2017

Postsecondary Instructor Attitudes Toward Tablet Use for Collaboration and Critical Thinking Development

Jerry Hubbard
Walden University

Walden University

College of Education

This is to certify that the doctoral dissertation by

Jerry Hubbard

has been found to be complete and satisfactory in all respects,
and that any and all revisions required by
the review committee have been made.

Review Committee
Dr. Christine Sorensen, Committee Chairperson, Education Faculty
Dr. Kay Persichitte, Committee Member, Education Faculty
Dr. Wellesley Foshay, University Reviewer, Education Faculty

Chief Academic Officer
Eric Riedel, Ph.D.

Walden University
2017

Abstract

Postsecondary Instructor Attitudes Toward Tablet Use for Collaboration and Critical Thinking Development

by

Jerry D. Hubbard

MS, University of Maryland, University College, 2009

BA, Southeastern University, 1990

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Education Technology

Walden University

September 2017

Abstract

Although research has identified critical thinking (CT) as an objective of higher education, limited quantitative research has focused on how postsecondary instructors view using handheld devices for classroom collaboration to support CT. There are studies examining how the use of tablet technologies influence collaborative learning (CL), showing a link between CL and CT, and connecting CT to academic achievement. However, understanding how instructors perceive the intersection of these factors has not been well studied. Applying Vygotsky's social cognitive theory as a foundation of CL, using adapted questions from two questionnaires (Technology Acceptance Model and Cooperative Learning Implementation) and two frameworks, this quantitative survey study examined the relationship between tablet application and implementation of CL, and then between CL implementation and the development of CT dispositions (CTD). An email with a link to the survey was sent to a population of 1,932 instructors in a professional education technology organization. From a sample of 59, the key findings indicated instructors accepted the use and usefulness of tablets in the classroom, and used applications for completing collaborative tasks. The Pearson's product moment correlations between tablets and CL, acceptance and implementation appear to be affected by instructor's professional views and teaching practices. Perceptions about the development of CTD were positive with limitations of statistical significance. Results of this study may provide insights into using tablets in effective ways to enhance learning outcomes as one social benefit. Improving the CT of students may support developing citizens who contribute to communities and society in positive ways as lifelong learners.

Postsecondary Instructor Attitudes Toward Tablet Use for Collaboration and Critical Thinking Development

by

Jerry D. Hubbard

MS, University of Maryland, University College, 2009

BA, Southeastern University, 1990

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Education Technology

Walden University

September 2017

Dedication

This dissertation is dedicated to the men and women of the Armed Forces that give their time, effort, talent and lives to defend our nation. The selfless service of the veteran and their families ensure we have the opportunity to be lifelong learners and community contributors. Thank you for all you do!

Acknowledgments

I want to acknowledge the people that have helped me complete this dissertation. Robin, thank you for your tireless support during long hours and your patience during frustrating days as I learned to be a professional researcher. Christian, I appreciate your questions about my progress and understanding as I wrote during our limited time together.

Walden Faculty, thank you for your guidance and direction throughout this process. Specifically, Dr. Christine Sorensen, Dr. Persichitte, and Dr. Foshay, your mentoring and patience during the dissertation has helped me to develop new knowledge and grow as a scholar practitioner.

Table of Contents

List of Tables

List of Figures

Chapter 1: Introduction to the Study

The use of instructional technology in higher education continues to elicit opposing views of how technology can encourage student development or improve learning. In this study, I investigated the attitudes and opinions of postsecondary instructors concerning the use of tablet technologies to facilitate group collaboration on influencing critical thinking development in college coursework. Collaborative or cooperative learning has been shown to enhance critical thinking (Gokhale, 1995; Kim, Sharma, Land, & Furlong, 2013), which supports the cognitive thinking skills identified as desired attributes for college success and career readiness (Lombardi, Conley, Seburn, & Downs, 2013). Encouraging students to engage in cooperative learning supported by technology offers an opportunity to apply peer learning in student centered coursework where students can foster the critical thinking dispositions necessary for a successful academic experience and career success.

Background

According to Facione (1991), critical thinking is a "purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation, and inference, as well as explanation of the evidential, conceptual, methodological, criteriological, or contextual considerations upon which that judgment is based" (p. 2). The application of critical thinking is a desired characteristic in postsecondary students and in the creation of habits of mind necessary for academic and professional success (Hart Research Associates, 2015). Critical thinking produces characteristics that prepare students to become lifelong learners ready to analyze and evaluate information to resolve problems (Kirschner &

Erkens, 2006; Krathwohl, 2002; Mendenhall & Johnson, 2010). Although critical thinking is a desired characteristic of learners, indications are students are entering college without these cognitive skills.

Conley (2007) recommended measuring student preparedness for college by the number of students taking remedial courses. A longitudinal study from 2004 to 2010 reported more than 16% of all students entering a four or two-year institution completed a remedial course in reading, writing, or mathematics. However, in two-year colleges alone, 38.7% of students completed remedial coursework in mathematics (Chen, Wu, & Tasoff, 2010). These skills are necessary as a foundation to assist students to develop the "problem formulation, research, interpretation, communication, and precision/accuracy [that] comprise the cognitive thinking skills associated with college and career readiness" (Lombardi et al., 2013, p. 168). Students in general do not come to postsecondary education with strong critical thinking skills expected by educators in higher education (Conley & Darling-Hammond, 2013).

Researchers have recently questioned the ability of students to think critically in higher education following the application of the No Child Left Behind education policy (Maleyko & Gawlik, 2011; Trolian & Fouts, 2011). Researchers have indicated that the "college-prep curriculum does not ensure the development of critical thinking" (National Center for Public Policy and Higher Education [NCPCHE], 2010, p. 4). The student's preparation for higher order thinking is restricted by poorly expressed academic expectations, broad government education policies, and limited precollege assessments to train students for their first-year of college (NCPCHE, 2010). One approach to addressing

this issue might be to intentionally focus on fostering students' dispositions toward critical thinking during higher education coursework through collaboration. Muis and Duffy (2013) identified that a graduate student's ability to analyze and evaluate new knowledge increased in collaborative groups, and students demonstrated a "significantly higher final grade" when compared to a control group that used a teacher-centered approach rather than a collaborative learning environment (pp. 222-223).

In addition to critical thinking, students are expected to work as collaborative team members to reach common objectives in professional and academic environments. Armatas and Vincent (2011) identified this as an underdeveloped employable skill requiring attention in education curricula. The interaction of students in a collaborative setting encourages conflict where they can develop "interpersonal, organizational, or teamwork skills" necessary in professional settings (Salisbury, Pascarella, Padgett, & Blaich, 2012, p. 303). In the academic environment, collaboration fosters the development of critical thinking outcomes in face-to-face and virtual learning where students can interact to identify and resolve problems (Armatas & Vincent, 2011; Bin, 2014). The key outcomes of critical thinking can be fostered through collaborative environments where students participate in the learning process, analytically use acquired information and assess their effectiveness to manage innovative tools (Benjamin et al., 2013).

Researchers have shown that collaboration is linked to enhanced critical thinking, and research points to the use of technology as an effective way to support collaboration (Kek & Huijser, 2011). Fleischmann (2014) identified the benefits of computer

applications as “useful tools in creating dialogue and exchange” in higher education (p. 49). Similarly, Frisch, Jackson, and Murray (2013) concluded that Web 2.0 applications like del.i.cious and Google Docs contributed to an “increased depth of understanding” and “critical evaluation” within a university biology course primarily consisting of junior and senior students (p. 77). Researchers in the application of computers in a Taiwanese nursing English comprehension course indicated that technology promoted collaborative learning and “communication with the teacher and peers” (Yu, 2013, p. 134). Additionally, technology provided a method to organize focused or object oriented collaboration to obtain the goals of an activity through shared knowledge using learning management systems (Damşa, 2014).

The use of technology to support the development of critical thinking is supported in the literature. Swart (2013) identified the use of simulation in the development of nurses in an inquiry-based approach that “fosters knowledge-seeking, inspires the capability to learn, encourages questioning and higher thinking, and builds critical reflection” (p. 1594). Mendenhall and Johnson (2010) discuss the integration of Web 2.0 tools and learning systems to improve “reading comprehension, critical thinking, and meta-cognition skills” in college freshman (p. 270). Goral (2011) described the growing use of Web 2.0 tools in higher education and their potential to encourage interaction and critical thinking in higher education. Finally, Bin (2014) discussed the benefits of using web-based cooperative learning to improve student interaction though expressed knowledge and group cooperation in a foundational chemistry class.

Students who develop critical thinking in college through social engagement and collaboration demonstrate a greater responsibility "to develop higher-order learning" (Wass, Harland, & Mercer, 2011, p. 326). These social learning environments can use computer assisted learning and collaboration to facilitate higher order thinking in undergraduate course work (Carroll, Diaz, Meiklejohn, Newcomb, & Adkins, 2013; Iinuma, Matsuhashi, Nakamura, & Chiyokura, 2014; Svenningsen & Pear, 2011). There has been resistance to adopting current technologies such as handheld devices as tools to expand experiential learning (Abrahams, 2010; Mirriahi, Dawson, & Hoven, 2012). However, some researchers have argued that technologies can be integrated into the education process to enhance learning, encourage the development of critical thinking skills, and positively influence academic achievement in collaborative learning environments (Fleischmann 2014; Frisch et al., 2013; Muis & Duffy, 2013). Like the adoption of handheld technology, the use of web-based tools has received mixed results in research when evaluating effectiveness in encouraging critical thinking in collaborative learning environments (Bin, 2014; Wu et al., 2013).

Researchers have examined the effectiveness of handheld technologies and Web 2.0 tools in terms of student measures, such as student grades, assessments of students' critical thinking, and student interactions. What is less well understood is how instructors report using such technologies and how they view the relationships between using technologies like tablet devices and Web 2.0 tools and development of students' collaboration and critical thinking skills. Researchers have suggested incorporating such technologies in instruction can have positive effects for students. How instructors think

about these relationships could influence whether or not they use such tools in the classroom and how they integrate these technologies as part of instruction. Insights from the instructor point of view could help in developing strategies to support instructors in using such technologies more effectively.

As an effective course design framework, Deal (2009) identified specific ways technology can support collaboration, including: (a) team definition, cohesion and participation through the use of social networking, (b) project management by using shared calendaring, (c) co-creation and ideation through the use of real-time collaborative editing, version tracking and commenting, (d) consensus building using polling tools, and (e) presentation with media sharing. Deal also reported on research showing computer mediated groups differed from face-to-face groups working on collaborative projects. Computer mediated groups were better at generating a range of ideas or brainstorming, were less likely to be dominated by a few individuals, and exhibited less "social loafing" (Deal, 2009, p. 5)

While Deal (2009) did not recommend a particular technology, tablet technology has the potential to support collaboration in the ways described. Perhaps using tablet technology with specific applications (e.g., GoogleDocs/Slides, Hootsuite/Slack, Skype, etc.) to encourage collaboration during the college experience can positively influence critical thinking skills. However, what is not known is how postsecondary instructors are using such technologies in instruction and how they view the connections between using tablets to support collaboration as part of instruction and whether they perceive such use to influence critical thinking dispositions. Understanding their perceptions could provide

insights for professional development around integrating such technologies effectively in the classroom or for designing instructional approaches instructors could adopt in their teaching. Ultimately, the goal of this research is to add to the body of empirical research to inform the development of curriculum that includes technology to improve learning.

Current research continues to be limited on the use of handheld and portable devices as tools for encouraging computer assisted collaboration with much of the research focusing on qualitative case studies (Sharples, 2013) and a majority of the studies focusing on student opinion rather than the pedagogical application of the devices (Hwang & Tsai, 2011) or perceptions of faculty. Jeong, Hmelo-Silver and Yu (2014) reported that only 20% (400 of 1,999 studies) of reviewed research articles were identified as empirical computer assisted collaborative learning research (p. 315). More research is needed to understand how postsecondary instructors actually use and view using handheld devices, such as a tablet, to support collaboration in an effort to enhance critical thinking among postsecondary students.

The perception of technology usefulness and ease of use may influence the acceptance of instructional tools like the tablet in learning environments. The perception of ease of use and attitude toward usefulness of a tool influences the behavioral intention to use the technology (Teo, 2011). For a postsecondary instructor, the perception of use and attitude towards usefulness could influence their acceptance to use tablets as a collaborative learning tool. In addition to Teo (2011), others have addressed the idea of perceived use and attitude to use technologies by postsecondary instructors (Farag, Park, & Kaupins, 2015; Schoonenboom, 2014). In these studies, the authors have sought to

understand how instructor perceptions effected the adoption of technology-based learning tools. Farag et al. (2015) investigated the adoption of the clicker by faculty (n = 104) with 71 participants having over 13 years of experience and 85 participants having taught with a clicker once or less. Using a unified theory of acceptance and use of technology based electronic survey and factor analysis, the study identified that teachers with experience using the clicker had a positive association with ease of use, and teacher without experience indicated they were apprehensive or intimidated concerning the use of clickers in the classroom. Additionally, instructors without experience perceived teaching quality would be affected by a long time to learn to use the clicker.

In another technology acceptance study, Schoonenboom (2014) investigated the acceptance of learning management systems (LMS) in higher education. The participants consisted of instructors (n = 180) from multiple departments with a majority of the instructors having over 10 years of experience. Using an electronic administered TAM questionnaire, the participants completed the survey during a data collection period. The result of the study showed low acceptance to use LMS was affected by task importance, usefulness and ease of use (Schoonenboom, 2014).

In each of the previous studies, the models demonstrated that perceptions towards usefulness and ease of use influence acceptance or apprehension towards instructional technology. The result of an instructor's perception could encourage experienced users to adopt a technology (Faraq et al., 2015) or resist a technology (Schoonenboom, 2014) based on familiarity or low task importance. Understanding how postsecondary faculty members are influenced by their attitudes and opinions toward common or emerging

instructional technology tools could positively affect acceptance instructional tools. Although Faraq et al. (2015) used an UTAUT-based survey, a tool consistently identified in other technology acceptance studies (e.g. Teo, 2011; Schoonenboom, 2014) is the technology acceptance model questionnaire.

Understanding postsecondary instructors' perceptions offers knowledge on how tablets support the instructor's pedagogy and student development as an interactive tool in discussion and cooperative learning assignments. Understanding instructor attitudes and opinions toward tablet use in classroom instruction using Deal's (2009) course design framework provides insights on how the shared instructional tools can encourage cohesion, task management, co-creation, consensus building, media sharing and project collaboration. With better understanding, this study provides insights to designing effective professional development towards integrating tablet technologies effectively in the classroom. With this understanding, perhaps instructional designers could create lessons or units for instructors to adopt in their teaching that would use such technologies as an approach to enhancing collaboration and critical thinking in ways valued by the instructors.

Problem Statement

Much research has been done on the ways to enhance critical thinking in regular face-to-face or traditional learning environments. In 2014, studies included general education (Piergiovanni, 2014), theory or core (Pelton, 2014), and first-year student coursework (Laird, Seifert, Pascarella, Mayhew, & Blaich, 2014). Each of these studies examined the benefits of higher order thinking on the student's analytical ability, and

contributed to the research associated with critical thinking skill effects on learning and achievement in higher education coursework. But there is limited understanding of the use of hand-held devices to support collaboration as an approach to developing critical thinking.

Recent research identified the benefits of collaboration to effectively support critical thinking development in postsecondary education. Wagner, Baum and Newbill (2014) found that students developed "communication, collaboration, critical thinking and problem solving" skills in trans-disciplined circumstances (p. 671). Through collaboration and critical thinking the students were challenged to develop new perspectives through interaction that challenged their original beliefs and contributed to developing these new skills.

The benefits of collaboration to encourage critical thinking skills have been described in the literature, and recently some have begun to take advantage of the portability and availability of technology to support collaboration. Collaboration research has focused heavily on computer-assisted instruction (CAI) in traditional, online, and blended learning environments (Kyndt et al., 2013; Larwin & Larwin, 2011; Schmid et al., 2014). Additionally, some literature concerning Computer-Supported Collaborative Learning (CSCL) focused on applying instructional technology to encourage or support collaborative engagement as a method of building knowledge through social interaction (Stahl, 2005). A modification to traditional computer-based CSCL learning includes mobile technologies that provide portable and personal options to encourage student collaboration.

The use of mobile technology research indicates that mobile Computer-Supported Collaborative Learning (mCSCL) is more effective if conducted in a planned learning environment (Song, 2014). Structured learning using mobile devices can provide collaborative opportunities in and out of the classroom. In a limited meta-analysis of mobile computer learning conducted between 2004 and 2011, Hsu and Ching (2013) identified that mCSCL encouraged social interaction between students using personal digital assistants rather than emerging smart technologies. Additionally, a majority of studies focused on collaborative learning in the K-12 classrooms and indicated a need to research the application of mobile technology in higher education (Hsu & Ching, 2013).

Although research and theory has identified the benefits of collaborative learning on the development of critical thinking (Jonassen, Carr, & Yueh, 1998; Wagner et al., 2014), limited empirical research has been done on the use of handheld devices to support classroom collaboration in postsecondary education, and little to none on using Web 2.0 applications on these devices to encourage critical thinking through collaboration in college coursework. Shinsky and Stevens (2011) discuss the use of computer-based applications (e.g., GoogleDocs, Wikis, learning management systems) in an organizational and community relations course to develop education leadership, which included learning objectives of critical thinking and collaboration. Granitz and Koernig (2011) examined the benefits of using Web 2.0 applications to encourage collaboration in an experiential marketing course using "wiki, blogs, and marketing plans" (p. 64). Although these research articles identify aspects of instruction using smart technology applications, there is a gap that collectively addresses the use of portable technology to

develop critical thinking using collaborative tools. In addition, these studies focus primarily on introduction of such tools in one course and do not provide information about the views of a broader swath of faculty about using mobile technologies to facilitate collaboration in an effort to improve critical thinking.

In college courses, it is a challenge to connect the desired outcome of developing confident and adaptive critical thinkers with the resources that allow for an informative and "sustained" collaborative dialogue in a learning environment (Mercer, 2008, p. 94). To inspire the development of an adaptive critical thinker, the collaborative tools on a tablet might be used to encourage analysis and evaluation of information when incorporated into course pedagogy. The tablet provides an innovative tool to integrate student collaboration with hands on resources to share, collect, and develop knowledge.

Therefore, this study supplements the current gap in the availability of research that examines instructor perceptions about the use of portable personal technologies as tools to promote collaboration in an effort to develop critical thinking skills in postsecondary student learning environments. Understanding postsecondary instructors' perceptions informs how tablets can support the instructor's pedagogy and student development as an interactive tool for use in discussion and cooperative learning assignments. Understanding instructor attitudes and opinions toward tablet use in classroom instruction using Deal's (2009) course design framework provides insights on how the shared instructional tools are used to encourage cohesion, task management, co-creation, consensus building, media sharing and project collaboration. Understanding the use of such technologies from the instructor point of view helps develop better strategies

to support instructors to effectively use these tools to promote collaboration and the development of critical thinking. Using a quantitative survey design without the application of an intervention, this study sought to understand the perceptions of postsecondary instructors on incorporating tablet technologies in instruction, whether their approaches exhibit characteristics described by Deal (2009) to support collaboration as a way to facilitate the disposition of critical thinking, and their perceptions of the link between collaboration and critical thinking.

