assigned requirements governing how an online discussion forum is conducted. Examples of such requirements might include message length, the frequency of discussion postings, and the quality of discussion postings (Branon & Essex, 2001).

Online Discussion Thread: A series of written communications which have been posted in an online discussion forum. Discussion threads include initial messages in addition to the responses to each other. The messages appear as a thread, or one after another, detailing the evolution of the discussion.

Perception: The way students measure the effectiveness of a particular learning strategy (asynchronous online discussion forums) in affecting their overall view and understanding of content in a particular course.

Reflection: The action of students looking back at what they did or know and analyzing their performance or perspective (Collins, 1991).

Structuredness: "Combination of factors that contribute to participation in and evaluation of online discussions…include the nature of online discussion activity, grade weight, and online discussion protocols, and rubrics" (Gilbert, 2002, p. 12).

Synchronous Communication: Communication which is conducted simultaneously (Huang, 2000). Tools which enable participants to send text,

voice messages, and images in real time by means of the Internet are all examples of synchronous communication.

Web Facilitated Course: Course which incorporates web-based technology to facilitate what is essentially a face-to-face course (Allen & Seaman, 2010). Learning management system may be utilized to post the syllabus and assignments.

Justification of Study

The face of education is changing as advances in technology are allowing institutions of higher education to reach a greater number of students through distance and online learning. In fact, many institutions of higher education have integrated the growth of online education into their long term strategies with community colleges demonstrating the greatest interest in expounding upon their current online course offerings (Allen & Seaman, 2006). Many institutions are expanding upon fully online courses as well as hybrid or blended instruction which allows the instructor to take advantage of technological advancements, primarily through the internet, in order to deliver pertinent content information to students with the potential to develop meaningful discourse (Parsad & Lewis, 2008).

Asynchronous online discussion forums are a popular and powerful instructional tool which is often integrated into hybrid/blended courses. A great deal of research exists which proclaims positive effects of asynchronous online discussion forums on meaningful discourse and development of critical thinking (Althaus, 1997; Ernst, 2008; Gilbert, 2002; Tiene, 2000; Tolmie & Boyle, 2000; Wang & Woo, 2007;). Research on asynchronous online discussion forums has

also focused on perceptions of student learning and students' sense of community (Dietz-Uhler & Bishop-Clark, 2001; Garcia, 2006; Koohang, Behling, & Behling, 2008; Meyer, 2003; Park, 2011; Rodriguez & Anicete, 2010; So & Brush, 2008; Tiene, 2000; Vonderwell, 2003). While an abundant amount of research is available to assist instructors in the design and implementation of asynchronous online discussions to generate the greatest effect, the current research available has focused primarily on students at the graduate school level and not among students at the undergraduate or community college level (Bangert, 2004; Bradley, Thom, Hayes, & Hay, 2008; Branon & Essex, 2001; Gilbert & Dabbagh, 2005; Hazari, 2004; Hiltz, 2006; Rovai, 2007; Swan, Shen, & Levine, 2007; Tolmie & Boyle, 2000).

In this research, I sought to determine if and to what extent asynchronous online discussions can be successful in generating meaningful discourse among community college students. In addition, I attempted to describe the attitudes and perceptions that students generate toward asynchronous online discussion forums. The conclusions drawn from this research will assist instructors at the community college level which seek to incorporate alternative pedagogical methods into their traditional classroom courses as to the effectiveness of asynchronous online discussions at the community college level. The information generated from this study will aid instructors in the development and design of nontraditional courses in order to meet the needs and concerns of a populace of students in higher education whom prefer the integration of technology in the classroom.

CHAPTER II

REVIEW OF THE LITERATURE

The review of the literature is divided into three sections. The first section examines the history of the online learning environments including the development of the hybrid or blended learning environment within the higher education system. This section will highlight the continued emphasis placed upon the development and improvement of current online learning programs within community colleges and the evidence demonstrating its superiority in student learning compared to face-to-face instruction. The second section includes an overview of computer-mediated communication modules such as asynchronous discussion forums as a pedagogical tool. This section will examine comparisons to their face-to-face discussion counterparts within the traditional classroom setting and their influence upon students' perception of learning and satisfaction. The third section includes the theoretical framework of constructivist learning with an emphasis upon the principles and strategies of the theory. This section will provide a blending of the literature on constructivist learning and its influence on asynchronous communication while highlighting research studies which address how the construction of knowledge within the constructivist learning theory is supported by asynchronous communication tools. This section will also explore the defining parameters of an online discussion forum which have been shown through research studies to optimize the construction of knowledge in college classrooms.

History of the Online Learning Environment

The online learning environment has a complex history. On one hand, it has a shared history with distance education and on the other hand online education is a direct descendant of instructional technology and computer-assisted instruction (Larreamendy-Joerns & Leinhardt, 2006). Both the distance and online learning environments may be defined as a learning environment in which the teacher and learner are separated through space and time and are largely text-based (Harasim, 2000; Tiene & Ingram, 2001). While, the exact origins of distance education have been debated amongst educators, many agree that distance learning began hundreds of years ago through print based correspondence courses (Huang, 2000; Larreamendy-Joerns & Leinhardt, 2006; Picciano, 2001). The primary intention of the early correspondence courses was democratization through the expansion of the availability of educational opportunities to those who could not otherwise afford instruction at an educational institution (Larreamendy-Joerns & Leinhardt, 2006). The critical factor which differentiates the online learning environment from the distance learning environment is that it is fundamentally a phenomenon of group communication (Harasim, 2000). As advances were made within the realm of technology, the concept and context of distance education began to evolve.

In the late twentieth century, delivery mediums such as radio and television were introduced to bridge the gap and increase student-teacher interactions from a distance (Huang, 2000). The 1970's saw the beginning of CMC with the invention of e-mail and computer conferencing (Harasim, 2000). The trend of electronic communication and instruction continued throughout the

decade as university courses were supplemented by both e-mail and computer conferencing. The continued growth in the access to computers and networks allowed for the expansion of the uses of cyberspace for the incorporation into education. Throughout the 1980's, the online learning environment continued to evolve with the introduction of the first online undergraduate and graduate courses, the first online degree program, and the first networked classroom model (Harasim, 2000). The 1990's saw the introduction of the World Wide Web which allowed for the first national educational network and the first large-scale online education field trials (Harasim, 2000).

While e-mail has been a consistent cornerstone as a major networking application within higher education, it is its group communication counterpart, computer conferencing, which has been established as the core of online education in terms of a collaborative learning environment (Harasim, 2000). The initial concept behind the design of computer conferencing was for it to serve as a collective intelligence system that would provide structured group communication allowing for information exchange and problem solving. It is through the creative applications of computer conferencing within higher education that the powerful new mode of learning, online collaborative learning, has been incorporated into many university courses (Harasim, 2000).

One major accomplishment experienced with the establishment of the online learning environment was the introduction of new modes of educational delivery. Harasim (2000) describes three modes of delivery which distinguish online education from the traditional classroom: adjunct mode, mixed mode, and totally online mode. The adjunct mode utilizes networks to enhance the

traditional face-to-face or distance education by expanding upon learning opportunities and communication by is generally not a required or graded component of the course (Harasim, 2000). The mixed mode can be distinguished from the adjunct mode by its full integration into the course curriculum (Harasim, 2000). The instructional delivery in the mixed mode can be variable and may include one or more major activities such as small group discussions, seminars, and group projects. The totally online mode utilizes the World Wide Web or computer networks as its primary learning environment for discussion and interaction (Harasim, 2000). All course activities including presentation of information, discussion, and group work are undertaken in the online learning environment.

Along with the establishment of the online learning environment was the development of a new learning domain characterized by the unique combinations of attributes associated with abilities experienced through computer conferencing and communication (Harasim, 2000). Five attributes have been identified which make the online learning environment a unique environment for higher education: (1) group communication; (2) place-independence; (3) time-independence; (4) text-based; and (5) computer-mediated messaging (Harasim, 2000). In combination, these five attributes enable an augmented learning environment capable of enhancing cognitive activities and offering an unlimited method of presenting online courses (Harasim, 2000). The success of the online learning environment is due in large part to its ability to create a collaborative learning environment which is based on a well-formulated and validated theory in which

individuals can pursue outcomes which are beneficial to them and in turn are beneficial to other members of the group.

The Role of the Online Learning Environment in Higher Education

Over the past seven years, institutions of higher education have reported that online enrollment is increasing significantly faster than overall higher education enrollments (Allen & Seaman, 2010). Nearly 30% or over 5.6 million students enrolled in institutions of higher education were reported to be enrolled in at least one online course in the Fall 2009 term. In addition, 63% of all reporting institutions declared that "online learning was a critical part of their institution's long term strategy" (Allen & Seaman, 2010, p. 2). The largest increase in the incorporation of online learning as a part of an institution's long term strategy was most evident among institutions awarding Associates degrees in the southern United States, whom in 2005, 78% agreed it was a part of their long-term strategy (Allen & Seaman, 2006).

The continued growth in online enrollments has resulted in institutions of higher education feeling the pressure to compete for the online student population through growth of existing course offerings (Allen & Seaman, 2010). Community colleges are among the forerunners of online course offerings with more than three-quarters of community colleges now offering the same course in face-to-face and online learning modules (Parsad & Lewis, 2008). In fact, ninety-seven percent of reporting public two year institutions offered online, hybrid/blended online or other distance education courses and of those institutions, 66% reported offering undergraduate hybrid/blended online courses. The greatest factors affecting the decisions among public two year institutions

regarding online course offerings included: seeking to increase student enrollment, making more courses available, meeting student demands for flexible schedules, and providing access to college to those whom otherwise would not have access (Parsad & Lewis, 2008).

The Integration of Hybrid Instruction into Higher Education

To some educational leaders, hybrid instruction has been touted as offering the *best of both worlds*. This approach to learning is often referred to as a web-enhanced course or blended learning model which incorporates both face-to-face and online learning elements and is often perceived as a positive alternative to face-to-face or fully online courses by administrators, instructors, and students. The Sloan Consortium defines a blended/hybrid course as any course which combines online and face-to-face delivery with a substantial proportion of content delivered online typically utilizing online discussions and having a reduced number of face-to-face meetings (Allen & Seaman, 2010). Through the blending of the traditional and web-based models of instructions, hybrid courses offer the accessibility and flexibility of the online course along with the personal face-to-face interaction and sense of community established within the traditional classroom.

While the perception of the relative quality of online instruction compared to face-to-face instruction has been reported to be favorable, over three-quarters of academic leaders report online education to be as good as or better than face-to-face instruction, the struggle between traditional face-to-face and fully online learning continues (Allen & Seaman, 2010). When resistance is encountered from faculty in regards to online courses, blended/hybrid formats tend to offer a

welcomed compromise (Toth et al., 2008). Much evidence has been presented within the literature which supports the benefits of the blended/hybrid formats in terms of student learning outcomes, student satisfaction, and faculty satisfaction.

Garrison and Kanuka (2004) concluded that "blended learning is consistent with the values of traditional higher education institutions and has the proven potential to enhance both the effectiveness and efficiency of meaningful learning experiences" (p. 95). Similarly, Zenger and Uehleinm (2001) suggest that the merge between electronic learning and traditional learning can actually create a learning environment which is superior to either environment individually. McFarlin (2008) determined that a hybrid lecture-online format increased student grades in an undergraduate exercise physiology course presumably due to an increase in exposure to course content via the learning management system WebCT©. Orhan (2008) found that the "majority of students enjoyed being in a blended learning environment" (p. 54) and "…did not prefer to continue their education with only traditional face-to-face learning environments or with a purely online learning environment" (p. 63). Within the hybrid/blended online courses offered, the public two year institutions reported the technology medium utilized, within a learning management system, to a moderate or large extent was asynchronous internet based technologies or tools for computer-mediated communication (Parsad & Lewis, 2008).

Overview of Computer-Mediated Communication

Computer mediated communication (CMC) is a generic term used to describe communication amongst individuals by means of computers and networks (Romiszowski & Mason, 1996). Computer mediated communication is

often conducted utilizing asynchronous internet based technologies which support the exchange of information and interaction within groups through a variety of electronic tools including electronic mail (email), bulletin boards, class listserves, and online discussion forums (Bodzin & Park, 2000). The integration of CMC into the learning environment has been described as an important pedagogical tool which is capable of engaging groups of students separated by time and space to engage in the active process of developing shared knowledge (Gunawardena et al., 1997). The incorporation and utilization of CMC at institutions of higher education range from the principal mode of instruction and communication between instructors and students in fully online courses, to the utilization of CMC as a method to enhance traditional face-to-face instruction in blended/hybrid courses.

The current trend in online learning is the use of web-based learning management systems like D2L or WebCT© which incorporate a variety of pedagogical CMC tools which may be used in the facilitation of instructor-to-student and student-to-student interactions at multiple levels. A learning management system may be defined as a set of software tools used to implement web-based courses and include features such as home pages, electronic bulletin boards, email systems, test generators, chat rooms, and other multimedia applications (Picciano, 2001). While each individual learning management system may be different in structure and appearance the overall design is meant to enable college instructors to distribute content to the students, create email distribution lists, and engage students through synchronous and/or asynchronous electronic communication.

Synchronous communication may be defined as communication which is conducted simultaneously (Huang, 2000). While, the traditional face-to-face classroom discussion is the most familiar example of synchronous communication, it can also be conducted in the online learning environment through the utilization of tools such as text or instant messages, voice messages, and/or images transmitted in real time by means of the Internet (Huang, 2000). Whereas, synchronous communication is conducted simultaneously, asynchronous communication is conducted independent of place and time allowing for multiple sequential communications which foster collaborative learning and reflective commentary (Harasim, 1990). Through his study, Tiene (2000) distinguished four elements which definitively distinguish the online discussion experience from its face-to-face counterpart as access, timing, mode of expression, and visual cues.

Online discussion forums are a form of web-based asynchronous communication which allows students to electronically post reflective messages in a common line area and allows for other participants within the group discussion to read and respond to (Huang, 2000). The written communications within asynchronous communications are grouped in threads allowing learners to track the sequence of messages exchanged within several discussions held in parallel (Klobas & Renzin, 2000). An individual discussion thread may be defined as a series of messages posted within a discussion forum in response to one another. The posted messages are displayed as a thread, or sequentially, to illustrate the progression of the discussion. The web interface enables students to display threads by date and author while utilizing some editing capabilities to

manage individual posts (Klobas & Renzin, 2000). The uniform integration of a web interface which supports threaded online discussion forums into learning management systems has allowed for the extension of teaching beyond the traditional face-to-face classroom (Levine, 2007).

Face-to-Face Discussion Versus Asynchronous Online Discussions

One goal of the integration of asynchronous online discussion forums into traditional face-to-face instruction is to assist students in the integration of complex course materials by supporting or enhancing, but not duplicating, class discussions (Gilbert, 2002). The comparison between the face-to-face and online discussion forums as a pedagogical tool meant to develop higher-order thinking and meaningful learning has been a source of continued interest among educational researchers (Althaus, 1997; Ernst, 2008; Gilbert & Dabbagh, 2005; Meyer, 2003; Pallofff & Pratt, 2001; Thomas, 2002; Tolmie & Boyle, 2000). Garrison (2003) argues that asynchronous online learning offers a unique advantage in comparison to face-to-face learning by creating cognitive presence and metacognition through reflective inquiry and self-direction. Thomas (2002) found that online discussion forums promoted higher levels of cognitive engagement and critical thinking, but were unable to promote the coherent and interactive dialogue necessary for conversational modes of learning.

Althaus (1997) examined whether supplementing face-to-face discussion with online discussion forums enhanced the academic performance of undergraduate students enrolled in a large lecture course. Althaus (1997) stated "…that a combination of face-to-face and computer-mediated discussion provides a learning environment superior to that of the traditional classroom" (p.

173). Through this study he found students who actively participated in online discussion forums not only reported learning more than they otherwise would have, but they also tended to have higher grades than students taking part in face-to-face discussions only. Althaus (1997) also reported that most of the students who participated in the online discussions expressed enjoyment with this form of interaction and recommended the integration of online discussion forums into other courses.

Meyer (2003) found that the face-to-face format had value in terms of its immediacy and energy while the online discussion format increased the amount of time students spent on class objectives and reflection upon course issues which, in turn, facilitated higher-order thinking. The threaded discussions were described as "often more 'thoughtful,' more reasoned, and drew evidence from other sources" (Meyer, 2003, p. 61). In addition, online discussion forums provided students an avenue "to share current articles or reports they were reading with the group, rather than waiting for class time to do so and to relate their readings or current events to course topics" (Meyer, 2003, p. 61). However, students with different strengths are likely to respond differently to the online setting. She suggests that, "the student who learns or processes information by talking…may feel disadvantaged in the online setting" whereas "the student who requires reflection to learn or construct an answer may be advantaged" (Meyer, 2003, p. 62). Therefore, it is recommended that "offering a mix of ways to be involved in discussion may well improve the likelihood that most students find an avenue for contributing that satisfies their learning needs" (p. 62) as each class is

likely to be comprised of students whose preferences for face-to-face versus online discussion is mixed (Meyer, 2003).

Gilbert and Dabbagh (2005) determined that “increased cognitive quality of student postings promoting a deeper and more meaningful understanding of course content” (p. 5) could be obtained when certain guidelines which assist in the facilitation and evaluation of online discussion forums are adhered to by the instructor. The study demonstrated that specific elements of structuredness including facilitator guidelines and addition of online discussion evaluation rubrics had a positive influence on meaningful learning while other elements were shown to be deterrents to the achievement of meaningful learning including restricting the length of online discussion postings and requiring reading citations.

Unlike other researchers, Ernst (2008) determined that student learning outcomes following the use of hybrid online instructional methods were not superior, but rather were similar to those of traditional face-to-face instruction. However, he suggests that the investigation supports the use of instruction through the online delivery system as a method of broadening “the instructional audiences in technology education programs” (p. 47). Ernst (2008) also suggests that the hybrid online educational approaches which permit “highly interactive instruction supplemented with practical applications of content provides a framework for successful acquisition of knowledge” (p. 47). Through their research, Palloff and Pratt (2001) suggest that while each learning environment has its own advantages in the use of dialogue – the face-to-face classroom facilitates immediate communication, the online classroom may allow for greater opportunities for communication, and the hybrid classrooms may offer

greater points of entry for communication to occur, it is the pedagogy and not the technology which is vital to student success within a classroom.

Student Perceptions Towards Asynchronous Online Discussions

A second area of interest amongst educational researchers in regards to the facilitation of higher-order thinking through the integration of online discussion forums in college courses is the overall perception of student learning and student attitudes towards online discussion forums (Dietz-Uhler & Bishop-Clark, 2001; Meyer, 2003; Rodriguez & Anicete, 2010; Tiene, 2000; Vonderwell, 2003; Wu & Hiltz, 2004). Dietz-Uhler and Bishop-Clark (2001) found that students who participated in face-to-face discussions followed by either synchronous or asynchronous CMC perceived the discussions to be more enjoyable and introduced a greater diversity of perspectives in comparison to face-to-face discussions not followed by CMC. In a similar study, Tiene (2000) stated the participants demonstrated a favorable perception of the online discussion experience as a form of communication; however, they did not prefer it as a substitute for face-to-face discussion, but rather as an addition to face-to-face discussion. While potential drawbacks associated with the online discussion experience included technical barriers and a lack of visual cues, these drawbacks were not perceived as significant disadvantages (Tiene, 2000).

Meyer (2003) found that students who participated in online discussion forums frequently noted an experience of *time expansion*. While nearly every student described the amount of time required to read their classmates' postings, think about a response, prepare a response, and return to examine further contributions to the discussion as a *drain on their time*, many were able to

balance such criticism with “an appreciation that they got more from the discussion because it took time for them to recognize connections, understand others’ ideas, and develop and convey a detailed response or posting” (Meyer 2003, p. 60). Many students expressed a favorable perception of threaded discussions because it allowed greater *time to reflect* which was viewed as an advantage in comparison to face-to-face discussions (Meyer, 2003). It should also be noted that several students expressed an appreciation for “…the opportunity to participate more fully in class discussions as afforded by the online setting, and indeed the online discussions included contributions from every student and several contributions from each student” (Meyer, 2003, p. 61).

Vonderwell (2003) explored the perspectives and experiences of undergraduate students in an online course towards asynchronous communication and discovered that students who participated in this study indicated that the group asynchronous online discussions were helpful in learning the course content. However, they also expressed a lack of social engagement with their peers in comparison to the face-to-face classroom and a sense of hesitation to contact each other (Vonderwell, 2003). In contrast, students expressed that they felt a greater sense of *anonymity*, which provided them with greater confidence in approaching the instructor with questions and constructing interpersonal and social relationships with the instructor (Vonderwell, 2003). As a result, Vonderwell (2003) stresses that instructors must be aware of the challenges associated with a communication gap which may exist in the online learning environment and overcome that barrier “…with effective, deliberate

planning, and strategies for improved communication between instructors and students and between students and themselves" (p. 87).

Rodriguez and Anicete (2010) utilized an undergraduate Ecology course presented in the hybrid learning environment to examine students' views of the incorporation of Modular Object Oriented Dynamic Learning Environment (MOODLE). The results indicated that despite some challenges, students had overall positive views and experiences with hybrid learning. Specifically, Rodriguez and Anicete (2010) determined that online tasks including journal compositions and discussion forums gave students more opportunities to think critically about their own ideas as well as readings. Such online tasks increased the mindfulness of the students when responding to questions which were designed to stimulate reflection and encourage them to seek information beyond that which was presented through the course content (Rodriguez & Anicete, 2010). In addition, the act of asking students to explain their ideas in which other students respond to them led to a heightened level of interactivity within a hybrid course (Rodriguez & Anicete, 2010).

