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A Quantitative Study with Online Collaborative Learning in a Computer Literacy Course

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A QUANTITATIVE STUDY WITH ONLINE COLLABORATIVE LEARNING IN A COMPUTER LITERACY COURSE

By

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Abstract

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A Quantitative Study with Online Collaborative Learning in a Computer Literacy Course

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Collaboration, along with critical thinking, communication and creativity, is one of the four C's identified in the Partnership for 21st Century Skills Framework. The word *collaboration* is becoming a common part of many conversations. This study explored which type of learning instruction, collaborative learning in an online environment or individual learning in an online environment, is the most effective in a beginning online computer literacy course. The problem underlying this study was that despite the popularity of collaboration in education, many educators are not properly implementing an environment that encourages and supports effective collaboration.

The purpose of this quantitative study was to determine if proper implementation of an ideal online collaboration environment will increase learning outcomes in a beginning computer literacy course. Two of the nine null hypotheses were rejected. First, $H1_0$ was rejected, indicating there is a statistically significant positive difference in gain scores between students learning collaboratively in an online environment and students learning individually in an online environment. Second, $H5_0$ was rejected, indicating there is a statistically significant difference in gain scores between students with Sensing and Intuition preferences and mean gain scores on the IC^3 Fast Track Assessment, dependent on the type of learning instruction.

For theory, the researcher recommended that future studies should consider male or female differences. Also for theory, the researcher recommends that future studies should include measures of Millennial differences, which would include within-group variation such as family income level, previous access to computer technology, and current access to computer technology outside the classroom.

For practice, the researcher recommended that the university consider increasing the content for the course and increasing the number of credits for the course. Also, the researcher recommended that as a part of the university's orientation, all freshman should complete the MBTI (Form M) personality inventory. Moreover, the researcher recommended that the Business and Technology Department at the university should incorporate additional collaborative learning in its online courses. Finally, the researcher recommended that all freshman take a class to understand the challenges of online collaboration, team dynamics, and team performance.

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Chapter 1

Introduction to the Study

Collaboration, along with critical thinking, communication and creativity, is one of the four C's identified in the Partnership for 21st Century Skills Framework (Partnership for 21st Century Skills, n.d.). The word *collaboration* is becoming a common part of many conversations. All over the world, people are collaborating daily on many different ideas and activities. Collaboration is occurring in the political arena, business world, and educational spaces. Not only is collaboration being used in education, but it is being used to solve some of our society's most challenging issues and problems. Innovation Exchange (IX) is an example of an online collaboration and open innovation marketplace. With IX, individuals from all over the world respond to challenges sponsored by Global 5000 companies and not-for-profit organizations (Innovation Exchange, n.d.).

Educators today, in both face-to-face and online courses, are transitioning from a teacher-centered atmosphere to a more student-centered one. Collaboration is a popular and widely used example of a more student-centered activity. Collaboration encourages both networking and teamwork, and it can help make learning an engaging and challenging activity (McAlpine, 2000). Today's 21st Century classrooms and the learning environment spaces are becoming more flexible, configurable, and collaborative in nature (Clemmons, 2013).

Today's students are classified as digital natives (Prensky, 2001). Because they are comfortable with collaborating and sharing outside the classroom, it seems logical to use collaboration to promote learning and student engagement in education as well. Today's internet provides a remarkable architecture for participation and collaboration in which learners can exchange information and ideas. According to Haley (2012), "The social Web allows users to work together with others of similar interests or common goals to achieve an objective.

Promoting collaboration at all levels of education paves the way for students to create new learning experiences" (p. 110).

Collaborative learning has roots in constructivism and the works of Piaget and Vygotsky (Dillenbourg, Baker, Blaye & O'Malley, 1996). With successful collaborative learning, the group is able to construct new meaning based on a shared framework of the goal and process of the project. As Jonassen, Myers and McKillop (1996) emphasized, "Constructivist processes are considered to be more evident when students collaborate to produce and share representations of their understanding of the world" (p. 94). Both Piaget and Vygotsky (1998) believed the teacher should help guide the collaborative learning process. Bernard, Rojo de Rubalvaca and St-Pierre (2000) indicated that collaboration is best when instructors act as more of a facilitator and a guide rather than a lecturer or expert. This constructivist strategy works well to engage the learners in a collaborative learning environment. Dillenbourg (1999) stated that "Collaborative learning is not one single mechanism: if one talks about 'learning from collaboration,' one should also talk about learning from being alone" (p. 5).

This study explored which type of learning instruction, collaborative learning in an online environment or individual learning in an online environment, is the most effective in a beginning online computer literacy course. This study compared the gain scores between pretest and posttest data of students enrolled in beginning online computer literacy courses, using either collaborative learning in an online environment or individual learning in an online environment. As an additional part of the study, students took the Myers-Briggs Type Indicator (MBTI) assessment to determine their Extraversion-Introversion (E/I), Sensing-Intuition (S/N), Feeling-Thinking (F/T) and their Judging-Perceiving (J/P) preferences. This information was used to determine if there was relationship between a student's personality preferences and his or her ability to learn in an online collaborative environment.

Problem Statement

The problem underlying this study was that despite the popularity of collaboration in education, many educators are not properly implementing an environment that properly encourages and supports effective collaboration. Educators often have good intentions about utilizing online collaboration, but they have not had the proper training. Moreover, they have not taken the proper steps in planning and implementing an ideal online collaborative environment. (See Appendix A and Appendix B.)

To succeed in the workplace, the ability to work well in a group is often a required skill (Chesney, 2003). Group interaction and being able to work together in teams effectively are vital to success in a person's personal and professional life. Students learning in a collaborative environment become aware of the existence of multiple points of view (McAlpine, 2000).

According to Chesney (2003), a problem with collaborative learning is that students are often asked to participate in collaborative learning activities without training or experience on how to do so. Although collaboration is a common practice in education, the following additional questions are raised: Do educators use collaboration because it is an educational buzzword, or is collaboration truly a more effective method to learn? Do students know how to collaborate successfully? If collaboration does not increase learning outcomes, is there a need to collaborate?

Purpose of the Study

The purpose of this quantitative study was to determine if proper implementation of an ideal online collaboration environment (see Appendix A) will increase learning outcomes in a beginning computer literacy course. Determining if there was a relationship in a student's personality preferences (Extravert-Introvert, Sensing-Intuition, Feeling-Thinking and Judging-

Perceiving) and his or her ability to learn in an online collaborative environment are another purpose of this study.

By addressing gaps in the existing literature, at the conclusion of this study, educators will have a better understanding of the effects of collaboration and individual learning in an online computer literacy course. Also, educators will know more about how a student's personality preference relates to her or his ability to learn in an online collaborative environment.

Research Questions

The main research question that guided this study was:

(1) Does the use of online collaborative learning improve student learning outcomes in a beginning computer literacy course at a Rocky Mountain University in the Western United States?

The secondary research questions were:

(2) Is there is a relationship between a student's preferred personality types (Extravert-Introvert (E-I) and mean gain scores on the IC^3 Fast Track Assessment, independent of the type of learning instruction (individual or collaborative)?

(3) Is there a relationship between a student's preferred personality types (Extravert-Introvert (E-I) and mean gain scores on the IC^3 Fast Track Assessment, dependent on the type of learning instruction (individual or collaborative)?

(4) Is there a relationship between a student's preferred personality types (Sensing-Intuition (S-N) and mean gain scores on the IC^3 Fast Track Assessment, independent of the type of learning instruction (individual or collaborative)?

(5) Is there a relationship between a student's preferred personality types (Sensing-Intuition (S-N) and mean gain scores on the IC^3 Fast Track Assessment, dependent on the type of learning instruction (individual or collaborative)?

(6) Is there a relationship between a student's preferred personality types (Feeling-Thinking (F-T) and mean gain scores on the IC^3 Fast Track Assessment, independent of the type of learning instruction (individual or collaborative)?

(7) Is there a relationship between a student's preferred personality types (Feeling-Thinking (F-T) and mean gain scores on the IC^3 Fast Track Assessment, dependent on the type of learning instruction (individual or collaborative)?

(8) Is there a relationship between a student's preferred personality types (Judging-Perceiving (J-P) and mean gain scores on the IC^3 Fast Track Assessment, independent of the type of learning instruction (individual or collaborative)?

(9) Is there a relationship between a student's preferred personality types (Judging-Perceiving (J-P) and mean gain scores on the IC^3 Fast Track Assessment, dependent on the type of learning instruction (individual or collaborative)?

Definition of Terms

The following terms were defined:

Collaborative Learning refers to "Collaboration is the instructional use of small groups or teams where peer interaction plays a key role in learning" (Yazici, 2009, p. 217).

Collaboration refers to "The mutual engagement of participants in a coordinated effort to solve a problem together" (Lai, 2011, p. 2).

Computer Literacy refers to "An awareness component that requires an individual to have knowledge of how computers affect his/her daily life or society as a whole, and a competence that requires an individual to demonstrate a 'hands on' proficiency with a software application" (Mason & McMorrow, 2006, p. 95).

Computer-supported collaborative learning (CSCL) refers to "online networks for facilitating and recording online interactions among two or more individuals who may be geographically and/or temporally dispersed" (Lai, 2011, p.10).

Digital Literacy refers to "the ability to understand and use information in multiple formats from a wide range of sources when it is presented via computers" (Gilster, 1997, p. 5).

IC^3 refers to Internet and Computing and Core Certification. IC^3 is a global certification that is designed to certify an individual's digital literacy skills associated with basic computer and Internet use. The IC^3 consists of three core areas:

- Computing Fundamentals,
- Key Applications, and
- Living Online (*Achieve a New Standard in Digital Literacy*, 2013, para. 7).

Fast Track refers to an IC^3 assessment that provides a quick overview of a student's digital and computer literacy skills. With the Fast Track assessment, the following can be accomplished:

- Assess student computer and digital literacy in a 50-minute performance based test.
- Track individual and school-wide digital literacy with custom reporting.
- Measure student digital literacy against globally recognized Certiport IC^3 standards.
- Provide a path for students to earn additional credit by achieving Certiport IC^3, accepted for credit by American Council on Education (ACE).
- Lay a foundation for addressing accreditation requirements for student digital literacy. (*Achieve a New Standard in Digital Literacy*, 2013)

Myers-Briggs Type Indicator (MBTI) refers to "a self-inventory test designed to identify a person's personality type, strengths and preferences" (Cherry, 2012, para. 1).