Purpose of the Study

Multiple studies have found critical thinking can be developed through intentional or purposeful instruction that includes collaborative learning (Lai, 2011; Scheuer, McLaren, Weinberger, & Niebuhr, 2013; Saeger, 2014). This study sought to better understand postsecondary instructors' attitudes toward using tablet technology in instruction, how they incorporate tablet technologies in instruction and whether those approaches exhibit characteristics described by Deal (2009) as supporting collaboration, and instructors perceptions about the relationships between use of such technology and collaboration skills and critical thinking dispositions of their students. The study used a quantitative survey design to explore faculty perspectives (attitudes and opinions) about using tablet technologies in a collaborative learning environment to foster the dispositions toward critical thinking. The independent variables of my study were collaborative learning and tablet technologies. The dependent variable of my study was critical thinking dispositions.

Research Questions and Hypotheses

The following research questions for this quantitative study were designed to address the gap in research on views of postsecondary instructors toward collaborative learning, whether they used tablets in ways that supported collaboration, and whether they perceived a link between such use and developing dispositions toward critical thinking:

Research Question 1: To what extent do postsecondary instructors accept tablet use in instruction (IV_1 - TAM) and use collaborative tools with tablets (IV_2 - CTU)?

Research Question 2: Is there a relationship between postsecondary instructor tablet acceptance (IV_1 -TAM) and implementation of collaborative learning (DV_1 - CLIQ)?

$H_0$2 There is no statistical relationship between postsecondary instructor tablet acceptance (IV_1 – TAM) and implementation of collaborative learning (DV_1 – CLIQ).

$H_1$2 There is a statistical relationship between postsecondary instructor tablet acceptance (IV_1 – TAM) and implementation of collaborative learning (DV_1 – CLIQ).

Research Question 3: Is there a relationship between postsecondary instructor use of collaborative tools on the tablet (IV_2 - CTU) and implementation of collaborative learning (DV_1 - CLIQ)?

$H_0$3 There is no statistical relationship between postsecondary instructor use of collaborative tools on the tablet (IV_2 – CTU) and implementation of collaborative learning (DV_1 – CLIQ).

$H_1$3 There is a statistical relationship between postsecondary instructor use of collaborative tools on the tablet (IV_2 – CTU) and implementation of collaborative learning (DV_1 – CLIQ).

Research Question 4: Is there a relationship between postsecondary instructor implementation of collaborative learning (DV_1 - CLIQ) and perception of student development of critical thinking dispositions (DV_2 - CTD)?

$H_0$4 There is no statistical relationship between postsecondary instructor implementation of collaborative learning (DV_1 – CLIQ) and perception of student development of critical thinking dispositions (DV_2 – CTD).

$H_1$4 There is a statistical relationship between postsecondary instructor implementation of collaborative learning (DV_1 – CLIQ) and perception of student development of critical thinking dispositions (DV_2 – CTD).

Conceptual Framework

The theory underlying this research was Vygotsky's (1978) social learning theory, including the zone of proximal development (ZPD). This theory addresses learning, and development from instructors or "with more capable peers" as the learner matures in a collaborative learning environment (Vygotsky, 1978, p. 86). According to Vygotsky (1978), a collaborative environment encourages students to develop problem solving (critical thinking) skills that stretch the individual to their learning potential as they interact in corporative learning to improve achievement as internally motivated learners. Vygotsky (1978) further expressed that individuals develop "higher mental functions" as they interact within a cooperative environment, and interact in zones of proximal

development (p. 90). Johnson and Johnson (1996) recognized Vygotsky as a theoretical basis in their "foundation of cooperative learning" using interactive technology (p. 789). Exploiting the technology tools, collaborative learning provides a "level of potential development" for students to develop knowledge from the diverse experiences by interacting with the instructor and dyad (Wertsch & Tulviste, 1992, p. 549). Vygotsky's theory, when taken collectively, infers that problem solving is developed through the interaction of participants in a collaborative learning environment.

While Vygotsky's ZPD points to the relationship between collaboration and critical thinking and there is support in the research literature for a relationship between collaboration and critical thinking, studies have used different definitions of critical thinking (Bloom, 1956; Ennis, 1993; Facione, 1991; Glaser, 1942; Kuhn, 1999; Paul & Elder, 2001) in studying that relationship. In this study, Facione's (1991) definition of critical thinking is used.

Johnson and Johnson (1996) and others have used Vygotsky's theory as a basis for supporting collaboration through the use of technology and Deal (2009) identified specific ways that technology could be used to support collaboration through social networking, project management, co-creation, consensus building and presentation. These tasks can all be accomplished using handheld devices.

Deal (2009) provided a framework for encouraging collaboration through technology-based applications. Grounded in project-based and collaborative learning, Deal discussed technology-focused applications that support a problem-based collaborative learning environment. The applications were used to support aspects "that

serve to organize and drive activities, and encourage application, analysis, and synthesis of course material" through communication, participation, management, creation, teamwork, and presentation (Deal, 2009, p. 2). The framework discussed by Deal (2009) offered a model to integrate collaborative learning processes using technology-based tools for learning and assessment. In this study, Deal's model provided a framework to understand how postsecondary instructors could use technology to support collaboration.

The framework used for technology acceptance for this study was developed from Alharbi and Drew's (2014) adaptation of Davis' (1986) Technology Acceptance Model (TAM). The TAM was developed by Davis (1986) to exam user acceptance of computer based information systems. Grounded in the work of Fishbein and Ajzen's (1975) concerning the effect that belief, attitude and intention has on a person's behavior, Davis' technology acceptance model investigated the motivations of the user toward the technology, and examined how the users motivations may affect the likelihood of information system adoption (Davis, 1986). Alharbi and Drew's (2014) adaptation of the focused on understanding the acceptance of learning management systems based on ease of use, perceived usefulness, attitude to use, intention to use, and job relevance of the technology. Using an adjusted questionnaire towards tablet technology, this study used an Alharbi and Drew (2014) modified model to investigate if there is a relationship between belief, attitude and intention and the acceptance of tablet technology in collaborative learning by postsecondary instructors.

Next, the collaborative learning implementation questionnaire (CLIQ) was developed by Abrami, Poulson, and Chambers (2004) to examine the self-reported use of

cooperative learning in teachers (p. 201). The CLIQ was designed to assess the factors that affect teacher integration of cooperative learning. Grounded in research focused on the factors "which teachers implement and persist in the implementation of an education innovation" (p. 202), Abrami et al. (2004) examined studies that focused on innovation acceptance and instructor philosophy (Briscoe, 1991; Rich, 1990), teacher self-efficacy (Ohlhausen, Meyerson, & Sexton, 1992; Ross, 1994); training and support (Joyce & Showers, 1988; Mathison, 1992); school climate and culture (Fullan & Hargreaves, 1996), resource constraints (Sleeter, 1992), and long-term sustainability of cooperative learning (Ishler, Johnson, & Johnson, 1998). Additionally, the development of the questionnaire was grounded in the motivational analysis of productivity losses in groups (Shepperd, 1993) and in expectancy theory (Shah & Higgins, 1997). The final version of the questionnaire consisted of 48 questions divided into three categories – expectancy (expectancy of success), value (value of the innovation) and cost (perceived cost) (Abrami et al., 2004). Modified for this study, the CLIQ sought to understand what factors affected the integration of collaborative learning in postsecondary education.

Finally, critical thinking dispositions offered a framework to assess the postsecondary instructor's perception concerning the development critical thinking in technology-based collaborative learning environments. Grounded in Facione's (1990) work on critical thinking, the dispositions used for this study were identified as "strategies for building intellectual character" (Facione, 2000, p. 80). Critical thinking dispositions of "truthseeking, judicious, inquisitive, systematic, analytical, open-minded and confident in reasoning" (Facione, 2013) are developed to foster the critical thinking

skills for application outside the "instructional setting" (Facione, 1990, p. 26). The critical thinking dispositions were chosen for this study as accepted strategies for developing critical thinking through problem-framing and problem-solving.

Using Vygotsky's (1978) and Johnson and Johnson's (1996) assertion that technology provides an interactive tool that supports collaborative learning in formal and informal environments, along with Deal's (2009) strategies and Facione's (1991) definition of critical thinking, this study examined postsecondary instructors in terms of their beliefs about collaborative learning and use of tablet technologies in instruction, their uses of such technologies to support collaboration, and their perception of the relationship between collaboration and development of critical thinking dispositions. Figure 1 shows the relationship of these theories and ideas that form the basis of the conceptual framework for this study.

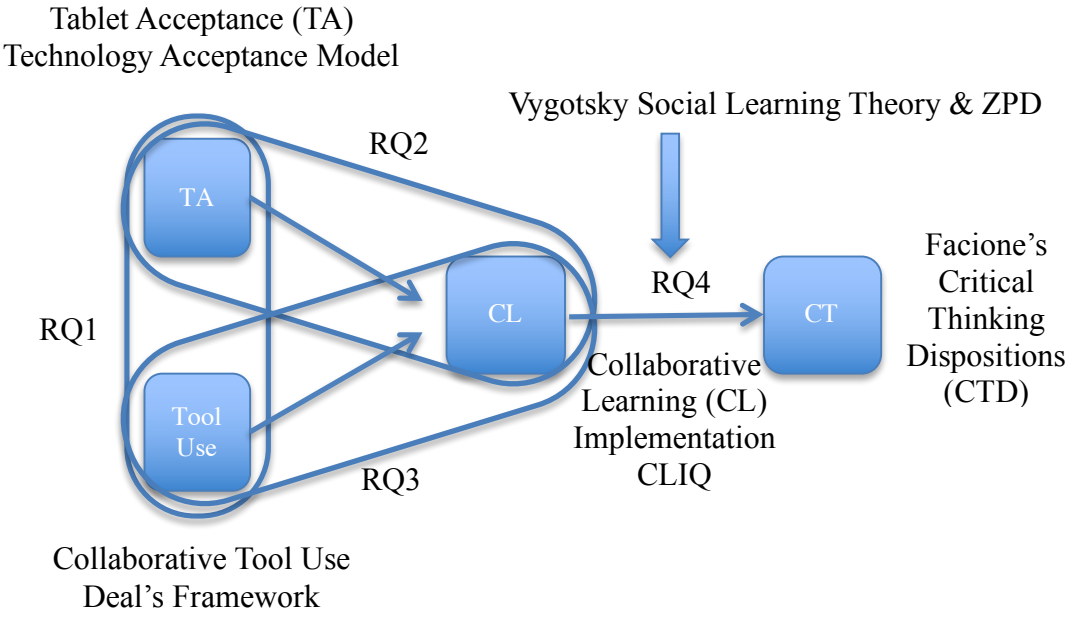

Figure 1. Conceptual framework.

Nature of the Study

This study used a quantitative survey design to understand postsecondary instructor perspectives. The focus of this research was supported by multiple studies that found critical thinking could be developed through intentional instruction that included collaborative learning (Lai, 2011; Scheuer et al., 2013; Saeger, 2014). This study examined tablet technology as a mode to extend collaboration through interactive applications using a common tool. The study sought to identify the perceptions of postsecondary instructors about using tablet technologies in instruction (TAM survey items), how postsecondary instructors were using tablet technologies in instruction and whether those uses were aligned with Deal's (2009) strategies for using such tools to support collaboration, and the perceptions of postsecondary instructors about relationships between using tablets as a tool to encourage and extend collaboration (CLIQ survey items) as an effective method to foster the dispositions towards critical thinking (Facione's critical thinking dispositions).

Applications that could support collaboration with the tablet include Hootsuite for instructor and student groups to interact over multiple social networks; Google applications to collaborate on presentations and word processing assignments; and Skype for synchronous interaction within the groups to solve problems. These tools address the ways technology can support collaboration as identified by Deal (2009) (see Table 1).

Table 1

Collaborative Tools Supporting Deal's Application of Technology for Collaboration

	Hootsuite/Slack	Google Apps	Skype
Social Networking	X		X
Project Management		X	
Co-Creation		X	X
Consensus Building	X	X	
Presentation		X	X

Note. Associated potential collaborative tools using Deal (2009) to crosswalk the tools to their function.

As a way to understand the attitudes and opinions of postsecondary instructors about using tablet technology to incorporate collaborative learning and develop of critical thinking dispositions in coursework, my study used a 61-question survey for members of an international education technology organization. The 61 items were developed based on previous studies and surveys. Instrumentation for this study was a combination of original and modified demographic questions from an EDUCAUSE study, Technology Acceptance Model (TAM) survey items (Alharbi & Drew, 2014), items from the Cooperative Learning Implementation Questionnaire (CLIQ) (Concordia, 1998), Deal's (2009) collaborative activities and Facione's (2013) dispositions of critical thinking. These are described further in chapter 3. The Association for Educational Communications and Technology (AECT) has a population of over 1,900 members from multiple countries and a large population of postsecondary professionals, including instructors (InfocusMarketing, 2016). The survey was sent to all members with a request for those who are postsecondary instructors to complete the survey voluntarily. Thus, this was a convenience sample. The organization's projected population offered the ability to

provide study results that are generalizable across international domains with an obtainable sample size (estimated $n = 321$).

The request to solicit survey data from the AECT members (Appendix A) was submitted during the proposal process. Once the study design was approved by Walden University's IRB, the organization board voted to share the study with the membership. Then AECT.org delivered an email to its members to request their participation in the study. The organization provided an electronic link to the survey and required members to consent before accessing the study questionnaire. The participants selected a link to the SurveyMonkey host website to complete the survey where they completed another consent statement approved by the Walden University IRB.

Construct Definitions

Collaborative applications (tools): Collaborative applications are Web 2.0 tools used to encourage problem-based collaborative learning (Deal, 2009), and in this study include GoogleDocs/Slides, Hootsuite, and Skype.

Collaborative learning: The social interaction (Damşa, 2014) of students in a formal or informal (Summers, Gorin, Beretvas, & Svinicki, 2005) environment where a group of students work collectively to resolve a common task, and develop new knowledge through collective contact with an instructor and peers within a zone of proximal development (Vygotsky, 1978) or learning group. In this study, the modified CLIQ was used to measure faculty perceptions of collaborative leaning.

Cooperative learning: According to Panitz (1999), cooperative learning is "a set of processes which help people interact together" for goal accomplishment (p. 5). A

cooperative learning environment would be more instructor centric (directing) rather than a student-centered learning environment (Panitz, 1999).

Critical thinking skills: Critical thinking is a "purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation, and inference, as well as explanation of the evidential, conceptual, methodological, criteriological, or contextual considerations upon which that judgment is based" (Facione, 1991, p. 2).

Critical thinking dispositions: Critical thinking dispositions are defined as "truthseeking, judicious, inquisitive, systematic, analytical, open-minded and confident in reasoning" (Facione, 2013) that are developed to foster the critical thinking skills for application outside the "instructional setting" (Facione, 1990, p. 26).

Higher education preparedness: The preparedness of students for postsecondary success is evaluated using commercially created standardized tests and university directed assessments (Conley, 2010). For this study, preparedness is defined as students not requiring remedial training in reading, writing and mathematics during their first-year or entry-level coursework in college (Conley, 2012).

Postsecondary instructors: Postsecondary instructors are defined as educators, faculty, or instructional designers who work in higher education institutions or in corporate training (Kim & Bonk, 2006); they are responsible for developing and implementing coursework for students to obtain an associate degree and higher (Bowers, Ragas, & Neely, 2009), or a career certificate.

Problem-Based Learning (PBL): Problem-based learning is defined as a learner-centered approach where students analyze and solve real-world challenges. During the

process, the instructor transitions from a director to an advisor role (guide) as the students demonstrate higher-order thinking skills (El-Shaer & Gaber, 2014).

Tablet technologies: Tablet technology is defined as a handheld, freestanding mobile device that provides wireless connection to the Internet and capable of downloading applications for use in postsecondary instruction (Park & del Pobil, 2013). For my study, the example is the iPad. Faculty use of tablet technologies were measured using questions from the TAM and Deal's framework (see Appendix B).

Assumptions and Limitations

The assumptions and limitations of this study provided clarity to the design and focus of the research. The assumptions established the context for the purpose of the study; while the limitations provided the acknowledgement of weaknesses resulting from internal, external, and construct validity that could influence the research design.

Assumptions

The key assumptions in the design of this research were accepting that the participants were using tablet technologies to develop collaborative learning environments and that their self-reporting were accurate in terms of both their practices and their perceptions. It assumed tablet technology and applications could be successfully integrated as team building tools to encourage students to contribute to group goals and learning objectives and that the postsecondary instructors provided an honest report of technology integration and collaborative learning and their perceptions of their influence on the development of critical thinking skills. The final assumption was that the participant's attitudes and opinions were honestly reflected in their survey responses, and

the 321 survey size (effect size = .198) was sufficient to provide an accurate assessment of instructors' perceptions of the value of collaboration using tablets for the development of students' critical thinking dispositions.

Limitations

The limitations were divided into internal and external validity categories to address weaknesses in the research design. Potential problems of internal validity included bias, history, instrumentation, and selection. In addition to experience with technology-based instruction, participant bias concerning the use of tablets as a computer supported collaborative learning tool could have influenced responses.

Instrumentation for this study was a combination of original and modified demographic questions from an EDUCAUSE study, Technology Acceptance Model (TAM) survey (Alharbi & Drew, 2014), a Cooperative Learning Implementation Questionnaire (CLIQ) (Concordia, 1998), Deal's (2009) collaborative activities and Facione's (2013) dispositions of critical thinking. While these instruments had been used separately and had been found to be reliable, they had not been used in combination. The combination of these questionnaires into a single survey did not affect the original reliability of the instruments. The final measure was assessed during data analysis to verify reliability using Cronbach's Alpha range above .70 (Frankfort-Nachmias & Nachmias, 2008) to indicate a reliable measure.

Respondents were self-reporting which is a limitation. Their responses may have or may not have been truthful. I assumed the respondents would answer truthfully, but

there was a possibility they may not or may not remember accurately so this also was a limitation.

Finally, selection for this study was not random. I used a convenience sample of volunteers drawn from the population of a professional international educator association focused on improving instruction through technology (AECT.org). Therefore, responses may not reflect the opinions of postsecondary instructors who were not as interested in technology. The questionnaire website was provided through an electronic mail to the AECT members who self-identified as postsecondary instructors who used tablet technologies and voluntarily completed the survey. This self-identification may or may not have been accurate. In addition, the nature of a self-report survey assumed that respondents actually answer truthfully, which is also a limitation as the accuracy of their responses were not verified.

Potential challenges to external validity that could have affected generalizability included selection bias, interaction of setting, and the effect of testing. The selection of the participants was limited to a specific professional organization; this organization may not be representative of similar professional organizations that use or advocate technology in higher education environments. The settings used by the participants were not controlled and the various testing environments could have affected how the participants responded to the 61 questions in the survey. A recommendation in the survey description was included to encourage the instructors to find a quiet place to complete the questions. Testing may have affected external validity by generating a measure with excessive questions. This survey was limited to 61 questions with the expectation that the

questionnaire would be completed in 20 minutes to reduce the effects of excessive testing.

Scope and Delimitations

The study was delimited to questions surrounding the use of tablet technology to encourage collaborative learning as a way to foster the dispositions toward critical thinking. The research addressed the relationship of collaborative tools available to students on portable technology, and the attitudes and opinions and of postsecondary instructors about how these tools might affect the development of critical thinking. The questions addressed instructor experiences with tablet technology and collaborative learning, their use of technology in collaborative tasks, and their perception of the relationship collaboration could have to critical thinking development.

The study's conceptual framework considered the interaction of students with peers and teachers to encourage knowledge growth associated with Vygotsky's social development theory, including the zone of proximal development (1978). The conceptual framework also incorporated the following components: technology acceptance (TAM), perceptions of collaborative learning (CLIQ), Deal's (2009) framework for technology tools to support collaboration, and Facione's (2013) critical thinking dispositions. The respondents' experiences with tablet technology in team or collaborative learning environments provided an insight into the perceived pedagogical usefulness in higher education.