Wu and Hiltz (2004) performed an exploratory study to investigate whether asynchronous online discussions which instructors are required to integrate into their courses where in fact effective in improving the students' perception of learning. In this investigation a post-course questionnaire designed to measure perceived learning from online discussions was provided to students in two undergraduate courses and one graduate course. The results of the study were positive with over half of the participants stating that they learned a substantial amount from their peers and nearly three-quarters of participants expressing the

perception of increased learning quality as a result of the integration of online discussions into the courses (Wu & Hiltz, 2004). Students also expressed that they thought online discussion forums provided a great opportunity which was both motivational and enjoyable for sharing opinions among peers and the instructor (Wu & Hiltz, 2004).

Online discussion forums certainly represent a unique opportunity for teaching which is capable of stimulating an individualized form of learning at the higher levels of the cognitive domain while making the educational experience both powerful and dynamic (Levine, 2007). Through online discussion forums, students are presented with the opportunity to interact, construct hypotheses, view knowledge and information from multiple perspectives, and reflect upon this information (Nicaise & Barnes, 1996). However, with the rise in popularity and use of such a powerful pedagogical instrument comes the challenge of its effective use to provide a substitute for interactive dimensions found within the traditional face-to-face classroom.

Theoretical Framework

The science classroom has been suggested as the most appropriate venue for active, hands-on instruction in research studies (Bilgin, 2006), however, the structure of the science classroom in institutions of higher education is changing in order to accommodate the needs of the growing student population and not necessarily to accommodate the integration of active, hands-on instruction. The expansion of online education within institutions of higher education has brought about the question of which learning theories are best suited for the development and implementation of online courses.

Constructivism has been touted as one such learning theory which may be applied to the online learning environment (Huang, 2002; Rovai, 2004; Schweizer, Whipp, & Hayslett, 2003).

Foundations, Principles, and Strategies of Constructivism

The foundations of constructivism are rooted in the ideas of educators and psychologists including John Dewey, Jean Piaget, and Lev Vygostky (Kivinen & Ristela, 2003). Constructivism is one interpretation of the complex process of learning from which a number of diverse educational theories have emerged. Through the theory of constructivism, the process of learning is thus shifted from a teacher-centered to learner-centered and collaborative approach in which the students are responsible for constructing their own understanding by actively constructing knowledge rather than passively absorbing it. The student builds upon existing knowledge with foundations in personal ideas and experiences by assimilating and constructing new knowledge through social interactions with their peers.

Two branches of constructivist thought, cognitive constructivism and social constructivism, are often recognized amongst psychologists and educators. The founding theorist for cognitive constructivism is Jean Piaget who described learning as a process of internal negotiation which occurs on the individual/personal level in a series of four stages: sensorimotor stage, preoperational stage, concrete operational stage, and formal operational stage (Powell & Kalina, 2009). These four stages describe how knowledge is constructed within the individual as the individual interacts with their external

environment from infancy to adulthood. When discussing student learning, Piaget used the terms assimilation and accommodation.

Assimilation may be defined as the point at which the learner brings in new knowledge to their own schemas, whereas, accommodation refers to the point at which the learner changes their schemas to “accommodate” the new information or knowledge (Powell & Kalina, 2009). A schema may be defined as the locale where information which is meaningful to the individual is stored within networks of connected facts or concepts (Cakir, 2008). Therefore, the learner constructs new knowledge when new information is acquired through experience and the child is capable of changing old information to fit the new information. In other words, it is through the reconstruction of old information to fit the new information that the student learns.

The other branch of constructivism, social constructivism, is based upon the theories of Lev Vygotsky who argued that social interaction is imperative to cognitive development. Vygotsky (1978) proposed that learning is a social process in which students learn through collaboration with more capable peers including instructors, other students, or qualified persons who allow the individual student to progress into a zone of learning referred to as the zone of proximal development. It is through the acquisitions of new concepts and information that the individual is able to expand upon their zone and learn (Powell & Kalina, 2009). For the purposes of this study, the focus will largely be on learning as a social process as is suggested through social constructivism.

All theories of constructivism are grounded in two common beliefs: a) learning is an active process of constructing rather than acquiring knowledge;

and b) instruction is a process of supporting that construction rather than communicating knowledge (Duffy & Cunningham, 1996). The knowledge of any individual can be defined as a network of comprehensive constructs of facts, concepts, experiences, emotions, values, and their relationships with each other (Baviskar, Hartle, & Whitney, 2009). If comparing one's knowledge to information gathered from the external environment results in conclusions which are incorrect or insufficient, the individual will experience a form of cognitive dissonance which will act as a motivator to reject the new information or integrate it into his or her own construct (Lorsbach & Tobin, 1993). Therefore, in order for changes in the knowledge construct to remain permanent, the learner must apply the altered construct to novel situations, receive feedback about the validity of the construct, and establish further connections to other elements in the construct (Baviskar et al., 2009).

Four critical elements can be identified within the theory of constructivism which must be addressed in the development and implementation of activities, structure, content, or context in order for a lesson or course to be considered constructivist in nature (Baviskar et al., 2009). The four elements include: 1) eliciting prior knowledge of the student; 2) creating cognitive dissonance; 3) application of the knowledge with feedback; and 4) reflection on learning. The first element requires that the instructor elicits the prior knowledge of the student (Baviskar et al., 2009). If a mechanism is not afforded for eliciting prior knowledge of the student, the new knowledge cannot be presented in a way which will lead to the incorporation into the student's construct or the learner will either ignore or incorrectly incorporate the new knowledge. A variety of

pedagogical tools exist which may be useful in eliciting the prior knowledge of the student including: formal pre-tests, informal questioning, formal interviews, or activities such as concept-mapping which draw from the application of basic knowledge (Baviskar et al., 2009). The activity must assess the learner's prior knowledge and relate it to the new knowledge while simultaneously identifying misconceptions.

The second element is for the instructor to create cognitive dissonance within the student by creating awareness that a difference exists between the student's prior knowledge and the new knowledge (Baviskar, et al, 2009). It is through the process of identifying the differences, that the student is able to create new knowledge. The third element is the application of the knowledge with feedback (Baviskar et al., 2009). If the student is unable to interpret and modify their prior knowledge in the context of the new knowledge, misinterpretation or rejection of the new knowledge is likely to occur. Application of the new construct could be presented in the form of quizzes, presentations, group discussions, or other activities where students compare their constructs with the constructs of their peers. The final element is reflection on learning (Baviskar et al., 2009). In order for the new knowledge construct to be made permanent, the student must be aware that the learning has taken place. Reflection can be attained through traditional assessment techniques including presentations, papers, or examinations.

Instructors who instill the theory of constructivism in their philosophy of teaching may be seen as coaches and facilitators rather than dictators of knowledge (Brandon & All, 2010). If constructivist ideals are to be implemented

into the instructional strategies of the learning environment, the following assumptions and criteria as defined by Bednar, Cunningham, Duffy, and Perry (1992) must be adhered to:

- Learning is constructed: Knowledge is constructed from experience. Learning is a constructive process in which the learner is building an internal representation of knowledge.
- Interpretation is personal: There is no shared reality and learning is a personal interpretation of the world and experiences.
- Learning is active: Learning is an active process in which meaning is developed on the basis of experience.
- Learning is collaborative: Meaning is negotiated from multiple perspectives. Intellectual growth comes from the sharing of perspectives, or internal representations.
- Learning is situated: Learning should occur in realistic settings or contexts.
- Testing is integrated: Testing should be integrated with the task, not a separate activity. The measure of learning is how instrumental the learners' knowledge structure is in facilitating thinking (pp. 21-30).

The four elements and the above principles of constructivist learning theory are relevant to instructional design because instructors with a constructivist philosophy of teaching can incorporate strategies that guide the student in actively exploring topics which will direct them into critical thinking (Ertmer & Newby, 1993). Such strategies might include an increase in student collaboration which allows for the integration of multiple perspectives, student

interactivity, and social negotiation in class discussions or debates; reflection and articulation supported through discourse or dialogue; self-reflection and articulation through the creation of a personal portfolio; or scaffolding which can assist the student in constructing new knowledge (Bednar et al., 1992; Brown, Collins, & Duguid, 1998; Jonassen, 1992). Asynchronous communication tools such as online discussion forums have the potential to support the principles of constructivist learning theory.

Merging Constructivism and Asynchronous Communication

One advantage often observed with the online learning environment is the ability to create a learner-centered environment in which students can interact with their peers while simultaneously reflecting on course material. Van Gorp (1998) suggests that the internet is no longer a place to access and post information, but rather is a place for interactive communication and knowledge construction. Dutt-Doner and Powers (2000) state that asynchronous communication allows for the promotion of self-reflection and achieving higher levels of social negotiation through a process of posting and replying to the ideas of other individuals. Hara, Bonk, and Anjeli (2000) suggest that the *time delay* associated with asynchronous communication supports the founding principles of constructivism by enabling the student to articulate, read, and reflect upon complex concepts more easily. Tiene (2000) found supporting evidence through his study as students stated that the asynchronous aspect of online discussions allowed for participation at their own convenience and time to reflect upon points made by their peers, time to decipher their feelings about certain issues and time to develop their own responses.

On the other hand, researchers such as Branon and Essex (2001) have discussed the disadvantages of asynchronous communication indicating that the lack of immediate feedback to postings and the length of time needed for students to develop in depth discussions may contribute to a lack of social negotiation and knowledge construction through meaningful discourse. As a result, students often voice concerns about a "sense of social disconnection" or isolation within the online learning environment (Branon & Essex, 2001, p. 36). However, strategies may be employed in providing additional structure to the asynchronous discussions which may prevent this potential pitfall.

Effective Implementation of Asynchronous Online Discussion Forums

Tolmie and Boyle (2000) suggested critical factors are present which influence the ultimate success of online discussion forums. If online communication is to be successful, it must address certain factors which provide a context and rationale for the online communication while establishing a shared purpose within the users (Tolmie & Boyle, 2000). Tu and McIsaac (2002) suggested that while asynchronous learning may be helpful for students with limited keyboarding skills, students may become lost within an environment of multithreaded discussions. Vrasidas and McIsaac (1999) suggest instructors heed caution to the idea that students who do not receive immediate feedback may hesitate in continuing to post messages thus limiting their learning experience. Similarly, Ko and Rossen (2001) stressed the importance of instructors to create clear guidelines and procedures in advance which will guarantee a more focused discussion.

The challenge presented to online instructors becomes how to filter and organize the endless suggestions presented with the research literature into a meaningful list which can be utilized as a guide for successful facilitation of interactive online discussion forums. Levine (2007) suggests ten conditions which instructors might use to support their initial attempts to design and implement an effective online discussion forum: (1) create an environment conducive to learning; (2) establish rules and provide introductory instruction; (3) guide the threaded discussion; (4) pose meaningful questions and problems; (5) focus on the highest three levels of the cognitive domain; (6) allow individualization without isolation; (7) be sensitive to nonparticipation; (8) stimulate participation; (9) encourage reflection; and (10) summarize key ideas.

Creating an Environment Conducive to Learning

Any instructor in higher education would argue that the tone for student learning is set at the beginning of any course and therefore, it is imperative to establish a climate that is truly conducive to learning. Smith (2005) related the concern of establishing such a climate to the online environment when she described specific steps which should be taken to assist learners in feeling comfortable with interacting with each other as well as with the technology of the online environment. Smith (2005) suggested that the establishment of the online learning community can be conducted utilizing a mix of synchronous and asynchronous communication meant to meet goals including: (1) learners getting "to know one another" and establishing relationships; (2) developing comfort and skills with the technology through practice of online communication and

conversation; and (3) reflecting upon the possibilities for learning within the online environment.

Similarly, Tolmie and Boyle (2000) suggested that online discussion forums will be more successful if the participants know each other. So and Brush (2008) agreed when they found that the establishment of a social connection within the online environment is a critical factor for student success. In their study, they examined the relationships between students' perceived levels of collaborative learning, social presence and overall satisfaction within a blended online environment and discovered that the "student perception of collaborative learning is related to social presence and overall satisfaction in a distance learning environment" (So & Brush, 2008, p. 322). The authors suggested that the integration of both synchronous and asynchronous CMC tools may "minimize communication barriers" (p. 332) and that instructors should "employ a variety of 'get-to-know' activities to increase the initial level of social presence" which will assist in establishing an environment conducive to learning (So & Brush, 2008, p. 332).

Establishing Rules and Providing Introductory Instruction

Levine (2007) suggested that a meaningful introduction to a discussion board is imperative for successful student interactions and learning. Instructors should be careful not to assume that the students' familiarity with the technology is equal to their own. Tolmie and Boyle (2000) stated that an online discussion forum will be more successful if the participants "understand how to go about the task they are engaged in, especially if this understanding is shared" (p. 122). So and Brush (2008) agreed that one role the instructor may be required to perform

is “modeling and scaffolding of social presence behaviors…for students who are new to distance learning” (p. 332).

In addition, Levine (2007) warned that a lack of clear rules for interaction may have a debilitating effect on both interaction and learning. Wu and Hiltz (2004) suggested that increased structure within online discussion forums will help in avoiding or decreasing the inefficiency of online discussions. A study by Gilbert and Dabbagh (2005) reinforced the need for structuredness in asynchronous online discussion protocols, but warns that while some elements of structure (guidelines assisting facilitation and evaluation rubrics) had a significant impact on meaningful discourse other elements (limiting length of posting and requiring reading citations) were determined to be deterrents.

Guiding the Threaded Discussion

The challenge of an online instructor is to establish and maintain a social presence within the online discussion demonstrating to students that their postings are being read while not becoming the center of all discussions (Rovai, 2007). An online instructor may employ two strategies to assist in the effective facilitation of the online discussion forums. The first strategy is to establish a social presence in the online learning environment by: accessing the online discussion forums daily in order to keep up with the conversations; post at least one message per day expressing appreciation, agreement, support, and encouragement; maintain focus within the online discussion by periodically summarizing what has been and needs to be done; ask thought-provoking questions that stimulate in-depth, reflective discussions and establishes a sense of responsibility within the students; reply immediately upon receipt of a message

via email (Rovai, 2007). The second strategy is to emphasize the student-to-student interactions by: not responding too quickly to student posts in order to establish the opportunity for students to respond first; avoid making statements or directly answering questions which may terminate the productive discourse of the discussion; provide closure or summarization to online discussion topics upon completion of the discussion topic or assign the responsibility for providing closure to a specific student; attend to problems that might disrupt student discussions including aggressive communication which may discourage participation from some students; tactfully and privately deal with students who dominate discussions or do not actively participate by phone conversation, email, or face-to-face in order to create an environment with more equitable communication (Rovai, 2007).

Posing Meaningful Questions and Problems

So and Brush (2008) warned that instructional designers and distance educators should take care in choosing which opportunities for meaningful collaboration and social interaction should be included in the design and implementation of distance courses for if an activity meant to promote student interaction is misused or overused it may negatively affect students' learning. Levine (2007) suggested that in order for the learner to extend beyond simply acquiring information and begin to construct knowledge, the instructor must move beyond simply asking questions to posing problems in question form which learners must take into consideration. Instructors must seek out activities which unobtrusively allow students to share their experience, knowledge, and willingness to help each other while assuming the role of a problem-posing

educator willing to reform his reflections in the reflection of the students (Levine, 2007).

Bradley et al. (2008) examined how six different question types (direct link, course link, brainstorm, limited focal, open focal and application) influenced the quantity and quality of online discussion postings of undergraduate students. Limited focal, brainstorm, open focal and direct link type questions were most influential on word count and degree of answer completion while application and course link type questions generated the fewest words and least complete answers (Bradley et al., 2008). In terms of the generation of higher-order thinking, course link, brainstorm, and direct link type questions were most influential while open focal and application type questions resulted in the lowest level of thinking (Bradley et al., 2008).

Focus on the Highest Three Levels of the Cognitive Domain

Tenenbaum, Naidu, Jegede, and Austin (2001) suggested that if an instructor wishes to move learners from low levels of learning to higher levels of learning they may attempt the integration of communicative activities into their courses such as: 1) arguments, discussions, and debates; 2) conceptual conflicts and dilemmas; 3) sharing ideas with others; 4) materials and measures targeted towards solutions; 5) reflections and concept investigation; and 6) making meaningful, real-life examples. Kanuka, Rourke, and Laflamme (2007) compared five groups of communication activities (nominal group technique, debate, invited expert, WebQuest, and reflective deliberation) on the quality of students' contributions to online discussions in undergraduate university courses. Through this study they determined that while overall the cognitive presence was

low, it was highest during the WebQuest and debate activities (Kanuka et al., 2007). Online discussion forums have the ability to instill the higher levels of learning within the students because concepts are challenged and new ideas are generated as learners analyze, synthesize, and draw value judgments (Levine, 2007).

Allow Individualization Without Isolation

Levine (2007) suggested that the online learning environment appeals to students because of the opportunities to self-guide their learning experience based upon their own schedule and time demands. However, the opportunity for controlling one's learning experience through the online learning environment may lead to a sense of isolation. It then becomes crucial for the online instructor to effectively deal with students' sense of isolation and replace it with "a recognition of the learner as a unique individual – a valued participant in the online learning activity" (Levine, 2007, p. 71). The reinforcement and establishment of unique, individual personas may be accomplished through opportunities such as student introductions at the beginning of the course, referencing specific learners by name, providing credit to specific students when their ideas are described and shared within a group, building upon the ideas of participants within a group, and through affirmative feedback for important contributions made to a discussion (Levine, 2007).

Tolmie and Boyle (2000) recommended that instructors implementing CMC through online discussion forums should focus on utilizing smaller groups rather than larger groups. Light, Colbourn, and Light (1997) found that groups of six students working in a self-reflective learning activity "made more frequent,

longer and balanced use of CMC than a large group of 80" (p. 230). However, Wibe (1995) warned that groups should not be too limited in size as "a certain amount of activity is needed or people will not log on to the system" (p. 220). Caspi, Gorsky, and Chajut (2003) found that the proportion of learner-learner interaction increased as the group size increased, while the proportion of instructor messages decreased. Therefore determining what is an effective group size for online discussion forums may become a challenge to the online instructor in designing the online activity which will result in the students achieving the expected learning outcomes.

Be Sensitive to Nonparticipation

Levine (2007) suggested that the "best way to deal with nonparticipation is by creating a learning environment that strongly encourages participation" (p. 71). At the same time, Levine (2007) warns that "a student who is not very active in posting comments to the discussion board may be highly involved in what is going on" (p. 71). Vonderwell (2003) recommended that the online instructor must understand and take into consideration student characteristics in order to bring about effective communication while impeding the limitations of asynchronous communication techniques. Online instructors must take into consideration that while shy students may be more likely to participate in online activities including online discussion forums, students who are outgoing and verbally expressive might avoid writing or posting in online discussions (Palloff & Pratt, 1999). Whereas, Wang and Woo (2007) found asynchronous online discussions may be more appropriate for group dynamics comprised of a mix of introversion and extroversion, and submissiveness and dominance. The

utilization of two-way conversations through email between the teacher and an individual learner may be an effective way for the instructor to gage the level of participation of a student while simultaneously encouraging the student to participate at a greater level in the online discussion forum (Levine, 2007).

Stimulate Participation

Encouraging students to actively and continuously participate in online discussion forums can be a major challenge for the online instructor. Salmon (2000) offered guidelines to the online instructor for stimulating student participation through a five-stage model of participation in computer-mediated conferencing. Each step of the model requires that the learner masters technical skills and the instructor provides different e-moderating skills which ultimately lead to the development of learner responsibility and knowledge construction (Salmon, 2000). As the learner progresses through the stages, the role of the instructor as a provider of information diminishes allowing for the exploration and knowledge building to occur within the student. Rovai (2007) also stressed that the online instructor must emphasize student-to-student interactions through course dialog to encourage student reflection prior to the instructor making a teaching point. It is through active student-to-student interaction that students help each other learn while simultaneously integrating all members of the learning community into the teaching-learning process.

Encourage Reflection

Online discussion forums provide an advantage over face-to-face discussions in that they allow for an opportunity of reflection and deliberation which is not found in synchronous learning environments due to the time delays

often associated with asynchronous communication (Levine, 2007). Tenenbaum et al. (2001) suggested that it is through the process of reflection that the student is capable of reaching higher orders of thinking and knowledge acquisition. Rovai (2007) suggested that the online instructor can encourage reflective discussions by asking thought-provoking questions at the beginning and throughout the course of the discussion topic. The instructor may choose to post messages which express appreciation, agreement, support, and encouragement, but should avoid messages which appear to be sharp or overly critical (Rovai, 2007). It is through the stimulation of in-depth, reflective discussions that the instructor begins to hold the students responsible for their own thinking and learning (MacKnight, 2000).

Summarize Key Ideas

One of the benefits of online discussion forums is that all of the postings are available to be read, reacted to, and reflected upon throughout the length of the activity (Levine, 2007). However, the online instructor is challenged with providing a framework through which each learner individually summarizes his or her own understanding and knowledge acquired through the online discussion forum and reflects upon its meaning within their world. Eastmond (1995) presented a model in which the instructor asks each individual learner a series of three questions based on *what*, *why*, and *now what*. The *what* question should be designed to allow the student to reflect back on the discussion in terms of what new concepts, what unanswered questions, what additional concerns, etc., were presented throughout the online discussion forum (Eastmond, 1995). For each new point identified by the student, he or she is then asked the *why*

question by analyzing why the key idea is important, the unique meaning it has, or the way in which it has affected he or she (Eastmond, 1995). Students should be encouraged to progress back and forth between the *what* and *why* questions as they interpret the importance of the discussion. Finally, students are challenged with the *now what* question as they are asked to move beyond the online discussion forum and relate their acquired knowledge to their own world (Eastmond, 1995). The model presented offers a systematic way of summarization as well as application and/or implication of learning into each student's world.