Vast refers to an online collaborative learning platform that allows for the assessment of work at both the individual and team level. Because the system is cloud-based, teams may work

on projects from different locations, using both synchronous and asynchronous technologies. By capturing user interactions with the system and offering an advanced set of assessment tools, Vast also provides the means to track and assess higher order thinking skills like creativity and critical thinking (Guzik, 2013).

Limitations

Possible limitations of the study include: (a) participants may not put forth maximum effort on the pretest; (b) pretest may bias posttest; (c) students may not be truthful when answering the MBTI online assessment; and (d) students may withdraw from the course. Due to the sample being drawn from students enrolled in CAPP 100 at a Rocky Mountain University in the Western United States, this study does not truly utilize a random sample and the results may not be generalizable beyond this specific population.

Delimitations

This study was delimited by the following: (a) the study took place during two different semesters (Fall 2013 and Spring 2014), and (b) the study was bounded by students at a Rocky Mountain University in the Western United States enrolled in the CAPP 100 Short Courses (Computer Literacy online courses during the Fall 2013 and Spring 2014 semesters taught by an Associate Professor of Business).

Ethical Assurances

Institutional Review Board (IRB) approval was sought prior to any data collected. Once students had volunteered for the study, they read the consent form and electronically signed the form. (See Appendix C.) The data for these participants were then collected. The course instructor, An Associate Professor of Business, was involved in the data collection process, but the researcher was not. Both the course instructor and the researcher had access to the data. The data were protected by keeping it in a confidential file on the researcher's secure work computer.

Importance of Research

This research was important because computer literacy skills and collaboration skills are necessary skills as students transition from college to the work force. One of the key elements of a 21st Century education is emphasizing learning skills, which includes interpersonal and collaborative skills (Partnership for 21st Century Learning, 2003). Interpersonal and collaborative skills are defined as "Demonstrating teamwork and leadership; adapting to varied roles and responsibilities; working productively with others; exercising empathy; respecting diverse perspectives" (Partnership for 21st Century Learning, 2003, p. 9).

Education is moving toward more online and blended classes. Online learning is a new social process that is beginning to act as a complete substitute for both distance learning and the traditional face-to-face class (Hiltz & Turoff, 2005). With this trend towards Massive Open Online Courses (MOOCs), and online learning, additional research is needed to discover the best way to provide technology to support learning with these models. By researching which method, collaborative learning in an online environment or individual learning in an online environment, produces higher learning outcomes, students, faculty and administration will benefit from this study.

A student's personality preference likely plays a significant role in their ability to enjoy and benefit from collaborating in an online environment. Understanding these personality preferences and determining if there is a relationship between personality preferences and learning in a collaborative online environment will benefit students and educators.

Summary

This quantitative study was designed to investigate if there was a difference in gain scores in beginning computer literacy courses using two different learning methods: collaborative online learning and individual online learning. This study also investigated if there was a relationship between a student's personality preference and his or her ability to learn in an online collaborative environment. The participants in the study were students enrolled in online beginning computer literacy courses at a Rocky Mountain University in the Western United States.

Chapter 2

Review of Literature

The following review of literature summarizes some of the existing research concerning the areas of collaborative learning, computer literacy, and online collaborative learning. The following will be briefly reviewed in this chapter: (a) Definition of Collaborative Learning, (b) Online Collaborative Learning, (c) Advantages of Collaborative Learning and Online Collaborative Online Learning, (d) Disadvantages and Problems with Collaborative Online Learning, (e) Computer and Digital Literacy, and (f) Personality Inventory Assessments.

Definition of Collaborative Learning

One of the major challenges with collaboration is that experts have a difficult time agreeing upon the definition of collaborative learning. According to Yazici (2009), "Collaborative learning is the instructional use of small groups or teams where peer interaction plays a key role in learning" (p. 217). Similarly, Dillenbourg (1999) defines collaborative learning as "a situation in which two or more people learn or attempt to learn something together" (p. 1). Although there are many definitions of collaboration, the three common terms found in most definitions are *people*, *together,* and *learning*. As Dillenbourg (1999) noted, these three terms can be interpreted in different ways. According to Kossuth (2011), collaboration "assumes that there are shared goals that have been defined and there is implicit agreement that sharing and learning together will lead to a consensus on how to maximize the positive outcomes for all involved in the work" (p. 2).

The terms *cooperative learning* and *collaborative learning* have often been confused and used interchangeably. Although there are some similarities between these two terms, cooperative learning and collaborative learning have different meanings. With cooperative learning, each member is often responsible for solving a portion of the problem, often times

independently from the rest of the group. With collaborative learning, the members of the team work interactively together on the same task. Another indication of collaboration is the quality of interactions among the team members (Dillenbourg, 1999).

Online Collaborative Learning

In designing an effective online collaborative learning environment, some of these considerations include:

- What type of assignments and activities will be expected of the collaborative learning groups?
- What is the optimal online group size?
- What training is necessary for the students to maximize the benefit from online collaborative learning?
- How will the collaboration software assist in engaging the students and maximize learning?
- How will the groups be determined?
- Will the collaboration activities enhance the course objectives?
- How will the students learning and interactions be monitored and assessed?

A key for successful collaborative learning experience is that the students need to be properly prepared for online collaboration (Bernard et al., 2000). Many students may have neither prior online collaboration experience nor have been properly trained with collaborating online. Educators should "provide explicit instruction that encourages development of skills such as coordination, communication, conflict resolution, decision-making, problem-solving, and negotiation" (Lai, 2011, p. 2). Providing effective team-building exercises and establishing shared norms aid in the success of building online teams (Goold, Craig, & Coldwell, 2008). According to Willingham (2010), "If we expect students to learn how to become better at working in groups, it's not enough simply to assign group work. We must teach them how to be better group members" (p. 1). Many educators lack the knowledge or feel uncomfortable on how

to properly prepare students for collaborative learning. Thus, educators often choose more traditional instructional methods.

For the online collaborative learning experience to be successful, it is important for the activities to promote deep learning. To accomplish this type of learning for understanding, Rhem (1995) lists four key principles:

- Activities should motivate students to learn;
- Activities should build on a carefully structured integrated knowledge base;
- Learning should include active student involvement; and
- Activities should include interactions among students.

Selecting the correct group size for online collaborative learning is crucial. Brandon and Hollingshed (1999) noted that online collaboration does not work well in large groups. According to Bernard, et al. (2000), there is no magic ideal size for collaborative online groups. The literature review on collaborative online learning does agree that using small groups for online work is best (Johnson, Johnson, & Smith, 2000). Research stresses that groups of three or four are preferred sizes for online collaboration (Johnson et al., 2000). With any number larger than four in online collaboration, there may be time, organizational, and communication constraints. For example, a communication issue that may arise with online communication is that students in large groups may find it difficult to respond to and keep up with the messaging within the group in a timely fashion (Burge, 1994).

There are two main methods to select groups in online collaborative learning. The most common method is students selecting their own groups. The other method is the instructor selects the groups. According to Roberts and McInnerney (2007), group selection tends to be easier in on online environment than in a face-to-face environment. When students select their own groups in a face-to-face class, they often select their friends or individuals they know. Selecting groups at random in an online environment produces fewer difficulties than in a face-

to-face environment (Roberts & McInnerney, 2007). Kagan (1997) indicated that forming heterogeneous groups may be useful due to the different perspectives brought to the group. As (Roberts & McInnerney, 2007) argued, "In many cases, however, a random selection may suffice, and may indeed prove to be as effective as some more contrived method" (p. 259).

Merely selecting students to perform online collaboration activities in groups does not ensure successful collaborative learning. However, Tu (2004) indicated that there are four important issues that must be considered for successful implementation of online collaboration: (a) empowering learners, (b) building communities, (c) continuing support, and (d) being patient. According to Bernard et al. (2000), collaborative learning needs to include the following: (a) sharing the learning task, (b) combining expertise, (c) knowledge and skills to improve the quality of the learning process, and (d) building a learning community. Tu (2004) stated that "The sense of community must be sustained when implementing online collaborative learning" (p. 11). The sense of community is often fragile in an online environment. If learners feel that their opinions, knowledge, and contributions are valued, they are more likely to be engaged and motivated in the online collaborative learning process (Garrison, 2006).

The collaboration software and tools utilized in online collaborative learning should allow for both asynchronous and synchronous communication. Frequently used tools in online collaborative learning include document sharing, screen sharing, social bookmarking, polling software, blogs, wikis, portals, groupware, discussion boards, and instant messaging (Fichter 2005; Raths, 2013).

For the students to have an enjoyable and successful collaborative experience, the collaboration software must function properly and efficiently. Today, most collaboration tools and software use cloud storage and operate through a web based environment. One advantage to using cloud storage is that students do not have to install the software on their computer. Brown

(2012) indicated cloud computing can help facilitate collaboration, and it also allows for computing opportunities anywhere and anytime.

Advantages of Collaborative Learning and Online Collaborative Learning

Lai (2011) indicated that collaboration can have positive effects on student learning, especially for low-achieving students. Collaboration may also enhance motivation because working with others often triggers situational interest and curiosity. Moreover, collaborative learning activities allow students to explain their understanding (Van Boxtel, Van der Linden, & Kanselaar, 2000). This type of self-explanation can help students elaborate and reorganize their knowledge.

According to Dillenbourg (1999), "research has emphasized that when students are actively involved in collaborative activities they tend to learn best and more of what is taught, retain it longer than conventional teaching, appear more satisfied with their classes and improve project quality and performance" (p. 12). Lai (2011) also noted that an advantage of collaborative learning environments is increased levels of critical thinking skills.

There are many advantages that students enjoy in online collaborative learning. As (McAlpine, 2000) stated, one advantage is that students are allowed to work at a time and a place that fits their individual schedules. Students also tend to have greater time for reflection. According to McAlpine (2000), "It encourages both teamwork and networking, and can make learning an immediate, challenging and engaging activity" (p. 67). Although misunderstandings and disagreements can often occur in a collaborative learning environment, these misunderstandings can also aid in the learning process because individuals may have to further explain and justify their position.

Benefits of online collaboration include: (a) teachers can see and respond to what all students are thinking; (b) shy students have a voice; (c) aggressive students are less able to

dominate; (d) slow students are less embarrassed; (e) all students have time to produce good work; (f) better focus on job; (g) work is more efficient; (h) work can be anonymous, and (i) pride of ownership (Klemm, 1997). Brindley and Walti (2009) indicated there are several pedagogical benefits of online collaborative learning, such as: (a) development of critical thinking skills, (b) co-creation of knowledge, and (c) meaning, reflection and transformative learning.