The population of education technology instructors was limited to the Association of Education Communication and Technology organization. AECT is "a professional

association of thousands of educators and others whose activities are directed toward improving instruction through technology" (AECT.org). These members include non-educators, secondary, postsecondary and industry instructors. Those who self-identified as postsecondary instructors were asked to complete the survey. The survey demographic information was used to verify those that self-reported as postsecondary instructors.

The participants voluntarily participated via an electronic email and self-identified as postsecondary instructors. This sampling approach and potential small sample size may have limited the generalizability of this study. However, given the limited research on the use of tablet technology applications to encourage collaboration to impact critical thinking, my study contributes to the current body of knowledge.

Significance of the Study

Existing studies have used a variety of technologies to examine the development of critical thinking through collaborative environments and there is a gap in looking specifically at the use of tablet technology to support collaboration as a strategy to enhance critical thinking. Therefore, examining postsecondary instructors' use of tablet technologies to support collaboration and their perception of its impact on critical thinking adds to the current body of knowledge, and contributes to the effective use of instructional technology in ways that influence the development of critical thinking dispositions. Better understanding of the relationship between technology supported instructional approaches and development of critical thinking in this population could lead to changes in practice for postsecondary instruction. If critical thinking can be enhanced through supporting collaborative work using tablet technologies, it could lead

to revised instructional approaches, better academic outcomes for students, and eventually, to better prepared citizens for society.

Summary

Developing critical thinkers can help students improve achievement and promote retention in college, while preparing them as productive change agents who develop beneficial solutions to societal problems. The possibility of using technology to support collaborative learning to enhance or develop critical thinking has the potential to improve academic performance in college students. The challenge is to construct a learning environment where the student can interact formally and informally with a collaborative tool that encourages students to develop new knowledge while engaging in a group discourse that allows for constructive reflection. Collaboration provides a process for students to evaluate their personal bias and to encourage new thought while growing in a social environment that encourages the development of critical thinking skills. The perceptions of postsecondary instructors about the use of tablets to support collaboration and the influence of such use to support critical thinking is important to understand as a step in promoting instructional approaches that are effective for student learning.

Chapter 2: Literature Review

The literature review is framed to examine technology acceptance, critical thinking, collaboration, and technology research that investigates the collective impact of using technology as a tool to promote critical thinking through collaboration in college courses. Using a quantitative survey design, the study sought to understand the perceptions of postsecondary instructors on incorporating tablet technologies in instruction, and whether their approaches exhibited characteristics described by Deal (2009) to support collaboration as a way to facilitate the disposition of critical thinking (Facione, 2013). The reviewed literature considers: (a) the postsecondary instructors' perceptions about collaborative learning; (b) the postsecondary instructors' perceptions about using tablet technologies in instruction; (c) the extent and how postsecondary instructors are using tablet technologies to support collaborative learning; and (d) the impact postsecondary instructors believe collaborative activities using tablet technologies have on the critical thinking dispositions of students. The literature review grounded the study in current research and provided the foundation for designing this study. Following a description of the literature research strategy, this chapter addressed collaboration and Vygotsky's ZPD, critical thinking and success in higher education, critical thinking and collaboration, and technology tools and collaboration.

Literature Research Strategy

The research strategy for this study reviewed multiple databases using key words associated with critical thinking, collaboration, instructional technology, tablet technology, social networking, college success, career success, and Web 2.0/3.0

applications. The review identified relevant topics in the last six years (2010-2016) for primary references in refereed journals. Specifically, the database and library searches included Google Scholar, EBSCO host, Emerald Insight, ProQuest, Springer Link, John Hopkins University Library, Taylor and Francis Online, Science Direct, Sage Journals, Wiley Online Library, Purdue University Library, Walden University Library, JSTOR, and SFX. Search criteria included *critical thinking, critical thinking dispositions, collaboration, cooperative learning, collaborative learning, college and career success, critical thinking and collaboration, computer assisted collaborative learning, computer supported collaborative learning (CSCL), Vygotsky and Zone of Proximal Development, social learning, academic achievement and critical thinking, achievement and collaborative learning, Web 2.0/3.0 applications and critical thinking, Web 2.0/3.0 applications and collaboration, usefulness of technology in higher education, technology acceptance model (TAM); students and achievement, students and critical thinking, students and collaboration, student success, critical thinking in higher education, technology in support of collaborative learning, building collaborative knowing, collaborative technology and applications, and higher order thinking.*

In databases and libraries, these search words identified many journals with applicable information. The primary journals used in the study included *Computers and Education*, *Computers in Human Behavior*, *Higher Education Research and Development*, *Interactive Learning Environments*, *International Journal of Computer-Supported Collaborative Learning*, *International Journal of Learning*, and *Journal of Technology and Education*. Additionally, information was found at the Council for Aid to

Education, U. S. Department of Education, Higher Education Organization, and Critical Thinking organizations. Finally, when the research article provided sufficient data, effect size was calculated using Cohen's d or Pearson's correlation coefficient formulas.

Collaboration and Vygotsky's Social Learning Theory

Vygotsky's (1978) social learning theory, including the ZPD, identifies the benefits of peer and instructor influence on knowledge development in collaborative groups. Students learn to solve problems as they are challenged to grow and interact with others. Learning in the ZPD, students develop "higher mental functions" in cooperative learning environments (Vygotsky, 1978, p. 90). The process of social learning encourages and challenges the learner to develop knowledge as an active group member.

In groups, students develop foundational characteristics. One foundational characteristic is higher order or critical thinking (Hart Research Associates, 2015; National Governors Association Center for Best Practices [NGACBP], 2010). Vygotsky (1978) recognized that collaborative learning encourages student to develop problem-solving skills. Two recent studies that used Vygotsky's social learning theory indicated that interactive collaborative learning environments support the development of critical thinking skills (Kingpum, Ruangsuwan, & Chaicharoen, 2015; Wynn, Mosholder, & Larson, 2014) and supported the benefits of Vygotsky's learning theory related to the Zone of Proximal Development. Both studies found that diverse student groups challenge participants to resolve problems through a combined group of "socially available skills and knowledge" (Vygotsky, 1978, p. 130). These two studies are described in more detail next.

Wynn et al. (2014) studied students working in a learning community and found working in problem solving groups improved their higher order or *postformal* thinking skills. Wynn et al. conducted a mixed-methods study to examine the effects of PBL on the development of critical thinking skills in college students (n = 106) who participated in PBL learning communities (n = 40), PBL history courses (n = 31) and lecture courses (n = 35) taught by multiple instructors. The study used a Likert-scaled Postformal Thought Questionnaire (pretest) and end of study questionnaire (posttest). The learning community provided a group for first-year students to develop new skills and knowledge to close "the distance between the actual development level" and the students potential using "collaboration with more capable peers" (p. 86). From the qualitative student comments, the problem-based learning environment challenged the students to apply concepts and develop new understanding from the interaction with other students and their differing perspectives (Wynn et al., 2014, pp. 13-14). Students in the learning community had a statistically significant (p = 0.017) difference in performance on post formal thinking than participants in a lecture-based classroom (Wynn et al., 2014). Although the results were positive, the study was conducted by the course instructors, which may have biased the results. The self-admitted small sample size in the traditional general studies learning and discussion course affected the generalizability of the results. Finally, the smaller learning community class sizes of 25 participants may have raised the sense of community thus increasing the post formal gains from interaction rather than the problem-based and collaborative coursework.

Similarly, Kingpum et al. (2015) examined the benefits of collaborative learning on academic achievement and thinking ability in a blended learning environment and recommended that groups be selected with diverse "thinking ability and capable" (p. 2175). Additionally, the study identified the benefits of 4 to 6 person groups to encourage student involvement. The study examined the benefits of collaborative learning in undergraduate Physical Education coursework, and identified statistically significant benefits of collaborative learning to academic achievement and thinking within the experimental group indicating that collaborative environments significantly ($p < .01$) improved achievement.

Each of the previous studies suggested that collaborative learning encourages the development of post formal or critical thinking and can positively impact student learning. Both provided support for the benefits of Vygotsky's social learning theory and the Zone of Proximal Development achieved through intentional collaborative activities as part of instruction.

Critical Thinking and Success in Higher Education

Critical thinking is a desired result from higher education in preparation for future careers (Hart Research Associates, 2015). Learning to problem solve "begins in freshmen-level courses" as the student develops foundational knowledge used in the academic progression of more complex coursework (Burkholder, 2014, p. 555). The learning objectives associated with developing higher order thinking skills are foundational outcomes supported in current research (Anderson & Piro, 2014; Eklöf, 2013; Snyder & Wiles, 2015) and encouraged by the Association of American Colleges

and Universities as an "essential learning outcome" (The National Task Force on Civic Learning and Democratic Engagement [NTFCLDE], 2012, p. 12). There is agreement among some educational leaders that developing a student's ability to analyze and apply analytical skills prepares students for academic and career success. The greater challenge is establishing a common definition of critical thinking.

Defining Critical Thinking

Identifying an encompassing definition of critical thinking is made difficult by the diverse applications of the characteristics associated with higher order thinking. In a meta-analysis, Niu, Behar-Horenstein, and Garvan (2013) offered a list of key critical thinking philosophers, who provided a focus for this analysis that led to the original sources. While critical thinking philosophy continues to be influenced by Dewey's (1938/1997) reflective thought, Glaser's (1942) experience-based inquiry, and Bloom's (1956) knowledge synthesis work, recent viewpoints have recognized the processes and skills associated with critically developing new knowledge. Paul, Elder, and Bartell (1997) considered critical thinking a process of thought focused on acquiring knowledge by analyzing and assessing it for "clarity, accuracy, relevance, depth, breadth, and logic" in the context of the overall goal or objective being discussed (p. 11). In 2006, Paul and Elder added that critical thinking is a "self-directed, self-disciplined, self-monitored, and self-corrective thinking" process (p. 4). Facione (1990) identified it as skills applied for "interpretation, analysis, evaluation, inference, explanation and self-regulation" that can transcend subjects or remain in the application of a domain specific context (p. 8). This approach could include reflection in the form of "examining and evaluating one's own

reasoning process" (Facione, 1990, p. 10). Ennis (1993) identified critical thinking as "reasonable reflective thinking focused on deciding what to believe or do" (p. 180). Finally, Kuhn (1999) applied a social quality to critical thinking that recognized reflection, and the gap that exists between individuals in the acquisition of knowledge over time and situations. I developed Table 2 to provide a reference for the characteristics associated with critical thinking by each philosopher.

Table 2

Theoretical Definitions of Critical Thinking

Philosopher	Critical Thinking Philosophy (Quotes)
Dewey (1910)	Thinking is reflective thought of "active, persistent and careful consideration of a belief or supposed form of knowledge in the light of the grounds that support it" (p. 6). Reflection is based on believing through “witness, evidence, proof, voucher, warrant" (p. 8).
Glaser (1942)	“critical thinking…is the attitude of being disposed to consider in a thoughtful way the problems and subjects that come within the range of one's experience…in applying the methods of logical inquiry and reasoning, however, appears to be specifically related to, and in fact limited by, the acquisition of pertinent knowledge and facts concerning the problems…." (p.1)
Bloom (1956)	Intellectual abilities and skills as "processes of organizing and reorganizing material to achieve a particular purpose... material may be given or remembered" With the skills including comprehension, application, analysis, synthesis and evaluation. (p. 204).
Facione (1991)	"purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation, and inference, as well as explanation of the evidential, conceptual, methodological, criteriological, or contextual considerations upon which that judgment is based" (p. 2).
Ennis (1993)	"reasonable reflective thinking focused on deciding what to believe or do" (p. 180).
Kuhn (1999)	"by definition involves reflecting on what is known and how that knowledge is justified. Individuals with well-developed metacognitive skills are in control of their own beliefs...apply consistent standards of evaluation across time and situations" (p. 23).
Paul and Elder (2001)	"self-directed, self-disciplined, self-monitored, and self-corrective thinking" (p. 4)

Note. This table identifies past and current foundational definitions or elements of critical thinking. The table was inspired by Kek & Huijser’s (2011) descriptions of theoretical definitions of critical thinking; after reviewing the original sources, the definitions were included in the chart.

By analyzing multiple philosophies of critical thinking, this study chose to adopt Facione's (1991) definition, and related critical thinking dispositions (Facione, 2000) that were used to understand instructor perceptions concerning tablet based collaborative learning benefits to critical thinking development. The dispositions (systematic, inquisitive, judicious, truth seeking, analytical, open-minded and confident reasoning) focused on the motivations a student may have rather than a specific critical thinking skill characteristic (i.e., purposeful, interpretation, conceptual) (Facione, 1990, 2000, 2013). Unlike using critical thinking skills to assess a person's current skill, the dispositions were recommended by the Delphi research board to be used in "developing materials, pedagogies, and assessment tools" as effective and equitable measures to foster the skills for application outside the "instructional setting (Facione, 1990, p. 26).

Facione's (2000) later work supported that a one-to-one correlation of student disposition to a specific critical thinking skill was not evident. Although the research demonstrated there was no direct correlation of a specific skill to a disposition, the research showed a statistically significant ($p < .001$) correlation to thinking skills and dispositions in 1557 nursing students (Facione, 2000, p. 76). The benefit of Facione's research to this research is it provided a foundation for instructors to examine if current pedagogy nurtures student motivations towards developing specific critical thinking skills. Additionally, the critical thinking dispositions offered a framework to examine if using tablet technology in collaborative learning was perceived to encourage development of critical thinking dispositions.

Critical Thinking and Problem-Based Learning (PBL)

Current research has examined the application of higher order thinking to learning objectives in academic programs ranging across disciplines. Various studies have examined the relationship between critical thinking and problem-based learning with some showing improved critical thinking using this instructional method (El-Shaer & Gaber, 2014; Orique & McCarthy, 2015). El-Shaer and Gaber (2014) used problem-based learning with third-year nursing students (n = 200). Their study documented a statistically significant gain between groups to improve critical thinking abilities following the learner-centered instructional approach. Similarly, Orique and McCarthy (2015) identified a within group large effect (eta square=0.869) in critical thinking skills for first-semester undergraduate nursing students (n = 49) using a problem-based approach in a Nursing Fundamentals course. While each study used a student centered learning approach, El-Shaer and Garber (2014) emphasized reflection, and Orique and McCarthy (2015) used a combination of lecture, group discussion and student mentors to instruct participants on care plan development. Both studies used a variation of Facione-based critical thinking skill testing (i.e., California Critical Thinking Skills Test and Holistic Critical Thinking Scoring Rubric).

Other studies have found more limited or no connection between PBL and critical thinking (Choi, Lindquist, & Song, 2014; Masek & Yamin, 2012). Two studies used a pre/post-test approach with different instruments. One used the Critical Thinking Ability Scale for College Students (Choi et al., 2014) and the other used the Cornell Critical Thinking Test Specimen (Masek & Yamin, 2012). In the study consisting of 96 Korean

Nursing students, Choi et al. (2014) identified a positive significant correlation with "no significant difference in the groups [control and experimental]" (p. 54), while Masek and Yamin (2012) did not find a significant improvement in critical thinking between groups during an Electrical Engineering course of 53 first semester Malaysian students (p. 4). Although these studies indicate a limited or no significant effect, other studies (El-Shaer & Gaber, 2014; Orique & McCarthy) demonstrate a large effect where problem-based learning influenced the development of critical thinking. Thus, while it appears there is some evidence of potential for problem-based learning to influence critical thinking, there is no consensus on its effect.

Students and Critical Thinking

In general, higher education institutions have implemented critical thinking goals as a foundational learning objective for postsecondary education success. Much research in critical thinking for college students has recognized that critical thinking is a desired result and an established learning objective in higher education (Burke, Sears, Kraus, & Roberts-Cady, 2014; Kim et al., 2013; Rickles, Schneider, Slusser, Williams, & Zipp, 2013). Although the literature documents the desire of higher education to improve student critical thinking, there are mixed results concerning the improvement of critical thinking skills or attributes through course work. Kim et al. (2013) found critical thinking skills were being developed, but students did not demonstrate a mastery level of analytical thinking. Rickles et al. (2013) identified that interventions during the semester improved student critical thinking skills, and provided "evidence that critical thinking can be taught" when provided multiple assignments (p. 278). A key component in a few

studies of students and general education coursework was the positive application of collaborative or group learning with critical thinking and knowledge development in students (Kim et al., 2013; Torenbeek, Jansen, & Hofman, 2011).

Other research that has addressed critical thinking in coursework includes studies showing the benefits of writing assignments (Faragher & Huijser, 2014) and collaborative groups (Santiprasitkul, Sithivong, & Polnueangma, 2013). In a mixed-methods study, Faragher and Huijser (2014) analyzed 12 random scripts from students at the University of Southern Queensland, Australia to identify Higher Order Thinking Skills (HOTS) using Vygotsky's concepts of inner speech and self-regulation as a basis for examining critical thinking in the written assignments. Using Marzano's descriptors identified in Faragher and Huijser (2014), the scripts were evaluated for critical thinking skills, and showed varying degrees of higher order thinking skills (HOTS) in the students as they entered the institution (p. 39). Although inconclusive results were identified, the study provided an example of how critical thinking is being developed in postsecondary coursework.

The final study demonstrated how collaborative groups in problem-based learning can be used to develop critical thinking. Nargundkar, Samaddar, and Mukhopadhyay (2014) conducted an empirical study with pre- and post-tests to gather information on two groups (before and after) with 268 (n = 154 and n = 114) students in a business analysis course using two-sample t-tests on different levels of learning (knowledge, comprehension, and critical thinking). The guided problem-based learning (PBL) environment used 3 to 5 member groups to discuss situational problems. During the

discussions, the instructor asked questions to decide how to scaffold information for the students. The results showed "that students' performance on CT problems improved significantly ($p < .0001$) with a large effect (1.097) due to the use of the Guided PBL approach" (p. 98). The research found improvement in academic performance on the final exam of 9% and an improvement in critical thinking of 24%, with a group task performance increase of 6% (Nargundkar et al., 2014, pp. 97-98). This research indicated that collaborative learning environments may be effective at improving critical thinking skills.

Finally, the research indicated that critical thinking positively influenced student coursework. Although the research does not overwhelmingly identify significant results, when working in collaborative groups that complete multiple guided or scaffold learning assignments, the participants showed positive indications of improved higher-order thinking (Faragher & Huijser, 2014; Rickles et al., 2013; Santiprasitkul et al., 2013). In addition, some of the research supported knowledge development (Kim et al., 2013) and academic achievements (Nargundkar et al., 2014) in critical thinking focused instruction.

Critical Thinking Proficiency

In recent years, supporters of an increased focus on higher order or critical thinking skills in higher education have determined a need to improve this skill through an assessment-based process for college and career success (Benjamin et al., 2013; Conley & French, 2014; Hart Research Associates, 2015; NGACBP, 2010). In a "state of college readiness among high school students", Venezia and Jaeger (2013) expressed that high school students were not ready for higher education coursework, and iterated that

improved habits of mind (i.e., critical thinking) are needed to succeed in college (p. 117). In an online survey sponsored by Achieve (2015), 82% of college instructors (*n* = 767) and 26% of employers (*n* = 407) surveyed indicated they were dissatisfied with high school preparation of critical thinking skills in secondary graduates (*n* = 1,347). Additional results from a Hart Research Associates (2015) study of 400 employers and 613 college students indicated, although a majority of student participants felt they were prepared for critical and analytical tasks (66%), employers were not convinced graduates were prepared with those skills (26%).