Summary and Justification for Study

The face of higher education is changing as advances in technology are allowing institutions of higher education to reach a greater number of students through distance and online learning. Many institutions are expanding upon fully online courses as well as hybrid or blended instruction which allows the instructor to take advantage of technological advancements, primarily through the internet, in order to deliver pertinent content information to students with the potential to develop meaningful discourse (Parsad & Lewis, 2008). Asynchronous online discussion forums are a popular and powerful instructional tool which is often integrated into hybrid/blended courses and are structured within the constructivist learning theory or constructivist learning environment.

A great deal of research exists which proclaims positive effects of asynchronous online discussion forums on meaningful discourse and development of critical thinking skills (Althaus, 1997; Ernst, 2008; Gilbert, 2002; Tiene, 2000; Tolmie & Boyle, 2000; Wang & Woo, 2007;). Research on

asynchronous online discussion forums has also focused on perceptions of student learning and students' sense of community and its effects on student learning (Dietz-Uhler & Bishop-Clark, 2001; Garcia, 2006; Koohang et al., 2008; Meyer, 2003; Park, 2011; Rodriguez & Anicete, 2010; So & Brush, 2008; Tiene, 2000; Vonderwell, 2003). While an abundant amount of research is available to assist instructors in the design and implementation of asynchronous online discussions to generate the greatest effect on overall student learning and student satisfaction, the current research available has focused primarily on students at the graduate and undergraduate levels and not among students at the community college level (Bangert, 2004; Bradley et al., 2008; Branon & Essex, 2001; Gilbert & Dabbagh, 2005; Hazari, 2004; Kanuka et al., 2007; Levine, 2007; Rovai, 2007; Swan et al., 2006; Tolmie & Boyle, 2000).

Therefore, the purpose of this research was to determine if and to what extent asynchronous online discussions can be successful in generating meaningful discourse among community college students. In addition, I attempt to describe the attitudes and perceptions that students generate toward asynchronous online discussion forums. The conclusions drawn from this research will assist instructors at the community college level which seek to incorporate alternative pedagogical methods into their traditional classroom courses as to the effectiveness of asynchronous online discussions at the community college level. The information generated from this study will aid instructors in the development and design of nontraditional courses in order to meet the needs and concerns of a populace of students in higher education whom prefer the integration of technology in the classroom.

CHAPTER III

RESEARCH METHODOLOGY

This chapter includes a description of the research methods and procedures that were used in this study to collect and analyze data to determine if post reflective assignments, including online discussion forums, effectively enhance the level of student learning and to determine the extent to which the students attitudes towards the blending of an online learning environment with a traditional face-to-face course through the use of asynchronous online discussion forums. The chapter will include a description of the study participants, the instruments, the research design, and the method of data analysis. The specific research questions of this study were as follows: (1) What is the level of student learning for each of the four different types of reflective assignments?; (2) Is there a statistical difference between the level of student learning for the four different types of reflective assignments?; and (3) What are the students' reported levels of collaborative learning, social presence, and overall satisfaction with the online learning environment?

Research Hypotheses

The above research questions were examined through the statistical evaluation of the following research hypotheses:

Research Hypothesis 1: There will be a statistical difference in the pre-test and post-test scores for each of the reflective assignments: a) no reflection, b) written reflection, c) small group discussion forum, and d) large group discussion forum.

Research Hypothesis 2: There will be a statistical difference in the level of student learning based on the different types of reflective assignments.

Research Hypothesis 3: There will be a statistical relationship among students' perceived levels of collaborative learning, social presence, and satisfaction.

Participants

Participants for this study were students enrolled in Microbiology, a 200 level course and a prerequisite course for enrollment in the nursing program at two different campuses of a community college in southern Mississippi. The study participants were comprised of students enrolled in a total of six separate sections taught by three different instructors during the fall semester of 2012. Each instructor taught two sections of Microbiology with each section being comprised of 20-30 students. The two sections taught by each instructor were merged to create three larger sections within the learning management system of D2L with each merged section being comprised of 45-50 students. All participants of the study were 18 years of age or older. Student ID numbers were utilized in lieu of names in order to protect the anonymity of the participants.

Course Design

All sections of the Microbiology course were taught as a hybrid or web-enhanced course with the inclusion of online discussion forums. All sections of the course were designed to ensure a total of five contact hours per week through face-to-face instruction in the classroom and online instruction through the discussion forums. One instructor's class sessions with students were held for two and one-half hours biweekly. The second instructor's class sessions with

students were held for one hour twice a week and for one hour on a third day. The third instructor's class sessions with students were held for five hours once per week. All instructors held class sessions over a 17 week semester for a total of 80 contact hours. Over the course of the semester about 80% or 64 hours were spent face-to-face in the classroom and the laboratory in which students received instructor mediated lecture and lab content. The remaining 20% or 16 hours were dedicated to the online portion of the course in which the face-to-face lecture content was supplemented with the four required reading assignments and subsequent online discussion forums.

The topics of the four reading assignments encompassed current trends in Microbiology including genetic modification of plants, effects of antibacterial products on antibiotic resistance, current trends in development of antibiotics by pharmaceutical companies, and probiotics as dietary supplements (Table 1). The topics were chosen due to their relevance to Microbiology and their relationship to human health. Each topic was briefly considered and discussed during the lectures; however, the articles allowed the instructor an avenue to expand upon the students' knowledge and understanding of the current trends and how they impact human health and society. The reading assignments chosen for this study were of approximately equal length and level of difficulty. All students were required to access each of the required readings through the learning management system, D2L, and were required to participate in one of four types of reflections.

Table 1

Current topic and articles to be used as required reading assignments.

Topic	Article Citation
Genetically modified foods	Jones, L. (1999). Science, medicine, and the future genetically modified foods. *British Medical Journal, 318,* 581-584.
Effects of antibacterial products on antibiotic resistance	Aiello, A.E., & Larson, E. (2003). Antibacterial cleaning and hygiene products as an emerging risk factor for antibiotic resistance in the community. *The Lancet Infectious Diseases, 3,* 501-506.
Development of antibiotics	Walsh, C.T., & Fischback, M.A. (2009). Squashing superbugs – The race for new antibiotics. *Scientific American, 301(1),* 44-51.
Probiotics as dietary supplements	U.S. Department of Health and Human Services, National Institutes of Health, National Center for Complementary and Alternative Medicine. (2008). *An Introduction to Probiotics.* Retrieved from http://nccam.nih.gov/health/probiotics/D345.pdf

At the beginning of the semester, each instructor's students were randomly assigned into one of four student groups designated as A, B, C, or D. Each of the four student groups were assigned an approximately equal number of students which was dependent upon the number of students enrolled within the merged sections at the beginning of the semester. Students were required to

participate in a pre-test for each required reading assignment (Appendix D) which was administered face-to-face in the classroom by the instructor. Each pre-test was given prior to the article being made available to the students through the learning management system. Upon completion of the pre-test, students were given 11-14 days in which to access and review the required reading assignment and complete the follow-up reflective assignment. For each reading assignment the student groups were assigned to one of four types of reflective assignments: (1) no reflection; (2) written reflection submitted to instructor; (3) written reflection submitted to threaded online discussion forum with small group discussion; or (4) written reflection submitted to threaded online discussion forum with large group discussion. Over the course of the semester each student group, and thus each student, completed each of the four reflection assignments (Table 2). Upon completion of the assigned reflective assignment, students participated in a post-test which was administered face-to-face in the classroom by the instructor.

Table 2

Design of Study

	Article #1	Article #2	Article #3	Article #4
No Reflection	A	B	C	D
Written Reflection	D	A	B	C
Small Group Discussion	C	D	A	B
Large Group Discussion	B	C	D	A

Both the small group and large group online discussion forums were facilitated by the instructor. The student group assigned to the small group discussion forum was randomly divided into smaller groups and were comprised

of no fewer than 5 students and no more than 8 students, whereas, the student group assigned to the large group discussion forum was comprised of all students assigned to the group at the beginning of the semester. Student access to the discussion groups in which they were not assigned was blocked in order to prevent cross communication between the various discussion groups. The number of students assigned to the small and large group discussion forums was dependent upon the current number of students enrolled within the course at the time of the assignments.

In order to encourage meaningful discourse through the reflections and/or the online discussion forums, all supplemental readings and follow-up reflective assignment were a mandatory component of the final grade assigned to the student for the course. The four reading assignments together with the pre-tests/post-tests, reflective responses, and/or online discussions comprised at least ten percent of the students' overall final grade for the course. In addition, the instructor provided the students with a list of probing questions related to each of the reading assignments which were utilized as a platform for initiating their reflective responses and online discussions (Appendix E). Finally, students were provided a grading rubric (Appendix F) which was utilized by the instructor to grade the students' initial reflective post and follow-up responses to their classmates' postings in an attempt to enhance meaningful discourse and participation. Criteria included within the grading rubric focused on the quantity, quality, relevance, and structure of the reflective postings and responses.

An additional assignment was provided to the students at the beginning of the semester in relation to the current learning management system, D2L, and

online discussion forums. The assignment required students to demonstrate their ability to access, navigate, and utilize the D2L learning management system to complete a variety of tasks within the learning management system. During the assignment students were asked to login to the Mississippi Virtual Community College (MSVCC) and locate the link to the Microbiology section in which they are enrolled at the community college in southern Mississippi. Once the student had accessed the course homepage, they were asked to perform a series of tasks including providing a post within an online discussion forum called *Classmate Central*.

Each student was asked to provide a brief description about themselves which in turn was reviewed and commented upon by their classmates. The purpose of the assignment was three-fold: (1) demonstrate their ability to access course content for both the lecture and laboratory portions of the course; (2) increase their familiarity with posting and reviewing messages within a threaded online discussion forum; and (3) establish a sense of community in the online environment. Completion of the described assignment was optional. If students chose to complete the assignment, they were provided two weeks in which to complete it and received bonus points which were applied to their overall final grade for the course.

Instrumentation

In order to determine the student's perceptions towards the online learning environment, the collaborative learning, social presence, and satisfaction (CLSS) questionnaire will be administered to all participants. A copy of the instrument is located in Appendix G. This scale was designed by So and Brush (2008) to

examine the relationships of students' perceived levels of collaborative learning, social presence, and overall satisfaction in a blended learning environment. It is comprised of four sections including: 1) general information; 2) satisfaction scale; 3) collaborative learning scale; and 4) social presence scale. For purposes of this study, the original instrument was amended to include wording that focused on the online discussion forums.

The first section of the instrument was utilized to gather general demographic information including gender, age, ethnic background, estimated level of computer expertise, number of courses taken utilizing online pedagogical tools, computer and internet accessibility, student status (part-time or full-time), students' major of study, and expected final grade in course. The second section of the instrument was comprised of eleven questionnaire items which are based on the satisfaction scale by Gunawardena and Zittle (1997) and four items added to measure students' overall satisfaction with the course, instructor, and learning activities.

The third section of the instrument includes eight items constructed to measure student perspectives on preferences for group versus individual work as well as preferences to online interaction versus face-to-face interaction, amounts of collaboration, and overall satisfaction with collaborative learning. These items were based upon previous research investigating online collaborative learning (Driver, 2002; Kitchen & McDougall, 1998). The final section includes 17 items meant to examine the level of perceived social presence based on four factors: a) social context; b) online communication; c) interactivity; and d) privacy. This section is based on CMC questionnaire developed by Tu (2002).

Overall, the instrument included 46 multiple choice and three extended answer questions. Ten of the multiple choice questions focused on demographic information and general information about the student. The remaining 36 multiple choice questions were based on a Likert scale. Students were asked to respond to 36 statements asking about their opinions and/or experiences about a) satisfaction, b) collaborative learning, and c) social presence in relation to the blended learning environment and online learning activities. Students were asked to respond 1) strongly disagree, 2) disagree, 3) neutral, 4) agree, or 5) strongly agree. The reliability statistics of the instrument based on the three scales were calculated by So and Brush (2008). The Cronbach's alpha is a reliability test which is commonly used to provide a unique estimate of the reliability for a given test (Gliem & Gliem, 2003). The Cronbach's alpha coefficients for the CLSS were found to be 0.85 for the satisfaction scale, 0.72 for the collaborative learning scale, and 0.85 for the social presence scale (So & Brush, 2008). A Cronbach's alpha coefficient of 0.7 is generally considered acceptable (Gliem & Gliem, 2003); therefore, because each of the Cronbach's alpha coefficients for each of the scales was close to or higher than 0.7 this instrument can be considered reliable for data collection.

Research Design

The research design was quantitative in nature. Quantitative data analysis was performed utilizing the data collected from the pre-test/post-tests and the modified version of the CLSS. Pre-test/post-test data was collected to determine the level of student learning and to determine if a statistical significance exists between the types of reflective assignments following review

of the supplemental readings. Descriptive data was collected through the CLSS to determine the overall level of students' perceptions of collaborative learning, social presence, and satisfaction with the online learning environment.

Data Collection

Data specific to the level of student learning was collected through pre-test and post-tests that were administered by the instructor, face-to-face in the classroom. The pre-tests were administered prior to the article being accessible to the students on the learning management system, D2L. The post-tests were administered upon completion of reviewing the article and the subsequent reflective assignments. Data specific to the students' perceptions towards the online learning environment as measured by their reported perceived levels of collaborative learning, social presence, and satisfaction were collected using the modified CLSS to include demographic data and was administered through a survey administering tool like LimeSurvey. The survey was opened after the completion of the last discussion forum and remained open for the remainder of the semester. This was about three weeks in duration.

Quantitative Data Analysis

A descriptive analysis was performed on data collected using pre-test/post-test and the CLSS. The level of learning achieved by each student for the four different types of reflective assignments, research question one, was determined utilizing the data collected from the pre-test and post-tests and a paired sample t-test. A one-way Analysis of Variance (ANOVA) was utilized to determine if a significant difference in student learning existed which was dependent upon the order in which the students performed the reflective

assignments. Then, a repeated measures ANOVA was performed in order to determine if a significant difference existed in the level of student learning between the four types of reflective assignments in order to answer research question two.

In order to answer research question three, Pearson bi-variate correlational analyses were performed to calculate the linear relationships among collaborative learning, social presence, and satisfaction variables. Correlational analysis was also performed to establish significant relationships among satisfaction, collaborative learning, and social presence to demographical information collected in the CLSS. Finally, multiple regression analyses were performed to determine which variables were significant predictors of perceived levels of collaborative learning, student satisfaction, and social presence. All statistical analyses were conducted using SPSS. Significance was determined using an alpha of 0.05.

Evaluation of Open-Answer Questions

The questionnaire also included three open-answer questions which allowed the students to elaborate on their level of satisfaction towards the use of online discussion forums as an instructional pedagogy in a traditional face-to-face classroom. Through the open-answer questioning, students were allowed to explain or justify their responses to the multiple choice questioning within the CLSS survey. Questions focused on how students felt about the format of the online discussion forums and if they felt the online discussion forums helped to address the relevance of microbiology to their everyday life and/or professional

goals. The open-answer questions were analyzed collectively and different points of view for each question have been reported.

CHAPTER IV

ANALYSIS OF DATA

The purpose of this study was to determine if the incorporation of online discussion forums into a web-enhanced science course was an effective pedagogical tool for introduction of meaningful discourse at the community college level. The study included one independent variable: type of reflective assignment. Two dependent variables were evaluated. One dependent variable was the level of student learning which was measured using a pre-test and post-test. The second dependent variable was the student's perceptions of learning which was assessed utilizing an established instrument to determine levels of student satisfaction, collaborative learning, and social presence in relation to online assignments. The general goal of this study was to determine if online discussion forums are an effective pedagogical tool for establishing meaningful learning in community college students and to determine the perceptions of the students towards their experience with online discussion forums.

Participants

Data were collected from students enrolled in six sections of a 200-level Microbiology course taught by three different instructors located on two campuses of a community college in southern Mississippi. Microbiology is a prerequisite course for all students attempting to enroll in the nursing program at the community college in southern Mississippi. The overall sample for this study consisted of 137 students. All participants of the current study were asked to complete a questionnaire at the end of the semester, however, only 100 participants complied by completing the questionnaire. The first portion of the

questionnaire allowed the researcher to provide demographic information concerning the participants in the study. Thirty-seven students were not reflected in the demographic data because they failed to complete the questionnaire.

Table 3 provides information on the gender, age, ethnic background, access to internet, level of computer experience, number of web-enhanced courses completed, major of study, enrollment status, and expected grades of the participants. The majority of the participants in this study were female (86.0%) and enrolled at the community college as full-time students (83.0%) with a major of study designated as other science which included a major of nursing (90.0%). The participants were not evenly distributed in terms of ethnic background or age. The ethnic composition of the participants was predominantly Caucasian (69.0%) but also included African American (19.0%), Asian (6.0%), Latino (1%), and other ethnic background (5%). The majority of participants reported their ages as 18-25 (57.0%) followed by ages of 26-35 (30.0%), 36-45 (12.0%), and above 45 (1.0%).

When asked to describe their familiarity with computers and web-enhanced courses, the majority of participants reported their level of computer experience to be at an intermediate (75.0%) and expert level (15%). The majority of participants reported having completed anywhere from 2-5 (60.0%) web-enhanced and/or online courses; only 4% of the participants reported that they had not completed any web-enhanced and/or online courses. Participants were also asked when and how their computer based activities were completed with the majority of participants reporting using a personal computer (94%) while accessing the internet from their homes (89.0%). The remainder of the

participants reported accessing the internet at work (2%), school (5%), public (2%), and other locations (2%). A large portion of the participants reported that they were anticipating a final grade of B (49.0%) for the course; while 22% and 23% of participants were anticipating a final grade of A and C, respectively.

Table 3

Frequency Statistics of Demographic Data for CLSS (N = 100)

Variable	Frequency	Percentage
Gender		
Male	13	13.0
Female	86	86.0
Missing	1	1.0
Age		
18-25	57	57.0
26-35	30	30.0
36-45	12	12.0
Above 45	1	1.0
Ethnicity		
Caucasian	69	69.0
African American	19	19.0
Latino	1	1.0
Asian	6	6.0
Other	5	5.0
Computer Utilized		
Personal Computer	94	94.0
Other	6	6.0
Internet Access		
Home	89	89.0
Work	2	2.0
School	5	5.0
Public	2	2.0
Other	2	2.0
Level of Computer Experience		
No Experience	4	4.0
Novice	6	6.0
Intermediate	75	75.0
Expert	15	15.0

Table 3 (continued).

Variable	Frequency	Percentage
Number of Web-enhanced Courses		
0	4	4.0
1	3	3.0
2	12	12.0
3	18	18.0
4	18	18.0
5	12	12.0
6	9	9.0
7	5	5.0
8	2	2.0
9	1	1.0
10	3	3.0
More than 10	13	13.0
Enrollment Status		
Part-time	17	17.0
Full-time	83	83.0
Anticipated Final Grade		
A	22	22.0
B	49	49.0
C	23	23.0
D	5	5.0
F	1	1.0

Descriptive Analysis of Data

A descriptive analysis was conducted on data collected using the CLLS questionnaire. The mean and standard deviation for the overall sample were calculated for each item stem. Percentages of agreement, disagreement, and neutral were also calculated. Percentage of agreement was determined by adding the percentage of strongly agree with agree. Percentage of disagreement was determined by adding the percentage of strongly disagree with disagree. Information was separated according to the three subscales of the CLLS instrument – (1) Student Satisfaction, (2) Collaborative Learning, and (3) Social Presence. This data appear in Appendix H. A summary of this information is presented in the following paragraphs.

Overall Perceptions of Student Satisfaction, Collaborative Learning, and Social Presence

In subscale 1, student satisfaction, 69.4% agreed that the online discussions were useful in understanding other points of view. Of the participants, 59.2% agreed that they were able to learn from the online discussions and 51.0% agreed their level of learning was of the highest quality. More than half of the participants (52.0%) agreed that the online discussions stimulated them to perform additional readings or research on the various topics and 56.1% of participants agreed that the diversity of the topics prompted them to participate in the discussions. In addition, 68.4% stated that the course was a useful learning experience and 60.2% of participants agreed that the learning activities met their learning expectations. However, only 44.9% of participants agreed that as a result of their experience with the current course they would consider taking additional distance courses in the future.

In subscale 2, collaborative learning, 67.7% of participants reported that they actively exchanged their ideas with their group members even though only 45.4% of participants felt that they were a part of a learning community within their group. Of the participants, 46.9% agreed that they were able to develop new skills and knowledge from other members in their group; however, only 38.6% agreed that they developed problem solving skills through peer collaboration. When participants were asked if the computer-mediated communication environment was better than face-to-face learning environment, only 20.9% agreed while 62.5% disagreed. In addition, only 44.8% of participants agreed that collaborative learning in their group was effective and

45.9% agreed that they were satisfied with their collaborative learning experience in this course.

In subscale 3, social presence, 70.9% of participants agreed the CMC messages are a social form of communication and 46.9% agreed the CMC allowed relationships to be established based upon sharing and exchanging information. However, only 45.9% of participants agreed that CMC messages convey feeling and emotion, 30.2% of participants agreed that CMC messages are private, 34.4% agreed that CMC messages are impersonal, 32.3% agreed that CMC allowed them to build more caring social relationships, and 22.9% agreed that CMC permits the building of trustful relationships. On the other hand, 47.9% of participants agreed that using CMC was a pleasant way to communicate with others, 53.1% agreed that the language used to express oneself in online communication is easily understood, and 57.3% of participants agreed that it was easy to express what they wanted to communicate through CMC, but only 36.5% agreed that the language used to express themselves in online communication was stimulating. Interestingly, a large number of participants, 65.6%, agreed that they felt comfortable participating in the learning activities despite unfamiliarity with the topics. Of the participants, 78.1% agreed that where they accessed CMC did not affect their ability/desire to participate; however, only 55.2% of participants agree that the CMC is technically reliable and 59.4% agreed that the large amounts of CMC messages did not inhibit their ability to communicate.