Disadvantages and Problems with Online Collaborative Learning

Although there are many advantages of online collaboration, there are disadvantages as well. According to Kezar (2005), over 50% of collaborations fail. If collaboration is so popular and widely used, why is it that over half of the collaborations fail? One possible reason why collaborations may fail is due to malfunction of the teams (Yazici, 2009).

The malfunction of teams may be the result of several factors. One factor is that many students are not properly trained how to collaborate effectively and they do not understand the potential benefits of collaboration. As Roberts and McInnerney (2007) observed,

> Among the potential benefits which educators should stress to students are the social, psychological, and learning benefits, the much greater chance of being received appreciatively by potential employers, and the fact that much of their future careers will almost certainly involve working in groups with a diverse range of people who will have a wide variety of skills and abilities. (p. 258)

Simply placing students in groups and telling them to collaborate online on an activity or an assignment are not likely to be successful. Educators need to facilitate and foster the group efforts of students and increase the complexity of the activities over time (Teaching & Assessment Network, 1999). Building students' confidence and using scaffolding techniques is very beneficial (Johnson, 2001).

Assessing collaborative learning groups and the assessment of individuals within a group has also created challenges for educators. Effective and appropriate assessment are essential in education. Finding a way to provide fair and appropriate assessment to both the team and to the individual team members can be difficult in a collaborative learning environment. Kagen (1997) indicated that assigning group grades without attempting to distinguish the contributions of individual members is not only unfair but very dangerous. When assessing online collaboration, most educators use one of more of the following: (a) individual assessment, (b) self-assessment, (c) peer assessment, and (d) group assessment techniques (Roberts & McInnerney, 2007).

Another potential problem with online collaboration is the free rider effect (Kerr & Bruun, 1983). With the free rider effect, one or more of the group members do little or no work to contribute to the group, which reduces the potential and effectiveness of the group. Free riders perceive that their efforts are not important to the overall success of the team. If a team has a free rider, the other members of the group must make up for the lack of work and effort of the free rider. Kerr (1983) indicated that the *sucker effect* also can be an issue with collaborative learning. The sucker effect occurs when one or more of the more capable students in the group complete the majority of the work.

According to Capdeferro and Romero (2012), frustration is one of the most mentioned emotions associated with online learning. The following are areas of frustration with online learners and their collaborative learning experiences: (a) team members' lack of shared goals, (b) (b) difficulties related to group organization, (c) the inequities in the level of commitment of team members, (d) the quality of team members' contributions, (e) imbalance between individual and collective grades, and (f) difficulties in communication (Capdeferro and Romero, 2012). Technology issues can also increase a student's level of frustration (Goold, et al., 2008).

Computer Literacy and Digital Literacy

Although the terms *computer literacy* and *digital literacy* are often used interchangeably, they are not the same. According to Nelson, Courier and Joseph (2011), the concept of digital literacy is much broader than computer literacy. Digital literacy represents an umbrella framework for integrating other inter-related sub-disciplines, literacies, and skill-sets such as technology literacy, information literacy, media literacy and visual literacy (Bawden, 2008; Covello, 2010; Martin & Grudziecki, 2007). Computer literacy is often referred to as a sub-discipline of digital literacy (Covello, 2010).

Today's students are technology consumers, and are referred to as digital natives (Prensky, 2001). These students use technology on a daily basis and are comfortable using social media, computers, the Internet, and video games. Because technology is ubiquitous in our society, the need for students to become computer and digital literate is more important than ever. Today's students were born in this digital world, but the need for them to become responsible digital citizens is paramount.

Most high school students are not required to take a computer literacy or digital literacy course. Students entering college are assumed to have the computer and digital literacy skills to perform at a college level, but many do not possess these skills. Digital literacy is one component of being a digital citizen. Promoting digital literacy is an ongoing educational process. Students need to understand how to conduct proper research, cite sources correctly, and to realize that all sources are not equal. With increasing use of online resources for research, students will continue to find it easy to find an answer to a question, but not to understand, analyze, synthesize, and evaluate information for the depth of learning needed to write a research paper. Although there is a wealth of information available, students need to be able to discern between valuable and invaluable information as well as be able to determine what to do with the

information. As Brown (2012) emphasized, "All individuals—students and adults alike—must now understand and embrace what it means to be a digital citizen. Digital citizenship reflects what it means to be an active and productive citizen in a digital world" (p. 89).

To promote and emphasize digital citizenship, the International Society for Technology in Education (ISTE) developed the National Educational Technology Standards (NETS) for students and teachers. Standard #5 for students—Digital Citizenship—states the following:

- Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior;
- Advocate and practice safe, legal, and responsible use of information and technology;
- Exhibit a positive attitude toward using technology that supports collaboration, learning, and productivity;
- Demonstrate personal responsibility for lifelong learning; and
- Exhibit leadership for digital citizenship (International Society for Technology in Education, Digital Citizenship section, n.d.).

Personality Inventory Assessments

Although many personality inventories exist, the Myers-Briggs Type Indicator (MBTI) is one of the most widely used psychological instruments in the world (Cherry, 2012). The MBTI is an assessment of personality based on Carl Jung's theory of types (Pittenger, 1993). The purpose of the MBTI is to make the Jung's theory of psychological types useful and understandable in people's lives (MBTI Basics, 2013). Form M of the MBTI has 93 questions. Based on the answers to the questions on the MBTI, an individual is identified as having one of the 16 different personality types (Cherry, 2012). All personality types are equal and there is no one personality type that is better than any of the others. According to Myers, McCaulley,

Quenk, and Hammer (1998), the MBTI identifies preferences rather than competencies. Table 1 shows four dichotomies of the MBTI (Myers, et al., 1998, p. 6).

Table 1

Four Dichotomies of MBTI

E-I Attitudes or orientations of energy	**Extraversion (E)** Directing energy mainly toward the outer world of people and objects	**Introversion (I)** Directing energy mainly toward the inner world of experiences and ideas
S-N Functions or processes of perception	**Sensing (S)** Focusing mainly on what can be perceived by the five senses.	**Intuition (N)** Focusing mainly on perceiving patters and interrelationships
T-F Functions or processes of judging	**Thinking (T)** Basing conclusions on logical analysis with a focus on objectivity and detachment	**Feeling (F)** Basing conclusions on personal or social values with a focus on understanding and harmony
J-P Attitudes or orientations toward dealing with the outside world	**Judging (J)** Preferring the decisiveness and closure that result from dealing with the outer world using one he the Judging processes	**Perceiving (P)** Preferring the flexibility and spontaneity that results from dealing with the outer world using one of the Perceiving processes

According to Myers et al. (1998), Sensing-Intuition (S/N) and Thinking-Feeling (T-F) reflect basic preferences for use of judgment and perception. In contrast, Extraversion-Introversion (E-I), and Judging-Perceiving (J-P) reflect orientations or attitudes. Meyers et al. (1998) emphasized that "Combinations of the two attitudes of energy (E and I) and the two attitudes toward the outer world (J and P) do more than reflect the presence of the two attitudes specified; they identify particular type dynamics" (p. 37).

Understanding students' personality preferences may help educators understand why some students perform better in an online environment and are successful collaborating in an online environment. Educators need to recognize the different learning preferences and plan for

these differences by providing flexible course designs (Soles & Moller, 2001). A study of student personality types indicated that extraverted students displayed a stronger preference for the ways online courses presented information (Daughenbaugh, Daughenbaugh, Surry, & Islam, 2002). The extraverted students liked the involvement of the threaded discussions, the chat rooms, and e-mail correspondence. However, the introverted students had little participation in the threaded discussions or the chat rooms. This study also found that students who had a perceiving (P) preference expressed stronger preferences for the amount of student interaction than students who had a judging (J) preference (Daughenbaugh et al., 2002).

Chapter three describes the research methods and design that was used to determine which learning method, collaborative online learning or individual online learning, had a greater impact on gain scores with pretest and posttest data in a beginning computer literacy course offered at a Rocky Mountain University in the Western United States. This chapter covers the following sections: (a) Research Design, (b) Sample, (c) Variables and Levels of Data, (d) Hypotheses, (e) Instruments, (f) Statistical Procedures, and (g) *A priori* Assumptions. Lastly, the chapter concludes with a summary.

Chapter 3

Methodology

This chapter describes the research methods and design that was used to determine which learning method, collaborative online learning or individual online learning, had a greater impact on gain scores with pretest and posttest data in a beginning computer literacy course offered at a Rocky Mountain University in the Western United States. Each student also took the MBTI (Form M) online assessment to determine their Extravert-Introvert (E-I), Sensing-Intuition (S-N), Feeling-Thinking (F-T) Judging-Perceiving (J-P) preferences. Data was collected from six online courses. The course was a one-credit Computer Literacy course. Three sections were offered during the Fall 2013 semester and three sections again in the Spring 2014 semester. All six of the sections of this course were taught by the same Associate Professor.

Statistical Procedures

First, a t-test was used to analyze the gain scores between students' learning individually in an online environment and students' learning collaboratively in an online environment. Second, t-tests were used to analyze a student's gain score based on their four MBTI personality preferences: Extravert-Introvert (E-I), Sensing-Intuition (S-N), Feeling-Thinking (F-T) and Judging-Perceiving (J-P), independent of the type of learning instruction (individual or collaborative). Third, Analysis of Covariance (ANCOVA) was used to analyze each student's gain score based on their four MBTI personality preferences: Extravert-Introvert (E-I), Sensing-Intuition (S-N), Feeling-Thinking (F-T) and Judging-Perceiving (J-P), dependent of the type of learning instruction (individual or collaborative).

Research Design

The research design was an experimental pretest-posttest design (Cozby, 2009; Ravid, 2011). An ANCOVA was used to analyze the gain scores between pretest and posttest data.

"The purpose of using the pretest scores as a covariate in ANCOVA with a pretest-posttest design is to (a) reduce the error variance and (b) eliminate systematic bias" ((Dimitrov & Rumrill, 2003, p. 1). A factorial ANCOVA (2 x 2) was used to analyze each student's gain score based on collaborative versus individual learning (factor 1) and their four MBTI personality preferences (factor 2).