The culmination of the qualitative and quantitative data presented above from national policy contributors, higher education stakeholders, and education influencer surveys provided some support for a need to address a perceived gap between secondary education and college/career expectations for students to improve critical thinking skills. Curriculum, pedagogy and assessment based on critical thinking dispositions have potential for connecting secondary and postsecondary critical thinking skills development. The next section elaborates on this potential solution.

Critical Thinking and Collaboration

In addition to Nargundkar et al. (2014), further research has addressed the benefits of collaborative learning for critical thinking development. The common indications are that group work encourages student engagement, peer learning, and goal attainment through social interaction that challenges individual beliefs (Eklöf, 2013; Mohan, 2012; Waite & Davis, 2006). Eklöf (2013) and Waite and Davis (2006) identify the benefits of research to encourage reflection through small group interaction. In each of the previous

studies mentioned, the students were challenged to develop new knowledge from alternate viewpoints, and learn from their peers to help scaffold the adoption of new ideas or information. The process of creating new knowledge through fact-finding and collaborative experience was supported by Glaser's (1942) definition of critical thinking through logical inquiry.

Waite and Davis (2006) used peer learning, and instructor provided input (scaffolding, mentoring, guidance) as part of the collaborative teams in a higher education setting. The researchers worked within the groups and as contributors to the process as co-tutors. The study recognized that students have different levels of knowledge, and could have improved the development of critical thinking within the groups. Based on information from a questionnaire, the research reported that alternate experience and views benefitted critical thinking development, and that collaboration provided a supportive learning environment (Waite & Davis, 2006, p. 415). Though researcher influences may have affected the results by tutor input, the study "findings support the belief that collaboration offers an appropriate way to foster critical thinking" using a mixed-methods format (Waite & Davis, 2006, p. 417).

In a different study, Eklöf (2013) used a qualitative approach that reviewed written assignments assessed in 60 hours of student team groups from upper secondary school students filmed over a three-year project. In 28 video clips, the students were assessed on their "critical thinking practices" as they analyzed and planned a collaborative writing assignment (Eklöf, 2013, p. 65). Qualitative statements showed indications of critical thinking development in social learning groups as the students

resolved conflicts associated with resource selection and sources of information. Awareness of other group performance, “Sonia: check how much the other group has written”, appeared to provide peer influence on the collaborative process (Eklöf, 2013, p. 62). After assessing the student’s comments and collaboration, Eklöf (2013) introduced an alternate description of critical thinking that incorporated the group’s interaction as "what students do together to analyze, deliberate on, and evaluate based on a desire to succeed" (p. 73). Eklöf (2013) suggested that critical thinking occurred during and after the writing assignments from self-regulated work and reflection when focused on the task content.

Mohan’s (2012) research demonstrated that instructional technology provided a tool to encourage critical thinking development in collaborative learning environments. Based in Facione’s (1990) focus on "purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation, and inference" (p. 6), Mohan (2012) encouraged students to examine different perceptions (reflection) using a blackboard as a tool for encouraging critical thinking in college students. The 19 students were divided into two groups ($n = 13$, $n = 6$) with the larger group receiving the intervention (classroom collaboration and lab work). Although the study did not specifically address critical thinking in the findings, the students in the intervention group did show an increase in academic achievement over the control group when compared on five years of course grades. This empirical study suggested that collaborative learning environments can positively affect academic achievement.

In contrast to the previous three studies, Santiprasitkul et al. (2013) conducted a one-group pre-post-test study on 94 students in a nursing course that included collaboration to develop critical thinking skills and improve achievement. The control group was the lecture course from the previous year. The problem-based learning environment used group work to complete course tasks. When examined against students in a traditional learning environment, the findings indicated that achievement was no different between the two groups and the students demonstrated a statistically higher ($p < .05$) level of improved critical thinking following the problem focused learning approach.

Some research indicates that collaborative learning can moderately influence the development of critical thinking with no influence on achievement (Santiprasitkul et al., 2013), other research indicated that at the very least, the conflict associated with group interaction, task accomplishment and peer influence encouraged students to analyze knowledge and develop new understanding (Eklöf, 2013; Waite & Davis, 2006). By developing the ability to acquire this new knowledge and understanding, technology may overtime influence how the student performs academically (Mohan, 2012). Overall, the literature in this section seemed to indicate a link between collaboration and development of critical thinking and academic achievement.

Technology Tools and Collaboration

As noted in the previous section, there appears to be a connection between collaboration and critical thinking, next I reviewed the potential of technology tools to support collaboration. In this section, three areas were examined: computer supported collaborative learning (CSCL), computer assisted learning, and tablet technologies.

Computer Supported Collaborative Learning

Researchers have claimed that using interactive learning and engagement tools improves student knowledge development and challenges students to develop socially (informally) and cognitively within groups (Tlhoaele, Hofman, Winnips, & Beetsma, 2014). Some research has shown computer supported collaborative groups improved the quality of problem solving resulting from shared domain knowledge or group awareness (Bodemer & Dehler. 2011; Noroozi, Teasley, Biemans, Weinberger, & Mulder, 2013; Phielix, Prins, Kirschner, Erkens, & Jaspers, 2011; Slof, Erkens, Kirschner, & Helms-Lorenz, 2013). The collaborative learning environment encouraged the student to develop critical thinking skills as they developed knowledge, and learned to engage their peers through a technology supported collaborative learning environment.

Computer Supported Collaborative Learning (CSCL) may facilitate knowledge development through social interaction using collaborative tools to create an effective group-learning environment. Noroozi et al. (2013) concluded that students using collaborative tools could learn through interaction or shared information to resolve problems (p. 192). The student interaction within a group encouraged students to share information between team members through cognitive and social engagement to "construct knowledge" (Phielix et al., 2011, p. 1088). Dehler, Bodemer, Buder, and Hesse (2011), indicated computer based tools assisted in building knowledge awareness cognitively and socially. Using computer-based collaborative tools, "social and cognitive behavior" can be encouraged using reflection and peer feedback in group learning (Phielix et al., 2011, p. 1099).

CSCL tools support knowledge construction through multiple types of media to facilitate student interaction. Internet based tools have been shown to encourage students to engage during synchronous and asynchronous discussion using support systems such as collaborative or electronic mail applications (Noroozi et al., 2013). Computer-based tools, positively influence performance as students reflect on group work and provide peer level feedback to improve knowledge sharing (Dehler et al., 2011; Phielix et al., 2011). Dehler et al. (2011) indicated that the use of technology improves collaboration through awareness and student interaction with the instructor and/or peers. Research indicates that computer-based tools facilitate interaction among learners that can enhance knowledge construction.

Although collaborative learning often focuses on an ill-defined problem, scripts provided by the instructor help to guide student progress and encourage a high-quality learning environment. Single script or scaffold inputs are useful in guiding knowledge development and sharing in collaborative learning (Noroozi et al., 2013; Phielix et al., 2011). These directed inputs offer a framework for ensuring informal learning is supplemented with learning objectives that provide goals for the group learning experience (Dehler et al., 2011).

Computer supported learning can support the application of scaffolding through social media, electronic mail and collaborative tools to encourage shared knowledge. As the students transfer information and interact socially, team development increases, and students demonstrate a more positive attitude (Kirschner, Kreijns, Phielix, & Fransen, 2015; Phielix et al., 2011, p. 1100). The added benefit of technology to support

communication is that it may facilitate learning during the student's social interaction to improve quality (Jeong & Hmelo-Silver, 2016; Stahl, Koschmann, & Suthers, 2006). Effectively integrating computer supported learning uses tools that encourage social engagement, information exchange and knowledge construction through a shared experience.

In contrast, current research has demonstrated conflicting results in Computer Supported Collaborative Learning in producing effective collaboration, social interaction, and knowledge acquisition to enhance the learning environment (Lu & Churchill, 2014; Zheng, Niiya, & Warchauer, 2015). Lu and Churchill (2014) concluded that although social interaction was encouraged, it was temporary and remained at an informal level (i.e., information sharing) rather than a meaningful, learning focused engagement. Lu and Churchill (2014) defined this as "cognitive engagement" in their mixed-methods study of thirteen first-year college students to identify social interaction patterns and learning engagement in a social network environment (p. 402). Similarly, Zheng et al. (2015) observed the collaboration between 139 participants over four semesters in a qualitative study in China to identify the success of collaborative learning using wikis. The results stated that students co-located tended to interact socially while preventing "in-depth inter-group collaboration" (Zheng et al., 2015, p. 366). In these studies, student interaction was limited to a surface level of social interaction and there was limited collaborative engagement, thus demonstrating that Computer Supported Collaborative Learning may have challenges in meeting the outcomes associated with effective collaboration, social interaction, and knowledge acquisition in the learning environment.

Computer Assisted Learning

Although computer assisted learning research indicates student collaboration and learning is enhanced when using applications, Chung, Lee, and Liu (2013) suggested social interaction may be negatively affected when used in face-to-face learning. The study used three groups of three graduate students that either completed a collaborative assignment from a single group display or from individual devices using web search and mind-mapping applications. The shared display group demonstrated a higher level of communication and coordination that benefitted from non-verbal social cues (Chung et al., 2013). In a non-shared display setting, group discussion and student interaction "mostly occur in the form of peer-to-peer [unsocial] rather than joint discussion" (Chung et al., 2013, p. 195). Conversely, two distributed groups demonstrated a deeper level of communication among the students in a non-shared display group. The results from this study indicate that student's applying computer-supported applications are more effective when the learning objective encourages a common focus using a common display or distributed assignment.

Tablet Applications

Enhancing the learning environment for students through the application of technology can provide a way for engaging the learner with hands-on tools to create knowledge and encourage students to interact. Based on research cited in previous sections of the literature review, the process of learning or developing knowledge within a technology centered learning group fosters the relationships from "formal and informal interaction" (Mäkimattila, Junell, & Rantala, 2015, p. 467). This interaction can

challenge the learner to question what they know or do not know and to reflect on the knowledge built as a foundation for developing the discipline needed in a critical thinker.

Recent uses of collaborative applications are creating innovative ways to engage students in social and cognitive discussion during coursework engagement, and are providing the instructor with methods to help students acquire new knowledge through cognitive learning (Fleischmann, 2014). One tool, the tablet, offers a medium for students to collaborate and organize projects using Web 2.0 applications (Frisch et al., 2013). Fabian and MacLean (2014) indicated "student engagement was improved" using applications on the tablet (p. 13). While working in groups of two to three members, the students (n = 70) in the pilot study completed various types of coursework using word processing, task-specific and Internet search applications. Similarly, Wakefield and Smith (2012) observed students (n = 17) using applications on tablets in an undergraduate education course. Findings from the case study indicated that students "demonstrated a deeper understanding of multiculturalism" in collaborative learning (p. 647). Additionally, the instructor recognized the tablet as a "tool with which learning is enhanced" (p. 647). The results from both studies suggest that tools such as a tablet that can support collaborative applications may be useful in postsecondary instruction as a way to improve student involvement in collaborative learning and enhance critical thinking.

Collaborative Applications

Collaborative applications provide a way to urge participation within the group learning process to engage with peers and instructors. The applications provide a means

of communication in virtual and face-to-face engagements using social media and project management applications, while promoting group interaction and knowledge gathering (Al-rahmi, Othman, Yusof & Musa, 2015; Deal, 2009; Zhou, Simpson, & Domizi, 2012). Al-rahmi et al. (2015) examined the benefits of social media to influence collaboration in a mixed-methods study including 941 postgraduate Malaysian students. The results indicated social media "greatly and positively" affected collaborative learning, and social media and collaboration had a positive impact on academic performance (Al-rahmi et al., 2015, p. 272). Similarly, Zhou et al. (2012) investigated the effectiveness of GoogleDocs, an online word processing application, to encourage communication (written) in a collaborative learning environment with 35 undergraduate students working in small groups of three to four students. At the end of six weeks, the findings from the mixed-methods study suggested GoogleDocs was an effective tool for "in and out-of-class collaborative writing" activities (p. 365). Although this research demonstrated a positive effect on collaboration, the students did not show a positive effect on achievement when evaluated pre- and post-intervention.

Hsu, Ching, and Grabowski (2014) claimed the selection of software and Web 2.0 tools is important to facilitating group interaction and knowledge acquisition. Collaborative tools that encourage group interaction, reflection, and feedback contribute to the effectiveness of group learning. Noroozi et al. (2013) found in their study that graphical concept maps and problem resolution applications supported the sharing of ideas during critical analysis. Dehler et al. (2011) used tools in a computer-mediated environment to enhance student awareness of domain knowledge and social knowledge

and found such tools influenced communication and student interactions. Similarly, Kirschner et al. (2015) assert that tools that encourage social interaction and reflection contribute to the creation of a self-regulated learning experience to improve group collaboration (pp. 64-67). Deal's work on technology and collaboration aligned with the concept of using collaborative technology to encourage critical thinking development. Deal (2009) demonstrated how current Web 2.0 tools could be used to support project-based collaborative learning that encouraged communication, team definition and participation, project management, resource management, co-creation, consensus building, and presentation and archiving (see Figure 2). The framework was created by combining project-based and collaborative learning approaches focused on solving a problem though the use of technology (Deal, 2009, p. 2). Deal's (2009) project-based technology model provided a framework to support the learning process through social interaction, knowledge acquisition and task productivity tools.

In Deal's (2009) model socialization is supported through the application of social networking tools to encourage students to share formal and informal information (Johnson & Johnson, 1996) as they build relationship and a team identity. Self-regulation (knowledge gathering, project construction, critical thinking) is supported during co-creation, where students can see peer input and ask questions as the final presentation is created during consensus building (Facione, 1990; Kirschner et al., 2015). Co-creation resulted in students "generating a [better] range of ideas" (Deal, 2009, p. 5). The Web 2.0 tools supported collaboration using concept maps, wikis or other interactive editing tools to encourage "direct interaction between team members" and individual reflection (Deal,

2009, p. 3). Based on the work of Deal (2009), applications such as GoogleDocs/Slides, Hootsuite, and Skype were identified as applications that could support collaboration. Google applications could provide the project management, resource management, co-creation, consensus building, and presentation and archiving tools (knowledge building), while Hootsuite and Skype may provide the communication, team definition, and participation tools (social interaction). Other applications used on tablets might also provide ways to support collaboration, but the choice of what applications are selected to encourage group collaboration may depend on the instructor's acceptance or relevance of the tablet as a collaborative learning tool.

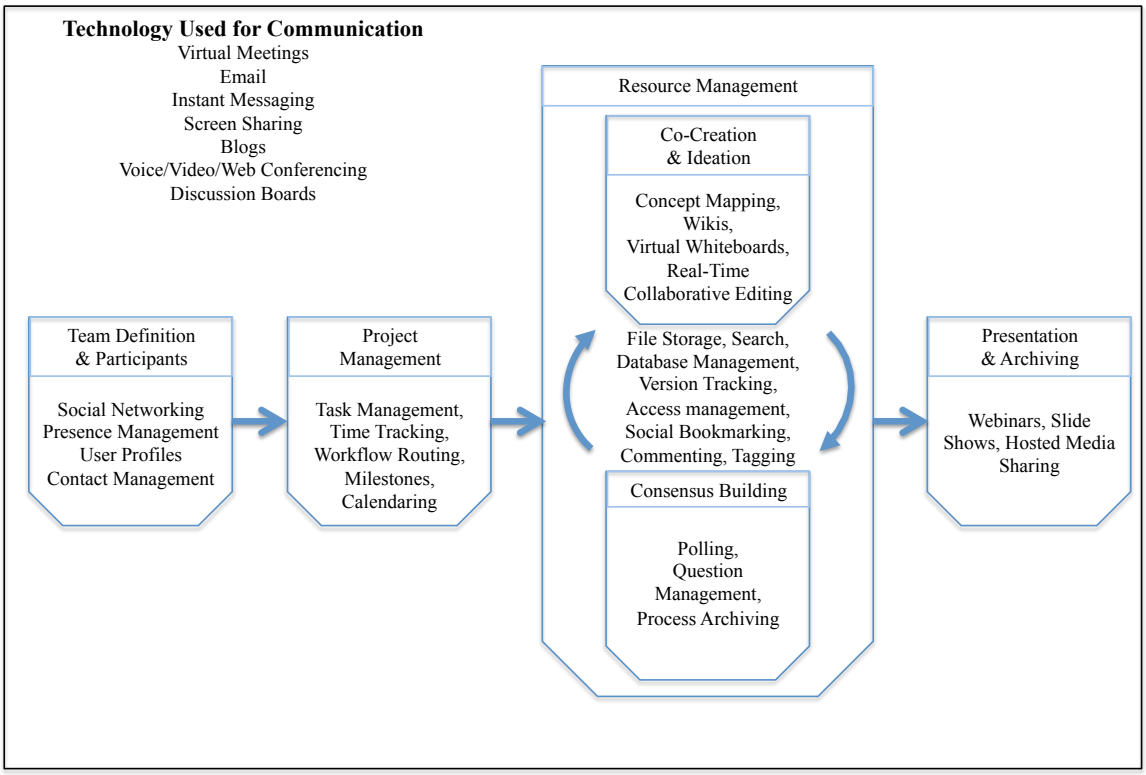

Figure 2. Deal's (2009) Technology Support for Project-Based Collaborative Learning.

Technology Acceptance

Since Davis' (1986) early work, the TAM has been used to assess the perceived usefulness and ease of use to understand the user's attitude toward using different types of technology. Later work addressed the acceptance of information technology based on technology design (Davis, 1993). In the field study of 112 users, Davis' (1993) research identified that perceived usefulness outweighed ease of use by .52 or 52% on predicting actual use (p. 482). Later, Venkatesh and Davis (1996) conducted research with 108 subjects in three experiments to understand the influence computer skill self-efficacy has on technology acceptance. In each of the three experiments, there was a positive indication that a user's computer self-efficacy before and after training influences

acceptance of a given technology. These findings (Davis, 1993; Venkatesh & Davis, 1996) could provide insight into how an instructor's perception of a technology influences how and how much a technology is implemented in learning.

Study Measures

In addition to using Deal's (2009) collaborative learning design, and Facione's (2013) critical thinking dispositions as survey questions, the study used demographic questions from the EDUCAUSE Center for Analysis and Research (ECAR), and modified versions of the Cooperative Learning Implementation Questionnaire (CLIQ) and the Technology Acceptance Model (TAM). The ECAR demographic items were used in research to gain a better understanding of the participants being examined at the instructor levels in higher education (Brooks, 2015; Dahlstrom, Brooks, Grajek, & Reeves, 2015). The ECAR study information section and demographic format was chosen as a common standard of gathering educational technology data for the instructor (EDUCAUSE, 2015). A more complete discussion of the survey components is in chapter 3 and items are included in Appendix B.

The CLIQ is a measure used to study teacher motivation while implementing cooperative learning (Abrami et al., 2004). Other studies have used the CLIQ to examine the integration of cooperative or collaborative learning (Kirik & Markic, 2012; Ruys, Keer, & Aelterman, 2010). Kirik and Markic (2012) developed an instrument from the CLIQ and the Cooperative Learning Science Questionnaire (CLSQ) to examine pre-service elementary teacher development of self-efficacy (p. 5005). The study compared the confidence to integrate cooperative learning strategies of pre-service elementary

instructors with pre-service junior high instructors. Using the CLIQ and CLSQ based questions to understand a definition and applied value of cooperative learning, the study identified that pre-service elementary teacher had a more naïve understanding of the definition of cooperative learning, and pre-service elementary and junior high teachers have high expectations of cooperative learning (Kirik & Markic, 2012). The study demonstrated that CLIQ based questions could be used in understanding how instructor attitudes and opinions influence the application of cooperative learning.