Statistical Analysis of Data

In order to perform statistical analysis of the data collected for level of student learning, a gain score was tabulated for each of the four types of reflective assignments for each participant. The gain score may be defined as the post-test score minus the pre-test score. The mean and standard deviation for the gain score for each type of reflective assignment were calculated. The results for the gain score is listed in Table 4.

Table 4

Mean and Standard Deviation for Gain Scores by Reflective Assignment

Type of Reflective Assignment	N	Mean	SD
No Reflection	137	0.49	1.61
Written Reflection	137	1.08	1.73
Small Group Online Discussion	137	0.93	1.84
Large Group Online Discussion	137	1.22	1.83

Statistical analysis was conducted using a one-way ANOVA to test for order effects. The independent variable was the order in which the types of reflective assignments were performed and the dependent variable was student achievement represented by the gain score. The results for the one-way ANOVA analyses are listed in Table 5. The one-way ANOVA analysis suggests that the order in which the participant completed the four different types of reflective assignments (i.e., the group they were assigned to) had no significant bearing on the level of student learning.

Table 5

One-way ANOVA Analysis of Order Versus Gain for Each Reflective Assignment

Type of Reflective Assignment	N	df	F	Sig.
No Reflection	137	3	0.95	0.41
Written Reflection	137	3	0.07	0.98
Small Group Online Discussion Forum	137	3	1.24	0.30
Large Group Online Discussion Forum	137	3	0.76	0.52

In order to ensure the reliability of the CLSS instrument for the current study, the Cronbach's alpha reliability test was utilized to determine a coefficient for each of the three subscales, student satisfaction, collaborative learning, and social presence. The Cronbach's alpha coefficients were determined to 0.90 for the student satisfaction subscale, 0.82 for the collaborative learning scale, and 0.87 for the social presence scale. A Cronbach's alpha coefficient of 0.7 or greater is considered acceptable (Gliem & Gliem, 2003); therefore, the data collected for the current study was determined to be reliable.

Test of Research Hypotheses

The following analyses evaluate the research hypotheses related to achievement for the four different types of reflective assignments. A paired sample t-test was used to determine the statistical difference between pre-test and post-test scores for each type of reflective assignment followed by a repeated measure ANOVA to determine if a statistical difference existed between the four different types of reflective assignments. The mean and standard deviation for the pre-test and post-test scores for each type of reflective

assignment were calculated. The results of the pre-test and post-test scores are listed in Table 6.

Table 6

Mean and Standard Deviation for Pre-test and Post-test Scores by Reflective Assignment

Type of Reflective Assignment		N	Mean	SD
No Reflection	Pre-test	137	5.81	1.80
	Post-test	137	6.30	1.82
Written Reflection	Pre-test	137	5.56	1.71
	Post-test	137	6.64	1.75
Small Group Online Discussion	Pre-test	137	5.51	1.75
	Post-test	137	6.45	1.81
Large Group Online Discussion	Pre-test	137	5.45	1.64
	Post-test	137	6.67	1.65

The score for a student's reported level for each of the subscales was calculated by averaging the scores of each question within the subscale. A Pearson's correlation coefficient was calculated to determine the statistical relationships among students' perceived levels of collaborative learning, social presence and satisfaction similar to So and Brush (2008). Three separate multiple regression analyses were performed to determine statistically significant predictors of the perceived levels of collaborative learning, social presence, and student satisfaction. The demographic variables entered in the multiple regression analysis were: (a) age, (b) gender, (c) ethnicity, (d) computer

competency, (e) number of web-enhanced courses taken prior to Microbiology, (f) location of internet access, (g) enrollment status, and (h) anticipated final grade for the course.

Research Hypothesis 1: There will be a statistical difference in the pre-test and post-test scores for each of the reflective assignments: a) no reflection, b) written reflection, c) small group online discussion forum, and d) large group online discussion forum.

In order to test research hypothesis 1, a paired sample t-test was computed to compare the mean pre-test score with the mean post-test score for each of the different types of reflective assignments (Figure 1). A significant difference occurred between the mean pre-test and mean post-test score for each of the different reflective assignments with a $p < 0.005$ for the no reflection and a $p < 0.001$ for the written reflection, small group online discussion forum, and large group discussion forum (Table 7). Therefore, the research hypothesis was supported.

Research Hypothesis 2: There will be a statistical difference in the level of student learning based on the different types of reflective assignments.

In order to test research hypothesis 2, a repeated measures ANOVA was computed to compare the mean gain scores for each of the different types of the four reflective assignments (Table 4). The four levels of the repeated measure ANOVA were the gain scores available for each of the four reflective assignments from each participant. Results of this analysis indicated that there was a significant difference in the level of student learning between the no reflection gain scores and the gain scores for each of the other three reflective

assignments (written reflection, the small group online discussion forum, and the large group online discussion forum) verified by a significant Greenhouse-Geisser measure for tests of within-subjects effects (F (2.943, 41.175) = 4.508, p = 0.004) (Figure 2). Significant F-values for within-subject factors were followed up with paired t-tests and adjusted with a sequential Bonferroni technique, reducing the chance of a type I error in making multiple pairwise comparisons. Post-hoc tests indicated there was not a significant difference between the written reflection, small group online discussion forum, and the large group discussion forum; however, the mean gains from least to greatest were small group online discussion forums, written reflection, and large group online discussion forums. Therefore, there was a general by non-significant trend in the responses, thus the research hypothesis was generally supported.

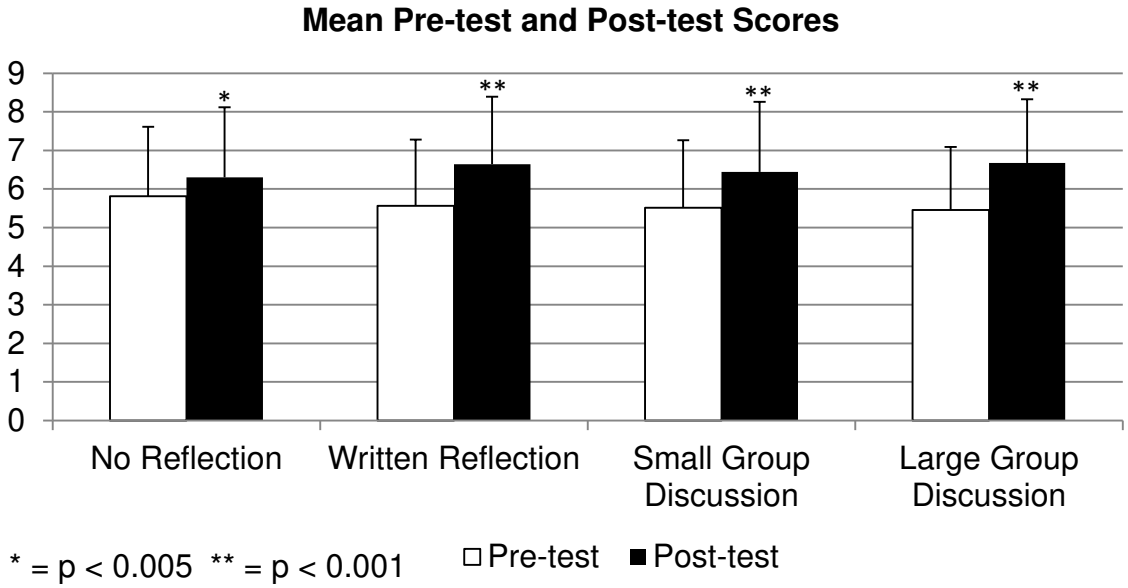


Figure 1. Comparison of mean pre-test to mean post-test for each reflective assignment type. The mean for pre-test and post-test scores for each reflective assignment type were calculated along with the standard deviations. Paired sample t-tests were computed to determine that a significant difference occurred between the mean pre-test and mean post-test score for each of the different

reflective assignments with a $p < 0.005$ for no reflection and a $p < 0.001$ for the written reflection, small group online discussion forum, and large group discussion forum.

Table 7

Paired Sample t-Test of Mean Pre-test Compared to Mean Post-test for Each Type of Reflective Assignment

Type of Reflective Assignment	t	df	Sig. (2-tailed)	Mean Difference
No Reflection	3.14	136	0.002	0.49
Written Reflection	7.24	136	0.000	1.08
Small Group Online Discussion	6.04	136	0.000	0.93
Large Group Online Discussion	8.62	136	0.000	1.22

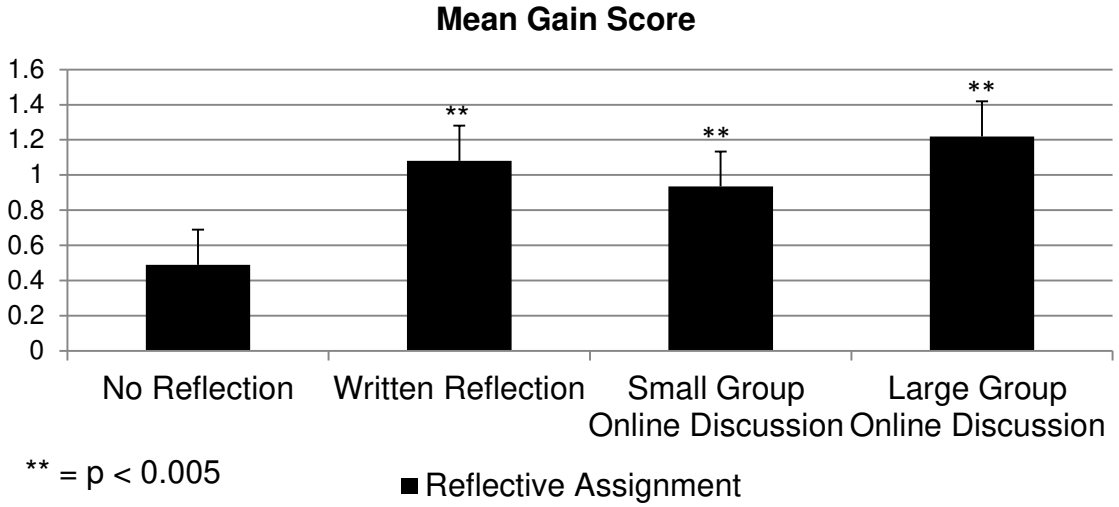


Figure 2. Comparison of mean gain score amongst reflective assignments. The mean gain score for each of the different types of reflective assignments were calculated by subtracting the pre-test scores from the post-test scores. Repeated measures ANOVA was utilized to determine if a statistical difference existed in the level of student achievement amongst the four reflective assignment types. A significant difference between the no reflection gain score and the gain scores for each of the other three types of reflective assignments

was verified by a significant Greenhouse-Geisser measure for tests of within-subjects effects ($F(2.943, 41.175) = 4.508$, $p = 0.004$.

Research Hypothesis 3: There will be a statistical relationship among students' perceptions of collaborative learning, social presence, and satisfaction.

In order to test research Hypothesis 3, the Pearson's correlation coefficients were calculated to find statistical relationships among students' perceived levels of collaborative learning, social presence, and student satisfaction. The correlation coefficients of the three relationships are shown in Table 8. First, a statistically positive relationship was found between collaborative learning and satisfaction scores ($r = 0.652$, $p < 0.001$), indicating that students who reported high levels of collaborative learning tended to be highly satisfied with the course as well. Second, the relationship between collaborative learning and social presence was also determined to be statistically significant ($r = 0.695$, $p < 0.001$). This correlation revealed that students who reported high levels of collaborative learning tended to perceive high levels of social presence. Finally, a positive correlation was found between social presence and overall satisfaction with the course ($r = 0.493$, $p < 0.001$). This correlation suggests that students who perceived high levels of social presence tended to be highly satisfied with the course. The statistically significant correlation between collaborative learning with both social presence and student satisfaction has been previously reported by So and Brush (2008); however, the current study found a statistically significant correlation between student satisfaction and social presence which was not reported in the previous study. Therefore, the research hypothesis was supported.

Table 8

Pearson's Correlation Coefficients of Participant Characteristics, Student Satisfaction, Collaborative Learning, and Social Presence.

Variable	Satisfaction	Collaborative Learning	Social Presence
Satisfaction	---	0.652**	0.493**
Collaborative Learning	0.652**	---	0.695**
Social Presence	0.493**	0.695**	---
Computer Competency	0.147	0.069	0.043
No. of Web-Enhanced Courses	0.273**	0.261*	0.144
Location of Internet Access	0.203*	0.124	0.096
Enrollment Status	-0.026	-0.019	0.057
Anticipated Final Grade	-0.082	0.153	0.006

*p < 0.05, two-tailed; **p < 0.01, two-tailed

Data regarding general demographics of participants were analyzed to examine whether (a) computer competency, (b) number of web-enhanced courses taken prior to Microbiology, (c) location of internet access, (d) enrollment status, and/or (e) anticipated final grade for the course were correlated to the students' reported levels of satisfaction, collaborative learning, and social presence. The correlation coefficients of these relationships are shown in Table

8. There were three statistically significant relationships. First, the reported levels of student satisfaction were positively but weakly related to where students accessed the internet ($r = 0.203$, $p = 0.045$), indicating that students who accessed the internet at home were more likely to have higher levels of satisfaction than students who accessed the internet elsewhere. However, the majority (89%) of the participants reported accessing the internet at home which may skew the results of a correlation between student satisfaction and internet access.

Second, the number of web-enhanced courses that students had taken prior to Microbiology was positively but weakly associated with the level of student satisfaction ($r = 0.273$, $p = 0.007$) and the level of collaborative learning ($r = 0.261$, $p = 0.010$). This relationship suggested that students who had taken more web-enhanced courses tended to report higher levels of satisfaction and enhanced perceptions of collaborative learning. So and Brush (2008) also reported a statistically significant correlation between the number of web-enhanced courses and the level of student satisfaction. In addition, So and Brush (2008) reported a significant correlation between age and the level of student satisfaction; however, this relationship was not detected in the current study. The correlation between internet access and student satisfaction reported in the current study was not observed by So and Brush (2008).

A multiple regression analysis with a dependent variable of student satisfaction level was performed to determine which of the independent variables could be utilized as predictors (Appendix I). The R-square value was 0.570, indicating that the model explains 57.0% of the variability seen within the

perceived level of student satisfaction. The model was significant in explaining the variability seen within the reported level of student satisfaction ($F(18, 76) = 5.595$, $p < 0.001$). Three of the independent variables were significant within the model to a level of 0.05. The independent variables of level of collaborative learning ($p < 0.001$), accessing internet at school ($p = 0.006$), and an anticipated final grade of C ($p = 0.044$) were significant within the model. Although previous correlation analysis showed that the number of web-enhanced courses was significantly related to the perceived level of student satisfaction with $r = 0.273$ ($p = 0.007$), the multiple regression analysis showed that the number of web-enhanced courses was not a significant predictor. The influence of the three significant independent variables on the level of student satisfaction from the most influential to the least influential according to the standardized coefficients (β) were perceived level of collaborative learning (0.561),accessing internet at school (0.231), and anticipated final grade of C (-0.175).

A multiple regression analysis with a dependent variable of reported level of collaborative learning was performed to determine which of the independent variables could be utilized as predictors (Appendix J). The R-square value was 0.681, indicating that the model explains 68.1% of the variability seen within the perceived level of collaborative learning. The model was significant in explaining the variability seen within the reported level of collaborative learning ($F(18, 76) = 8.993$, $p < 0.001$). The independent variables of perceived level of student satisfaction and perceived level of social presence were both significant within the model ($p < 0.001$). The influence of the two significant independent variables on the dependent variable from the most influential to the least influential

according to the standardized coefficients (β) were level of social presence (0.456) and level of student satisfaction (0.417).

Finally, a multiple regression analysis with a dependent variable of reported level of social presence was performed to determine which of the independent variables could be utilized as predictors (Appendix K). The R-square value was 0.570, indicating that the model explains 57.0% of the variability seen within the reported level of social presence. The model was significant in explaining the variability seen within the perceived level of social presence ($F(18, 76) = 5.604$, $p < 0.001$). The independent variable of perceived level of collaborative learning was significant ($p < 0.001$). Although previous correlation analysis showed that the level of student satisfaction was significantly related to the level of social presence with $r = 0.493$ ($p < 0.001$), the multiple regression analysis showed that the level of student satisfaction was not a significant predictor. The influence of the significant independent variable on the dependent variable according to the standardized coefficients (β) was perceived level of collaborative learning (0.613).

Assumptions of Data Analyses

Normality of Residuals for Paired Sample t-Tests

In order to test the assumption that the residuals are normally distributed statistical analysis was performed. The assumption of normality of residuals was examined statistically by exploring the descriptive statistics of the gain scores for skewness and kurtosis for each of the four reflective assignments (Table 9). Pseudo-z values were calculated for both skewness and kurtosis for each of the four reflective assignments by dividing the statistic value of each by its

corresponding standard error. The pseudo-z value of skewness and kurtosis for no reflection were determined to be 0.052 and -0.193 respectively. The pseudo-z value of skewness and kurtosis for written reflection were determined to be -0.168 and -0.109 respectively. The pseudo-z value of skewness and kurtosis for small group online discussion were determined to be -0.326 and 1.008 respectively. The pseudo-z value of skewness and kurtosis for large group online discussion were determined to be 0.317 and 0.853 respectively. Violations of skewness and kurtosis were assumed to have occurred if the pseudo-z values were greater than ± 3.000. In the data analysis performed, the assumption of normality of residuals was not violated in terms of skewness or kurtosis for any of the four reflective assignments.

Table 9

Normality of Residuals for Types of Reflective Assignments

		No Reflection	Written Reflection	Small Group Discussion	Large Group Discussion
N	Valid	137	137	137	137
	Missing	0	0	0	0
Skewness		0.052	-0.168	-0.326	0.317
Std. Error of Skewness		0.207	0.207	0.207	0.207
Kurtosis		-0.193	-0.109	1.008	0.853
Std. Error of Kurtosis		0.411	0.411	0.411	0.411

Assumption of Sphericity for Repeated Measures ANOVA

In order to test for the assumption of sphericity of the repeated measures ANOVA, Mauchly's test was utilized. If one is to assume that the condition of

sphericity has been met, Mauchly's test should be nonsignificant. Mauchly's test indicated that the assumption of sphericity was not violated, $X^2(5) = 3.797$, $p = 0.579$.

Assumptions of Multiple Regression

Assumptions of multiple regression included linearity, normal distribution of residuals, and homoscedasticity. In order to determine if the assumption that the dependent variable is a linear function of the independent variables was violated, the data was tested for curvilinearity statistically. Statistical determination of linearity was performed by first computing a centered variable of the number of enhanced courses taken which was calculated by subtracting the mean for the independent variable of interest from each participant within the study. Next, a second variable was computed by squaring the values of the centered variable. Finally, the all three multiple regression analyses were repeated for each of the dependent variables of student satisfaction, collaborative learning, and social presence. The new multiple regression analysis included all of the original independent variables except that the independent variable of number of web enhanced courses taken was replaced with the centered variable and the squared centered variable was included in order to determine the significance of the squared centered variable within the model. The squared variable was not significant with a dependent variable of student satisfaction ($t = -0.921$, $p = 0.360$), a dependent variable of collaborative learning ($t = 0.529$, $p = 0.599$), nor a dependent variable of social presence ($t = -1.388$, $p = 0.169$). As a result, the assumption of linearity within the model was not violated.

In order to determine if the assumption of homoscedasticity or that the variance of errors is not a function of the independent variables had been violated, graphical analysis was performed. First, unstandardized predicted values and unstandardized residuals were calculated for the three dependent variables of student satisfaction, collaborative learning, and social presence. A scatter-plot graph with the unstandardized predicted values plotted on the x-axis against the unstandardized residuals plotted on the y-axis was performed for each of the three subscales of the CLSS. Figure 3 illustrates the variation of the paired values around a mean of 0.00 for student satisfaction. Figure 4 illustrates the variation of the paired values around a mean of 0.00 for collaborative learning. Figure 5 illustrates the variation of the paired values around a mean of 0.00 for social presence. The distribution of the variance of errors for each of the subscales suggests that there were no violations of homoscedasticity in the original models.

In order to test the assumption that residuals are normally distributed for each of the three dependent variables (student satisfaction, collaborative learning, and social presence), statistical analysis were performed by exploring the descriptive statistics of the unstandardized residuals for skewness and kurtosis for student satisfaction, collaborative learning, and social presence (Table 10). Pseudo-z values were calculated for both skewness and kurtosis for each of the subscales by dividing the statistic value of each by its corresponding standard error. The pseudo-z value of skewness and kurtosis for student satisfaction were determined to be -0.323 and 0.481 respectively. The pseudo-z value of skewness and kurtosis for collaborative learning were determined to be -

0.430 and -0.412 respectively. The pseudo-z value of skewness and kurtosis for social presence were determined to be -0.545 and 0.885 respectively. Violations of skewness and kurtosis were assumed to have occurred if the pseudo-z values were greater than ± 3.000. In the data analysis performed, the assumption of normality of residuals was not violated in terms of skewness or kurtosis for any of the three subscales.