During the first week of each course, a pretest, (the IC^3 Fast Track Assessment) was administered. Approximately half of the students were randomly assigned to the treatment group (online collaborative learning) and approximately half of the students were assigned to the control group (online individual learning). For example, if there were 20 students in one of the sections, there will be three groups of three students per group (nine students total), using collaborative learning, and 11 students using individual learning. The randomization was performed using the randomize feature within the VAST software. After students were assigned into the treatment group, VAST was used to randomize those students into separate teams of three students per team. At the end of the course, a posttest (the IC^3 Fast Track Assessment) was administered. The VAST learning system was used to track which students were a part of the collaborative teams of three and which students were working individually. The VAST learning system also tracked and monitored the following:

- Time spent by each student on each activity.
- Number of total log-ins per student.
- Number of ideas each student had submitted.
- Number of comments on ideas posted by other members on the team.

Examples of assignments to show the similarities and differences between the individual and the collaborative groups were provided. (See Appendix D)

Sample

The participants in the study were students enrolled in beginning online computer literacy class. The class is a required course for Business Administration majors, and an elective course for non-Business majors at a Rocky Mountain University in the Western United States. There were 121 total students enrolled in the six online sections, however only 82 students (39 students from the Fall 2013 semester, and 43 students from the Spring 2014 semester) completed the course and whose data were used in this study. There were 39 students in the experimental (online collaborative learning) group and 43 students in the control (online individual learning) group.

Variables and Levels of Data

The independent (treatment) variable was the type of instruction the student receives, either online collaborative learning or online individual learning. This independent variable was a nominal type. The dependent variable was each student's gain score from the two different learning methods: collaborative learning or individual learning. The gain score is the difference between the posttest (IC^3 Fast Track Exam) and the pretest (IC^3 Fast Track Exam). This dependent variable was a ratio type.

A student's MTBI results: (Extraversion-Introversion), (Sensing-Intuition), (Feeling-Thinking) and (Judging-Perceiving) were dependent variables and was a nominal type.

Hypotheses

$H1_0$. There is no statistically significant difference in gain scores between students learning collaboratively in an online environment and students who learning individually in an online environment, in beginning computer literacy courses at a Rocky Mountain University in the Western United States.

$H1_A$. There is a statistically significant positive difference in gain scores between students learning collaboratively in an online environment and students learning individually in an online environment, in beginning computer literacy courses at a Rocky Mountain University in the Western United States.

$H2_0$. There is no statistically significant difference between students with Extravert and Introverts (E and I) preferences and mean gain scores on the IC^3 Fast Track Assessment, independent of the type of learning instruction (individual or collaborative)?

$H2_A$. There is a statistically significant difference between students with Extravert and Introverts (E and I) preferences and mean gain scores on the IC^3 Fast Track Assessment, independent of the type of learning instruction (individual or collaborative)?

$H3_0$. There is no statistically significant difference between a student's preferred personality types (Extravert-Introvert (E-I) and mean gain scores on the IC^3 Fast Track Assessment, dependent on the type of learning instruction (individual or collaborative)?

$H3_A$. There is a statistically significant difference between a student's preferred personality types (Extravert-Introvert (E-I) and mean gain scores on the IC^3 Fast Track Assessment, dependent on the type of learning instruction (individual or collaborative)?

$H4_0$. There is no statistically significant difference between students with Sensing and Intuition (S and N) preferences and mean gain scores on the IC^3 Fast Track Assessment, independent of the type of learning instruction (individual or collaborative)?

$H4_A$. There is a statistically significant difference between students with Sensing and Intuition (S and N) preferences and mean gain scores on the IC^3 Fast Track Assessment, independent of the type of learning instruction (individual or collaborative)?

$H5_0$. There is no statistically significant difference between students with Sensing and Intuition (S and N) preferences and mean gain scores on the IC^3 Fast Track Assessment, dependent on the type of learning instruction (individual or collaborative)?

$H5_A$. There is a statistically significant difference between students with Sensing and Intuition (S and N) preferences and mean gain scores on the IC^3 Fast Track Assessment, dependent on the type of learning instruction (individual or collaborative)?

$H6_0$. There is no statistically significant difference between students with Feeling and Thinking (F and T) preferences and mean gain scores on the IC^3 Fast Track Assessment, independent of the type of learning instruction (individual or collaborative)?

$H6_A$. There is a statistically significant difference between students with Feeling and Thinking (F and T) preferences and mean gain scores on the IC^3 Fast Track Assessment, independent of the type of learning instruction (individual or collaborative)?

$H7_0$. There is no statistically significant difference between students with Feeling and Thinking (F and T) preferences and mean gain scores on the IC^3 Fast Track Assessment, dependent on the type of learning instruction (individual or collaborative)?

$H7_A$. There is a statistically significant difference between students with Feeling and Thinking (F and T) preferences and mean gain scores on the IC^3 Fast Track Assessment, dependent on the type of learning instruction (individual or collaborative)?

$H8_0$. There is no statistically significant difference between students with Judging and Perceiving (J and P) preferences and mean gain scores on the IC^3 Fast Track Assessment, independent of the type of learning instruction (individual or collaborative)?

$H8_A$. There is a statistically significant difference between students with Judging and Perceiving (J and P) preferences and mean gain scores on the IC^3 Fast Track Assessment, independent of the type of learning instruction (individual or collaborative)?

$H9_0$. There is no statistically significant difference between students with Judging and Perceiving (J and P) preferences and mean gain scores on the IC^3 Fast Track Assessment, dependent on the type of learning instruction (individual or collaborative)?

$H9_A$. There is a statistically significant difference between students with Judging and Perceiving (J and P) preferences and mean gain scores on the IC^3 Fast Track Assessment, dependent on the type of learning instruction (individual or collaborative)?

Instruments

The instrument used to measure the learning outcomes in the course is the Internet and Computing Core Certification (IC^3) Fast Track Assessment by Certiport. Certiport delivers nearly 3 million certification exams each year around the world (Certiport About Us, n.d.). According to Certiport (n.d.),

> Certiport prepares individuals with current and relevant digital skills and credentials for the competitive global workforce. These solutions are delivered by more than 12,000 Certiport Authorized Training Centers worldwide and include Certiport Internet and Computing Core Certification (IC^3), the official Microsoft Office certification programs, iCritical Thinking, CompTIA Strata IT Fundamentals, and the Adobe Certified Associate certification program. (p. 1)

Also, Certiport (2003) stated that "The IC^3 is a standards-based certification program for basic computing and Internet literacy. IC^3 provides specific guideline for the knowledge and skills required to be a functional user of computer hardware, software, networks and the Internet" (p. 2).

The IC^3 Fast Track assessment uses several different questioning methods, including the following: (a) multiple choice, (b) multiple response, (c) matching items, and (d) performance based questions. Performance based testing has proven to have a high degree of statistical

reliability and user satisfaction (Certiport, 2003). The IC^3 Fast Track utilizes an appropriate mix of linear and performance-based testing questions. These questions measure an individual's knowledge, skills, and abilities and ensure a high degree of validity, reliability and impartiality (Certiport, 2003). The Donath Group, a leading psychometric and evaluative research consulting organization with over fifty years of highly specialized experience in test construction, measurement, and statistical analysis, guided the IC^3 exam development process (Certiport, 2003). The Donath Group determined that the IC^3 was validated by empirical, theoretical, statistical, and conceptual evidence to ensure it measures an individual's computer literacy skills (Certiport, 2003).

The IC^3 Fast Track assessment utilizes the item construction and selection methods designed, developed, and validated for the IC^3 certification exams (Haber & Stoddard, n.d.). The IC^3 Fast Track aligns with Global Standard 4 (GS4), which is an internationally recognized standard for digital literacy (Define Yourself in a Digital World, n.d.). Global Standard 4 is the most current and relevant digital literacy requirements and addresses several new concepts common to digital literacy, including:

- social media
- collaboration
- research fluency
- digital devices
- critical thinking
- cloud computing (IC^3 GS4, n.d.).

The IC^3 Fast Track is an assessment that provides an overview of an individual's knowledge of computer and digital literacy skills. There are 75 questions on the IC^3 Fast Track assessment, and the students have 50 minutes to complete the assessment. To maintain integrity, the IC^3 Fast Track launches a browser lockdown during the assessment so the students cannot

open or access any other web browser page or launch any software program or application during the assessment.

While each question is loading during the assessment, the time does not count against the 50 minute time limit. Each assessment is unique, pulling from a bank of questions in each category. The assessment allows for students to skip a question, or mark a question for later review. The questions are randomized for each assessment. There are between six to nine questions from each of the following 11 different areas:

- Common Program Functions
- Communicating with Presentation Software
- Communication Networks and the Internet
- Computer Hardware Peripherals and Troubleshooting
- Computer Software
- Electronic Communication and Collaboration
- Spreadsheet Features
- The Impact of Computing and the Internet on Society
- Using an Operating System
- Using the Internet and the World Wide Web
- Word Processing Functions.

The MBTI (Myers-Briggs Type Indicator) Form M online assessment was used to determine each student's Extravert-Introvert (E-I), Sensing-Intuition (S-N), Feeling-Thinking (F-T), and Judging-Perceiving (J-P) preferences. According to the Cpp.com Home Page (2013), the MBTI is the most trusted personality assessment tool available today. Each year as many as 1.5 million assessments are administered annually to individuals, including employees of most Fortune 500 companies (History, Reliability and Validity of the MBTI Instrument, 2013). The MBTI assessment was administered through CPP Inc. and SkillsOne. CPP is the exclusive publisher of the world's most widely used personality assessment, the MBTI. CPP helps

customers integrate powerful assessment products, such as the MBTI instrument, and professional services with key development initiatives for individual employees companies as a whole (Cpp.com Home Page, 2013). SkillsOne is CPP's online assessment site for the MBTI. The students were given the login and password information and directed to the following website to take the MBTI assessment: online.cpp.com. CPP's Research Services was utilized to obtain the MBTI statistical summaries, data analysis and interpretation, and reporting of aggregate data.

Based on results from a wide-ranging, nationally representative sample of 3,009 individuals, each of the four preference scales (E-I, S-N, T-F, J-P) has an internal consistency reliability of .9 or greater (History, Reliability and Validity of the MBTI Instrument, 2013). According to the Myers & Briggs Foundation (n.d.), in terms or reliability, the MBTI instrument meets and exceeds the standards for psychological instruments.

Several studies have shown the validity of the MBTI instrument in three categories: (a) the validity of the four separate preference scales, (b) the validity of the four preference pairs as dichotomies, and (c) the validity of whole types or particular combinations of preferences (Myers Briggs Foundation, n.d.).

A priori Assumptions

Alpha was set at 0.05. The assumption of normality was met by a sufficient sample size. The levels of data were interval (MBTI) and ratio (IC^3 Fast Track Exam).