In addition to Kirik and Markic (2012), Ruys et al. (2010) used the CLIQ for their study and modified the term cooperative learning to collaborative learning (CL) in the instrument. The study examined 120 teacher educators and 369 pre-service teacher beliefs and conceptions about education and collaborative learning, implementing collaborative learning, impact of self-efficacy (sense of competence) on the teacher's concepts toward collaborative learning, how collaborative learning was implemented, and the differing factors that explained the teachers teaching behavior (Ruys et al., 2010, p. 4). The CLIQ was used specifically to measure the collaborative learning concepts for this study (Ruys et al., 2010). The results of the CLIQ questions indicated that all participants "expect positive results from CL", and the teacher educators were more positive about implementing CL than the student techers (Ruys et al., 2010, p. 8). The value of this study for the current research design is the use of collaborative learning rather than cooperative learning in the CLIQ, and the use of the questionnaire to understand instructor perceptions concerning CL.

In 2000, Venkatesh and Davis developed the TAM2. The TAM2 expanded the model to include social influence and cognitive instrumental processes (Venkatesh & Davis, 2000, p.187). The extended model characteristics included influences like social norms, job relevance and output quality as contributors to the user's behavior intention (Venkatesh & Davis, 2000). The TAM and its extended form has been used and adopted for various technologies (i.e. learning management systems, collaborative e-learning environments; and smartphone adoption and usage (Alharbi & Drew, 2014; Cheung & Vogel, 2013; Joo & Sang, 2013). Alharbi and Drew's (2014) TAM question methodology included the user behavioral intentions as an influencer to acceptance, and was used for this study to understand the postsecondary instructors' perceptions about using tablet technologies in instruction.

Summary

The literature review provided significant documentation that critical thinking is an important skill in both academic success and career readiness. Critical thinking is an interactive process of development that can be taught through an intentional learner centered instruction with formal and informal interactions. Using a guided problem-based learning environment, computer-supported instruction can encourage learning through instructor and peer collaboration, described by Vygotsky as the Zone of Proximal Development (ZPD), while challenging the student to develop new knowledge. Instructional technology like the tablet, takes advantage of Web 2.0 applications to foster collaborative engagement through a flexible medium for communication. The technology offers a tool for student interaction as a reflective and scaffolding tool during group

activity. By engaging in interactive learning instruction, the student learns to analyze and apply new knowledge, and begins to develop the thinking skills through the fostering of disposition towards critical thinking. Ultimately, this study sought to understand if postsecondary instructors were using tablet technologies in their instruction in ways that support collaboration, and if they believed collaborative activities using tablet technologies could have an impact on fostering the critical thinking dispositions of students. In the following methodology section, the research design was explained to empirically explore instructor attitudes and opinions toward the application of tablets for collaborative learning as a way to encourage critical thinking dispositions in postsecondary learning environments.

Chapter 3: Methodology

Current quantitative research is limited on the use of portable technology to develop critical thinking through collaboration. My study sought to explore the perceptions of postsecondary instructors on incorporating tablet technology to support collaborative learning through application-based tasks identified by Deal (2009) to foster Facione's (2013) critical thinking dispositions. The study contributes to the literature on the application of collaborative tools in education to promote the development of critical thinking. Results may inform future course designs that focus on collaboration and critical thinking. In addition, by focusing on postsecondary instructors who are members of a technology-oriented professional association, insights may be gained that could inform less technology-oriented faculty about how such technologies can be used to support the development of critical thinking skills through collaborative learning. This chapter provides a review of the research questions, describes the research design and rationale, explains the methodology used, including the population to be studied and the sampling approach, procedures, and instrumentation. The data analysis procedures, threats to validity, and the ethical procedures to be followed also are included.

Research Design and Rationale

This study used a quantitative survey design without the application of an intervention. Through an electronically mailed survey, the study used a survey approach as explained in Pinsonneault and Kraemer (1993) to focus on the instructors' attitudes and opinions associated with integrating collaborative tools on tablet technology to encourage collaborative group-based knowledge acquisition as a way to foster critical

thinking dispositions in higher education students. The survey was provided to postsecondary instructors who were members of the Association for Educational Communications and Technology (AECT) organization, an international professional organization.

Initially, a quasiexperimental approach with nonequal groups was examined as an approach to research this topic. The nonequivalent control group is "a more elaborate design for contrasted groups" that allows for examining intact groups, and an excellent method to compare groups using a pre- post-test approach (Frankfort-Nachmias & Nachmias, 2008, p. 119). Although the quasiexperimental approach would effectively research this topic, identifying faculty members willing to implement the intervention over the course of a semester would be difficult. The survey approach allowed flexibility to examine instructors' perceptions (attitudes and opinions) about the effectiveness and usefulness of tablet technology in the postsecondary classroom to support collaboration as a way to encourage critical thinking.

Use of an electronic survey provided a flexible and effective method to gather information from a geographically dispersed sample (population) of individuals (Frankfort-Nachmias & Nachmias, 2008, p. 207) involved in postsecondary instruction. In addition to improving the accessibility of participants, Frankfort-Nachmias and Nachmias (2008) identified low cost, reduced bias error, greater anonymity and increased question consideration as advantages when using mail-based surveys for research. Conversely, this method has disadvantages in the survey design including the loss of potential for complex research questions, inability to probe for greater understanding,

participant experience validation, and lower response rates (Frankfort-Nachmias & Nachmias, 2008).

Some strategies that were used to address the disadvantages of electronic surveys are included in the following paragraph. Based on recommendations from Ary, Jacobs, Sorensen and Walker (2013) for ensuring quality research questions, the questions for the survey were constructed with a single focus and limited to a single sentence. The questions were grouped in similar sections to allow respondents to stay focused on a specific area and avoid answering scattered questions throughout the survey. To improve understanding, the survey included sets of questions focused on collaborative learning, collaborative tools, technology use, and critical thinking dispositions. Additionally, to understand who the respondents were, the survey included questions concerning years of experience as an instructor, type of instructor (part-time, full-time), current faculty position, age, and gender.

Instruments

Survey research is a common design in the social sciences. This method offers flexibility, while providing a quantitative resource that can reach diverse populations. Similar to this study, others have used the survey method to gather data about tablet technology in the classroom (Fabian & MacLean, 2014), understand technology usefulness (Padilla-Meléndez, Del Aguila-Obra, & Garrido-Moreno, 2013), elicit instructor perceptions about collaborative learning (Ruys et al., 2015), and promote critical thinking through collaboration (Scheuer et al., 2013).

Using a mixed method study that included a survey, Fabian and MacLean (2014) conducted research at Perth College to understand instructor perceptions of the benefits and issues of using tablet technology in the classroom. The Technology Acceptance Method (TAM) has been used in other work to understand the role of gender on the intent to use, the perceived use/ease of use and the attitude toward technology, and playfulness in a blended learning system (Padilla-Meléndez et al., 2013). In a teacher education curriculum, the Cooperative Learning Implementation Questionnaire (CLIQ) has been used in previous research to understand instructor and student perceptions concerning collaborative instruction and learning (Ruys et al., 2010). In addition to traditional surveys, recent studies have used web-based surveys to understand how peer feedback influences the role of collaborative learning on critical thinking skills in computer-based learning environments (Scheuer et al., 2013). The previous studies support the use of a survey method in understanding the role of technology in learning, and provide a framework for using a survey method to gather data for collaboration and technology, understanding technology usefulness, instructor perception towards collaborative learning, and promoting critical thinking through collaboration.

I chose an online survey for this study to access a dispersed population with experience in applying instructional technology in postsecondary institutions. The electronic or web-based method provided a way to improve the response rate by engaging a diverse AECT population. Using a web-based approach provided an opportunity to reach the 1,932 registered AECT members, and achieve a reasonable effect size with a confidence level of 95% and a margin of error of 5% (see Table 3). The survey identified

the attitudes and opinions of postsecondary instructors on collaboration in instruction, the use of tablet technologies to support collaborative activities, and how this use might enhance the development of critical thinking dispositions among postsecondary students. Results may lead to a better understanding of ways to use tablet technologies effectively. Ultimately, the survey provided quantitative data to add to the current body of knowledge concerning instructor perceptions of the role of technology tools to support collaborative learning and the development of critical thinking dispositions.

Drawing from existing instruments, this study used previous surveys and questionnaires as the foundation for the instrument. Although grounded in previous work, the questionnaire for my study was reviewed and face-validated by experts from the AECT organization. Two AECT educational technology professors who also teach doctoral level research design and research methods classes and one who is an author for a long published educational research methods text were asked to review and provide comments to adjust the draft survey for potential bias, wording, organization, and question quality associated with leading, threatening, and/or double-barrel statements as recommended in the literature by Frankfort-Nachmias and Nachmias (2008). Three rounds of revision and review occurred until no further recommendations were made. Adjusting the survey questions (see Appendix B) after requesting comments resulted in a final survey for submission to the IRB and to input into SurveyMonkey (see Appendix C). SurveyMonkey allowed for easy access for the participants, anonymous survey data collection, and greater question consideration.

Methodology

In this section, the population under study, the sampling approach, and data collection and analysis are described. In addition, I provide a description of the one-time cross-sectional self-administered survey. Finally, threats to the research methodology and ethical concerns are addressed to ensure the integrity of the study.

Population

The survey strategy used a purposeful, cross-sectional approach to draw information from the population. An estimation of the population to achieve a confidence level of 95% and a margin of error of 5% resulted in a target sample size of approximately 321 participants (see Table 3). This sample size was considered to give a small effect size (.198) that indicated the relative effect for this study to use when compared to other similar studies (Thalheimer & Cook, 2002).

The target population for this study was postsecondary instructors who were members of an educational technology professional association. There were an estimated 1,932 registered members of AECT.org according to InfocusMarketing (2016) at the time of this study. With 1,932 members, a desired sample of size of 321 was the target which would be about 17% of the population (see Table 3). Members who self-identified as postsecondary instructors were asked to voluntarily complete the survey. This population was surveyed through a web-based survey provided to the organization through their research approval department.

Table 3

*G*Power Sample Size*

Input		Output	
Effect Size	.198	Noncentrality Parameter	3.616
α Error Probability	0.05	Critical *t*	1.967
Power	0.95	Denominator *df*	319
		Total Sample Size	321
		Actual Power	.950

Sampling and Sampling Procedures

The AECT organization provides a clear expression of research expectations before members are asked to interact with outside research studies (see Appendix A). The approval process included a statement of why AECT member participation was appropriate, the importance of the study to the field, and how the results would be used (AECT.org). A copy of the completed request is in Appendix D. Once accepted, the organization required IRB approval paperwork from Walden University to be submitted with a copy of the instrument prior to submitting the survey to the AECT membership.

Following submission of the application, the Executive Board accepted the study, and distributed it to the AECT membership through an email from AECT Headquarters. Members of AECT were all adult professionals involved in the education enterprise. Distribution was through an email that connects the participants with the research study. In this case, the email directed the participants to a consent form with a link to the SurveyMonkey survey. Participants were requested to print a copy of the consent form before completing the survey. Clicking on the link and responding to the questions served as consent to participate. A reminder was sent after the initial email. All input was

through the web-based survey for the study data. Hard copies of the survey were provided to AECT for approval to access the membership.

Ethics

Ethical procedures provided in this study can be divided into three distinct actions: (a) stakeholder approval, (b) organizational participation, and (c) participant involvement. Stakeholder approval included the request to use and modify survey items from previous studies or pre-existing surveys, which is discussed in the following section on survey development. Next, organizational participation was sought from AECT.org for the final study survey that was distributed through SurveyMonkey. AECT ensures the individual safety and professional rights of their members by requiring research to gain approval from their internal managing board before requesting participation of the organization's membership.

Finally, for participant involvement ethical procedures were followed to ensure the integrity of the study and the confidentiality of the participants' identities in this study. The existing member data and contact information was maintained by AECT. The participants received a web-based survey through a hyperlink. The link was provided to the participants by AECT in an email. The participants had an opportunity to decline involvement before choosing to select the hyperlinked survey. The linked survey provided an informed consent document prior to receiving access to the survey.

Participants were informed that survey responses were completely anonymous; once responses were submitted, the researcher was not able to identify the participants. The data were collected online by SurveyMonkey and provided as anonymous data by

systems held in password-protected cloud-based data centers. Participants were informed that only the account holder (researcher) could access the data contained within the account. After the data were collected from the survey, the research data were retained on a password secure computer and an external storage device protected in a locked firebox. All data for this study will be destroyed at the end of five years from the completed research date. Following the completion of the study, the results will be disseminated to participants and stakeholders using an email link provided to AECT for the published study.

Survey

The survey for this study was developed from a collection of questionnaires – TAM, CLIQ, and ECAR – along with researcher-developed questions based on Deal (2009) and Facione (2013). The Technology Acceptance Model was originally developed by Fred Davis (1986) for his dissertation to be used for selecting new technology support systems based on ease of use and perceived usefulness towards system acceptance. In later work, he "developed and validated a new measurement for perceived usefulness and perceived ease of use", the foundational work of current TAM questionnaires. In recent work, the TAM has been extended (TAM2) to include the effect that subjective norms (i.e., perception, job relevance) may have on intent to use and perceived use/usefulness of technology (Venkatesh & Davis, 2000). The extended form of this questionnaire has been used and adopted for various technologies: collaborative e-learning environments (Cheung & Vogel, 2013); smartphone adoption and usage (Joo & Sang, 2013), and learning management systems (Alharbi & Drew, 2014).

For this study, Alharbi and Drew's (2014) TAM questionnaire was used to understand the perception and attitudes toward using tablet technology in instruction. The technology being studied was modified to include tablet technology. Alharbi and Drew's (2014) version of the TAM provided a succinct number of questions and included use and usefulness questions in addition to behavioral and job relevance questions as they relate to attitude about using the technology. This aspect of their questionnaire offered insight without an excessive number of questions. The more succinct approach reduced the total number of questions for this study. Adjustments to the Alharbi and Drew (2014) questionnaire were requested from and approved by the authors (see Appendix E).

The Cooperative Learning Implementation Questionnaire (CLIQ) was developed to study teacher motivation while implementing cooperative learning (Abrami et al., 2004). The original survey was administered face-to-face and designed to examine 933 instructors' (secondary and postsecondary) concerns as they related to expectancy, value, and cost in cooperative learning environments. Expectancy was defined as the instructor's view of the benefit of implementing cooperative learning and obtaining the desired outcome which can be affected by their self-efficacy, skill, student characteristics, classroom environment, and collegial support (Abrami et al., 2004). Next, value was described as perception that the innovation (cooperative learning) outcomes were worthwhile to produce benefits such as support to the instructors chosen pedagogy or student enhanced personal skills (Abrami et al., 2004). The cost examined by the CLIQ focused on demands associated with resources like time, effort and specialized materials (Abrami et al., 2004). The appropriateness for this study is that attributes of expectancy,

value, and cost influence the instructor choice to implement cooperative learning. Similarly, these attributes could affect how instructors perceive the benefits of collaborative pedagogy to improve student skills in college.

In this study, the CLIQ term *cooperative* was exchanged with *collaborative*. The research question investigated by the CLIQ-based section of the survey was RQ2:

> Are there differences in faculty perceptions of collaborative learning (IV_1) based on faculty perceptions of critical thinking dispositions (DV_2)?

The survey questions examined instructor perceptions as they related to the application of collaborative learning in section three of the questionnaire. Permission was requested and granted from Concordia to adjust the questionnaire for this study (see Appendix F).

Additional questions were included in the questionnaire to examine the instructors' perceived value in using collaboration to meet expectations as a learning pedagogy while effectively using course resources to develop critical thinking dispositions in postsecondary classrooms. Deal's (2009) framework for using technology to support collaboration was included in the survey to answer the question about how postsecondary instructors were using tablet technologies to support collaboration. The last section of the survey asked participants to answer questions about how they believed tablet technology mediated collaborative activities to support the development of Facione's (2013) critical thinking dispositions. The ECAR demographic questions were used to understand experience and individual characteristics of respondents potentially important in the study. Finally, permission requests to use or modify the TAM, CLIQ, and ECAR were submitted to the institutions or researchers that managed the measures.

Each representative provided an electronic mail response and the corresponding responses are included in Appendix E (TAM), Appendix F (CLIQ), and Appendix G (ECAR).

Although all ECAR survey questions were not used in this study, the 2015 faculty questionnaire reported the "17 items used to measure disposition, attitude, and usage…explained approximately 76% of the variance in the data" in a rotated factor analysis with a scale measure reliability of α=0.93 (Brooks, 2015, p. 56). Next, the original TAM questionnaire has been verified and used with various technologies as the subject of the questionnaire with the validity of the instrument showing a correlation for convergence for usefulness and ease of use questions (α=.05) using multi-trait-multimethod analysis (MTMM) (McCord, 2007). Davis (1989) reported reliability of the questionnaire was effective at measuring perceived usefulness (α=0.98) and perceived ease of use (α=0.94). The 12 scale items explained greater than 54% of the variance in the initial two-study development of the instrument that resulted in a correlation of usefulness (r = .63, study 1; r = .85, study 2) and ease of use (r = .45, study 1; r = 59, study 2) (Davis, 1989). In addition to the base measures of validity maintained by Alharbi and Drew (2014), they reported that their version of the TAM resulted in an instrument reliability "ranging from 0.901 to 0.924, with a satisfactory value of 0.801" using a Cronbach alpha score 0.70 or higher to indicate a reliable instrument. Finally, the CLIQ contained 48 questions with three categories (perceived value of the innovation, expectancy of success, and perceived cost) resulting in 42.3% of the variance reported by 933 teachers using cooperative learning (Abrami et al., 2004). Using Cronbach's alpha,

the survey reliability by category resulted in high consistency: perceived value of the innovation ($\alpha = 0.74$), expectancy of success ($\alpha = 0.86$), and perceived cost ($\alpha = 0.87$) (Abrami et al., 2004). Finally, for the additional questions based on Deal (2009) and Facione (2013), reliability was assessed during data analysis to verify or establish validity and reliability using Cronbach alpha (Creswell, 2009) from the reliability statistics in SPSS.

Operationalization

The survey for this study was designed from pre-existing surveys (see Table 4) focused on technology user behavior, collaborative learning, and demographic data using various published surveys as guides (Abrami et al., 2004; Alharbi & Drew, 2014). The survey in Appendix B consists of multiple sections that include a demographic and professional experience section and sections aligned to the research questions. The 61 questions were intended to explore the attitudes and opinions of postsecondary instructors concerning the application of tablets in instruction, attitudes towards collaborative learning, uses of tablets to support collaboration, and the role of collaborative learning with tablets in the development of critical thinking dispositions.

The survey included questions that indicated if the participants had experience with tablet technologies and collaborative learning. Those who indicated they had not used both were instructed to stop and not continue the survey. Demographic and professional information were requested in the study questionnaire. The demographic information included age, gender, and education level. The letter requesting participation informed members that the target audience was instructors teaching in institutions of

higher education (IHEs). In addition to scales from other surveys, my survey requested information about how the faculty members incorporated tablet technologies in instruction (based on Deal's work). The questions sought responses about the experiences the instructors have had with using tablet technologies and their attitudes and opinions about tablet use. Professional information included experience with tablet technologies, collaborative learning, critical thinking and learning applications.

Table 4

Survey Section Sources with Scale

Section (What it Measures)	Original Measure	Variable	Scale
1. Instructional Technology Use (Alharbi & Drew, 2014)	TAM	Ordinal	5pt Likert
2. Deal's Framework (Deal, 2009)		Ordinal	5pt Likert
3. View of Collaborative Learning (Abrami et al., 2004)	CLIQ	Ordinal	5pt Likert
4. Critical Thinking Dispositions (Facione, 2013)		Ordinal	5pt Likert
5. Demographics	ECAR	Nominal	Multiple Choice and Open Response

Note. Origin of the research survey format by section from other published instruments.