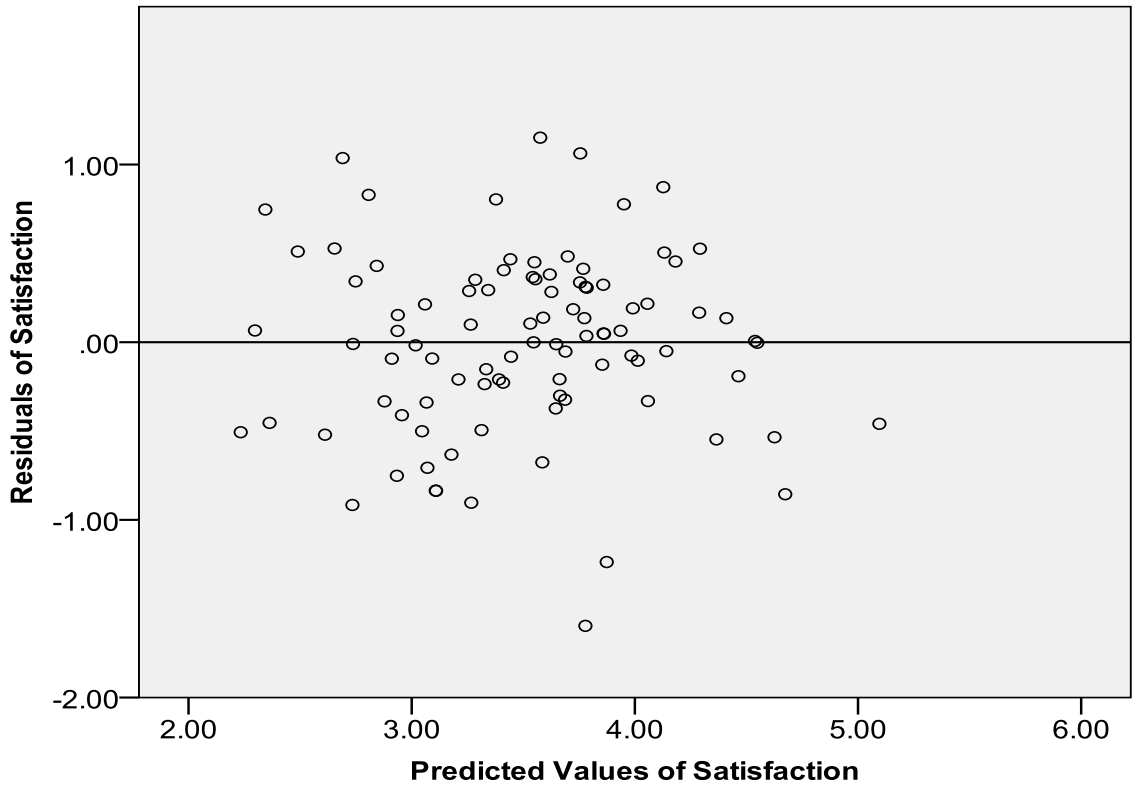


Figure 3. Graphical analysis of homoscedasticity of student satisfaction. A scatter-plot graph of unstandardized predicted values versus unstandardized residuals illustrating the variation of the paired values around a mean line of 0.00. The even distribution of the variance of errors suggests that the assumption of homscedasticity was not violated.

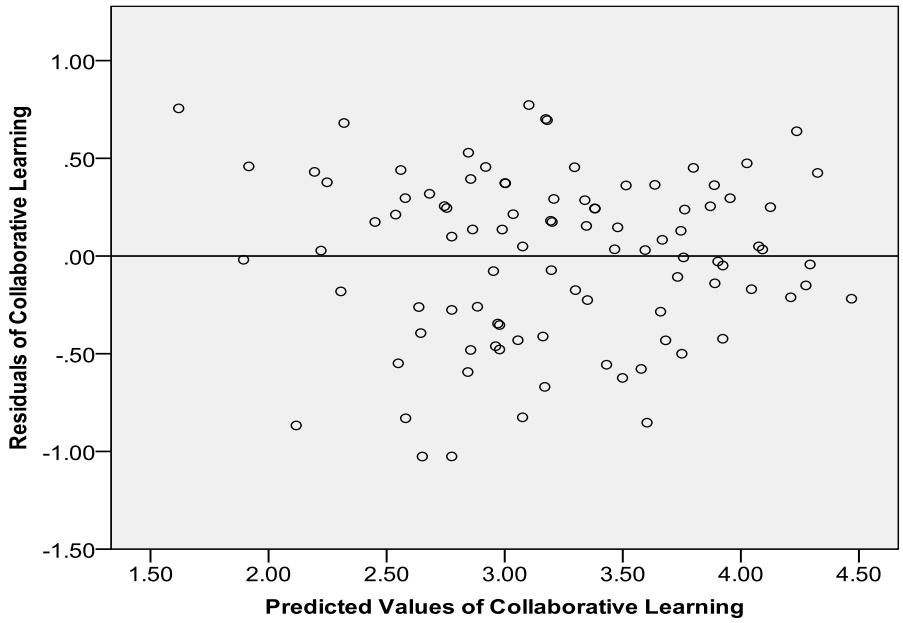


Figure 4. Graphical analysis of homoscedasticity of collaborative learning. A scatter-plot graph of unstandardized predicted values versus unstandardized residuals illustrating the variation of the paired values around a mean line of 0.00. The even distribution of the variance of errors suggests that the assumption of homscedasticity was not violated.

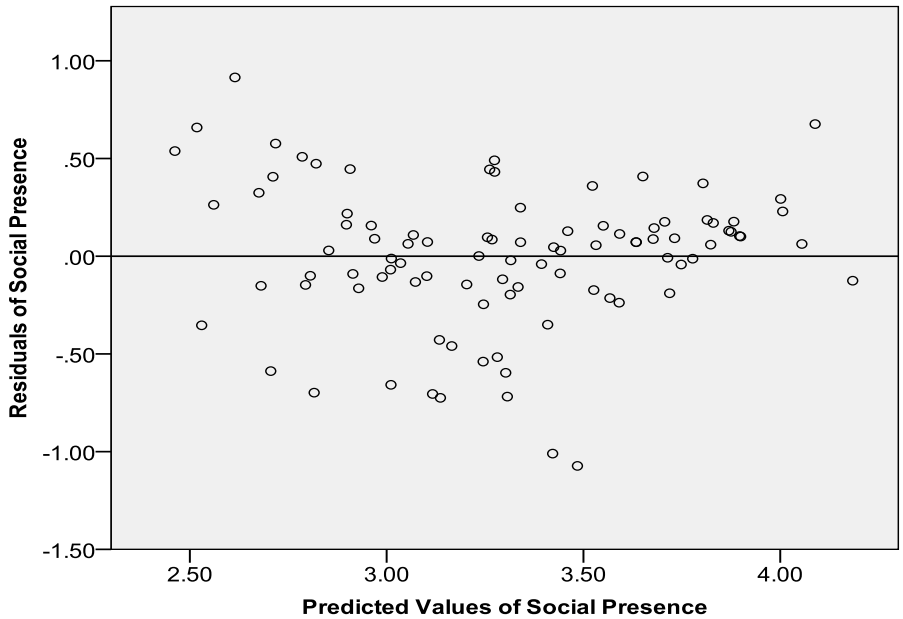


Figure 5. Graphical analysis of homoscedasticity of social presence. A scatter-plot graph of unstandardized predicted values versus unstandardized residuals illustrating the variation of the paired values around a mean line of 0.00. The even distribution of the variance of errors suggests that the assumption of homscedasticity was not violated.

Table 10

Normality of Residuals for CLSS Subscales

		Satisfaction	Collaborative Learning	Social Presence
N	Valid	95	95	95
	Missing	5	5	5
Skewness		-0.323	-0.430	-0.545
Std. Error of Skewness		0.247	0.247	0.247
Kurtosis		0.481	-0.412	0.885
Std. Error of Kurtosis		0.490	0.490	0.490

Analysis of Open-Answer Questions

In addition to the quantitative data, students were asked to complete three open-ended questions. Each question was analyzed and the overall opinions from the qualitative data were reported for the sample as a whole.

Question 1 – Which online discussion forum format did you prefer more, the small group or large group? Why?

Overall, 74 participants out of 100 answered this question. Of the participants that responded, 32 (43.2%) preferred the small group online discussion forums and 42 (56.8%) preferred the large group online discussion forums. Of the participants who did not respond, three participants reported that they had no preference and enjoyed both the small group and large group online discussion forums; while, five participants reported that they did not enjoy either the small group or large group online discussion forum. Students provided a

variety of answers as to why they preferred one forum over the other. The reasons for participants' preferences were evaluated for general themes.

Participants who preferred the small group online discussion forum provided reasons which were encompassed within 5 general themes:

1. The overall reduced number of posts made the assignment less overwhelming and easier to process.
2. Participants were able to establish more personal relationships.
3. The conversations established were easier to follow and provided better feedback which was more in-depth.
4. The amount of time required to complete the assignment was less.
5. Group members were more likely to participate due to the perception of less effort and time commitment.

Participants who preferred the large group online discussion forum provided reasons which were encompassed within 4 general themes:

1. More opinions, points of view, and information were provided within the large group discussions due to the increased number of participants.
2. The increased number of responses made it easier to complete the assignment.
3. More people within the large group discussion translated into more participation and less frustration amongst group members.
4. Increased level of understanding due to more depth, opinions, points of view, and information provided within the large group discussions.

Participants who did not prefer either small group or large group online discussion forums provided reasons which were encompassed within 3 general themes:

1. Prefer individual tasks which are not dependent upon participation of classmates such as reading and written reflections.
2. Online discussions were unproductive use of time and took away from regular class studies.
3. Preference for face-to-face contact with instructor and classmates which leads to dislike for online or hybrid courses.

Question 2 – Do you think the use of the online discussion forums enhanced your ability to relate microbiology to your everyday life? Why or why not?

Overall, 80 participants out of 100 answered this question. Of the participants that responded, 56 (70%) agreed whereas 24 (30%) disagreed that the online discussion forums did enhance their ability to relate microbiology to their everyday life. One participant responded maybe and the remaining 19 participants provided no response. Students provided a variety of answers as to whether or not the online discussions enhanced their ability to relate microbiology to their everyday life which were evaluated for general themes.

Participants who agreed that the online discussion forums enhanced their ability to related microbiology to their everyday life provided reasons which were encompassed within four general themes:

1. The topics chosen for the online discussions were things that participants had no or limited prior awareness or knowledge allowing for a heightened awareness of the importance of microorganisms.

2. Alternative perspectives, knowledge, and/or experiences enhanced participants ability to understand concepts related to the chosen topics and to their everyday contact with microorganisms.
3. The topics chosen for the online discussions emphasize the relationships between microorganisms and humans.
4. The topics chosen for the online discussions enhanced the information that was presented in the course lecture materials.

Participants who disagreed that the online discussion forums enhanced their ability to related microbiology to their everyday life provided reasons which were encompassed within four general themes:

1. The instructions for the assignments were not clearly presented.
2. The online discussion topics did not relate to what was covered in the class and only provided greater confusion.
3. Introduction of topics covered in online discussion forums could have been accomplished with face-to-face instruction with similar results in terms of enhancing ability to relate microbiology to everyday life.
4. Participants had a fair understanding of the discussion topics prior to the course.

Question 3 – Do you have any other comments?

The comments provided by students varied from positive to negative feedback. Other participants chose to provide recommendations for improving the format of the online discussion forums. Of those participants who provided positive feedback, one participant commented that the "…articles helped us to learn at the college level we are at…" and yet another participant commented

that the instructor's use of online discussion forums "…challenges you to think outside the box." Another participant stated that the online discussion forums "…is a great idea to help reinforce the knowledge gained in class by our truly exceptional instructor." Yet another participant stated that "…it was an interesting experience and I would do it again in spite of the time required." One participant simply stated, "This was a good learning experience." One participant had mixed feelings about the online discussion forums commenting that "I didn't absolutely love doing this, but I do feel like it helped me better understand the information."

Of those participants who provided negative feedback, one participant commented that they "…(I) prefer an in-class discussion to an online one. In class the conversation flows better, and nothing is lost in translation, but with online, there are starts and stops. It's not as stimulating." Another participant agreed stating, "I prefer in class learning." Similarly a third participant commented "Trying to do classes online is not easy for me because I get distracted and I also learn better in a classroom setting." One participant stated that the online discussion forums was "…time consuming and with the intensty of this course it make things difficult." One participant expressed frustration through the comment, "the only bad thing was that some people wouldn't participate and others complained about it." One participant expressed total displeasure with online discussion forums by commenting, "I would rather not participate in any other discussion groups in any classes."

Other participants utilized this opportunity to provide insight into improving the incorporation of online discussion forums in web-enhanced courses. One

participant suggested “that in order to keep students focused on the material and make them enjoy the online aspect, the articles need to be MUCH shorter!” Another participant recommended to focus on “…big groups, not small groups, and mix the classes up to get different opinions.” A third student recommended that “…it should be clearly stated that this is a hybrid course in the future.”

Summary

Participants’ perceived levels of satisfaction, collaborative learning, and social presence were relatively split down the middle; however, the reports of positive perceptions was slightly higher than the negative reports. These results suggest that students perceived the incorporation of scientific articles with a post-reflective assignment as a valuable and effective learning experience in which they were exposed to alternative perspectives which assisted in formulating an increased level of understanding and learning. In addition, statistical analysis supported the overall perceptions of the students’ learning by indicating a statistical difference in the level of learning achievement for all of the reflective assignment types in comparison with no post-reflective assignment. While there was not a statistical difference in achievement between the individual written reflection assignments and the collaborative small group and large group online discussion forums, a general trend did exist in which the large group discussion forum scored higher than the individual written reflection. Therefore, it can be concluded that students at the community college level benefit from the incorporation of post-reflective assignments such as individual written reflections or online discussion forums.

CHAPTER V

DISCUSSION

For centuries, the focus of instruction in higher education has been through face-to-face interaction between the instructor and the students. The primary source of instruction occurs through dissemination of information from the instructor to the students through lectures in an attempt to generate student understanding; however, it has been suggested that the process of restructuring information can only be achieved through active learning, in which students are engaged in problem solving, inference making and investigation, and/or resolution of contradiction and reflection (Catherine Fosnot, 1989, as quoted in Johnson et al., 1991, p. 1:20-21). The science classroom has been suggested as the most appropriate venue for active, hands-on instruction in research studies (Bilgin, 2006); however, the structure of the science classroom in institutions of higher education, especially at the community college level, is changing in order to accommodate the needs of the growing student population and not necessarily to accommodate the integration of active, hands-on instruction.

Over the past seven years, institutions of higher education have reported that online enrollments have been increasing significantly faster than overall higher education enrollments (Allen & Seaman, 2010). The continued growth in online enrollments has resulted in institutions of higher education, with community colleges being amongst the forerunners, feeling the pressure to compete for the online student population through growth of existing course offerings (Allen & Seaman, 2010). The greatest factors affecting the decisions

among public two year institutions regarding online course offerings included: seeking to increase student enrollment, making more courses available, meeting student demands for flexible schedules, and providing access to college to those whom otherwise would not have access (Parsad & Lewis, 2008).

To some educational leaders, hybrid instruction has been touted as offering the *best of both worlds* in which the blending of the traditional and web-based models of instructions offer the accessibility and flexibility of the online course along with the personal face-to-face interaction and sense of community establish within the traditional classroom (Allen & Seaman, 2010). The challenge associated with hybrid instruction is to maintain the fidelity of student learning within an online environment.

Computer mediated communication (CMC), a mechanism of asynchronous internet based technology supporting information exchange and group interactions (Bodzin & Park, 2000) is based on the constructivist learning theory and has been described as an important pedagogical tool capable of engaging groups of students separated by time and space in the active process of developing shared knowledge (Gunawardena et al., 1997). Online discussion forums are a form of web-based asynchronous communication which has become a central element within every online learning management system allowing for the extension of teaching beyond the traditional face-to-face classroom (Levine, 2007). A wealth of research on the use of online discussion forums in the hybrid classroom exists; however, the primary focus of such studies has been upon the utilization of online discussion forums as a pedagogical method in graduate level courses of various subject areas. The question

remains as to the whether or not online discussion forums can be utilized as an effective pedagogical method at the undergraduate and/or community college level?

I designed a research project to answer that question. The purpose of this study was to determine the academic achievement associated with post reflective assignments as well as the students perceived level of learning associated with the incorporation of online discussion forums in a traditional instructional setting. Below is a summary of the research conducted as well as a discussion of the findings.

Summary of Procedure

In this study, I examined both the level of student learning as well as students' attitudes towards the incorporation of cooperative online learning activities, online discussion forums, into a traditional instructional setting. Participants included students enrolled in six sections of a 200-level course of Microbiology, a prerequisite course for all students attempting to enroll in the nursing program, at a community college in southern Mississippi. The six sections were taught by three instructors located on two different campuses of the same community college located in southern Mississippi. Overall, 137 students agreed to participate in the study during the fall semester of 2012.

During the study, participants were asked to read a series of four scientific articles related to various topics relevant to the course, Microbiology. They were then asked to participate in one of four reflective assignments: no reflection, written reflection, small group online discussion forum, or large group online discussion forum. Over the course of the semester each student participated in

each of the four reflective assignments. Participants in this study were randomly assigned to one of four groups at the beginning of the semester to determine the order in which they participated in the four post reflective assignments. Participants in this study were asked to complete a content-based pre and post-test for each of the four articles and post reflective assignments. The change in scores from pre-test to post-test was used to assess differences in academic achievement between the four post reflective assignments.

Students' attitudes towards the incorporation of cooperative online learning activities into the traditional classroom setting were measured by their perceived levels of learning determined through the use of the Collaborative Learning, Satisfaction, and Social Presence (CLSS) questionnaire. This instrument was originally administered to graduate students and yielded acceptable reliability scores. In this research study, the instrument was used solely for community college students and also yielded acceptable reliability scores.

Findings

The current study addressed the question of whether or not a post reflective assignment, both individual and cooperative in nature, could increase academic achievement through the development of metacognition. The individual post reflective assignment was a written reflection while the cooperative reflective assignment utilized the incorporation of online discussion forums. There was a significant difference between pre-test and post-test scores for both the written reflection and the online discussion forums when compared to no post reflective assignment. There was not a significant difference amongst

the individual and cooperative reflective assignments. The gains observed for the three post reflective assignments from greatest to least were the large group online discussion forums, the individual written reflection, and the small group online discussion forum. In addition, students in the current study reported that the online discussion forums helped them to gain a better understanding of the topics presented, through exposure to alternative perspectives and experiences of their peers.

An increase in academic achievement associated with online discussion forums has been well documented by researchers such as Althaus (1997), Caspi et al. (2003), Dietz-Uhler and Bishop-Clark (2001), and Garrison (2003). The current study reinforces the findings of other researchers by demonstrating the effectiveness of incorporating online discussion forums into a traditional classroom setting; however, the small group online discussion forum was not as effective as the large group online discussion forum. It is difficult to ascertain exactly why the small group online discussion forum was less effective. One area that may be reviewed is the preference of students towards the online discussion forums.

Descriptive analysis of responses to the CLSS questionnaire indicated that a slight majority of students reported positive attitudes toward the incorporation of online discussion forums into a traditional course framework. It is important for students to have a positive attitude towards assignments, as the likes and dislikes of students are just as important as the lesson. For if a student enjoys their classes they are more likely to learn more. In the current study, the students' reported that they felt that they had garnered greater information and

understanding on the various topics by being exposed to multiple perspectives and experiences provided by their peers through the online discussion forums. Most students reported a sense of social presence in an environment where they were not afraid to express their opinions.

When asked which format the students preferred, they were relatively split with 43% preferring the small group online discussion and 57% preferring the large group online discussion forums. Students who preferred the small group format suggested that the discussions were more personable, engaging, and easier to process due to fewer responses. Students who preferred the large group format suggested that they learned more due to the increased perspectives and opinions. In addition, some students expressed less frustration with completing the assignment due to increased participation amongst their group members. Other students suggested that both the small and large group online discussion forums assisted them in better understanding the topics presented in the class.

Of course not all students surveyed reported positive attitudes. Multiple students reported that they did not enjoy participating in the online discussion forums for various reasons. Several students expressed frustration with a lack of participation by their classmates which made it difficult to fulfill the requirements of the assignment. Other students expressed that the online discussion forums only exacerbated an already overwhelming wealth of information provided through the course and that the assignments “took time away from…regular class studies.” Some students expressed that they simply preferred to work alone and do not feel comfortable interacting with others. Finally, others

expressed that they do not learn well through an online interface, but rather prefer face-to-face instruction.

The statistical analysis of the CLSS questionnaire indicated that there was a direct correlation between the perceived level of student satisfaction, collaborative learning, and social presence. In addition, a positive correlation existed between the number of online/hybrid courses the students had taken with both the perceived level of student satisfaction and the perceived level of collaborative learning. The source of internet access was also determined to be positively correlated to the perceived level of student satisfaction.

The questionnaire was not without shortcomings. First, the anonymity of the questionnaire prevented a direct evaluation between a student's level of learning and their perceived levels of satisfaction, collaborative learning, and social presence. Second, a lack of variability in student responses for many of the demographical components may lead to bias within the results. For example, the majority of students reported accessing the internet at home which was determined to be positively correlated to the perceived level of satisfaction. If a greater number of students had gained internet access from other sources, the results may vary. Third, a high percentage (27%) of students did not respond to the questionnaire which may lead to non-response bias. It is unknown how the unresponsive participants would have altered the data set currently reported.

Multiple regression analysis concluded that the significant predictors of the perceived level of student satisfaction were the perceived level of collaborative learning, accessing the internet at school, and an anticipated final grade of C. The significant predictors of the perceived level of collaborative learning were

determined to be the perceived level of student satisfaction and the perceived level of social presence. Finally, the significant predictor of the perceived level of social presence was the perceived level of collaborative learning.

An instructor at any level can never expect to satisfy all of their students. There will always be students who are unhappy with the instructional methods utilized in the classroom. Thus, the only goal an instructor can aim for is to reach the majority of their students. Effective instruction is therefore obtained by not teaching at the highest level nor the lowest level, but rather somewhere in the middle. If an instructor chooses to incorporate online discussion forums into their course framework, they can expect to be met with opposition by some students. However, instructors should not be discouraged by those students, since online discussion forums have been demonstrated to be an effective pedagogical tool at all levels of higher education.