Summary

Online courses are incorporating collaboration activities to not only enhance learner satisfaction, but also to achieve learning outcomes (Garcia, 2012). Online collaborative learning will better prepare students for the requirements of today's global industries where workers who are often geographically separated are working on common projects (Bernard et al., 2000).

Educators utilizing online collaboration need to consider the learning preferences of students. According to Soles and Moller (2001), the better the match between a student's learning preferences and the environment, resources and methods, the greater the potential for learning achievement to occur.

Chapter four covers three sections. First, the results are presented based on descriptive statistics. Second, the results from these statistics are assessed in the evaluation of results. Third, the chapter concludes with a summary of the results.

Chapter 4

Results

The purpose of this quantitative study was to investigate which learning method, collaborative online learning or individual online learning, would have a greater impact on gain scores with pretest and posttest data in six different sections of a computer literacy course. Three of the sections were offered in the Fall 2013 semester, and three of the sections were offered in the Spring 2014 semester. The same Associate Professor of Business taught all six sections. Data were gathered using a pretest, the IC^3 Fast Track Exam, which each student took at the beginning of the course, and a posttest, the IC^3 Fast Track Exam, which each student took at the conclusion of the course. Each student also took the MBTI (Form M) online assessment to determine their Extrovert-Introvert (E-I), Sensing-Intuition (S-N), Feeling-Thinking (F-T), and Judging-Perceiving (J-P) preferences. This chapter covers three sections. First, the results are presented based on descriptive statistics. Second, the results from these statistics are assessed in the evaluation of results. Finally, the chapter concludes with a summary of the results.

Results

Descriptive statistics. Table 2 shows the descriptive statistics for the pretest and posttest scores for the IC^3 Fast Track Exam.

Table 2

Descriptive Statistics for Pretest and Posttest of IC^3 Fast Track Exam

Instruction	*N*	Pretest Mean	Std. Deviation	Posttest Mean	Std. Deviation
Individual	43	474	122	565	130
Collaborative	39	478	112	614	118

Notes. Total $N = 82$. Levene's Test of Equality of Error Variances on Pretest: $F(.009, .926)$. Levene's Test of Equality of Error Variances on Posttest: $F(.029, .865)$.

Research questions and hypotheses. The first research question was stated: Does the use of online collaborative learning improve student learning outcomes in a beginning computer literacy course? The null hypothesis was stated: There is no statistically significant difference in gain scores between students learning collaboratively in an online environment and students learning individually in an online environment in a beginning computer literacy courses at a Rocky Mountain University in the Western United States. The alternative hypothesis was stated: There is a statistically significant positive difference in gain scores between students learning collaboratively in an online environment and students learning individually in an online environment in a beginning computer literacy course.

Table 3 shows a statistically significant positive difference in gain scores ($p = 0.029$) between students learning collaboratively in an online environment and students learning individually in an online environment in a beginning computer literacy course. Thus, these results indicate that the null hypothesis ($H1_0$) is rejected, indicating there is a statistically significant positive difference in gain scores between students learning collaboratively in an online environment and students learning individually in an online environment.

Table 3

Gain Scores for Individual and Collaborative Groups

Instruction	Mean Gain Score	Standard Deviation	*N*	*t* value	*p* value
Individual	91	89	43	-2.230	.029
Collaborative	136	93	39	-2.230	.029

Notes. Total $N = 82$. Levene's Test of Equality of Error Variances: $F(.002, .963)$.

The second research question was stated: Is there is a relationship between a student's preferred personality types (Extravert-Introvert (E-I)) and mean gain scores on the IC^3 Fast Track Assessment, independent of the type of learning instruction (individual or collaborative)? The null hypothesis was stated: There is no statistically significant difference between students with Extravert and Introvert (E and I) preferences and mean gain scores on the IC^3 Fast Track Assessment, independent of the type of learning instruction (individual or collaborative). The alternative hypothesis was stated: There is a statistically significant difference between students with Extravert and Introvert (E and I) preferences and mean gain scores on the IC^3 Fast Track Assessment, independent of the type of learning instruction (individual or collaborative).

Table 4 shows a non-statistically significant difference in gain scores ($p = 0.285$) between students with Extravert and Introvert (E and I) preferences and mean gain scores on the IC^3 Fast Track Assessment, independent of the type of learning instruction (individual or collaborative). Thus, the null hypothesis ($H2_0$) is failed to reject, indicating there is not a statistically significant difference in gain scores between students with Extravert and Introvert (E and I) preferences and mean gain scores on the IC^3 Fast Track Assessment, independent of the type of learning instruction (individual or collaborative).

Table 4

Gain Scores for Individual and Collaborative with MBTI (Extravert-Introvert)

Instruction	Myers-Briggs Type	Mean Gain Score	Standard Deviation	*N*	*t* value	*p* value
Combined	Extravert	122	97	48	1.077	.285
Combined	Introvert	100	87	34	1.077	.285

Notes. Total *N* = 82. Levene's Test of Equality of Error Variances: F(.006, .938).

The third research question was stated: Is there a relationship between a student's preferred personality types (Extravert-Introvert (E-I) and mean gain scores on the IC^3 Fast Track Assessment, dependent on the type of learning instruction (individual or collaborative)? The null hypothesis was stated: There is no statistically significant difference between students with Extravert and Introvert (E and I) preferences and mean gain scores on the IC^3 Fast Track Assessment, dependent on the type of learning instruction (individual or collaborative). The alternative hypothesis was stated: There is a statistically significant difference between students with Extravert and Introvert (E and I) preferences and mean gain scores on the IC^3 Fast Track Assessment, dependent on the type of learning instruction (individual or collaborative).

Table 5 shows a non-statistically significant difference in gain scores ($p = 0.641$) between students with Extravert and Introvert (E and I) preferences and mean gain scores on the IC^3 Fast Track Assessment, dependent on the type of learning instruction (individual or collaborative). Thus, these results indicate that the null hypothesis ($H3_0$) is failed to reject, indicating there is not a statistically significant difference in gain scores between students with Extravert and Introvert (E and I) preferences and mean gain scores on the IC^3 Fast Track Assessment, dependent on the type of learning instruction (individual or collaborative).

Table 5

ANCOVA for Individual and Collaborative with MBTI (Extravert-Introvert)

Instruction	Myers-Briggs Type	Mean Gain Score	Standard Deviation	*N*	*F* value	*p* value
Individual	Extravert	96	87	23	.219	.641
Individual	Introvert	87	93	20		
Collaborative	Extravert	146	101	25		
Collaborative	Introvert	118	77	14		

Notes. Total $N = 82$. Levene's Test of Equality of Error Variances: $F(.083, .969)$.

The fourth research question was stated: Is there is a relationship between a student's preferred personality types (Sensing-Intuition (S-N)) and mean gain scores on the IC^3 Fast Track Assessment, independent of the type of learning instruction (individual or collaborative)? The null hypothesis was stated: There is no statistically significant difference between students with Sensing and Intuition (S and N) preferences and mean gain scores on the IC^3 Fast Track Assessment, independent of the type of learning instruction (individual or collaborative). The alternative hypothesis was stated: There is a statistically significant difference between students with Sensing and Intuition (S and N) preferences and mean gain scores on the IC^3 Fast Track Assessment, independent of the type of learning instruction (individual or collaborative).

Table 6 shows a non-statistically significant difference in gain scores ($p = 0.277$) between students with Sensing and Intuition (S and N) preferences and mean gain scores on the IC^3 Fast Track Assessment, independent of the type of learning instruction (individual or collaborative). Thus, these results indicate that the null hypothesis ($H4_0$) is failed to reject, indicating there is not a statistically significant difference in gain scores between students with Sensing and Intuition (S and N) preferences and mean gain scores on the IC^3 Fast Track Assessment, independent of the type of learning instruction (individual or collaborative).

Table 6

Gain Scores for Individual and Collaborative with MBTI (Sensing-Intuition)

Instruction	Myers-Briggs Type	Mean Gain Score	Standard Deviation	*N*	*t* value	*p* value
Combined	Sensing	130	89	58	1.095	.277
Combined	Intuition	95	103	24	1.095	.277

Notes. Total $N = 82$. Levene's Test of Equality of Error Variances: $F(.064, .801)$.

The fifth research question was stated: Is there is a relationship between a student's preferred personality types (Sensing-Intuition (S-N) and mean gain scores on the IC^3 Fast Track Assessment, dependent on the type of learning instruction (individual or collaborative)? The null hypothesis was stated: There is no statistically significant difference between students with Sensing and Intuition (S and N) preferences and mean gain scores on the IC^3 Fast Track Assessment, dependent on the type of learning instruction (individual or collaborative). The alternative hypothesis was stated: There is a statistically significant difference between students with Sensing and Intuition (S and N) preferences and mean gain scores on the IC^3 Fast Track Assessment, dependent on the type of learning instruction (individual or collaborative).

Table 7 shows a statistically significant difference in gain scores ($p = 0.011$) between students with Sensing and Intuition (S and N) preferences and mean gain scores on the IC^3 Fast Track Assessment, dependent on the type of learning instruction (individual or collaborative). Thus, these results indicate that the null hypothesis ($H5_0$) is rejected, indicating there is a statistically significant difference in gain scores between students with Sensing and Intuition (S and N) preferences and mean gain scores on the IC^3 Fast Track Assessment, dependent on the type of learning instruction (individual or collaborative).

Table 7

ANCOVA for Individual and Collaborative with MBTI (Sensing-Intuition)

Instruction	Myers-Briggs Type	Mean Gain Score	Standard Deviation	*N*	*F* value	*p* value
Individual	Sensing	114	94	28	6.788	.011
Individual	Intuition	49	62	15		
Collaborative	Sensing	125	85	30		
Collaborative	Intuition	173	113	9		

Notes. Total $N = 82$. Levene's Test of Equality of Error Variances: $F(.352, .788)$.

The sixth research question was stated: Is there is a relationship between a student's preferred personality types (Feeling-Thinking (F-T)) and mean gain scores on the IC^3 Fast Track Assessment, independent of the type of learning instruction (individual or collaborative)? The null hypothesis was stated: There is no statistically significant difference between students with Feeling and Thinking (F and T) preferences and mean gain scores on the IC^3 Fast Track Assessment, independent of the type of learning instruction (individual or collaborative). The alternative hypothesis was stated: There is a statistically significant difference between students with Feeling and Thinking (F and T) preferences and mean gain scores on the IC^3 Fast Track Assessment, independent of the type of learning instruction (individual or collaborative).