The study used multiple choice questions to document the participants' experience and academic role. Likert scale questions were used to discover the participant's experience and opinion concerning applying tablet tools in postsecondary collaborative learning environments to encourage critical thinking. The non-demographic sections of the survey used a 5-point scale (i.e., strongly agree, agree, no opinion,

disagree, strongly disagree) with 5 as the most positive answer and 1 as the most negative answer. The gathered data provided generalized perspectives (Gable, 1994) and documented the opined value of collaborative learning, as they related to the criteria of Deal's (2009) applications, on the development of critical thinking dispositions.

The adapted instrument used elements from the Technology Acceptance Model (TAM), Cooperative Learning Implementation Questionnaires (CLIQ), and EDUCAUSE Center for Analysis and Research (ECAR) aligned with the research questions (see Table 5). The TAM questions were modified to include tablets as the technology being researched concerning instructor use of tablet technology in the classroom. The CLIQ questionnaire replaced the word cooperative with collaboration. Researcher added questions were based on Facione's (2013) definition of critical thinking dispositions and Deal's (2009) model for applications of technology for group collaboration. The ECAR items focused on demographic and professional data from the participants.

Table 5

Research Variable Alignment with Survey Questions, Original Measure and Score Range

Variable(s)	Measures	Survey Questions	Score Range
IV_1 Tablet Acceptance	TAM	Questions 1-14	14 (Min) – 70 (Max)
IV_2 Collaborative Tool Use	Deal (2009)	Questions 15-26	12 (Min) – 60 (Max)
DV_1 Collaborative Learning	CLIQ	Questions 27-46	20 (Min) – 100 (Max)
DV_2 Critical Thinking Dispositions (CTD)	Facione's Critical Thinking Dispositions (2013)	Questions 47-61	15 (Min) – 75 (Max)

Note. Collaborative Tasks Using Tablets and Critical Thinking Dispositions questions for this study were developed from Deal's (2009) and Facione's (2013) published work.

Data Analysis Plan

The analysis plan for the study used descriptive (frequencies, means, and standard deviations) and correlational statistics to understand postsecondary instructors' experiences, attitudes, and/or opinions. The analysis focused on the relationship between (1) perceptions of collaborative learning, (2) the use of tablet technologies in collaborative instruction, and (3) perceptions of the relationship between collaborative learning, tablet technology use and the development of critical thinking dispositions. The Statistical Package for the Social Sciences (SPSS) was used to analyze the data (IBM Corp, 2016). The survey questionnaire was produced in SurveyMonkey to allow for ease of access and the collection of data that is importable into SPSS.

SurveyMonkey (SM) was identified as the survey tool to use for this study. SM offers features that allow unlimited questions, SPSS integration, and committee

collaboration to complete and analyze the final survey. The questionnaire was initially developed in a word processing document and pasted into the survey web format, which allowed for multiple drafts to be examined before the final questionnaire was finalized for distribution and data collection.

Anonymous data were collected from SurveyMonkey. SPSS was used to organize and analyze the data from this study. At the completion of the study, the results will be provided to three separate groups EDUCAUSE, Concordia, and Alharbi and Drew (2014) as requested in exchange for use of their survey items.

Data cleaning and screening procedures were evaluated to ensure bias was minimized in the statistical analysis. In addition to examining the demographic and professional information provided by the participants, the responses were examined to identify extreme scores. Extreme cases identified were assessed to see if the demographic data was complete, and if professional experience could be (excessively) influencing the results. Next, the extreme cases or outlier data were assessed to identify if winsorizing was a viable option to maximize participant responses in the study. Winsorizing is a method used to "substitute outliers with the highest value that isn't an outlier" (Field, 2013, p. 196). Ultimately, cases identified as biased or extreme were removed from the study.

Data were examined for bias and outliers using histograms, plots, and Levene's test. Additionally, data were reviewed to identify standardized scores in excess of 3.29 or scores that exceeded three deviations from the mean (Field, 2013). Strategies for controlling for outliers in this study included removing variables and winsorizing (Field,

2013). Removing participants from this study reduced the sample size and affected the effect size. The desired approach to correcting for outliers is to modify the data by identifying the score with a standardized residual value of +/- 3.29; then, identify the highest value that is not an outlier and replace the outlier score (Field, 2013). After outliers were addressed, the data were assessed for normality of variables using a histogram. If non-normality was identified, further analysis was conducted to examine the skewedness and kurtosis of variables using SPSS. Any abnormalities are reported in the data analyses.

Next, data were assessed to identify any missing data from sample. If missing data were identified over 5% of the survey items, the grand mean of the data was used in place of the data to maintain generalizability. Missing data in excess of 15% was assessed for overall effect on generalizability.

Data gathering consisted of surveys completed by the members of AECT who self-identified as postsecondary instructors with experience using tablet technologies to support collaboration as part of instruction. Demographic questions provided a description of the diversity of the participants. Descriptive and correlational statistics were analyzed to identify the attitudes and opinions of the participants toward the use of tablet tools to encourage collaboration as a way to improve the development of critical thinking dispositions in postsecondary coursework. Demographic data was reported using descriptive statistics.

The following research questions were designed to address the gap in quantitative research on how perceptions about collaborative learning and the use of tablet

technologies may encourage dispositions toward critical thinking. The research questions were:

Research Question 1: To what extent do postsecondary instructors accept tablet use in instruction (IV_1 - TAM) and use collaborative tools with tablets (IV_2 - CTU)?

Research Question 2: Is there a relationship between postsecondary instructor tablet acceptance (IV_1 -TAM) and implementation of collaborative learning (DV_1 - CLIQ)?

$H_0$2 There is no statistical relationship between postsecondary instructor tablet acceptance (IV_1 – TAM) and implementation of collaborative learning (DV_1 – CLIQ).

$H_1$2 There is a statistical relationship between postsecondary instructor tablet acceptance (IV_1 – TAM) and implementation of collaborative learning (DV_1 – CLIQ).

Research Question 3: Is there a relationship between postsecondary instructor use of collaborative tools on the tablet (IV_2 - CTU) and implementation of collaborative learning (DV_1 - CLIQ)?

$H_0$3 There is no statistical relationship between postsecondary instructor use of collaborative tools on the tablet (IV_2 – CTU) and implementation of collaborative learning (DV_1 – CLIQ).

$H_1$3 There is a statistical relationship between postsecondary instructor use of collaborative tools on the tablet (IV_2 – CTU) and implementation of collaborative learning (DV_1 – CLIQ).

Research Question 4: Is there a relationship between postsecondary instructor implementation of collaborative learning (DV_1 - CLIQ) and perception of student development of critical thinking dispositions (DV_2 - CTD)?

$H_0$4 There is no statistical relationship between postsecondary instructor implementation of collaborative learning (DV_1 – CLIQ) and perception of student development of critical thinking dispositions (DV_2 – CTD).

$H_1$4 There is a statistical relationship between postsecondary instructor implementation of collaborative learning (DV_1 – CLIQ) and perception of student development of critical thinking dispositions (DV_2 – CTD).

Correlation statistic– Pearson product moment

The alpha level (α) for all data analyses was set *a priori* at .05.

Figure 3 provides a visual representation of the study framework to the research questions and the measures associated with understanding postsecondary instructors' attitudes toward using tablet technology in instruction (IV_1 - TAM), how they incorporate tablet technologies in instruction and whether those approaches exhibit characteristics described by IV_2 - CTU as supporting collaboration (DV_1 - CLIQ), and instructors perceptions about the relationships between use of such technology and collaboration skills and critical thinking dispositions of their students (DV_2 - CTD).

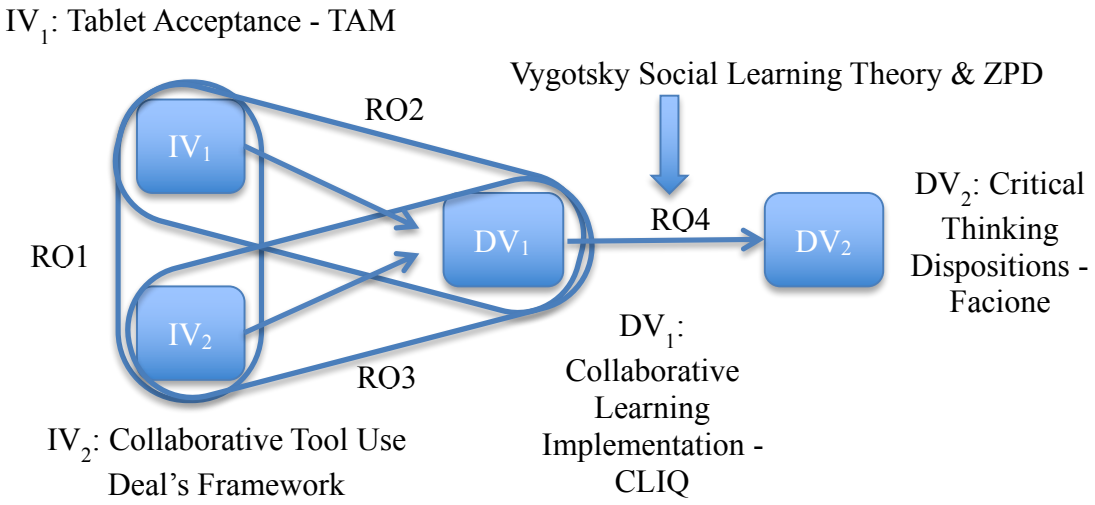

Figure 3. Conceptual Framework with Variable and Measure Integration.

The independent and dependent variables for this study were comprised of subscales (see Figure 4) which were used in the analysis for answering the research questions. Additionally, Figure 5 expresses how the subscales were associated with the independent and dependent variables in the questionnaire.

IV_1: Tablet Acceptance – measured by TAM

1. Perceived ease of use (PEU)
2. Perceived usefulness (PU)
3. Attitude toward usage (ATU)
4. Behavioral intention to use (BIU)
5. Job relevance (JR)

IV_2: Collaborative Tool Use - items developed from Deal's Framework

1. Team definition, cohesion and participation
2. Project management (shared documents)
3. Co-creation and ideation (real time interaction)
4. Consensus building (polling tools)
5. Presentation and archiving (group interaction and reflection)

DV_1: Collaborative Learning Implementation – measured by CLIQ

1. Professional views on collaborative learning
2. Current collaborative teaching practices

DV_2: Critical Thinking Dispositions – measured by items developed from Facione's Model

1. Systematic
2. Analytical
3. Inquisitive
4. Judicious
5. Truth seeking
6. Confident in reasoning
7. Open minded

Figure 4. Subscales by independent and dependent variables.

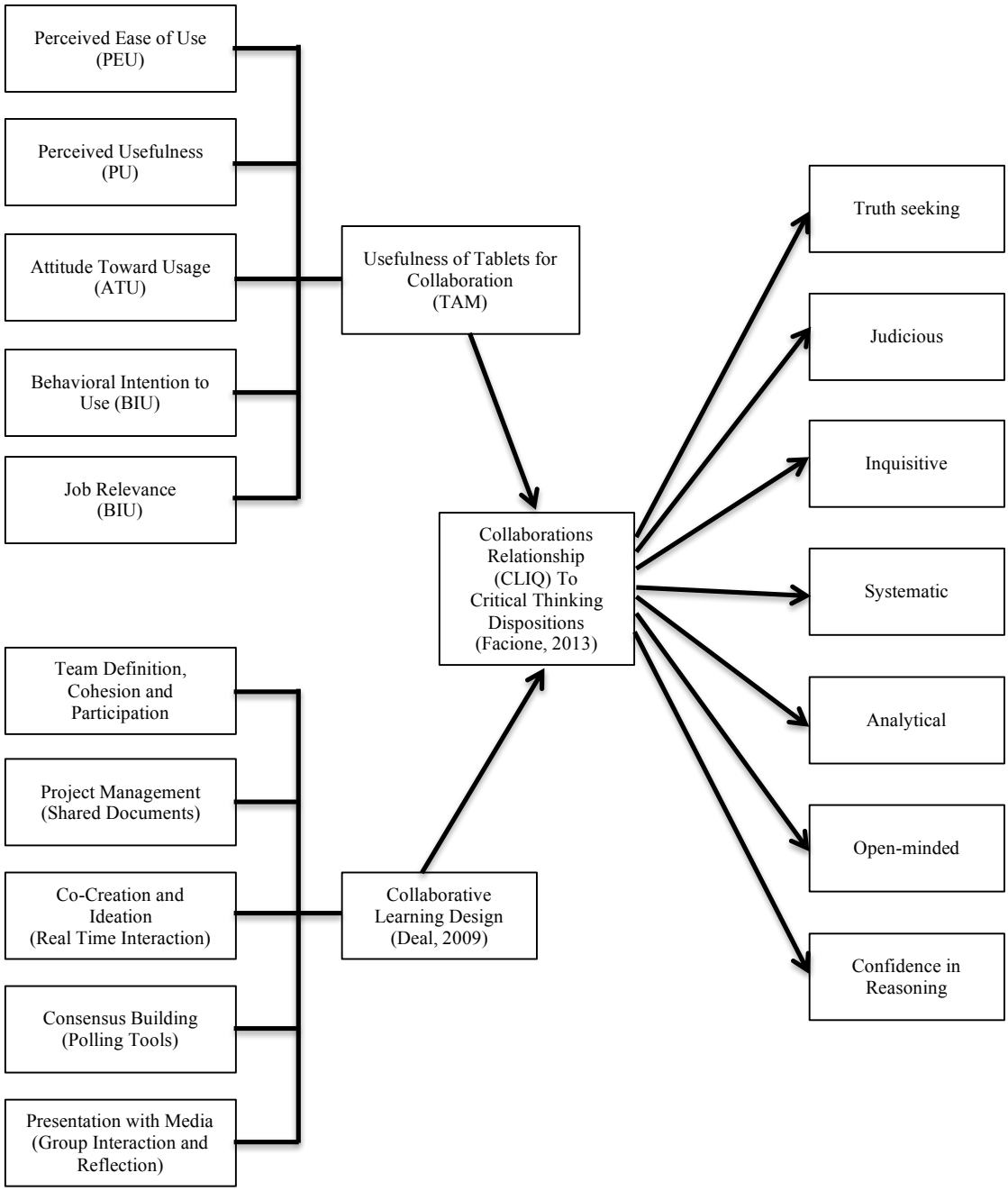

Figure 5. Questionnaire model using Deal's (2009) collaborative learning design, instructor perceived usefulness of tablet technology (Alharbi & Drew, 2014) with the CLIQ to identify any perceived benefits of collaborative learning on Facione's (2013) critical thinking dispositions.

Threats to Validity

External Validity

The survey research method creates some challenges to generalizability. The population in this study was limited by the experience of the AECT members and may not represent a true cross section of the larger postsecondary faculty population. The selected population allows for a specific organizational perspective. Although the chosen population narrows the participant selection, the international members of the organization may provide a more diverse understanding of how tablet tools are being used in collaborative activities and how faculty believe such use influences critical thinking dispositions in collaborative learning environments from a more global position. All AECT activities and publications are in English and all members are fluent in English. Demographic data from the participants who completed the survey helped to shape the overall generalizability of the study.

The setting for completing the survey was likely different for each participant. Setting is an uncontrolled external influence. Minimizing the effects of multiple environments was accomplished by ensuring the questionnaire was clear and succinct. Questions were ordered to reduce confusion with the demographic and professional questions at the end. Simply designed questions allowed the participant to answer quickly and move on to the next question. Collaborative learning, critical thinking, and tablet tools definitions were provided before each section of the survey. The final characteristic employed to reduce participant fatigue was to develop a survey that did not exceed 20 minutes to complete on average as recommended by Cape and Phillips (2015).

The last influence on generalizability is the effect of history on treatment. The amount of time between the participant's most recent use of tablet technologies in a collaborative learning environment may be over short or long periods. The inconsistent times could influence the participant accuracy in answering survey questions. Reducing this influence on external validity was accomplished by adding a question in the professional questions to assess the participant's most recent use of tablet technology in the classroom.

Internal Validity

Internal validity concerns include maturation, selection, history, and testing. Maturation is a concern based on participant experience levels. Levels of experience and knowledge could introduce bias into the survey responses due to varying understanding of how to apply tablet technologies in collaborative learning. Demographic information and professional data was available to identify any differences in survey answers and experience. Selection for this study was not random. The respondent's chose to contribute to the study from an AECT generated email, acknowledging experience and choice to participate. Instrumentation is also a potential issue with internal reliability. Instruments used in this study, while based on previously validated and reliable instruments, were modified and combined, which could influence the reliability of the final instrument used in this study. Finally, history and testing were covered in the external validity section above.

Content Validity

Content validity is the measurement used to assess that the instrument is analyzing the studied concept or phenomenon (Frankfort-Nachmias & Nachmias, 2008). As noted earlier, the instruments adopted from others have demonstrated content validity used individually. Content validity for the instrument developed for this study, which uses a combination of items from other instruments, was tested for face validity through a review by the researcher's committee. However, further examination of content validity is warranted and is a limitation of this study.

Ethical Procedures

The population for this study was postsecondary instructors who were members of AECT, a professional organization for educators interested in technology with 1,932 estimated members. Cooperation to conduct the research was requested of AECT once the proposal was completed. After the proposal was complete and Walden University's IRB approved the study, the Walden University IRB approval and survey were submitted for final organization approval using a letter (Appendix H); the survey was provided to the participants once approved by the AECT Executive Board.

The participants in the study were sent an invitation to participate in the research via electronic mail from AECT Headquarters. The contributors were provided consent forms with a link to the survey. Any individual could choose to decline the survey or stop the survey at any time. Participants were not provided monetary or gift incentives to complete the questionnaire. The data were collected by the SurveyMonkey web survey to insure no contact with the participants that would result in researcher bias. Responses

were anonymous. The downloadable SurveyMonkey data did not provide names of the participants or email addresses, which insured the data was anonymous. The collected data is the property of the survey developer, the individual survey response is the property of the participant, and the data was maintained in a data center that required password authentication before access (SurveyMonkey.com). The data on the web site remains until 12 months after an individual account is made inactive (SurveyMonkey.com). My SurveyMonkey account and all downloaded data for this study will be destroyed after five years. As an AECT member, I refrained from discussing the research results with, or actively recruiting other members, until the study was complete. I have no leadership role within AECT and have no relationships with other members that could create a conflict of interest.

Walden University's Institutional Review Board (IRB) approval was sought prior to collecting any data. The IRB request form was completed after the proposal oral. Once approved, the university provided an approval number and expiration date for my study (approval #02-20-17-0348392 and expiration date February 19, 2018).

Summary

The quantitative structure of this study supported the examination of the perceived effects of collaboration using tablet technology tools on the development of critical thinking dispositions from postsecondary instructors' perceptions using a correlational analysis. The survey approach provided the viewpoint of experienced instructors on collaboration using tablet technology, information on how they are using tablets to support collaboration, and the relationship they perceive to exist between the

use of collaborative technology tools to support critical thinking. Possible benefits of this study are educational; that is, to contribute to the body of knowledge about the use of tablet technology to support collaborative learning and the development of critical thinking dispositions. Individual benefits included the opportunity to gain knowledge in using technology for collaboration and a potential for improved strategies to support critical thinking.