Limitations

At the beginning of this study the following limitations were identified:

(1) Participants in the research were limited to those students enrolled in Microbiology courses taught by myself and two other instructors at a community college in south Mississippi during the fall semester of 2012. Multiple sections of Microbiology were utilized in order to increase the sample size. The instructors were located at one of two campuses of the same community college in south Mississippi. One possible limitation amongst instructors which could have affected the research study is the students' overall attitude towards their instructor and/or their instructor's style of teaching which may have been transferred to their overall attitude towards participating in the study. In order to

minimize this effect, the principal investigator of the study was made available to all participants throughout the semester to entertain questions, problems, and/or concerns directly related to the study.

(2) The study was limited by the adult learner populations' understanding of the terminology of the instrument utilized to measure their satisfaction with the online learning environment as well as pre-test and post-test instruments utilized to measure meaningful discourse and their prior experience with the Desire2Learn (D2L) interface and utilization of asynchronous online discussions. Any prior knowledge and experience of participants with the learning management system may have increased the comfort level of participants and affected their willingness to participate in the study. A 200-level science class was utilized in an attempt to include participants who had prior experience with navigation of the learning management system. In addition, an introductory assignment was presented to students in an attempt to familiarize participants with navigation of the learning management system and increase their comfort level; however, the assignment was optional and was not completed by all participants.

(3) The study was limited by the honesty and clarity with which the adult learners provided responses to the instrument of measure and asynchronous online discussions. Although the participants were not required to provide their name or any identifying characteristics on the questionnaire, there is always the possibility of a lack of honesty and clarity. Due to the length of the questionnaire involved in this study, participants may have rushed through the questionnaire without thoroughly considering their responses.

(4) The format of the asynchronous online was limited by the applications available through the Learning Management System, D2L. The online discussion forums were available for viewing by all students throughout the assignment period. It was impossible to prevent students who were not assigned to an online discussion forum from reading the postings of their classmates thus gaining access to alternative perspectives and knowledge. Participants also had the ability to post within other groups that they were not assigned to during their online discussion forums. There was no evidence of this throughout the study.

(5) The design of the study limited the order in which the students participated in the reflective assignments, ie. group B always followed group A, group C always followed group B, group D always followed group C. Due to the small population size it was impossible to assign students randomly into groups as well as randomly assign the order in which they participated in the reflective assignments. However, one-way ANOVA analysis of the level of student learning (ie. gain scores) versus the order in which the assignments were performed demonstrated a lack of bias do to order effects.

Recommendations

Recommendations for Practice

This research project was designed to determine whether or not online discussion forums were an effective pedagogical method at the community college level. The data from this study indicate that the incorporation of scientific articles followed by a post reflective assignment, including online discussion forums is in fact effective in disseminating information to students. This is extremely important in the educational environment due to the increase

emphasis upon developing alternative class modules in order to accommodate the increasing enrollment of students in nontraditional courses. As institutions, especially community colleges, begin to shift their focus away from traditional face-to-face courses towards hybrid and online courses, it is important that the same quality of instruction is provided to their students.

Online discussion forums are a key component of all learning management systems which offer instructors and students ease of electronic interaction and the opportunity to learn through shared information and perspectives. Many hours were invested in the design of a working module for online discussion forums in preparation of this research project. Instructors who choose to incorporate online discussion forums into a traditional, hybrid, and/or online course can expect to invest time for proper implementation of an effective cooperative learning experience for their students. Without proper preparation, online discussion forums may not provide the quality experience that was achieved through this project.

When designing online discussion forums, instructors should take a variety of factors into consideration including the educational level and background of their students, the size of the groups participating in the online discussion forums, the period of time that the online discussion forum is available to students, and the ability of students to access the internet. The educational level and background of students is important when determining the topics and/or reading materials to be utilized for the online discussion forum. The reading materials should provide accurate information on a level that is challenging, but not overly complex to ensure that students will not lose interest in the assignment

or become frustrated due to a lack of comprehension. In order to enhance the learning experience of the student and increase student involvement, it is recommended that the topics chosen should relate both to the course materials and the students everyday lives. If possible, an instructor may consider allowing the students to choose topics of the online discussion forums to increase student motivation and participation.

One particular challenge experienced by the researcher in implementation of online discussion forums was determining the most effective size of the student groups. Too many students can lead to students feeling overwhelmed by the workload associated with the assignment and may deter them from participating; whereas, too few students may lead to frustration and an inability to complete the assignment due to a lack of participation by some group members. One suggestion is that the instructor must be willing to remain flexible in terms of group assignments for the students that actively participate in the online discussion forums.

Although it was not possible to do in the current study, an instructor might consider changing the students assigned to various groups in order to increase the level of exposure to varied perspectives and prior knowledge of other students. It is also essential for an instructor to monitor the progress of the online discussion forum and evaluate the level of student participation throughout the activity period. It is impossible to ensure that all students will actively participate in the assignment, but flexibility should be allowed for those students who are willing to actively participate.

Another consideration which an instructor must make is the period of time over which the online discussion forum is held. Students must be provided with ample time to complete the cooperative learning activity; however, too long can lead to frustration amongst group members due to late participation by their classmates. An instructor may find that the period of time will be different for each course depending upon the frequency with which the course meets in the face-to-face environment. The researcher recommends that the students be provided no less than one week to complete the assignment, but no more than two weeks. The instructor may find it necessary to provide frequent reminders to the students through face-to-face contact, email, message board, and/or calendar applications within the learning management system in order to maximize student participation and reduction of frustration within the student groups.

A final factor that instructors should consider when incorporating online cooperative learning activities including online discussion forums is the students' ability to access the internet. Despite living in a technology based society, instructors should not make the assumption that all students have reliable access to the internet in order to participate in online cooperative learning activities. One suggestion to evade complications which might arise due to a lack of internet access is for students to be fully aware that the course incorporates online activities prior to enrollment. An instructor may also choose to provide students with an alternative assignment which fulfills the learning experience, but does not require internet access for completion.

Recommendations for Future Research

The concept of nontraditional learning is early in the developmental stages. Educational institutions are feeling mounting pressure to incorporate technological applications into both traditional face-to-face courses as well as the development of hybrid and/or online courses. Research should continue within the area of alternative learning environments in order to evaluate its effectiveness and ensure the best possible educational output. The current study could be expanded in the future to include a much larger sample size including students enrolled in other science courses as well as non-science courses. In addition, the current study focused on the incorporation of online discussion forums in a traditional face-to-face course; however, future research could be expanded to include the effectiveness of incorporating online discussion forums into hybrid and online courses. Additional studies may also include comparisons of the asynchronous discussion forums available within the various learning management systems marketed to institutions of higher education.

Summary

It is the hope of the researcher that instructors will not shy away from the incorporation of online discussion forums into their traditional, hybrid, and/or online courses due to the commitment of time required for the preparation and implementation of the online learning activity. Online discussion forums are an effective method of active learning that when executed successfully can provide students with a valuable and enjoyable learning experience that develops understanding and knowledge through metacognition. Through this study and previous research it has been demonstrated that the incorporation of online

discussion forums has the potential to have a positive effect on the level of student learning affecting both the students' academic achievement and the students' attitudes towards learning at all levels of academia.

APPENDIX A

HUMAN SUBJECTS DOCUMENTATION

THE UNIVERSITY OF
SOUTHERN MISSISSIPPI

INSTITUTIONAL REVIEW BOARD
118 College Drive #5147 | Hattiesburg, MS 39406-0001
Phone: 601.266.6820 | Fax: 601.266.4377 | www.usm.edu/irb

NOTICE OF COMMITTEE ACTION

The project has been reviewed by The University of Southern Mississippi Institutional Review Board in accordance with Federal Drug Administration regulations (21 CFR 26, 111), Department of Health and Human Services (45 CFR Part 46), and university guidelines to ensure adherence to the following criteria:

- The risks to subjects are minimized.
- The risks to subjects are reasonable in relation to the anticipated benefits.
- The selection of subjects is equitable.
- Informed consent is adequate and appropriately documented.
- Where appropriate, the research plan makes adequate provisions for monitoring the data collected to ensure the safety of the subjects.
- Where appropriate, there are adequate provisions to protect the privacy of subjects and to maintain the confidentiality of all data.
- Appropriate additional safeguards have been included to protect vulnerable subjects.
- Any unanticipated, serious, or continuing problems encountered regarding risks to subjects must be reported immediately, but not later than 10 days following the event. This should be reported to the IRB Office via the "Adverse Effect Report Form".
- If approved, the maximum period of approval is limited to twelve months. Projects that exceed this period must submit an application for renewal or continuation.

PROTOCOL NUMBER: **12040304**
PROJECT TITLE: **The Effect of Online Discussion Forums on Student Learning and Student Perception of Learning in a Science Course at the Community College Level**
PROJECT TYPE: **Dissertation**
RESEARCHER/S: **Rachel A. Ryan**
COLLEGE/DIVISION: **College of Science & Technology**
DEPARTMENT: **Center for Science & Mathematics Education**
FUNDING AGENCY: **N/A**
IRB COMMITTEE ACTION: **Expedited Review Aprpoval**
PERIOD OF PROJECT APPROVAL: **04/10/2012 to 04/09/2013**

Lawrence A. Hosman, Ph.D.
Institutional Review Board Chair

APPENDIX B

REQUEST TO CONDUCT RESEARCH AT MGCCC

MGCCC

Mississippi Gulf Coast Community College **Request to Conduct Research at MGCCC**	LEAVE BLANK – FOR MGCCC USE ONLY. PROJECT NUMBER: 14 DATE RECEIVED: 3/8/12 EC RECOMMENDATION (Check One): ☑ Approve ☐ Not Approve ☐ Approve with Stipulations ☐ Table for Further Review – Review Date: Comments: See comments on signature page.
DIRECTIONS: Individuals who wish to conduct research utilizing MGCCC students or employees must complete this application and email to jason.pugh@mgccc.edu.	

Purpose – This application must be completed and approval granted by the MGCCC Executive Council prior to conducting any research utilizing college students or employees. The purpose of this application is to ensure that the researcher complies with the following conditions:

(1) requires the researcher to summarize the proposed research and provide supporting documentation ensuring that research is performed in compliance with all applicable laws, regulations, and institutional and federal policies regarding human subjects research,

(2) ensures the proposed research has institutional support or will have such support through IRB approval and the endorsement of a qualified research advisor (i.e., faculty member) who assumes responsibility for the project,

(3) provides the applicant with appropriate documentation that the MGCCC Executive Council has reviewed the proposed study.

Principal Investigator (PI) Contact Information – The PI for the purposes of this application is the individual who will personally conduct this research study. Under most circumstances, the PI will be the student researcher.

Name:	Rachel Ryan	Phone:	228.497.7835
Email:	rachel.ryan@mgccc.edu	Fax:	228.497.7778
Address:	PO Box 100	City:	Gautier
		State:	MS
		Zip	39553-0100

Research Advisor (RA) Contact Information – The RA for the purposes of this application is the individual who will personally supervise and oversee this research study. Under most circumstances, the RA will be the faculty member working with the student researcher.

Name:	Dr. Shery Herron	Phone:	601.266.4739
Email:	sherry.herron@usm.edu	Fax:	601.266.6145
Address:	118 College Dr.	City:	Hattiesburg
	Box 5087	State:	MS
		Zip:	39406

Sponsoring Institution or Agency:	University of Southern Mississippi
Sponsoring Academic Division/Department:	Center for Science and Mathematics Education

Has the study obtained IRB approval from sponsoring institution?

☐ Yes, Approve Date _____ If Yes, was Study ☐ Exempt or Expedited (deemed minimal risk to human subjects)

☒ No ☐ Full Board (deemed greater than minimal risk or work with special populations of human subjects)

☐ Not Applicable, Explain:

IRB approval will be submitted to USM; prospectus has been defended and approved by committee members as of 3/2/2012.

I. Title. Provide the title of the research study.

The Effect of Online Discussion Forums on Student Learning and Student Perception of Learning in a Science Course at the Community College Level

II. Research Summary. Provide a brief, non-technical description of the study. Typical summaries are less than 150 words. This summary should readily identify the following:

(a) *Purpose and Rationale.* State research questions and/or hypotheses and tell why the study is needed.

Although theory and research have indicated that the integration and implementation of online discussion forums have been shown to be an effective way to induce higher order thinking and learning at the post-secondary level, little is known about its effective use at the community college level. This study will examine if the integration of online discussion forums into a traditional face-to-face course at the community college level is an effective pedagogical tool. In addition, the overall perception of student learning and satisfaction in relationship to the pedagogical tool will be examined.

(b) *Justification.* Provide a brief justification for the study.

Asynchronous online discussion forums are a popular and powerful instructional tool which is often integrated into online and hybrid/blended courses. A great deal of research exists which proclaims the positive effects of asynchronous online discussion forums on meaningful discourse, developments of critical thinking, and perceptions of student learning and satisfaction. A wealth of information is also available within the research community to assist instructors in the design and implementation of asynchronous online discussions in order to generate the greatest effect. While an abundant amount of research has been conducted, it has focused primarily on students at the undergraduate and graduate level and not among students at the community college level. In this research I seek to determine if and to what extent asynchronous online discussions can be successful in generating meaningful discourse and student satisfaction among community college students. Conclusions drawn from this research may be used in assisting instructors at the community college level which seek to incorporate alternative pedagogical methods into their traditional classrooms courses.

(c) *Procedures and Methods.* Provide a brief summary of research methods and procedures.

At the beginning of the semester, students will be randomly assigned into one of four groups designated as A, B, C, or D. Each of the four student groups will be assigned an approximately equal number of students. Throughout the semester, the students will be assigned to read four scientific articles related to topics within Microbiology. Prior to reading the article, each of the students will be asked to take a pre-test. Each group will then be assigned to one of four follow-up assignments: no reflection, written reflection, small group online discussion, or large group online discussion. Following completion of the follow-up assignments, the students will be asked to take a post-test. The pre-test/post-test data will be utilized to measure student learning. Over the course of the semester each student group will have been assigned to each of the four reflection types once. The level of student satisfaction will be determined through the collaborative learning, social presence, and satisfaction (CLSS) questionnaire. Participants will be asked to take the survey at the end of the semester. The survey includes four sections: general information, satisfaction scale, collaborative learning scale, and social presence scale. Excerpts of the online discussion forums may also be used to verify or demonstrate different levels of student learning and critical or higher-order thinking.

Note: Section III below applies to survey, interview, and other research methods that include direct or indirect contact with human subjects. Researchers using data limited to databases may omit Section III and continue with the Section IV.

III. Participants. Provide a brief, non-technical description of the human subjects of the study. This summary should readily identify the following:
(a) *Participants.* Specify number of participants and their gender, ethnicity, race, and age. Clearly state any inclusion/exclusion criteria as well as identify any select populations such as minors, pregnant women, non-English speaking, remedial, elderly, specific major, etc.
The participants in this study will be drawn from the general population of MSVCC. The sample for this study will consist of Mississippi community college students enrolled in two Microbiology classes at the MGCCC. The estimated number of students in this study will be approximately 50-70 students. The sample will consist of a mixture of males and females attending MGCCC. The sample will also include people from a variety of cultural and ethnic backgrounds, and all participants will be no less than 18 years of age. Therefore, minors are the only class of individuals who will be excluded from the study. All other students enrolled in the courses will be included in order to assure a sample which is representative of the general population.
(b) *Recruitment.* Describe how potential subjects will be made aware of the study and outline any recruitment procedures (email, letters, class announcements, newspaper ads, etc.), including any compensation or incentives.
Recruitment will not be involved in this study. Students will choose their course for the Summer 2012 semester during the open enrollment period. The students will have no foreknowledge that they will be involved in this study because the classes will appear as all other courses on the schedule. On the first day of class, participants will receive an informed consent form from the instructor. Participants that fill out the CCS will be entered in a drawing to win one of two $50 gift certificates.
(c) *Informed Consent.* Identify the process of gaining participant consent. Attach a copy of any consent forms used in the study. Provide any necessary explanation if informed consent is waived or not applicable.
An informed consent form will be used in this study. The finalized informed consent form used in this study will be submitted to MGCCC upon USM IRB approval of the form. Any student(s) that waive or refuse to sign the informed consent will be excluded from the study. Students may withdraw from participation in the study at any point.
(d) *Risks and Deception.* Describe any immediate or long-term risks to participants that may arise from participation in this study (physical, emotional, social, occupational, financial, legal, etc.). Indicate if these risks are greater than those faced in normal life, and provide justification for any deception of participants.
This study will not pose any immediate or long-term risks to participants greater than those faced in normal life.

IV. Procedures and Methods. Provide a brief, non-technical description of the research methods and procedures of the study. This summary should readily identify the following:

(a) *Data Collection.* Describe the data collection procedures and provide any necessary supporting documentation (survey, interview questions, etc.). Explain when and where data will be collected, specifying if class time and/or institution facilities will be used to collect data. If databases will be used specify the exact data needed (file layouts, data elements, etc.), the timeframe, and identify the agency or agencies housing the data. (Note: Researchers using databases should ensure that the necessary data elements are available from the appropriate source.)

At the beginning of the semester, students will be randomly assigned into one of four groups designated as A, B, C, or D. Each of the four student groups will be assigned an approximately equal number of students. Throughout the semester, the students will be assigned to read four scientific articles related to topics within Microbiology. Prior to reading the article, each of the students will be asked to take a pre-test during the face-to-face class time. Each group will then be assigned to one of four follow up assignments: no reflection, written reflection, small group online discussion, or large group online discussion. Students will be provided a list of prompting questions which they may utilize to stimulate their written reflection and/or online discussions. Students will be provided one week of time to complete the follow up assignment outside of the scheduled class time. Following completion of the follow-up assignments, the students will be asked to take a post-test during the face-to-face class time. The pre-test/post-test data will be utilized to measure the level of student learning. Over the course of the semester each student group will have been assigned to each of the four reflection types once. The assigned reading along with the follow up assignment is a graded component of the course and will account for approximately 10 percent of their final grade in the course. The level of student satisfaction will be determined through the collaborative learning, social presence, and satisfaction (CLSS) questionnaire. Participants will be asked to take the survey at the end of the semester upon completing all four of the assigned reading and follow-up assignments. The survey includes four sections: general information, satisfaction scale, collaborative learning scale, and social presence scale. The survey will also include several open-ended questions. Students will be redirected to an external secured website designed to administer surveys (ie. LimeSurvey). In addition, excerpts of the online discussion forums may also be used in a qualitative study designed to verify or demonstrate different levels of student learning and critical or higher-order thinking.

(b) *Personal Identifiers.* Identify any of the following personal identifiers that the study will collect or receive:

☐ No, the study will not use identifiers		
☒ Names	☒ Student ID Numbers (used by school)	☐ Any Account Number
☐ Birthdates	☒ Academic (GPA, major, classification)	☐ Telephone Numbers
☐ Other Dates	☐ Photos (full face or other image)	☐ Fax Numbers
☐ Social Security Numbers	☐ Internet Protocol (IP) Addresses	☒ Other (Explain Below)

Other #1: After participants take the electronic survey, each subject will be assigned a confidential identification number (i.e., token). The token will not carry any identifiable information.
Other #2: Participant's postings in an online discussion forum may also be utilized; however, pseudonyms will be utilized in place of real names.

(c) *Confidentiality and Anonymity.* Describe procedures for maintaining participant confidentiality and/or anonymity.
All survey data will be collected through LimeSurvey. The only individuals with possible access to the information will be the researcher, members of the dissertation committee, and MGCCC's Vice-President of Instruction, Student Services, and Related Technologies. LimeSurvey is a secure application for delivering and retrieving survey data and is password protected. The researcher will take the data from LimeSurvey and enter it into PASW Statistics GradPack 18 software to execute statistical analysis of the raw data.
(d) *Data Security.* Describe procedures for protecting the data from unauthorized use. This should include any security or encryption measures used for the collection, transmission, and storage of any electronic or print data. Researchers using databases should state how the data will be securely transmitted.
The data for this study will be kept confidential. All data will be housed on a password-protected computer in the researcher's possession and will remain there until the results are published.
(e) *Data Sharing.* Explain whether or not the collected data will be shared with other individuals. Specify if identifiable records (at the individual student level) will be shared with anyone other than the immediate researcher or research team. Include any confidentiality measures or data use agreements. External parties may include statisticians, consultants, sponsors, journals, etc.
The information will only be accessible to the researcher and other researchers involved in the study (i.e., dissertation committee), the Vice President of Instruction, Student Services, and Related Technologies. Future publication might result from this study, but identifiable student data will not be shared in any such publication.

MGCCC

Steps for Research Request Approval:

(1) COMPLETE REQUEST FORM – Principal Investigator shall submit the completed research request form and all supporting documentation (surveys, file layouts, interview questions, etc.) electronically to jason.pugh@mgccc.edu at least 60 days prior to the desired date of approval.

(2) VERIFICATION OF REQUEST – Once request is received, the Vice President of Instruction, Student Services, and Related Technologies and his/her designee will review for completeness.

(3) MGCCC ACTION – The Vice President of Instruction, Student Services, and Related Technologies will forward all application materials electronically to the other members of Executive Council. The Executive Council will consider the request for approval and/or recommendation at their earliest convenience.

(4) NOTIFICATION OF PRINCIPAL INVESTIGATOR – The Vice President of Instruction, Student Services, and Related Technologies will notify the principal investigator and provide signed documentation of the Executive Council action.

Signatures

Principal Investigator – I certify that the information in this request is complete and correct. As Principal Investigator, I have the ultimate responsibility for protecting the rights and welfare of human participants, secure conduct of the research, and the ethical performance of the project. I will comply with all applicable federal, state, and local laws regarding the protection of participants in human research.

Rachel A. Ryan 03/8/2012

Signature of Principal Investigator Date

Research Advisor – I certify that the information in this request is complete and correct, and that this proposed research has been approved by the IRB of the sponsoring institution or will be approved before the research is conducted. As Research Advisor, I confirm that the student researcher under my guidance is knowledgeable about the regulations and policies governing research with human subjects, and has sufficient training and experience to conduct the research outlined in this application.