Table 8 shows a non-statistically significant difference in gain scores ($p = 0.592$) between students with Feeling and Thinking (F and T) preferences and mean gain scores on the IC^3 Fast Track Assessment, independent of the type of learning instruction (individual or collaborative). Thus, these results indicate that the null hypothesis ($H6_0$) is failed to reject, indicating there is not a statistically significant difference in gain scores between students with Feeling and Thinking (F and T) preferences and mean gain scores on the IC^3 Fast Track Assessment, independent of the type of learning instruction (individual or collaborative).

Table 8

Gain Scores for Individual and Collaborative with MBTI (Feeling-Thinking)

Instruction	Myers-Briggs Type	Mean Gain Score	Standard Deviation	*N*	*t* value	*p* value
Combined	Feeling	117	93	53	.538	.592
Combined	Thinking	105	94	29	.538	.592

Notes. Total $N = 82$. Levene's Test of Equality of Error Variances: $F(.079, .780)$.

The seventh research question was stated: Is there is a relationship between a student's preferred personality types (Feeling-Thinking (F-T) and mean gain scores on the IC^3 Fast Track Assessment, dependent on the type of learning instruction (individual or collaborative)? The null hypothesis was stated: There is no statistically significant difference between students with Feeling and Thinking (F and T) preferences and mean gain scores on the IC^3 Fast Track Assessment, dependent on the type of learning instruction (individual or collaborative). The alternative hypothesis was stated: There is a statistically significant difference between students with Feeling and Thinking (F and T) preferences and mean gain scores on the IC^3 Fast Track Assessment, dependent on the type of learning instruction (individual or collaborative).

Table 9 shows a non-statistically significant difference in gain scores ($p = 0.105$) between students with Feeling and Thinking (F and T) preferences and mean gain scores on the IC^3 Fast Track Assessment, dependent on the type of learning instruction (individual or collaborative). Thus, these results indicate that the null hypothesis ($H7_0$) is failed to reject, indicating there is not a statistically significant difference in gain scores between students with Feeling and Thinking (F and T) preferences and mean gain scores on the IC^3 Fast Track Assessment, dependent on the type of learning instruction (individual or collaborative).

Table 9

ANCOVA for Individual and Collaborative with MBTI (Feeling-Thinking)

Instruction	Myers-Briggs Type	Mean Gain Score	Standard Deviation	*N*	*F* value	*p* value
Individual	Feeling	82	83	26	2.695	.105
Individual	Thinking	106	98	17		
Collaborative	Feeling	150	91	27		
Collaborative	Thinking	105	93	12		

Notes. Total $N = 82$. Levene's Test of Equality of Error Variances: $F(.252, .860)$.

The eighth research question was stated: Is there is a relationship between a student's preferred personality types (Judging-Perceiving (J-P)) and mean gain scores on the IC^3 Fast Track Assessment, independent of the type of learning instruction (individual or collaborative)? The null hypothesis was stated: There is no statistically significant difference between students with Judging and Perceiving (J and P) preferences and mean gain scores on the IC^3 Fast Track Assessment, independent of the type of learning instruction (individual or collaborative). The alternative hypothesis was stated: There is a statistically significant difference between students with Judging and Perceiving (J and P) preferences and mean gain scores on the IC^3 Fast Track Assessment, independent of the type of learning instruction (individual or collaborative).

Table 10 shows a non-statistically significant difference in gain scores ($p = 0.154$) between students with Judging and Perceiving (J and P) preferences and mean gain scores on the IC^3 Fast Track Assessment, independent of the type of learning instruction (individual or collaborative). Thus, these results indicate that the null hypothesis ($H8_0$) is failed to reject, indicating there is not a statistically significant difference in gain scores between students with Judging and Perceiving (J and P) preferences and mean gain scores on the IC^3 Fast Track Assessment, independent of the type of learning instruction (individual or collaborative).

Table 10

Gain Scores for Individual and Collaborative with MBTI (Judging-Perceiving)

Instruction	Myers-Briggs Type	Mean Gain Score	Standard Deviation	*N*	*t* value	*p* value
Combined	Judging	130	90	34	1.439	.154
Combined	Perceiving	100	94	48	1.439	.154

Notes. Total $N = 82$. Levene's Test of Equality of Error Variances: $F(.184, .907)$.

The ninth research question was stated: Is there is a relationship between a student's preferred personality types (Judging-Perceiving (J-P) and mean gain scores on the IC^3 Fast Track Assessment, dependent on the type of learning instruction (individual or collaborative)? The null hypothesis was stated: There is no statistically significant difference between students with Judging and Perceiving (J and P) preferences and mean gain scores on the IC^3 Fast Track Assessment, dependent on the type of learning instruction (individual or collaborative). The alternative hypothesis was stated: There is a statistically significant difference between students with Judging and Perceiving (J and P) preferences and mean gain scores on the IC^3 Fast Track Assessment, dependent on the type of learning instruction (individual or collaborative).

Table 11 shows a non-statistically significant difference in gain scores ($p = 0.144$) between students with Judging and Perceiving (J and P) preferences and mean gain scores on the IC^3 Fast Track Assessment, dependent on the type of learning instruction (individual or collaborative). Thus, these results indicate that the null hypothesis ($H9_0$) is failed to reject, indicating there is not a statistically significant difference in gain scores between students with Judging and Perceiving (J and P) preferences and mean gain scores on the IC^3 Fast Track Assessment, dependent on the type of learning instruction (individual or collaborative).

Table 11

ANCOVA for Individual and Collaborative with MBTI (Judging-Perceiving)

Instruction	Myers-Briggs Type	Mean Gain Score	Standard Deviation	*N*	*F* value	*p* value
Individual	Judging	127	88	15	2.182	.144
Individual	Perceiving	73	85	28		
Collaborative	Judging	133	94	19		
Collaborative	Perceiving	139	94	20		

Notes. Total $N = 82$. Levene's Test of Equality of Error Variances: $F(.182, .144)$.

To summarize, two of the nine null hypotheses were rejected. First, $H1_0$ was rejected, indicating there is a statistically significant positive difference in gain scores between students learning collaboratively in an online environment and students learning individually in an online environment. Second, $H5_0$ was rejected, indicating there is a statistically significant difference in gain scores between students with Sensing and Intuition (S and N) preferences and mean gain scores on the IC^3 Fast Track Assessment, dependent on the type of learning instruction (individual or collaborative).

Evaluations of Results

To evaluate the results, the researcher framed this section based on the following two sources. First, according to Vacha-Haase and Thompson (2004), "For decades, statistical significance has been the norm for evaluating results…. However, the field of psychology appears to be moving in the direction of placing more emphasis on effect sizes [practical significance]" (p. 473). Second, according to Cohen (1988), an effect size of .2 is considered small; an effect size of .5 is considered medium; and an effect size of .8 is considered large. The expected maximum Cohen's *d* can range from -3.0 to 3.0. The effect-size correlation can range from -1.0 to 1.0. The researcher calculated Cohen's *d* based on Becker (2014). Table 12 shows Cohen's *d* and the corresponding effect-size correlations for the two hypotheses that were statistically significant.

Hypothesis 1. For hypothesis one, the results indicated a statistically significant positive difference in gain scores between students learning collaboratively in an online environment and students learning individually in an online environment. Cohen's *d* was 0.4926, which is considered a medium effect. The effect-size correlation was 0.2391.

The researcher compared these findings to those of Tutty and Klein (2008). Their study included 120 undergraduate preservice teachers. The study included homogenous high-ability and homogeneous low-ability groups in a computer-mediated collaborative (CMC) program. Using their means and standard deviations for these two groups, the researcher converted these data to Cohen's *d* and corresponding effect-size correlations following Becker (2014). Tutty and Klein's Cohen's *d* was 0.8105, which is considered a large effect. The effect-size correlation was 0.3756.

Table 12

Cohen's d and Effect-Size Correlation

Hypothesis	Variable	Cohen's *d*	Effect-Size Correlation
1	Individual/Collaborative	0.4926	0.2391
5	Individual-Sensing/Intuition	0.8291	0.3829
	Collaborative-Sensing/Intuition	0.4788	0.2328
	Individual/Collaborative-Sensing	0.1206	0.0602
	Individual/Collaborative-Intuition	1.3650	0.5637

Also, the researcher compared these findings to those of Kolloffel, Eysink and Jong, (2011). Their study included 215 high school students. The study included individual and collaborative groups in face-to-face learning environments. Using their means and standard deviations for these two groups, the researcher converted these data to Cohen's *d* and corresponding effect-size correlations following Becker (2014). Kolloffel, Eysink and Jong's

Cohen's *d* was 0.5768, which is considered a medium effect. The effect-size correlation was 0.2771.

Hypothesis 5. For hypothesis five, the results indicated a statistically significant difference in gain scores between students with Sensing and Intuition (S and N) preferences and mean gain scores on the IC^3 Fast Track Assessment, dependent on the type of learning instruction (individual or collaborative).

For Individual-Sensing/Intuition Cohen's *d* was 0.8291, which is considered a large effect. The effect-size correlation was 0.3829. For Collaborative-Sensing/Intuition Cohen's *d* was 0.4788, which is considered a medium effect. The effect-size correlation was 0.2328. For Individual/Collaborative-Sensing, Cohen's *d* was 0.1206, which is considered a small effect. The effect-size correlation was 0.0602. For Individual/Collaborative-Intuition, Cohen's *d* was 1.3650, which is considered a large effect. The effect-size correlation was 0.5637.

There are no comparable research studies that control for or consider the four MBTI personality types in individual and collaborative learning environments in higher education. Consequently, the researcher compared the differences between Individual/Collaborative-Sensing and Individual/Collaborative-Intuition in this study.

For Individual/Collaborative-Sensing, the effect-size correlation was 0.0602. For Individual/Collaborative-Intuition, the effect-size correlation was 0.5637. The latter effect-size correlation is nearly ten times as large as the former effect-size correlation. Possible explanations for this large difference between these effect sizes include the following reasons.

First, individuals with an Intuition personality type (intuitors) focus mainly on perceiving patterns and interrelationships. Intuitors look at the big picture and understand complexity (Ludford & Terveen, 2003; Myers, et al., 1998). Second, individuals with a Sensing personality type (sensors) focus mainly on what can be perceived by the five senses. Sensors respond best to

facts and react directly to what was said rather than what was implied (Ludford & Terveen, 2003; Myers, et al., 1998).