Chapter 4: Results

The purpose of this study was to better understand postsecondary instructors' attitudes toward using tablet technology in instruction, how they incorporate tablet technologies in instruction, whether those approaches exhibit characteristics described by Deal (2009) as supporting collaboration, and instructors' perceptions about the relationships between use of such technology and collaboration skills and critical thinking dispositions of their students. This chapter offers the results of the quantitative survey analyses. This chapter includes descriptions of the response rate and characteristics of the respondents followed by the analyses organized according to the following research questions:

Research Question 1: To what extent do postsecondary instructors accept tablet use in instruction (IV_1 - TAM) and use collaborative tools with tablets (IV_2 - CTU)?

Research Question 2: Is there a relationship between postsecondary instructor tablet acceptance (IV_1 -TAM) and implementation of collaborative learning (DV_1 - CLIQ)?

$H_0$2 There is no statistical relationship between postsecondary instructor tablet acceptance (IV_1 – TAM) and implementation of collaborative learning (DV_1 – CLIQ).

$H_1$2 There is a statistical relationship between postsecondary instructor tablet acceptance (IV_1 – TAM) and implementation of collaborative learning (DV_1 – CLIQ).

Research Question 3: Is there a relationship between postsecondary instructor use of collaborative tools on the tablet (IV_2 - CTU) and implementation of collaborative learning (DV_1 - CLIQ)?

$H_0$3 There is no statistical relationship between postsecondary instructor use of collaborative tools on the tablet (IV_2 – CTU) and implementation of collaborative learning (DV_1 – CLIQ).

$H_1$3 There is a statistical relationship between postsecondary instructor use of collaborative tools on the tablet (IV_2 – CTU) and implementation of collaborative learning (DV_1 – CLIQ).

Research Question 4: Is there a relationship between postsecondary instructor implementation of collaborative learning (DV_1 - CLIQ) and perception of student development of critical thinking dispositions (DV_2 - CTD)?

$H_0$4 There is no statistical relationship between postsecondary instructor implementation of collaborative learning (DV_1 – CLIQ) and perception of student development of critical thinking dispositions (DV_2 – CTD).

$H_1$4 There is a statistical relationship between postsecondary instructor implementation of collaborative learning (DV_1 – CLIQ) and perception of student development of critical thinking dispositions (DV_2 – CTD).

Data Collection

Response Rate

The Association for Educational Communications and Technology (AECT) members provided the respondents for this study. The AECT Board of Directors approved participation of the organization and distributed the invitation to participate to all members along with a follow-up reminder. Table 6 provides the response rate to the survey. A total of 74 surveys were started; 59 provided data with 42 complete, 10 with

incomplete survey questions, 6 complete with missing instructor experience and demographic information, and 1 without any instructor and demographic information completed (see Table 7). The desired N for the survey was 321, which would have provided sensitivity to an effect size of at least .198 and a larger population of participants. The small effect size associated with a larger power would have provided greater generalizability (external validity) of the results from a larger participation of AECT's member population of 1,932 (InfocusMarketing, 2016). The actual number of participants (n = 59) results in a minimum detectable effect size of .477 using the Fisher z' transformation of r (Cohen & Cohen, 1983).

Since statistical significance depends upon both sample size and effect size, an alpha level of .05 (confidence level of 95%) was strictly adhered to throughout data analyses to avoid a Type II error where the data "fails to reject a null hypothesis that is actually false in the population" (Banerjee, Chitnis, Jadhav, Bhawalkar, & Chaudhury, 2009, p. 129). Furthermore, the smaller sample size limits the value of the study in representing the population (Field, 2013; Frankfort-Nachmias, & Nachmias, 2008) of education technology professionals in AECT or those working in other like technology-based learning environments (i.e., different settings, larger populations).

Table 6

Response Rate (n = 59)

Participant Request	Responses	Complete	Partially Complete	Useable Surveys
Mar 03, 2017	28	17	10	27
Mar 20, 2017	46	25	07	32

Note. The total participant surveys started were 74. Fifteen were incomplete: 10-completely without data; 5 – greater than 14 questions missing or incomplete survey section. After removing the 10 surveys without data and 5 with greater than 14 missing questions the total surveys used for this study were 59.

Table 7

Missing Data by Participant (n = 59)

Type of Question	Participant	Questions Missing
Survey	6	3
	9	1
	13	1
	25	2
	27	1
	42	1
	45	1
	46	1
	48	2
	50	1
	58	1
Instructor Experience And Demographics	8	1
	12	1
	16	1
	17	All But 1
	20	2
	53	1

Data Cleaning

The accuracy of the data for this study was verified between the response data from the SurveyMonkey questionnaire when transferred to SPSS. The data were

compared to ensure respondent input was properly input into SPSS. The incomplete surveys (*n* = 15: 10 - completely without data; 5 – greater than 14 questions missing or incomplete survey section) were removed from the data set, which left 59 surveys to be screened and cleaned.

The remaining surveys were screened for missing information (see Table 7). The survey data were reviewed using SPSS to identify if the missing data were "at random" or "not at random" using the Missing Value Analysis (Roni, 2014). The results of the test identified the data as Missing Completely At Random (MCAR) which is verified by the non-significant value of Little's Chi Square test (Sig = .709).

After identifying the missing questionnaire data was MCAR, I used the impute missing data values tool in SPSS to resolve the missing data. Imputing the data in three simulations provided scores that were averaged and assessed against the average of the responses. The averaged imputed values were rounded down to the nearest whole number. Rounding down was used during all analysis for consistency.

Finally, the demographic and experience data were not adjusted to fill in the missing information. Where relevant, these missing data are highlighted as a limitation of participant information.

Research Instrument

The research instrumentation for this study was a combination of original and modified questions from the Technology Acceptance Model (TAM) survey (Alharbi & Drew, 2014), items from the Cooperative Learning Implementation Questionnaire (CLIQ) (Concordia, 1998), Deal's (2009) collaborative activities, and Facione's (2013)

dispositions of critical thinking. The 61 questions explored the attitudes and opinions of postsecondary instructors concerning the application of tablets in instruction, attitudes towards collaborative learning, the uses of tablets to support collaboration, and the role of collaborative learning with tablets in the development of critical thinking dispositions.

The survey (see Appendix B) consisted of multiple sections that included a demographic and professional experience section, and sections aligned to the research questions. The adapted instrument used elements (14 questions) from the Technology Acceptance Model (TAM), the Cooperative Learning Implementation Questionnaires (CLIQ) (20 questions), Facione's (2013) definition of critical thinking dispositions (15 questions) and Deal's (2009) model for applications of technology for group collaboration (12 questions). The EDUCAUSE Center for Analysis and Research (ECAR) items focused on demographic and professional data from the participants (9 questions).

Two subject matter experts provided input and analysis of the measure to confirm face validity given their extensive use of instruments in previous research. Similar to the method employed by Alharbi and Drew (2014) validity was maintained by using validated measures and adjusting questions or words (i.e., cooperative to collaborative) to adapt the measure to the current study (Ruys et al., 2010). Additionally, reliability was assessed using Cronbach's alpha (see Table 8). Cronbach's alpha scores above .70 indicate the measure is reliable (Frankfort-Nachmias & Nachmias, 2008). The subscales of each section (TAM, CTU, CLIQ, CTD) of the questionnaire exceeded Cronbach's alpha of .70 (see Table 8). The alpha scores for the subscales in this study were consistent

with the original surveys used by Alharbi and Drew (2014) (TAM) and Abrami et al. (2004) (CLIQ). This analysis indicates that the adapted survey is reliable and the subscales are valid measures.

Table 8

Reliability Measures of Instruments

	Cronbach's Alpha
TAM	.937
CTU	.970
CLIQ	.866
CTD	.962
Survey	.969

Note. Cronbach's Alpha range for a reliable measure is above .70 (Frankfort-Nachmias & Nachmias, 2008)

Sample Characteristics

The participants of this study were from a professional international association focused on improving instruction through technology (AECT.org). The characteristics of the sampled population provided insight into the diversity of the participants and their professional experience. The participants were predominantly female, Caucasian, over age 50, and from North America. Complete demographic information is provided in Table 9 and professional information is provided in Table 10.

The participant and professional characteristics offer a general picture of the sample who completed the survey. The respondents were primarily over age 50, worked full-time as instructors, and had more than 10 years of experience. Over 72% of the participants worked as professors, lecturers, instructors, or adjuncts. The class environment in which they taught was fairly balanced across online, face-to-face, and

blended. See Table 10 for detailed descriptive statistics of the respondent professional characteristics.

Table 9

Participant Characteristics (n = 59)

Demographics	Frequency	%
Gender		
Male	17	28.81
Female	41	69.49
Other/No Response	1	1.69
Age		
25-30	2	3.39
31-40	14	23.73
41-50	09	15.25
Over 50	32	54.24
Not Answered	2	3.39
Ethnic Background		
White	35	59.32
White/Asian Pacific	1	1.69
White Other	1	1.69
Black/African American	3	5.08
Black/African/Other	1	1.69
Hispanic/Latino	2	3.39
Asian Pacific Islander	2	3.39
Other	6	10.17
Prefer Not to Answer	7	11.86
Not Answered	1	1.69
Geographic Area Taught		
Asia	6	10.17
North America	45	76.27
North America/Pacific	1	1.69
North America/Africa	1	1.69
North America/Europe	2	3.39
North America/Africa/ Europe/Other	1	1.69
North America/Asia/	1	1.69
South America	1	1.69
Not Answered	1	1.69

Table 10

Professional Characteristics (n = 59)

	Frequency	%
Type of Instructor		
Full-Time	27	45.76
Part-Time	18	30.50
Not Currently/ Taught in the Past	14	23.72
Years of Experience		
0-2	4	6.78
3-5	13	22.03
6-10	12	20.33
11-15	10	16.94
16-20	4	6.78
Over 20	14	23.72
No/Incorrect Response	3	5.08
Current Position		
Professor	20	33.90
Instructor	7	11.86
Lecturer	4	6.78
Adjunct	12	20.34
Faculty	1	1.69
Teacher	2	3.39
Ph.D. Candidate	1	1.69
Staff	4	6.78
Retired	1	1.69
NA	2	3.39
Not Answered	5	8.47
Class Environment		
Online	25	42.37
Face-to-Face	21	35.59
Blended	12	20.34
Not Answered	1	1.69
Academic Level Taught		
Undergrad/Postsecondary	14	23.73
Graduate	11	18.64
Undergrad/Graduate	12	20.34
Undergrad/Graduate/ Professional	15	25.42
Undergrad/Postsecondary Professional	1	1.69
Postsecondary	1	1.69
Professional Student	2	3.39
Not Directly with Students	2	3.39
Not Answered	1	1.69

Results

The data for this study were examined for bias. With correlation studies, Field (2013) indicates that linearity and normality are the most common assumptions to examine. Additionally, outliers were inspected for participants that consistently responded more than three standard deviations from the mean. Linearity and normality were examined using scatter plots (Q-Q Plots) and histograms for each survey question. The scatter plots indicated a normal distribution and the histogram indicated a standard deviation (SD) range of .643 to 1.518; no question exceeded two standard deviations from the mean and 95% of the data were within two deviations of the mean. The results from the scatter plots and histograms indicate these data meet the assumptions of linearity and normality.

Outliers were identified for each question by exploring respondent input for the question using a boxplot. After reviewing the results, surveys 9, 19, 42, and 55 showed responses that diverged significantly from the mean (see Figure 6). These surveys were not removed from the study. In addition to further reducing the generalizability of the study if removed (by reducing the sample size), these questionnaires provide additional context for the study results based on demographic and experience data.

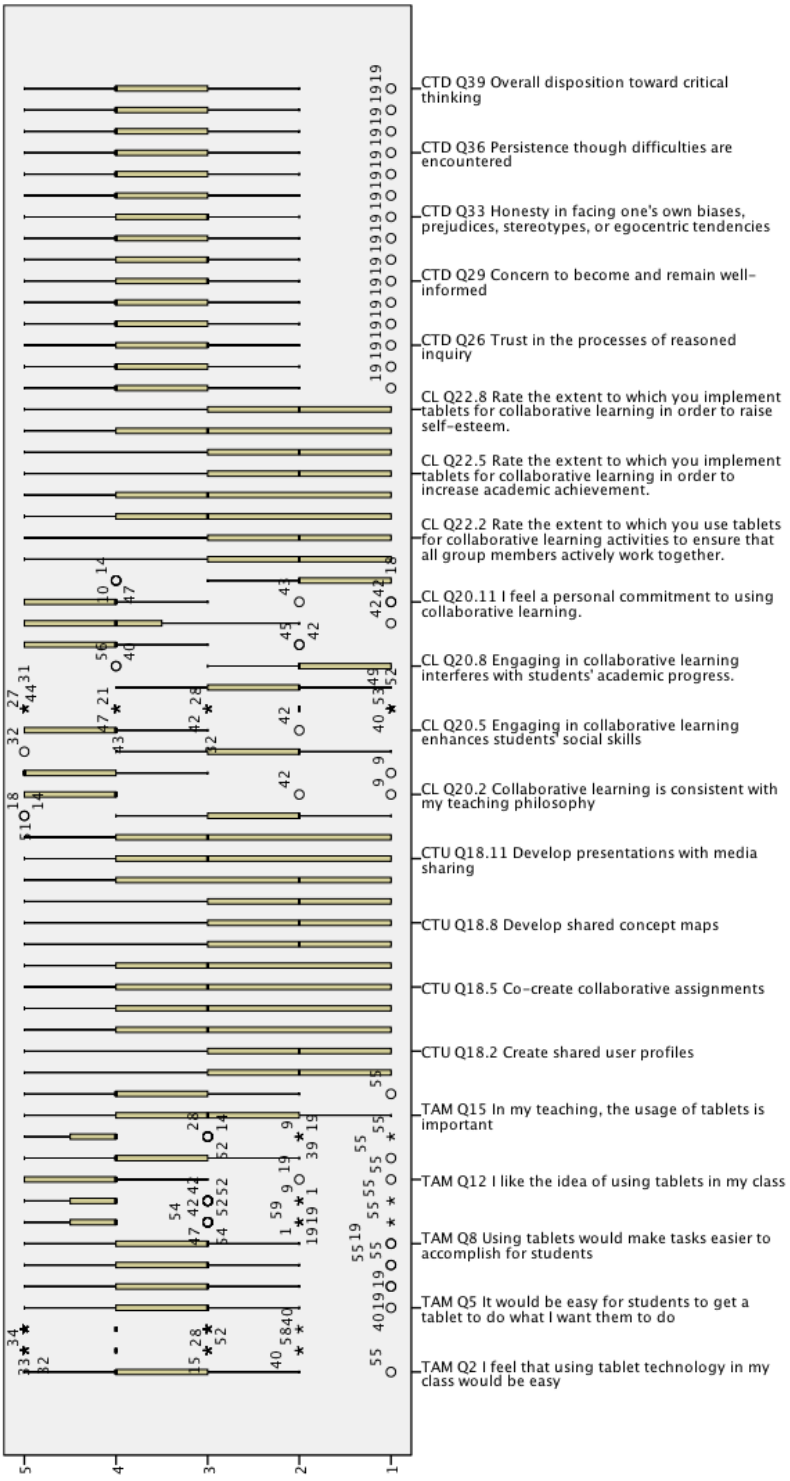

Figure 6. Box plot.

Analyses by Research Question

Based on the perceptions and attitudes of postsecondary technology instructors, the survey provided insight into the relationships between technology acceptance, collaborative tools, collaborative learning, and critical thinking. Overall (see Table 11), the study indicated there was a statistically significant positive relationship between the Technology Acceptance Model (TAM) and Collaborative Tool Use (CTU) ($r = .600$, $p < .001$); the TAM and Collaborative Learning (CLIQ) ($r = .540$, $p < .001$); CTU and CLIQ ($r = .756$, $p < .001$); and CL and Critical Thinking Dispositions (CTD) ($r = .466$, $p < .001$). The following sections provide the results of the data analyses as related to the research questions and null hypotheses.

Table 11

Correlation of Survey Data by Questionnaire Section

	TAM	CTU	CLIQ
CTU	.600**		
CLIQ	.540**	.756**	
CTD	.688**	.558**	.446**

Note. **$p < 0.01$.

Research Question 1

RQ 1: To what extent do postsecondary instructors accept tablet use in instruction (IV_1 - TAM) and use collaborative tools with tablets (IV_2 - CTU)?

Table 12 indicates that the responding instructors generally accept tablet use in instruction. Three-quarters (75%) of respondents indicated they agreed or strongly agreed that it would be easy for students to become skillful at using a tablet (91.6%, M=4.051, SD=.680), students would find a tablet to be flexible to interact with (83.0%, M=4.000,

SD=.643), assuming access to tablets, they intend to use them (83.0%, M=4.000, SD=.851), they like the idea of using tablets in their classes (79.7%, M=4.034, SD=.830), they believe it is a good idea to use tablets in their classes (78%, M=3.932, SD=.888), and that they would find tablets useful in their classroom (77.9%, M=3.949, SD=.879). More than half agreed or strongly agreed that tablets were relevant to their teaching (64.5%, M=3.559, SD=.970), using tablets in their classes was easy (62.7%. M=3.644, SD=.996), and they planned to use tablets in their future teaching (54.2%, M=3.644, SD=.978).

Table 12

Technology Acceptance Model (TAM) Descriptive Data

	% Strongly Disagree/ Disagree	% Undecided	% Agree/ Strongly Agree	Mean	Std. Deviation
I feel that using tablet technology in my class would be easy	15.30	22.00	62.70	3.644	0.996
I feel that it would be easy for students to become skillful at using a tablet	3.40	5.00	91.60	4.050	0.680
Students would find a tablet to be flexible to interact with	1.70	15.30	83.00	4.000	0.643
It would be easy for students to get a tablet to do what I want them to do	23.70	27.10	49.20	3.372	1.032
Using tablets would improve student performance	11.90	49.20	38.90	3.356	0.924
Using tablets would increase student productivity	16.90	39.00	44.10	3.339	0.958
Using tablets would make tasks easier to accomplish for students	18.60	33.90	47.50	3.390	1.017
I would find tablets useful in my classroom	6.80	15.30	77.90	3.949	0.879
I believe it is a good idea to use tablets in my class	5.10	16.90	78.00	3.932	0.888
I like the idea of using tablets in my class	3.40	16.90	79.70	4.034	0.830
I plan to use tablets in the future in my class	10.20	35.60	54.20	3.644	0.978
Assuming that I and my students have access to tablets, I intend to use them	6.80	10.20	83.00	4.000	0.851
In my teaching, the usage of tablets is important	27.10	32.20	40.70	3.220	1.099
In my teaching, the usage of tablets is relevant	18.60	16.90	64.50	3.559	0.970

Forty to 50% agreed or strongly agreed it would be easy for students to get a tablet to do what they wanted it to do (49.2%, M=3.37, SD 1.03), using tablets would make tasks easier to complete for students (47.5%, M=3.39, SD=1.02), using tablets would increase student productivity (44.1%, M-3.34, SD=.96), and use of tablets in their teaching was important (40.7%, M=3.22, SD=1.10). Only one item had fewer than 40% of respondents indicating agree or strongly agree: using data would improve student performance (38.9% agree or strongly agree, 49.2% undecided, M=3.36, SD=.92).

While Table 12 indicated instructors were generally accepting of using tablets in their teaching, Table 13 indicates that they used tablets for collaborative tasks less often. More than half of respondents indicated that they rarely or did not at all use tablets in these ways: create wikis (71.2%), shared user profiles (61%), shared concept maps (61%), consensus building (59.3%), social networking (57.6%), and polling (57.6%).

Between 40% and 50% indicated they rarely or did not at all use tablets to conduct collaborative editing (49.2%), track project progress (49.2%), archive materials and media presentations (49.2%), collaboratively manage project tasks (45.8%), co-create collaborative projects (45.8%), or develop presentations with media sharing (40.7%).