I further agree to regularly meet with the student researcher to monitor his or her progress; and if problems arise, I will become personally available to help the student researcher resolve those problems. As an advisor of this project, I will assure the protection of the rights and welfare of human participants, secure conduct of the research, and the ethical performance of the project. I will comply with all applicable federal, state, and local laws regarding the protection of participants in human research.

MGCCC

Sherry S. Herron

Dr. Sherry Herron 3/8/2012

Signature of Research Advisor Date

Vice President of Instruction, Student Services, and Related Technologies – I acknowledge on behalf of the MGCCC Executive Council that this research has been reviewed and has subsequently received the following recommendation by consensus of the Executive Council membership:

☒ Approved ☐ Tabled for Further Review ☐ Not Approved

☐ Approved with Stipulations:

Must provide a copy of final work to the office of the VP. Researcher may be asked to present results to MGCCC employees.

3/23/12

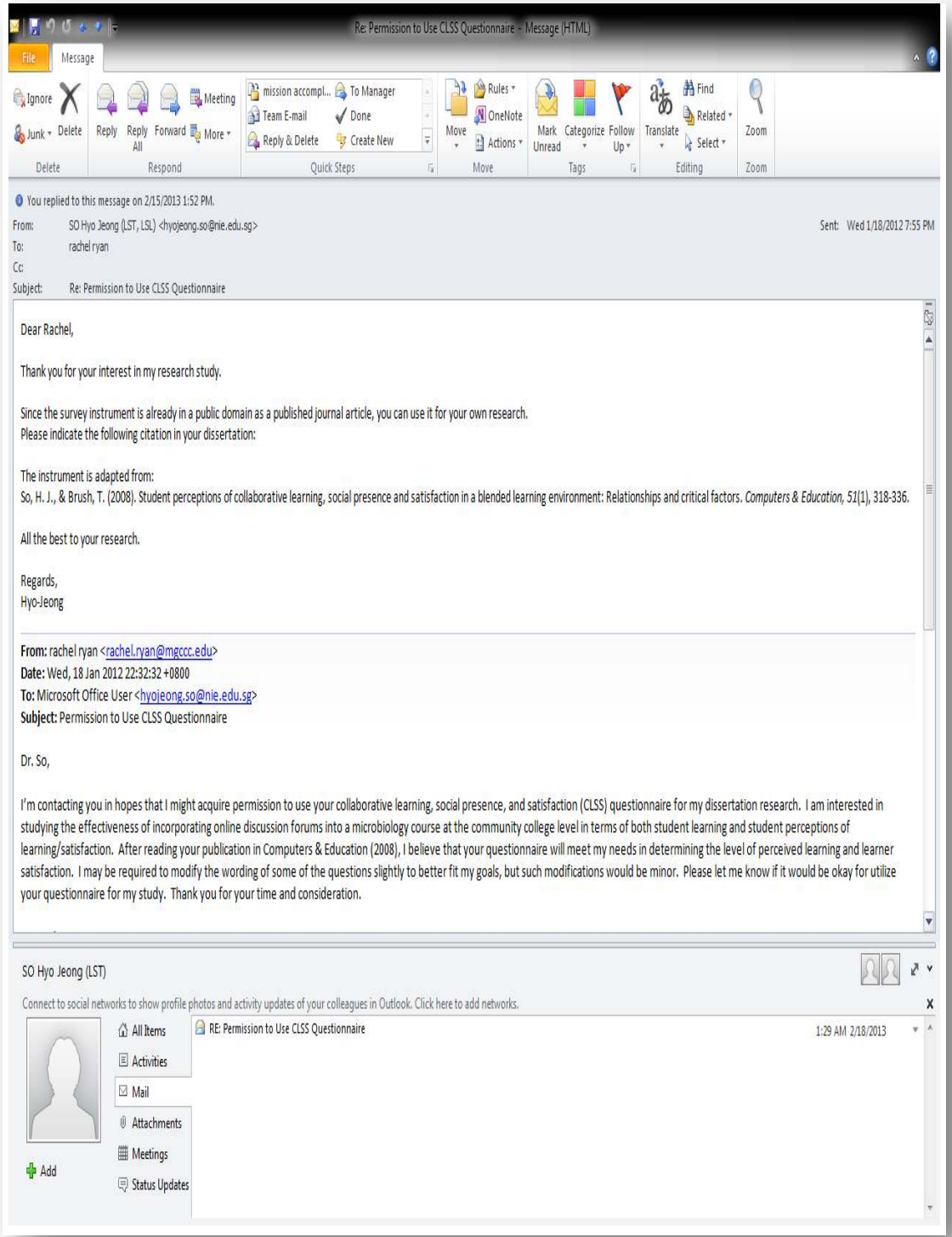
Signature of Vice President of Instruction, Student Services, and Related Technologies Date

INS-ACD-26(A-8/11)

Mississippi Gulf Coast Community College is an Equal Opportunity Employer and welcomes students and employees without regard to race, color, religion, national origin, sex, age or qualified disability. For further information, contact the Equal Opportunity Officer at a Mississippi Gulf Coast Community College Center, Campus, or the District Office. Compliance is coordinated by the Vice President for Administration and Finance, Perkinston Campus, P. O. Box 609, Perkinston, Mississippi 39573, telephone number 601-928-5211.

APPENDIX C

APPROVAL FOR USE OF INSTRUMENT (CLSS)



Re: Permission to Use CLSS Questionnaire - Message (HTML)

File | Message

Ignore | Junk | Delete | Reply | Reply All | Forward | Meeting | More | mission accompl... | Team E-mail | Reply & Delete | To Manager | Done | Create New | Move | Rules | OneNote | Actions | Mark Unread | Categorize | Follow Up | Translate | Find | Related | Select | Zoom

Delete | Respond | Quick Steps | Move | Tags | Editing | Zoom

You replied to this message on 2/15/2013 1:52 PM.

From: SO Hyo Jeong (LST, LSL) <hyojeong.so@nie.edu.sg>
Sent: Wed 1/18/2012 7:55 PM
To: rachel ryan
Cc:
Subject: Re: Permission to Use CLSS Questionnaire

Dear Rachel,

Thank you for your interest in my research study.

Since the survey instrument is already in a public domain as a published journal article, you can use it for your own research.
Please indicate the following citation in your dissertation:

The instrument is adapted from:
So, H. J., & Brush, T. (2008). Student perceptions of collaborative learning, social presence and satisfaction in a blended learning environment: Relationships and critical factors. *Computers & Education, 51*(1), 318-336.

All the best to your research.

Regards,
Hyo-Jeong

From: rachel ryan <rachel.ryan@mgccc.edu>
Date: Wed, 18 Jan 2012 22:32:32 +0800
To: Microsoft Office User <hyojeong.so@nie.edu.sg>
Subject: Permission to Use CLSS Questionnaire

Dr. So,

I'm contacting you in hopes that I might acquire permission to use your collaborative learning, social presence, and satisfaction (CLSS) questionnaire for my dissertation research. I am interested in studying the effectiveness of incorporating online discussion forums into a microbiology course at the community college level in terms of both student learning and student perceptions of learning/satisfaction. After reading your publication in Computers & Education (2008), I believe that your questionnaire will meet my needs in determining the level of perceived learning and learner satisfaction. I may be required to modify the wording of some of the questions slightly to better fit my goals, but such modifications would be minor. Please let me know if it would be okay for utilize your questionnaire for my study. Thank you for your time and consideration.

SO Hyo Jeong (LST)

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RE: Permission to Use CLSS Questionnaire 1:29 AM 2/18/2013

APPENDIX D

PRE-TEST AND POST-TEST FOR ARTICLES 1-4

Pre-test/Post-test for Article 1:

Jones, L. (1999). Science, medicine, and the future genetically modified foods.

British Medical Journal, 318, 581-584.

1. All of the following are ways by which crops have been genetically modified by humans EXCEPT:

    a. cross breeding between species
    b. natural mutations
    c. genetic engineering
    d. artificial selection

2. Genetically modified plants are developed when genes from one species are introduced into the cells of another species using what type of organism as a vector?

    a. Virus
    b. Bacteria
    c. Fungi
    d. Algae

3. A rigorous safety assessment process prevented the introduction of a potentially unsafe genetically modified product. Which product was stopped from mass-production?

    a. Cheese with modified chymosin
    b. Tomato paste from slow softening tomatoes
    c. Soybeans with genes from Brazil nuts
    d. Brewer's and baker's yeast

4. Genetic modification is possible because the genes of all organisms are made of the same chemical. What is that chemical?

    a. RNA
    b. Proteins
    c. Carbohydrates
    d. DNA

5. All of the following are examples of future developments which may result from genetic modification of plants and/or animals EXCEPT:

    a. Crops which are resistant to pests, diseases, and herbicides.
    b. Organisms which express increased concentrations of natural toxins.
    c. Plants which produce large-scale quantities of drugs such as vaccines.
    d. Plants and/or animals which serve as a renewable and sustainable source of new materials such as bioplastics.

6. What nation(s) was the first to lead the world in developing systems for rigorous safety assessment of genetically modified foods?

    a. United States
    b. European Union (EU)
    c. Canada
    d. United Kingdom

7. Which of the following is false? The genetic make-up of any living organism…

    a. changes due to natural mutations.
    b. is static and unchanging.
    c. can be used to create new biological variations.
    d. changes as a result of artificial selection.

8. All of the following are examples of crops which have been genetically modified EXCEPT:

    a. Corn
    b. Soybean
    c. Potatoes
    d. Carrots

9. All of the following are potential drawbacks of genetically modified foods EXCEPT:

    a. Reduced effectiveness of pesticides.
    b. Introduction of genes coding for resistance to clinically useful antibiotics into the environment.
    c. Increased tolerance of plants to environmental factors such as cold, drought, and/or salinity.
    d. Introduction of toxins into the environment which may affect organisms that were not originally targeted.

10. Which government agency regulates genetically modified foods produced and distributed in the United States?

    a. United States Department of Agriculture (USDA)
    b. Environmental Protection Agency (EPA)
    c. Food and Drug Administration (FDA)
    d. All of the above

Pre-test/Post-test for Article 2:

Aiello, A.E., & Larson, E. (2003). Antibacterial cleaning and hygiene products as an emerging risk factor for antibiotic resistance in the community. *The Lancet Infectious Diseases, 3,* 501-506.

1. Which of the following is an antibacterial agent commonly added to many personal hygiene and household disinfecting products?

    a. Ampicillin
    b. Erythromycin
    c. Triclosan
    d. Methicillin

2. Which of the following resistant bacterial species has been associated with an increase in the rate of incidence of disease and death within a community setting?

    a. Methicillin-resistant *Staphylococcus aureus* (MRSA)
    b. Vancomycin-resistant *Enterococcus faecium* (VRE)
    c. Clindamycin-resistant *Clostridium difficile*
    d. Extensively drug-resistant Tuberculosis (XDR TB)

3. Cleaning and hygiene products containing which chemical will disinfect surfaces, but does not contribute to the emergence of antibiotic resistance within a community setting?

    a. Water
    b. Triclosan
    c. Ethanol
    d. Pine-oil

4. Proven risk factors for the emergence of antibiotic resistance within a community setting include all of following EXCEPT:

    a. Misuse and/or overuse of antibiotics
    b. The use of antibiotics in the food industry
    c. Person-to-person transmission in crowded settings or living conditions
    d. The use of antibacterial hygiene and cleaning products

5. All of the following are potential consequences of antibiotic resistance EXCEPT:

    a. Delay in treatment or treatment failure of infections
    b. Reduced recovery period from infection
    c. Alteration of natural microbial ecology
    d. Increased severity of infections

6. The emergence of antibiotic resistance in a community setting has no implications on public health.

    a. True
    b. False

7. Antibiotics are effective in killing bacteria because they

    a. act upon non-specific targets which degrade bacterial cells.
    b. act upon a specific target which interfere with bacterial metabolism.
    c. act upon non-specific targets which inhibit bacterial growth.
    d. all of the above.

8. Triclosan

    a. is a broad-spectrum antibacterial agent with limited effectiveness against viruses and fungi.
    b. acts upon a specific target within bacterial cells in a mode similar to antibiotics commonly used in clinical treatment of infections.
    c. may confer cross-resistance for antibiotics used in clinical treatment of infections within potentially pathogenic bacterial species.
    d. all of the above.

9. Of the following individuals, who is least likely to be colonized by species of bacteria which are resistant to antibiotics?

    a. An individual living in the same household as a healthcare worker exposed to resistant strains.
    b. An individual who is undergoing prolonged antibiotic treatments for health conditions like acne.
    c. A child who has never undergone antibiotic treatment.
    d. An individual who is immunocompromised or ill.

10. Completely omitting the use of all types of antibacterial products (ie. personal hygiene products, cleaning products, antibiotic treatment) is an appropriate response to reducing the occurrence of antibiotic resistance within a community setting.

    a. True
    b. False

Pre-test/Post-test for Article 3:

Walsh, C.T., & Fischback, M.A. (2009). Squashing superbugs – The race for new antibiotics. *Scientific American, 301(1),* 44-51.

1. In 2007, the Center for Disease Control and Prevention reported that more people died from methicillin-resistant *Staphylococcus aureus* (MRSA) than what other disease?

    a. Heart disease
    b. HIV/AIDS
    c. Cancer
    d. Stroke

2. What is the antibiotic commonly used in the treatment of methicillin-resistant *Staphylococcus aureus* (MRSA) infections and often referred to as the "antibiotic of last resort"?

    a. Ampicillin
    b. Vancomycin
    c. Erythromycin
    d. Penicillin

3. Which of the following is a strategy utilized by bacteria to avoid the deadly effects of antibiotics?

    a. Replacing the target of the antibiotic with a structure that does not bind.
    b. Production of enzymes that destroy or modify the antibiotic.
    c. Expression of a pump within the cell membrane which removes the antibiotic from inside the cell.
    d. All of the above.

4. Most antibiotics used in the medical community are naturally produced by bacteria and fungi or are chemically modified derivatives of these natural products.

    a. True
    b. False

5. Methicillin is a derivative of what better-known antibiotic?

    a. Ampicillin
    b. Vancomycin
    c. Penicillin
    d. Amoxicillin

6. The use of improper hand sanitation techniques by hospital staff workers can lead to a reduction in the number of infections associated with antibiotic resistant pathogens.

    a. True
    b. False

7. Which of the following is an example of the mechanisms by which antibiotics kill bacteria?

    a. Block the synthesis of the cell wall.
    b. Inhibit the synthesis of proteins.
    c. Inhibit the synthesis of DNA and RNA precursor synthesis.
    d. All of the above.

8. Genes which code for antibiotic resistance are often contained within circular pieces of DNA called?

    a. Chromosomes
    b. Viruses
    c. Plasmids
    d. Nuclei

9. Bacteria can contain only one antibiotic-resistant gene at any given time.

    a. True
    b. False

10. What type of antibiotic attempts to target the pathogenic bacteria while not harming the normal flora of the patient?

    a. Broad-spectrum
    b. Chemotherapeutic
    c. Narrow-spectrum
    d. None of the above.

Pre-test/Post-test for Article 4:

U.S. Department of Health and Human Services, National Institutes of Health, National Center for Complementary and Alternative Medicine. (2008). *An Introduction to Probiotics.* Retrieved from http://nccam.nih.gov/health/probiotics/D345.pdf

1. Probiotics are

    a. nondigestible food ingredients that stimulate growth of beneficial bacteria.
    b. dead microorganisms which stimulate the immune response.
    c. pathogenic microorganisms which cause illness or disease.
    d. living microorganisms which provide a health benefit to the host.

2. All of the following are examples of foods which contain probiotics EXCEPT:

    a. Yogurt
    b. Milk
    c. Meats
    d. Soy beverages

3. The bacterial species which make up a person's normal flora is the same for all individuals.

    a. True
    b. False

4. Which of the following is an example of how bacteria can benefit human health?

    a. Development of the immune system.
    b. Protection against potentially pathogenic bacteria.
    c. Assisting in digestion and absorption of food and nutrients.
    d. All of the above.

5. The interactions between an individual and the microorganisms which inhabit the body as well as the interactions among the microorganisms are a crucial component to a person's health.

    a. True
    b. False

6. Probiotics and prebiotics act through similar mechanisms to benefit an individual's health.

    a. True
    b. False

7. All of the following are examples of how the use of probiotics may benefit an individual's health EXCEPT:

    a. Prevent and treat infections of the urinary tract.
    b. Shorten the length of an intestinal infection.
    c. Prevent and manage eczema in children.
    d. To reduce recurrence of cervical cancer.

8. Dietary supplements of probiotics are available in

    a. capsules.
    b. tablets.
    c. powders.
    d. all of the above.

9. Most probiotics include bacterial species which are similar to those naturally found in the guts of breastfed infants.

    a. True
    b. False

10. What is the mixing of probiotics and prebiotics called?

    a. mutual biotic
    b. synbiotic
    c. antibiotic
    d. symbiotic

APPENDIX E

INTRODUCTIONS/QUESTIONS FOR ARTICLES

Article 1: Jones, L. (1999). Science, medicine, and the future genetically modified foods. *British Medical Journal, 318,* 581-584.

Research with microorganisms has contributed greatly to advancements in biotechnology. Genetically modified food is one application of biotechnology. However, producing genetically modified foods raises many concerns. These concerns range from the purely scientific to environmental, social, economic, and political.

For this discussion each of you should read the review, “Science, medicine, and the future: Genetically modified foods,” which can be accessed through the content area on D2L for this course. After reading the article discuss the following questions:

- Do you believe that foods and food products containing genetically modified foods should be labeled as such to inform the consumer? Why or why not?
- Would you purchase/consume foods and/or food products containing genetically modified foods? Why or why not?
- Do you believe that consumers within our country are aware of the debate/concerns over the introduction of genetically modified foods? Why or why not?

Article 2: Aiello, A.E., & Larson, E. (2003). Antibacterial cleaning and hygiene products as an emerging risk factor for antibiotic resistance in the community. *The Lancet Infectious Diseases, 3,* 501-506.

The introduction and use of cleaning and hygiene products containing antibacterial components has become common place. It is virtually impossible to purchase cleaning and hygiene products which lack some form of antibacterial chemical. The question remains as to whether the use of antibacterial products is beneficial or harmful. The use of antibacterial products is also problematic in its potential as an emerging risk factor for contributing to antibiotic resistance within the community.

For this discussion each of you should read the article, “Antibacterial cleaning and hygiene products as emerging risk factor for antibiotic resistance in the community,” which can be accessed through the content area on D2L for this course. After reading the article discuss the following questions:

- Do you currently use antibacterial products and will you continue to use antibacterial products? Why or why not?
- Do you believe the “average” consumer has enough understanding of the growth of microorganisms and antibiotic resistance to understand the potential risk factors associated with utilizing antibacterial products? Why or why not?
- Should manufacturers be forced to discontinue adding antibacterial agents to their products? Why or why not?

Article 3: Walsh, C.T., & Fischback, M.A. (2009). Squashing superbugs – The race for new antibiotics. *Scientific American, 301(1),* 44-51.

Antibiotic resistance is a continuous concern within the field of microbiology and human health. The occurrence of microorganisms which have developed resistance to single and/or multiple antibiotics is due to a multitude of

factors including improper use by patients, prescribing antibiotics too frequently, natural evolution of microorganisms, etc. As a result dangerous strains of bacteria are developing which are resistant to existing antibiotics faster than humans can invent or develop new drugs. Many pharmaceutical companies have moved away from the development of new or novel antibiotics due to a loss in potential revenue through the development of antibiotics further compounding the issues of antibiotic resistance.

For this discussion each of you should read the article, “New ways to squash superbugs,” which can be accessed through the content area on D2L for this course. After reading the article discuss the following questions:

- Do you believe that federal institutions like the National Institute of Health (NIH) and National Science Foundation (NSF) should fund research programs attempting to discover/develop new antibiotics? Why or why not?
- Should pharmaceutical companies receive incentives from federal programs to continue the development of new/novel antibiotics? Why or why not?
- Should federal programs be established to educate the general public about the consequences of antibiotic resistance? Why or why not?
- Can you recognize behaviors in your own life which might be contributing to the dilemma of antibiotic resistance? What are those behaviors?

Article 4: U.S. Department of Health and Human Services, National Institutes of Health, National Center for Complementary and Alternative Medicine. (2008). *An Introduction to Probiotics.* Retrieved from http://nccam.nih.gov/health/probiotics/D345.pdf

Many of you have probably seen television advertisements for probiotic diet supplements and foods which claim to “balance” your digestive system through the ingestion of “friendly” bacteria. Interest in probiotics and their effects on human health has been increasing in recent years. In fact, the amount of money spent of probiotic supplements had nearly tripled from 1994 to 2003. While the interest in probiotics has increased, the question remains as to whether consumers truly understand what probiotics are and what their potential benefits are to their overall health and immune systems.

For this discussion each of you should read the pamphlet, “An introduction to probiotics,” which can be accessed through the content area on D2L for this course. After reading the article discuss the following questions:

- Have you ever taken or considered supplementing your diet with probiotics and prebiotics? Why or why not?
- Do you believe that the average consumer has enough understanding about their “normal flora” to fully understand the potential benefits or functions of probiotics and prebiotics? Why or why not?
- Do you believe that probiotics and prebiotics should be monitored and regulated by the FDA? Why or why not?

- Prior to reading this pamphlet, what was your knowledge/understanding of probiotics? Did reading this pamphlet enhance your knowledge? If so, how?