To summarize, for H1, the indicators of practical significance for Cohen's *d* was 0.4926 and for the effect-size correlation was 0.2391. For H5, the indicators of practical significance were the following. For Individual-Sensing/Intuition Cohen's *d* was 0.8291, which is considered a large effect. The effect-size correlation was 0.3829. For Collaborative-Sensing/Intuition Cohen's *d* was 0.4788, which is considered a medium effect. The effect-size correlation was 0.2328. For Individual/Collaborative-Sensing, Cohen's *d* was 0.1206, which is considered a small effect. The effect-size correlation was 0.0602. For Individual/Collaborative-Intuition, Cohen's *d* was 1.3650, which is considered a large effect. The effect-size correlation was 0.5637.

Summary

In summary, two of the nine null hypotheses were rejected. First, $H1_0$ was rejected, indicating there is a statistically significant positive difference in gain scores between students learning collaboratively in an online environment and students learning individually in an online environment. Second, $H5_0$ was rejected, indicating there is a statistically significant difference in gain scores between students with Sensing and Intuition (S and N) preferences and mean gain scores on the IC^3 Fast Track Assessment, dependent on the type of learning instruction (individual or collaborative).

Also, for H1, the indicators of practical significance for Cohen's *d* was 0.4926 and for the effect-size correlation was 0.2391. For H5, the indicators of practical significance were the following. For Individual-Sensing/Intuition Cohen's *d* was 0.8291, which is considered a large effect. The effect-size correlation was 0.3829. For Collaborative-Sensing/Intuition Cohen's *d* was 0.4788, which is considered a medium effect. The effect-size correlation was 0.2328. For

Individual/Collaborative-Sensing, Cohen's *d* was 0.1206, which is considered a small effect. The effect-size correlation was 0.0602. For Individual/Collaborative-Intuition, Cohen's *d* was 1.3650, which is considered a large effect. The effect-size correlation was 0.5637.

Ludford and Terveen (2003) stated that "We believe that more research is needed to understand how all four MBTI dimensions predict technology use" (p. 7). Similarly, this researcher believes that additional research is required to understand how all four MBTI dimensions influence individual and collaborative learning in online environments, which are the topics for Chapter 5.

Chapter 5

Conclusions and Recommendations

This quantitative study had two purposes. First, it sought to determine if proper implementation of an ideal online collaboration environment (see Appendix A) will increase learning outcomes in a beginning computer literacy course. Second, it sought to see if there was a relationship in a student's personality preferences (Extravert-Introvert, Sensing-Intuition, Feeling-Thinking and Judging-Perceiving) and his or her ability to learn in an online collaborative environment. This chapter provides conclusions and recommendations.

Conclusions

This study investigated nine research questions and nine null hypotheses. Two of the nine null hypotheses were rejected.

Research question one. The first research question was stated: Does the use of online collaborative learning improve student learning outcomes in a beginning computer literacy course at a Rocky Mountain University in the Western United States? The null hypothesis was stated: There is no statistically significant difference in gain scores between students learning collaboratively in an online environment and students learning individually in an online environment in a beginning computer literacy courses at a Rocky Mountain University in the Western United States. The alternative hypothesis was stated: There is a statistically significant positive difference in gain scores between students learning collaboratively in an online environment and students learning individually in an online environment in a beginning computer literacy courses at a Rocky Mountain University in the Western United States.

As Table 3 indicated, there was a statistically significant positive difference in gain scores ($p = 0.029$) between students learning collaboratively in an online environment and students learning individually in an online environment in a beginning computer literacy course

at a Rocky Mountain University in the Western United States. This result suggests that learning collaboratively online results in higher performance than learning individually online in a beginning computer literacy course at a Rocky Mountain University in the Western United States.

Cohen's *d* was 0.4926, which is considered a medium effect. The effect-size correlation was 0.2391. When compared to Tutty and Klein's (2008) effect size correlation (0.3756) and Kolloffel, Eysink, and Jong's (2011) effect size correlation (0.2771), this study had a smaller practical effect size (0.2391). Thus, this study had a practical effect size difference of .14 (.38 - .24) and practical effect size difference of .04 (.28 - .24) in comparison to these other studies.

Research question five. The fifth research question was stated: Is there is a relationship between a student's preferred personality types (Sensing-Intuition (S-N) and mean gain scores on the IC^3 Fast Track Assessment, dependent on the type of learning instruction (individual or collaborative)? The null hypothesis was stated: There is no statistically significant difference between students with Sensing and Intuition (S and N) preferences and mean gain scores on the IC^3 Fast Track Assessment, dependent on the type of learning instruction (individual or collaborative). The alternative hypothesis was stated: There is a statistically significant difference between students with Sensing and Intuition (S and N) preferences and mean gain scores on the IC^3 Fast Track Assessment, dependent on the type of learning instruction (individual or collaborative).

As Table 7 indicated, there was a statistically significant positive difference in gain scores ($p = 0.011$) between students with Sensing and Intuition (S and N) preferences and mean gain scores on the IC^3 Fast Track Assessment, dependent on the type of learning instruction (individual or collaborative). This result suggests that there is a statistically significant difference in gain scores between students with Sensing and Intuition (S and N) preferences and

mean gain scores on the IC^3 Fast Track Assessment, dependent on the type of learning instruction (individual or collaborative).

Because there were no comparable studies that had investigated the relationship between online collaborative learning versus online individual learning and the four MBTI personality preferences, this study compared the effect sizes among Individual-Sensing/Intuition, Collaborative-Sensing/Intuition, Individual/Collaborative-Sensing, and Individual/Collaborative-Intuition.

For Individual-Sensing/Intuition, Cohen's *d* was 0.8291, and the effect-size correlation was 0.3829. For Collaborative-Sensing/Intuition, Cohen's *d* was 0.4788 and the effect-size correlation was 0.2328. For Individual/Collaborative-Sensing, Cohen's *d* was 0.1206, and the effect-size correlation was 0.0602. For Individual/Collaborative-Intuition, Cohen's *d* was 1.3650, and the effect-size correlation was 0.5637.

Because the effect size (0.5637) for Individual/Collaborative-Intuition was nearly 10 times larger than the effect size (0.0602) for Individual/Collaborative-Sensing, the researcher provided these explanations for this large difference. First, individuals with a Sensing personality type (sensors) focus mainly on what can be perceived by the five senses. Sensors respond best to facts and react directly to what was said rather than what was implied (Ludford & Terveen, 2003; Myers, et al., 1998). Second, individuals with an Intuition personality type (intuitors) focus mainly on perceiving patterns and interrelationships. Intuitors look at the big picture and understand complexity (Ludford & Terveen, 2003; Myers, et al., 1998).

Recommendations

The researcher recognizes that the following recommendations are based on a single sample for a single course at a single rural university. Thus, the researcher acknowledges the limitations of the following recommendations.

Internal validity and external validity. This study used an experimental research design where students were randomly assigned to either the experimental group (collaborative online learning) or the control group (individual online learning). Because this study's design was experimental, the case for internal validity (cause and effect) is relatively robust. However, this design only has a single post-test. Consequently, to determine whether the computer and digital literacy knowledge learned holds for the same individual over a period of time, the researcher recommends that future studies should try to measure the effects at multiple points in time.

This study's participants were students that were not randomly selected. The participants were intentionally selected based on course enrollment, which is a purposive sample. Because the students were non-randomly selected, the case for external validity (generalizability) is relatively weak. Consequently, the researcher recommends that future studies should incorporate a stratified random sample. For example, a research study would randomly select from the entire freshman population at a Rocky Mountain University in the Western United States.

Theoretical. There are two theoretical recommendations. First, although this study did not consider male or female differences in online learning, there is evidence that females and males do learn differently. For example, as Sullivan (2011) noted, "There is a considerable body of research that suggest that male and female college students experience the online classroom environment differently…." (p. 805). Thus, the researcher recommends that future studies should consider male or female differences.

Second, although this study did not investigate Millennial (born between 1982-2002), differences in online learning, there is evidence that differences exist among Millennial students. For example, as Lei (2009) noted,

> Within the [Millennial] generation, there are people who indeed grow up with technologies, are proficient in using technologies, and feel confident with technologies, but there are also people who did not start using technology at an early age, do not know much about technology, and are less confident in using technology. We cannot take a simplistic view of this generation and ignore the within-group variation and individuality. (p. 93)

Thus, the researcher recommends that future studies should include measures of this within-group variation such as family income level, previous access to computer technology, and current access to computer technology outside the classroom.

Practical. There are five practical recommendations. First, a Rocky Mountain University in the Western United States, is on the block system and the majority of the courses are block courses. There are four blocks each semester. CAPP 100 is a one-credit online stringer. A stringer class is a course that lasts longer than a block. A student typically takes one four-credit course each block or 16 credits a semester. Students can take stringer courses in addition to their block classes. When this happens, the student's block class usually becomes the main priority and the stringer class typically becomes the secondary priority.

There were a total of 121 students (62 from the Fall 2013 semester, and 59 from the Spring 2014 semester) enrolled in the six online sections. Of these 121 students, 82 students, or about 68%, completed the course. As such, 39 students, or about a third of the students, had a failing grade (less than 60%) on the course assignment exercises, but still remained in the course. Many of these students were not logging into the course learning management system and/or

VAST on a regular basis. The data for these 39 students was not included in this study. Thus, the researcher recommends that this course (CAPP 100) at a Rocky Mountain University in the Western United States should consider increasing the content and number of credits for the course.

Second, it is important for university students to know not only their individual personality type, but also the personality preferences of others, because employers use MBTI to create diverse teams. Thus, the researcher recommends that as a part of orientation at a Rocky Mountain University in the Western United States freshman should complete the MBTI (Form M) personality inventory.

Third, as this study suggested, students who learned online collaboratively outperformed students who learned online individually. Thus, the researcher recommends that the Business and Technology Department at a Rocky Mountain University in the Western United States should incorporate additional collaborative learning in its online courses.

Fourth, for the researcher's CAPP 131: Basic Microsoft Office online course, the researcher should consider shifting the course format from solely individual activities to a balance of individual and collaborative activities. Also, the researcher should consider matching the personality preference of students with the appropriate learning environments (collaborative and individual).

Fifth, a Rocky Mountain University in the Western United States may consider designing and implementing a collaborative learning course. The first part of the course would be face-to-face and the second part would be online. This course content would include understanding the team formation processes. For example, teams go through a four-phase process of forming, storming, norming, and performing (Scholtes, Joiner, & Streibel, 2003). Thus, the researcher recommends that a Rocky Mountain University in the Western United States should require all

freshman take a class to understand the challenges of online collaboration, team dynamics, and team performance. Moreover, the researcher recommends that the university should design collaborative learning workshops for faculty to facilitate collaboration in additional courses. These workshops would increase the opportunities for faculty to become better online educators and designers.

Summary

This study had a practical effect size difference of .14 (.38 - .24) and practical effect size difference of .04 (.28 - .24) in comparison to these other studies. Because the effect size (0.5637) for Individual/Collaborative-Intuition was nearly 10 times larger than the effect size (0.0602) for Individual/Collaborative-Sensing, the researcher provided explanations for this large difference.

For internal validity, the researcher recommended that future studies should try to measure the effects at multiple points in time. For external validity, the researcher recommended that future studies should incorporate a stratified random sample.

For theory, the researcher recommended that future studies should consider male and female differences. Also for theory, the researcher recommends that future studies should include measures of Millennial differences, which would include within-group variation such as family income level, previous access to computer technology, and current access to computer technology outside the classroom.

For practice, the researcher recommended that this course (CAPP 100) at a Rocky Mountain University in the Western United States should consider increasing the content and number of credits for the course. Also, the researcher recommended that as a part of orientation at the university freshman should complete the MBTI (Form M) personality inventory. Moreover, the researcher recommended that the Business and Technology Department at the

university should incorporate additional collaborative learning in its online courses. The researcher recommended that the university should require all freshman take a class to understand the challenges of online collaboration, team dynamics, and team performance. Additionally, for the researcher's CAPP 131: Basic Microsoft Office online course, the researcher should consider shifting the course format from solely individual activities to a balance of individual and collaborative activities. Finally, the researcher recommended that the university should design a collaborative learning workshop for faculty.

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Appendix A

Ideal Online Collaboration Environment- Based on research and best practices.

1) Clear instructions provided (Lai, 2011)
    a. Step by step due dates
    b. Explain to students the nature of the proposed activities
    c. Objectives explained in detail
2) Student accountability and responsibility (Roberts & McInnerney, 2007)
    a. Require students to comment on other students work
    b. Effective assessment within the team (Peer assessment, self-assessment)*
    c. Instructor assessment of individual contribution to the team project
3) Framework established for mediating collaboration (Goold, Craig, & Coldwell, 2008)
    a. Students understand roles and responsibilities.
    b. Building more complex team activities
    c. Technology tools and software is used effectively to manage and assist in the team process
4) Instructor facilitated (Tu, 2004)
    a. Learners allowed to demonstrate their independence (Instructor requires individual work submission in addition to team submission)
    b. Weekly synchronous team meetings with instructor**
    c. Teams can request intervention from instructor

Notes: * According to an Associate Professor of Business, research indicates that peer assessment and self-assessment is relatively ineffective, which is why this item was not followed.

**** This item was an option given to all members of the collaborative groups but was not taken advantage by any student.

Appendix B

Ideal Online Collaboration Environment Checklist (to be completed by both Researcher & Instructor)

Project/Assignment: _____ Date: _____

Criteria	YES	NO	EVIDENCE & COMMENTS
1a			
1b			
1c			
2a			
2b			
3a			
3b			
3c			
4a			
4b			

Appendix C

Informed Consent Form

Title of Project:	A Quantitative Study with Online Collaborative Learning in a Computer Literacy Course
Project Directors:	Kevin Engellant Instructor of Business A Rocky Mountain University in the Western United States Associate Professor of Business A Rocky Mountain University in the Western United States
Purpose:	The purpose of this study is to investigate which learning method, collaborative online learning or individual online learning, is more effective within CAPP 100.
Procedures:	As part of the course, you will be asked to complete the Myers-Briggs Type Indicator assessment, a pre & posttest, and complete required course assignments and projects. If you agree to participate in this research project, your responses will be analyzed and reported as research data. If you do not agree, you will still need to meet the course assignment requirements as posted in the syllabus.
Risks/Discomforts:	None
Benefits:	Your help with this study will assist educators in determining which method, collaborative learning in an online environment or individual learning in an online environment, produces higher learning outcomes in online computer literacy courses.
Confidentiality:	Only the project directors will have access to the data, and your signed consent form will be kept separate from the data. If results are written in a professional journal or presented at a professional conference, your name will not be used.
Voluntary Participation:	Your decision to take part in this project is entirely voluntary. You may refuse to take part in the project or withdraw from the project at any time without penalty and without loss to benefits to which you are normally entitled.

Questions: If you have any questions about the project now or during the project, contact the project director (names above). If you have questions regarding your rights as a project participant, you may contact Anneliese Ripley, Dean of Outreach and Research, The University of Montana-Western (406) 683-7537.

Liability Statement: In the event that you are injured as a result of this project, you should individually seek appropriate medical treatment. If the injury is caused by the negligence of the University or any of its employees, you may be entitled to reimbursement or compensation pursuant to the Comprehensive State Insurance Plan established by the Department of Administration under the authority of M.C.A., Title 2, Chapter 9. In the event of a claim for such injury, further information may be obtained from the University's Claims Representative or University's Legal Counsel.

Statement of Consent: I have read the above description of this project. I have been informed of the risks and benefits involved, and all my questions have been answered to my satisfaction. Furthermore, I have been assured that any future questions I may have will also be answered by The Project Director or The Dean of Outreach and Research. I volunteer to take part in this project and I understand that I will receive a copy of the informed consent form.

NOTE: I AM AWARE that electronic submission of this form constitutes my signature and I agree to take part in the study.

 I agree to participate in the study.

 I do not agree to participate in study.

Appendix D

CAPP 100 Example Assignments

Global Assignment	Individual	Collaborative
Create a two paragraph Word Document on the topic of saving energy in the home.	**Assignment #1:** Many are now looking at ways to save money and do what they can to help save the planet. One of these ways is by starting at home and changing some habits there. You will now create a list of items you can do at home to help save energy as well as reduce any more contributing damage to the planet. After writing an opening paragraph explaining the purpose of this report, include example points such as: • Turn off any computer equipment if not in use. • Use energy saving light bulbs wherever possible. **For this assignment, complete the following steps:** 1. Brainstorm a list of item ideas at home to help save energy (minimum of 15 ideas). 2. Review and comment on your master list.	**Assignment #1:** Many are now looking at ways to save money and do what they can to help save the planet. One of these ways is by starting at home and changing some habits there. You will now create a list of items you can do at home to help save energy as well as reduce any more contributing damage to the planet. After writing an opening paragraph explaining the purpose of this report, include example points such as: • Turn off any computer equipment if not in use. • Use energy saving light bulbs wherever possible. **As a team, complete the following steps:** 1. Brainstorm a list of item ideas at home to help save energy (minimum of 5 ideas should be submitted by each team member). You will only be able to view other team member's ideas after you have submitted your 5 ideas. **(DUE: OCTOBER 22, 11:59 pm)** (Criterion met: 1a) 2. Review and comment on master list. Each team member must submit 5 comments. (**DUE: OCTOBER 23, 11:59 pm)**

	3. Rank your top 5 ideas in order: 1-best idea, 2-next best idea, etc. Based on your top 5 ideas, create a one-page report with an introductory paragraph and a description on your ideas. Be sure to consider the following: effectiveness, public acceptance, cost, impact, etc. (**DUE: OCTOBER 27, 11:59 pm)**	3. As individuals rank your top 5 ideas in order: 1-best idea, 2-next best idea, etc. **(DUE: OCTOBER 24, 11:59 pm)** 4. Based on your top 5 ideas, as a team collaboratively create a one-page report with an introductory paragraph and a description on your ideas. Be sure to consider the following: effectiveness, public acceptance, cost, impact, etc. You can use the chat feature and the notes section to help your team communicate. **(DUE: OCTOBER 27, 11:59 pm)** 5. Each team member must make at least 2 contributions to content and 2 comments on the draft before submitting. **(DUE: OCTOBER 27, 11:59 pm)**
Create a 10 slide PowerPoint Presentation describing ethics and how it applies to the use of computers.	**Assignment #2:** Create a PowerPoint presentation describing ethics and how it applies to the use of computers. You will need to complete research on the topic of professional ethics as it applies to computers/technology to provide information for your presentation. Below are the requirements for the PowerPoint. **Complete the following steps:** 1. Brainstorm a list of 15 ideas about ethics and how it applies to the use of computers. 2. Review and comment on your master list of ideas. 3. Rank your top 10 ideas in order: 1-best idea, 2-next best idea, etc.	**Assignment #2:** As a team create a PowerPoint presentation describing ethics and how it applies to the use of computers. Your team will need to complete research on the topic of professional ethics as it applies to computers/technology to provide information for your presentation. Below are the requirements for the PowerPoint. **As a team complete the following steps:** 1. Brainstorm a list of ideas about ethics and how it applies to the use of computers (minimum of 5 slide ideas for each team member). You will only be able to view other team member's ideas after you have submitted your 5 ideas. (**DUE: DECEMBER 10, 11:59 pm)** 2. Review and comment on master list. Each team member must submit 5 comments. **(DUE: DECEMBER 11, 11:59 pm)** 3. As individuals rank your top 10 ideas in order: 1-best idea, 2-next best idea, etc. **(DUE: DECEMBER 12, 11:59 pm)**

	4. Based on your top 10 slide ideas, create a PowerPoint presentation using the DropBox feature. **(DUE: DECEMBER 15, 11:59 pm)** **PowerPoint Requirements** • 10 slides (not including the title and works cited slides) • Include graphics that enhance the understanding of the presentation (minimum of 5 images, photos, etc.) • Choose an effective theme or background • Include one hyperlink that links to a website that discusses the topic of the ethics • Bulleted list • One graph • Include speaker notes for the slides where it is appropriate. A minimum of 4 slides need speaker notes.	4. Based on your top 10 slide ideas, as a team, collaboratively create a PowerPoint presentation using the DropBox feature. You can use the chat feature and the notes section to help your team communicate. . **(DUE: DECEMBER 15, 11:59 pm)** 5. Each team member must make at least 3 contributions (see requirements below: slide content, layout, background, order, etc.) and 2 comments on the presentation before submitting. (**DUE: DECEMBER 15, 11:59 pm)** **PowerPoint Requirements** • 10 slides (not including the title and works cited slides) • Include graphics that enhance the understanding of the presentation (minimum of 5 images, photos, etc.) • Choose an effective theme or background • Include one hyperlink that links to a website that discusses the topic of the ethics • Bulleted list • One graph • Include speaker notes for the slides where it is appropriate. A minimum of 4 slides need speaker notes.