APPENDIX F

GRADING RUBRIC FOR REFLECTIVE POSTING AND ONLINE DISCUSSION RESPONSES

GRADING RUBRIC FOR READING REFLECTION (16 TOTAL POINTS)					
PT	QUANTITY	QUALITY	RELEVANCE	STRUCTURE	
4	Sufficient information provided. Purpose of posting is clearly established.	Posting is reflective of student's opinions. Suggests new perspectives or interpretations AND asks questions to further discussion. Evoked multiple follow-up responses from other students. Demonstrate excellence in grasping key concepts.	Posting replies to all of the questions within the main topic. Sufficient and accurate evidence or examples are provided in support of key points/opinions.	Posting is logically organized. NO spelling, punctuation, or grammatical errors. Meaning of posting is clearly presented.	
3	Slightly too much OR too little information provided. Purpose of posting remains reasonably clear.	Posting is reflective of student's opinions. Suggests new perspectives or interpretations OR asks questions to further discussion. Evoked moderate follow-up responses from other students. Demonstrate grasp of most of the major key concepts.	Posting replies to at least two of the questions within main topic. Accurate evidence or examples are provided in support of key points/opinions.	Posting is adequately organized. Errors in spelling, punctuation, or grammar are minor and do not interfere with the overall meaning of posting.	
2	Too much OR too little information provided. Purpose of posting is occasionally obscured.	Posting is reflective of student's opinions. Repeats others' perspectives or interpretations OR questions to further discussion. Evoked minimal follow-up responses from other students. Demonstrate shallow grasp of understanding key concepts.	Posting replies to at least one of the questions within the main topic. Inaccurate evidence or examples are provided in support of key points/opinions.	Posting contains several problems with organization, spelling, punctuation, and grammar. Meaning of the posting is occasionally obscured.	
1	Too much OR too little information provided. Purpose of posting is not understood.	Posting is restatement of other student's opinions. Provides no new perspectives or interpretations NOR questions to further discussion. Evoked no follow-up responses from other students. Shows no significant understanding of material.	Posting does not reply to any of the questions within the main topic. No evidence or examples are provided in support of key points/opinions.	Posting is poorly organized. Contains serious errors in spelling, punctuation, and grammar. Posting is difficult to read and meaning is completely obscured.	TOTAL
SCORE					

GRADING RUBRIC FOR ONLINE DISCUSSION RESPONSES (9 TOTAL POINTS)				
PT	QUANTITY	QUALITY	RELEVANCE	
3	Student provides 5 or more responses to other students' postings. AND Responses are posted regularly throughout the week on different days.	Provide constructive feedback to student postings. Response is supported by accurate evidence/examples. Provides new perspectives or interpretations AND asks questions to further discussion.	Responses are on the main topic AND the previous postings.	
2	Student provides 3-4 responses to other students' postings. AND/OR Responses are all posted on the same day.	Provides constructive feedback to student postings. Response is supported by inaccurate evidence/examples. Provides new perspectives or interpretations OR asks questions to further discussion.	Responses are on the main topic OR the previous postings.	
1	Student provides 1-2 responses to other students' postings. AND/OR Responses are all posted on the same day.	Feedback to student postings is unconstructive Response lacks support through evidence/examples. Does not provide new perspectives or interpretations NOR asks questions to further discussion.	Responses are not on the main topic NOR the previous postings.	TOTAL
SCORE				

APPENDIX G

THE COLLABORATIVE LEARNING, SOCIAL PRESENCE, AND SATISFACTION (CLSS) QUESTIONNAIRE

Instructions: This questionnaire is designed to measure your perceptions on the level of collaborative learning, social presence, and satisfaction within the online learning environment especially the reflective assignments and online discussions which you have participated in during this course. There is no right or wrong answer for each question. However, it is important for you to respond as accurately and as honestly as possible by checking the most appropriate response.

SECTION 1: General Information

1. What is your gender?

   _____ Male

   _____ Female

2. What is your age?

   _____ 18-25

   _____ 26-35

   _____ 36-45

   _____ Above 45

3. What is your ethnicity?

   _____ Caucasian

   _____ African-American

   _____ Latino

   _____ Asian/Pacific Islander

_____ Other

4. Do you use your own personal computer to participate in computer-related activities/assignments?

   _____ Yes

   _____ No

5. Where did you access the internet for online learning activities?

   _____ Home

   _____ Work

   _____ School

   _____ Public Places

   _____ Other

6. Please estimate your level of computer expertise.

   _____ No experience

   _____ Novice

   _____ Intermediate

   _____ Expert

7. How many courses have you taken which incorporated online activities?

   0 1 2 3 4 5 6 7 8 9 10 more than 10

8. What is your major area of study?

   _____ Biology

   _____ Other science (including Nursing)

   _____ Non-science

9. What is your student enrollment status?

   _____ Part-time

   _____ Full-time

   _____ Not applicable

10. What do you expect will be your final grade for this course?

    _____ A

    _____ B

    _____ C

    _____ D

    _____ F

SECTION 2: STUDENT SATISFACTION

	SD	D	N	A	SA
1. I was able to learn from the online discussions.	1	2	3	4	5
2. I was stimulated to do additional readings or research on topics discussed in online discussions.	1	2	3	4	5
3. Online discussions assisted me in understanding other points of view.	1	2	3	4	5
4. As a result of my experience with this course, I would like to take another hybrid course in the future.	1	2	3	4	5
5. This course was a useful learning experience.	1	2	3	4	5
6. The diversity of topics in this course prompted me to participate in the discussion.	1	2	3	4	5
7. I put in a great deal of effort to learn the computer-mediated communication system to participate in this course.	1	2	3	4	5
8. My level of learning that took place in this course was of the highest quality.	1	2	3	4	5

9. Overall, the learning activities and assignments of this course met my learning expectations.	1	2	3	4	5
10. Overall, the instructor for this course met my learning expectations.	1	2	3	4	5
11. Overall, this course met my learning expectations.	1	2	3	4	5

SECTION 3: COLLABORATIVE LEARNING

	SD	D	N	A	SA
1. Collaborative learning experience in the computer-mediated communication environment is better than in a face-to-face learning environment.	1	2	3	4	5
2. I felt part of a learning community in my group.	1	2	3	4	5
3. I actively exchanged my ideas with group members.	1	2	3	4	5
4. I was able to develop new skills and knowledge from other members in my group.	1	2	3	4	5
5. I was able to develop problem solving skills through peer collaboration.	1	2	3	4	5
6. Collaborative learning in my group was effective.	1	2	3	4	5
7. Collaborative learning in my group was time consuming.	1	2	3	4	5
8. Overall, I am satisfied with my collaborative learning experience in this course.	1	2	3	4	5

SECTION 4: SOCIAL PRESENCE

The following section has been developed to investigate your attitude toward computer-mediated communication (CMC), including email and threaded online discussions. You are to consider your use of CMC as it relates to this

course only. You will be presented with a statement about CMC and then will select the appropriate response listed under each statement. The following descriptions apply to the entire questionnaire:

Email: electronic messaging system that permits communicating

Threaded Online Discussions: computer-based environments in which messages are "posted" and read by users who may or may not be logged on simultaneously. It is required that the users must access the discussion boards to participate.

Please read each statement carefully; then indicate the degree to which you Agree/Disagree with the statement as it relates to CMC, by selecting the appropriate answer.

	SD	D	N	A	SA
1. CMC messages are social forms of communication.	1	2	3	4	5
2. CMC messages convey feeling and emotion.	1	2	3	4	5
3. CMC is private/confidential.	1	2	3	4	5
4. CMC messages are impersonal.	1	2	3	4	5
5. Using CMC is a pleasant way to communicate with others.	1	2	3	4	5
6. The language people use to express themselves in online communication is stimulating.	1	2	3	4	5
7. It is easy to express what I want to communicate through CMC.	1	2	3	4	5
8. The language used to express oneself in online communication is easily understood.	1	2	3	4	5
9. I am comfortable participating, even though I am not familiar with the topics.	1	2	3	4	5
10. CMC is technically reliable (e.g., free of system or software errors that might compromise the reliability of your online messages reaching ONLY the target destination).	1	2	3	4	5

11. CMC allow relationships to be established based upon sharing and exchanging information.	1	2	3	4	5
12. CMC allows me to build more caring social relationships with others.	1	2	3	4	5
13. It is unlikely that someone might obtain personal information about you from the CMC messages.	1	2	3	4	5
14. Where I access CMC (home, office, computer labs, public areas, etc.) does not affect my ability/desire to participate.	1	2	3	4	5
15. CMC permits the building of trust relationships.	1	2	3	4	5
16. The large amounts of CMC messages (numbers of messages and length of messages) do not inhibit my ability to communicate.	1	2	3	4	5
17. It is unlikely that someone else might redirect your messages.	1	2	3	4	5

SECTION 5: OPEN-ENDED QUESTIONS

1.	Which online discussion forum format did you prefer more, the small group or large group? Why?
2.	Do you think the use of the online discussion forums enhanced your ability to relate microbiology to your "everyday life"? Why or why not?
3.	Do you have any other comments?

APPENDIX H

DESCRIPTIVE DATA FROM CLSS FOR THE OVERALL SAMPLE

Subscale 1 – Student Satisfaction

Item	Item Stem	SA + A	N	SD + D
1	I was able to learn from the online discussions.	59.2	29.6	11.2
2	I was stimulated to do additional readings or research on topics discussed in online discussions.	52.0	27.6	20.4
3	Online discussions assisted me in understanding other points of view.	69.4	22.4	8.2
4	As a result of my experience with this course, I would like to take another distance course in the future.	44.9	27.6	27.5
5	This course was a useful learning experience.	68.4	18.4	13.3
6	The diversity of topics in this course prompted me to participate in the discussion.	56.1	27.6	16.3
7	I put in a great deal of effort to learn the computer-mediated communication system to participate in this course.	46.0	30.6	23.5
8	My level of learning that took place in this course was of the highest quality.	51.0	29.6	19.4
9	Overall, the learning activities and assignments of this course met my learning expectations.	60.2	22.4	17.3
10	Overall, the instructor for this course met my learning expectations.	60.3	27.6	12.2
11	Overall, this course met my learning expectations.	56.2	28.6	15.3

Subscale 2 – Collaborative Learning

Item	Item Stem	SA + A	N	SD + D
1	Collaborative learning experience in the computer-mediated communication environment is better than in a face-to-face learning environment.	20.9	16.7	62.5
2	I felt part of a learning community in my group.	45.4	24.0	30.2
3	I actively exchanged my ideas with group members.	67.7	25.0	7.3

4	I was able to develop new skills and knowledge from other members in my group.	46.9	30.2	22.9
5	I was able to develop problem solving skills through peer collaboration.	38.6	30.2	31.3
6	Collaborative learning in my group was effective.	44.8	32.3	22.9
7	Collaborative learning in my group was time consuming.	54.2	24.0	21.9
8	Overall, I am satisfied with my collaborative learning experience in this course.	45.9	32.3	21.9

Subscale 3 – Social Presence

Item	Item Stem	SA + A	N	SD + D
1	CMC messages are social forms of communication.	70.9	24.0	5.2
2	CMC messages convey feeling and emotion.	45.9	25.0	29.2
3	CMC is private/confidential.	30.2	39.6	30.2
4	CMC messages are impersonal.	34.4	43.8	21.9
5	Using CMC is a pleasant way to communicate with others.	47.9	37.5	14.6
6	The language people use to express themselves in online communication is stimulating.	36.5	40.6	22.9
7	It is easy to express what I want to communicate through CMC.	57.3	22.9	19.8
8	The language used to express oneself in online communication is easily understood.	53.1	25.0	21.9
9	I am comfortable participating, even though I am not familiar with the topics.	65.6	21.9	12.5
10	CMC is technically reliable (e.g., free of system or software errors that might compromise the reliability of your online messages reaching ONLY the target destination).	55.2	30.2	14.6
11	CMC allow relationships to be established based upon sharing and exchanging information.	46.9	35.4	17.7
12	CMC allows me to build more caring social relationships with others.	32.3	29.2	38.5
13	It is unlikely that someone might obtain personal information about you from the CMC messages.	39.6	36.5	24.0

14	Where I access CMC (home, office, computer labs, public areas, etc.) does not affect my ability/desire to participate.	78.1	21.9	4.2
15	CMC permits the building of trust relationships.	22.9	45.8	31.3
16	The large amounts of CMC messages (numbers of messages and length of messages) do not inhibit my ability to communicate.	59.4	27.1	13.5
17	It is unlikely that someone else might redirect your messages.	29.2	46.9	24.9

Subscale 1 – Student Satisfaction

Item	Item Stem	N	Mean	SD
1	I was able to learn from the online discussions.	98	3.65	0.96
2	I was stimulated to do additional readings or research on topics discussed in online discussions.	98	3.40	1.00
3	Online discussions assisted me in understanding other points of view.	98	3.82	0.99
4	As a result of my experience with this course, I would like to take another distance course in the future.	98	3.16	1.14
5	This course was a useful learning experience.	98	3.67	1.11
6	The diversity of topics in this course prompted me to participate in the discussion.	98	3.48	1.09
7	I put in a great deal of effort to learn the computer-mediated communication system to participate in this course.	98	3.27	1.00
8	My level of learning that took place in this course was of the highest quality.	98	3.42	1.10
9	Overall, the learning activities and assignments of this course met my learning expectations.	98	3.53	1.09
10	Overall, the instructor for this course met my learning expectations.	98	3.70	1.10
11	Overall, this course met my learning expectations.	98	3.54	1.07

Subscale 2 – Collaborative Learning

Item	Item Stem	N	Mean	SD
1	Collaborative learning experience in the computer-mediated communication environment is better than in a face-to-face learning environment.	96	2.38	1.21
2	I felt part of a learning community in my group.	96	3.15	1.16
3	I actively exchanged my ideas with group members.	96	3.81	0.89
4	I was able to develop new skills and knowledge from other members in my group.	96	3.29	1.10
5	I was able to develop problem solving skills through peer collaboration.	96	3.05	1.21
6	Collaborative learning in my group was effective.	96	3.21	1.11
7	Collaborative learning in my group was time consuming.	96	3.47	1.09
8	Overall, I am satisfied with my collaborative learning experience in this course.	96	3.30	1.13

Subscale 3 – Social Presence

Item	Item Stem	N	Mean	SD
1	CMC messages are social forms of communication.	96	3.80	0.75
2	CMC messages convey feeling and emotion.	96	3.20	1.09
3	CMC is private/confidential.	96	3.00	0.99
4	CMC messages are impersonal.	96	3.17	0.89
5	Using CMC is a pleasant way to communicate with others.	96	3.32	1.00
6	The language people use to express themselves in online communication is stimulating.	96	3.16	0.87
7	It is easy to express what I want to communicate through CMC.	96	3.43	1.03
8	The language used to express oneself in online communication is easily understood.	96	3.31	1.05
9	I am comfortable participating, even though I am not familiar with the topics.	96	3.58	0.96

10	CMC is technically reliable (e.g., free of system or software errors that might compromise the reliability of your online messages reaching ONLY the target destination).	96	3.52	0.98
11	CMC allow relationships to be established based upon sharing and exchanging information.	96	3.31	0.97
12	CMC allows me to build more caring social relationships with others.	96	2.91	1.09
13	It is unlikely that someone might obtain personal information about you from the CMC messages.	96	3.14	0.94
14	Where I access CMC (home, office, computer labs, public areas, etc.) does not affect my ability/desire to participate.	96	3.89	0.69
15	CMC permits the building of trust relationships.	96	2.84	0.90
16	The large amounts of CMC messages (numbers of messages and length of messages) do not inhibit my ability to communicate.	96	3.50	0.89
17	It is unlikely that someone else might redirect your messages.	96	3.04	0.91

APPENDIX I

MULTIPLE REGRESSION ANALYSIS OF CLLS: STUDENT SATISFACTION

Dependent Variable: Student Satisfaction

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.76[a]	0.57	0.47	0.56

a. Predictors: (Constant), Other, Q2_Age, Q7_Courses, Work, Other_Internet, none, novice, F, School, Q9_Enroll_Status, A, Social_Presence, C, expert, Male, Black, D, Collaborative_Learning

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	31.62	18	1.76	5.60	0.000[a]
	Residual	23.86	76	0.31		
	Total	55.48	94			

a. Predictors: (Constant), Other, Q2_Age, Q7_Courses, Work, Other_Internet, none, novice, F, School, Q9_Enroll_Status, A, Social_Presence, C, expert, Male, Black, D, Collaborative_Learning

b. Dependent Variable: Satisfaction

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.07	0.48		2.26	0.027
	Q2_Age	-0.01	0.09	-0.01	-0.10	0.920
	Collaborative_ Learning	0.58	0.12	0.56	4.82	0.000
	Social_Presence	0.14	0.16	0.10	0.85	0.400
	Q7_Courses	0.02	0.02	0.09	1.03	0.305
	expert	0.27	0.19	0.12	1.45	0.153
	novice	0.01	0.26	0.00	0.02	0.981
	none	0.29	0.35	0.07	0.83	0.411
	School	0.79	0.28	0.23	2.83	0.006
	Work	0.35	0.47	0.06	0.74	0.461
	Other_Internet	0.24	0.31	0.07	0.79	0.434
	C	-0.31	0.15	-0.18	-2.05	0.044
	A	0.20	0.16	0.11	1.21	0.230
	D	-0.34	0.40	-0.08	-0.85	0.397
	F	0.50	0.63	0.07	0.79	0.430
	Q9_Enroll_Status	-0.10	0.16	-0.05	-0.62	0.535
	Male	-0.15	0.20	-0.07	-0.76	0.452
	Black	-0.02	0.17	-0.01	-0.13	0.894
	Other	-0.01	0.20	-0.00	-0.05	0.958

a. Dependent Variable: Student Satisfaction

APPENDIX J

MULTIPLE REGRESSION ANALYSIS OF CLLS: COLLABORATIVE LEARNING

Dependent Variable: Collaborative Learning

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.83[a]	0.68	0.61	0.47

a. Predictors: (Constant), Satisfaction, Q2_Age, novice, none, F, Work, Other_Internet, Black, Other, School, Q9_Enroll_Status, A, expert, C, Q7_Courses, Male, D, Social_Presence

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	35.75	18	1.99	8.99	0.000[a]
	Residual	16.78	76	0.22		
	Total	52.53	94			

a. Predictors: (Constant), Satisfaction, Q2_Age, novice, none, F, Work, Other_Internet, Black, Other, School, Q9_Enroll_Status, A, expert, C, Q7_Courses, Male, D, Social_Presence

b. Dependent Variable: Collaborative_Learning

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	T	Sig.
1	(Constant)	-0.53	0.41		-1.30	0.20
	Q2_Age	0.03	0.07	0.03	0.43	0.67
	Social_ Presence	0.62	0.12	0.46	5.43	0.00
	Q7_Courses	0.03	0.02	0.11	1.50	0.14
	expert	-0.08	0.16	-0.04	-0.53	0.60
	novice	-0.20	0.21	-0.07	-0.94	0.35
	none	0.08	0.30	0.02	0.25	0.80
	School	-0.16	0.25	-0.05	-0.63	0.53
	Work	0.45	0.39	0.09	1.17	0.25
	Other_Internet	0.01	0.26	0.00	0.06	0.96
	C	0.16	0.13	0.09	1.26	0.21
	A	-0.20	0.14	-0.11	-1.46	0.15
	D	0.11	0.33	0.03	0.33	0.74
	F	0.16	0.53	0.02	0.30	0.77
	Q9_Enroll_ Status	-0.00	0.14	-0.00	-0.03	0.98
	Male	-0.08	0.17	-0.04	-0.48	0.63
	Black	0.18	0.14	0.10	1.28	0.21
	Other	0.10	0.17	0.04	0.58	0.56
	Satisfaction	0.41	0.08	0.42	4.82	0.00

a. Dependent Variable: Collaborative_Learning

APPENDIX K

MULTIPLE REGRESSION ANALYSIS OF CLLS: SOCIAL PRESENCE

Dependent Variable: Social Presence

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.76[a]	0.57	0.47	0.40

a. Predictors: (Constant), Collaborative_Learning, Q9_Enroll_Status, School, F, none, Other_Internet, Other, Work, novice, Q2_Age, C, expert, Black, Male, Q7_Courses, A, D, Satisfaction

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	16.05	18	0.89	5.60	0.000[a]
	Residual	12.09	76	0.16		
	Total	28.15	94			

a. Predictors: (Constant), Collaborative_Learning, Q9_Enroll_Status, School, F, none, Other_Internet, Other, Work, novice, Q2_Age, C, expert, Black, Male, Q7_Courses, A, D, Satisfaction

b. Dependent Variable: Social_Presence

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	T	Sig.
1	(Constant)	1.79	0.28		6.34	0.00
	Q2_Age	-0.08	0.06	-0.12	-1.39	0.17
	Q7_Courses	0.00	0.02	0.00	0.01	0.99
	expert	-0.12	0.14	-0.07	-0.85	0.40
	novice	0.24	0.18	0.11	1.33	0.19
	none	-0.15	0.25	-0.05	-0.61	0.55
	School	-0.15	0.21	-0.06	-0.72	0.48
	Work	-0.33	0.33	-0.09	-1.00	0.32
	Other_Internet	0.14	0.22	0.05	0.65	0.52
	C	-0.06	0.11	-0.04	-0.49	0.62
	A	0.13	0.12	0.10	1.08	0.28
	D	0.26	0.28	0.09	0.94	0.35
	F	-0.32	0.45	-0.06	-0.71	0.48
	Q9_Enroll_Status	0.10	0.12	0.07	0.89	0.38
	Male	0.13	0.14	0.08	0.95	0.35
	Black	0.13	0.12	0.10	1.06	0.29
	Other	-0.21	0.14	-0.12	-1.50	0.14
	Satisfaction	0.07	0.08	0.10	0.85	0.40
	Collaborative_ Learning	0.45	0.08	0.61	5.43	0.00

a. Dependent Variable: Social_Presence

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