Tasks where approximately one-third or more of instructors reported using tablets typically or extensively in the classroom included: developing presentations with media sharing (39%, M=2.780, SD=1.378), tracking project progress (35.5%, M=2.542, SD=1.430), collaboratively managing project tasks (33.9%, M=2.644, SD=1.528), collaborative editing (33.9%, M=2.695, SD=1.512), archiving material and media presentations (32.2%, M=2.525, SD=1.356), and co-creating collaborative assignments

(30.5%, M=2.695, SD=1.512). About a quarter or fewer used tablets typically or extensively for polling (27.1%, M=2.271, SD-1.388), shared user profiles (23.7%, M=2.220, SD=1.340), shared concept maps (23.7%, M=2.254, SD=1.434), consensus building (20.4%, M=2.254, SD=1.359), social networking (20.4%, M=2.220, SD=1.232), and creating wikis (15.2%, M=2.000, SD=1.145).

Table 13

Collaborative Tool Use (CTU) Descriptive Data

	% Not at All/Rarely	% Sometimes	% Typically/ Extensively	Mean	Std. Deviation
Develop group cohesion through social networking	57.60	22.00	20.40	2.220	1.232
Create shared user profiles	61.00	15.30	23.70	2.220	1.340
Collaboratively manage project tasks	45.80	20.30	33.90	2.644	1.529
Track project progress	49.20	15.30	35.50	2.542	1.430
Co-create collaborative assignments	45.80	23.70	30.50	2.695	1.512
Conduct collaborative editing	49.20	16.90	33.90	2.627	1.519
Create wikis	71.20	13.60	15.20	2.000	1.145
Develop shared concept maps	61.00	15.30	23.70	2.254	1.434
Build consensus	59.30	20.30	20.40	2.254	1.359
Do polling	57.60	15.30	27.10	2.271	1.388
Develop presentations with media sharing	40.70	20.30	39.00	2.780	1.378
To archive materials and media presentations	49.20	18.60	32.20	2.525	1.356

Research Question 2

RQ2: Is there a relationship between postsecondary instructor tablet acceptance (IV_1 -TAM) and implementation of collaborative learning (DV_1 - CLIQ)?

The variable of acceptance of tablet use was measured using a Technology Acceptance Model survey (14 questions – see Table 12) and the variable implementation of collaborative learning was measured using the CLIQ (20 questions – see Appendices J and K). The relationship between TAM and CLIQ was examined using the Pearson's product moment correlation. Given the findings of the correlation analysis, the null hypothesis of no relationship is rejected and the alternative hypothesis for RQ2 is retained: H_1 There is a statistical relationship between postsecondary instructor tablet acceptance (IV_1 - TAM) and implementation of collaborative learning (DV_1 - CLIQ). Due to the relatively small sample size, caution should be used in interpreting the correlation as there is greater likelihood of obtaining high correlations simply by chance. The National Institute for Health (NIH) provides guidance on interpreting the strength of relationships for correlation studies: +/-.90 to 1.00 is considered very high, + /- .70 to .90 is considered high, +/- .50 - .70 moderate, +- .30 - .50 low, and +/- .00 \- .30 negligible.

Postsecondary instructor opinions concerning the acceptance of tablets (TAM) in learning and their relationship to the implementation of collaborative learning (CLIQ) indicated a positive significant relationship. The correlation of TAM to CLIQ was positive and statistically significant ($r = .540$, $p < .01$). This would indicate a moderately positive relationship between acceptance of tablets for instruction and implementation of collaborative learning. Almost 30 percent of the variance (29.2%) in collaborative

learning implementation can be accounted for by level of instructor acceptance of tablets. Table 14 provides the correlation results for Research Question 2 between the TAM and CLIQ subscales.

Table 14

Correlation Results for RQ2

	DV1 Professional Views of CL	DV1 Collab Teaching Practices
IV1 Perceived Ease of Use (PEU)	.125	.215
IV1 Perceived Usefulness (PU)	.378**	.417**
IV1 Attitude Toward Usage (ATU)	.338**	.519**
IV1 Behavioral Intent to Use (BIU)	.390**	.465**
IV1 Job Relevance (JR)	.466**	.524**

Note. **$p < .01$.

Each of the TAM subscales indicated a low to moderate positive relationship to the two subscales for collaborative learning implementation except the perceived ease of use of tablets. There was a significant positive correlation between CLIQ subscales of professional views of collaborative learning and collaborative teaching practices and four of the five TAM subscales: perceived usefulness ($r = .378, .417$), attitudes toward usage ($r = .338, .519$), intent to use ($r = .390, .465$) and job relevance ($r = .466, .524$). The correlations between TAM subscales and collaborative learning practice subscale were slightly higher than those with professional views of collaborative learning with the highest correlations, accounting for over 25% of variance, between collaborative teaching practices and attitude toward tablet use (26.7%) and job relevance (27.5%).

The results indicated that instructors perceived usefulness, positive attitude, intent to use tablets, and job relevance to have a low to moderate positive relationship to their

personal views and current implementation of collaborative teaching practices. In other words, the more positive attitude an instructor had toward tablets, the higher the intent to use tablets and the perception of tablets as relevant to their job, the more likely instructors were to view collaborative learning more positively and to more often use collaborative teaching practices.

Research Question 3

RQ3: Is there a relationship between postsecondary instructor use of collaborative tools on the tablet (IV_2 - CTU) and implementation of collaborative learning (DV_1 - CLIQ)?

The variable of collaborative tool use with tablets was measured using questions based on Deal's (2009) framework for using technology (12 questions – see Table 13) and the dependent variable of implementation of collaborative learning was measured using the CLIQ (20 questions – see Appendix I). The relationship between collaborative tool use and implementation of collaborative learning was examined using the Pearson's product moment correlation and was found to be positive and statistically significant (r = .756, p < .000). Given the findings of the correlation analysis, the null hypothesis was rejected and the alternate the alternative hypothesis for RQ3 was retained: H_1 There is a high positive statistical relationship between postsecondary instructor use of collaborative tools on the tablet (IV_2 - CTU) and implementation of collaborative learning (DV_1 - CLIQ). Over half (57.2%) of the variance in can be explained. The higher the reported used of collaborative tools on the tablet, the higher the implementation of collaborative learning.

When relating Deal's collaborative tool use to the CLIQ, this survey sought to understand a relationship between collaborative tool use and the implementation of collaborative learning from the instructor's personal view and current collaborative teaching practices. Postsecondary instructor's perceptions concerning the use of collaborative tools on the tablet (IV_2 - CTU) and implementation of collaborative learning (DV_1 - CLIQ) indicated a statistically significant relationship *(*$r = .756$, $p = .000$). The instructors use of tablets was positively related to implementation of collaborative learning. Table 15 provides the correlation results for Collaborative Tool Use (CTU) and the CLIQ subscale questions.

Table 15

Correlation Results for RQ3

	DV1 Professional Views of CL	DV1 Collab Teaching Practices
IV2 Team Def, Cohesion and Participation	.322*	.752**
IV2 Project Management	.312*	.740**
IV2 Co-Creation and Ideation	.299*	.746**
IV2 Consensus Building	.221	.652**
IV2 Presentation and Archiving	.188	.648**

Note. *$p < .05$ level; **$p < .01$.

Each of Deal's (2009) collaborative tool use subscales indicated a statistically significant positive relationship to collaborative learning implementation subscale professional views of collaboration except consensus building ($r = .221$, $p = .093$) and presentation and archiving ($r = .188$, $p = .153$) which showed negligible relationships. Three of the five CTU subscales were positively correlated and statistically significant with the respondents' professional views of collaborative learning: team definition,

cohesion and participation (r = .322, p = .013), project management (r = .312, p = .016), co-creation and ideation (r = .299, p = .021). However, these correlations would be considered low positive, accounting for only nine to ten percent of variance. All five CTU subscales indicated much higher positive correlations with the collaborative teaching practices subscale of the CLIQ. The strong positive relationships to the instructor's current collaborative teaching practices included: team definition, cohesion and participation (r = .752, p = .000), project management (r = .740, p = .000), co-creation and ideation (r = .746, p = .000), consensus building (r = .652, p = .000), presentation and archiving (r = .648, p = .000). These higher correlations account for between 42% and 57% of variance. In other words, the more frequently an instructor reported using tablets in ways Deal defined as supporting collaboration, the more likely they were to report actually implementing collaborative instructional practices in the classroom.

The postsecondary instructors indicated that collaborative tool use of tablets indicated a positive relationship with collaborative learning implementation given positive correlation values ranging from .299 to .752. The results indicated that collaborative tools related to team definition, cohesion and participation, project management, co-creation and ideation, consensus building, and presentation and archiving had a strong positive ($p < .01$) correlation to their current collaborative teaching practices, while team definition, cohesion and participation, project management, and co-creation and ideation had a weak but statistically significant ($p < .05$) relationship to their professional views of collaborative learning. Consensus

building, and presentation and archiving indicated a non-significant relationship to participant professional views of collaborative learning.

The weakest relationship of presentation and archiving (r = .188) could indicate that the instructors' professional views of collaborative learning consider tool use for these tasks to be the least relevant of Deal's model. The strongest relationship of team definition, cohesion and participation (r = .752) to the instructor's current collaborative teaching practice could indicate tools related to these tasks are more relevant in collaborative learning environments.

Research Question 4

RQ4: Is there a relationship between postsecondary instructor implementation of collaborative learning (DV_1 - CLIQ) and perception of student development of critical thinking dispositions (DV_2 - CTD)?

The variable of implementation of collaborative learning was measured using the CLIQ (20 questions – see Appendix I) and the variable of critical thinking dispositions (CTD) was measured using questions based on Facione (2013) (15 questions – see Appendix J). The relationship between CLIQ and CTD was examined using the Pearson's product moment correlation. Based on the findings of the correlation analysis, the null hypothesis was rejected and the alternative hypothesis for RQ4 was retained: H_1 There is a statistically significant but low positive relationship (r = .466, p = .000) between postsecondary instructor implementation of collaborative learning (DV_1 - CLIQ) and perception of student development of critical thinking dispositions (DV_2 - CTD) with about 21.2 percent of variance explained.

The examination of the CLIQ (DV_1) to Critical Thinking Disposition (DV_2) sought to understand if there was a relationship between the implementation of collaborative learning and perceptions of the impact of collaborative activities on developing critical thinking dispositions. In surveying the application of collaborative learning and the critical thinking dispositions, the postsecondary instructors indicated there was a positive and statistically significant correlation between the two variables (r = .466, p = .000). The data suggested that those reporting more collaborative learning practices were more likely to view such practices as contributing to the development of critical thinking dispositions among students. Table 16 provides the correlation results for the CLIQ and Facione (CTD) subscales.

Table 16

Correlation Results for RQ4

	DV1 Professional Views of CL	DV1 Collab Teaching Practices
DV2 Systematic	.093	.463**
DV2 Analytical	.171	.402**
DV2 Inquisitive	.176	.243
DV2 Judicious	.261*	.325*
DV2 Truth Seeking	.256	.393**
DV2 Confident in Reasoning	.301*	.452**
DV2 Open Minded	.298*	.441**

Note. *p < .05 level; **p < .01.

Each of the collaborative learning implementation subscales indicated a positive significant relationship with Facione's (2013) critical thinking dispositions (CTD) except the instructors' professional views of collaborative learning and the dispositions of systematic thinking (r = .093, p = .485), analytical thinking (r = .171, p = .195),

inquisitiveness (r = .176, p = .182) and truth seeking (r = .256, p = .050). The remaining dispositions of judiciousness (r = .261, p = .046), confidence in reasoning (r = .301, p = .021) and open mindedness (r = .298, p = .022) had statistically positive relationships with the participants professional views toward collaborative learning. Overall there was no to a very low positive relationship between any of the critical thinking dispositions and professional views of collaborative learning. There were higher correlations between critical thinking dispositions and collaborative teaching practices.

The instructors that reported they practice current collaborative teaching indicated more positive beliefs about the relationship between collaborative practices and development of critical thinking dispositions of systematic thinking (r = .463, p = .000), analytical thinking (r = .402, p = .002), truth seeking (r = .393, p = .002), confidence in reasoning (r = .452, p = .000), open mindedness (r = .441, p = .000), and judiciousness (r = .325, p = .012). There was a very low and insignificant correlation with inquisitiveness (r = .243, p = .064). In general, ratings on use of collaborative teaching practices could account for between 10.5% and 21.5% of variance in instructor perceptions about the influence of those practices on the development of specific critical thinking dispositions.

These results indicate that the dispositions that were statistically *(p < .05)* correlated with professional views toward collaborative learning were judiciousness, confidence in reasoning and open mindedness, with judiciousness also correlated *(p <* .05) with collaborative teaching practices. These correlations ranged from r = .261 to 463. The instructors that currently use collaborative learning in their teaching practices indicated a stronger statistical (p < .01) relationship with the dispositions of systematic

thinking, analytical thinking, truth seeking, confidence in reasoning and open mindedness. The difference of perceptions of impact in systematic, analytical and truth seeking between the professional views of collaborative learning, and current collaborative teaching practices may be related to the experience of currently practicing instructors (76.26%) versus the instructors not currently practicing (23.72%) (see Table 10). The disposition of inquisitiveness did not indicate a strong correlation with collaborative learning with tablets.

The weakest relationship of systematic thinking (r = .093) could indicate that instructors with professional views of collaborative learning do not see the tablet as a tool for expressing clarity in questions or concerns, nor as a tool for seeking relevant information. Conversely, the subscale questions associated with current collaborative teaching practices indicated the strongest correlation in systematic thinking (r = .463); the opposing relationships in systematic thinking may be related to practicing versus non-practicing instructors.

Additional Analyses

Additional analyses were conducted to better understand the data collected for this study that were not directly related to the research questions. The information for these analyses is provided as appendices for reference. Instructors indicated that they disagreed that students tended to veer of task in collaborative learning (71.2%), students expected other group members to do the work (61.0%), impossible to evaluate students fairly (76.3%), there is too little time available to prepare students to work effectively (61.0%), that CL interfered with academic progress (91.5%), and that CL gives too much

responsibility to the student (86.4%) (see Appendix I). The participants agreed that CL is consistent with their teaching philosophy (96.6%), a valuable part of their instructional approach (94.9%), helped to meet instructional goals (89.8%), and felt a personal commitment to use CL (81.3%). They indicated CL enhanced student social skills (91.5%), and fosters a positive student attitude towards learning (74.6%). In practice, the post-secondary instructors that used tablets in instruction expressed that to some extent group members actively participated (67.8%), students completed their share of the group tasks (67.8%), and, as a collaborative tool, tablets were used to increase academic achievement (61.0%).

Next, the participants agreed that tablets could have an impact on developing critical thinking dispositions (see Appendix J). The dispositions where instructors indicated a higher perception of impact were in truth seeking - understanding the opinions of others (66.1%), inquisitiveness - with regard to a wide range of issues (64.4%), systematic - diligence in seeking relevant information (62.7%), and judiciousness - flexibility in considering alternatives and opinions (61.1%). Although the participants agreed tablets could have an impact on developing the dispositions, there were indications the instructors were undecided about how the tablet would be used to implement the dispositions in tasks associated with judiciousness – prudence in suspending, making or altering judgements (52.5%), analysis – trust in the process of reasoned inquiry (44.1%), and inquisitiveness – concern to become and remain well-informed (44.1%).

Finally, additional analysis used the descriptive data associated with full-time, part-time, and currently not working instructors to develop a better understanding of how their responses may have influenced the research. A majority of full-time instructors (*n* = 27) (see Appendix K) agreed there was a perceived ease of use for tablets (51.9%), a positive attitude toward tablet use (70.4%), and almost half had an intent (48.2%) to use tablets in their classroom. They were undecided about the perceived usefulness (48.2%) and the relevance of using tablets (40.7%). These participants indicated their professional views toward collaborative learning were undecided (85.2%), and to some extent used tablets for collaborative instruction (55.6%). This group agreed or strongly agreed with the impact tablets would have on developing the critical thinking dispositions of systematic (51.9%), inquisitive (48.1%), and confidence in reasoning (48.1%). They were undecided on how tablets would impact the development of the disposition of analytical (51.9%) and truth seeking (44.5%); while split between undecided (44.5%) and strongly agree and agree (44.4%) on the disposition of judicious. Instructors age was reported as 31-40 (9), 41-50 (4) and over 50 (12), with an average of 12.6 years of experience. Two participants did not report their age, and two did not provide a number of years of experience.

The part-time instructors (*n* = 18) (see Appendix L) indicated a positive attitude toward tablet use in their class (66.7%). They were undecided on the perceived ease of use (55.5%), perceived usefulness (61.1%), and relevance of using tablets in the classroom (44.4%). This group was split between their intent to use tablet (undecided – 50.0%; strongly agree and agree – 50.0%). These participants indicated their professional

views toward collaborative learning were balanced between strongly disagree and disagree (50.0%) and undecided (50.0%). They largely indicated (61.1%) they did not use tablets in their current collaborative learning practices with a smaller percentage reporting slight or somewhat use (38.9%). The view of using tablets to develop critical thinking dispositions for this group was undecided. Instructors age was reported as 25-30 (1), 31-40 (9), 41-50 (4) and over 50 (12), with an average of 11.4 years of experience. One did not provide a number of years of experience.

The instructors reporting as not currently working (n = 14) (see Appendix M) indicated a positive attitude toward the use of tablets (85.7%), intent to use (71.4%), and relevance (78.6%) of tablets in instruction. They were split on the perceived ease of use of tablets (undecided – 50.0%, strongly agree and agree – 50.0%), and were slightly undecided (57.10%) over strongly agree and agree (42.9%) on perceived usefulness. These participants indicated their professional views toward collaborative learning were undecided (100.0%), and to some extent used tablets for collaborative instruction (85.7%). This groups strongly agreed or agreed that tablets were useful in developing critical thinking dispositions. Instructors age was reported as 25-30 (n = 1), 31-40 (n = 2), 41-50 (n = 3) and over 50 (n = 8), with an average of 16.5 years of experience.

Summary

In this chapter, information was provided through the descriptions of the response rate and characteristics of the respondents followed by data analysis organized according to the research questions. The results of the quantitative survey were provided to better understand postsecondary instructors' attitudes toward using tablet technology in

instruction, how they incorporate tablet technologies in instruction, whether those approaches exhibited characteristics described by Deal (2009) as supporting collaboration, and instructors' perceptions about the relationships between use of such technology for collaboration and development of critical thinking dispositions of their students. The inferential and descriptive statistics indicated significant relationships among these constructs.

The research question analyses indicated that postsecondary instructors accepted tablet use in instruction and sometimes used collaborative tools with tablets (RQ1). The instructors indicated that acceptance of tablets in instruction had a positive relationship to collaborative learning implementation (RQ2). The perceptions of the instructors suggested that use of collaborative tools on tablets was positively related to the use of collaborative learning in instruction (RQ3). Additionally, the study provided results showing a statistically significant relationship between collaborative learning practices and the development of critical thinking dispositions (RQ4). In the following chapter, a discussion of the findings will provide additional interpretation; introduce recommendations; and provide implications of the study on the application of tablets to support collaborative learning to develop the critical thinking dispositions.

Chapter 5: Discussion, Conclusions, and Recommendations

The purpose of this quantitative study was to better understand postsecondary instructor attitudes toward using tablet technology in instruction to extend collaboration through interactive applications, incorporating tablet technologies in instruction, whether those approaches exhibit characteristics described by Deal (2009) as supporting collaboration, and instructors' perceptions about the relationships between use of such technology for collaboration and development of critical thinking dispositions of their students. The study used a 61-question survey to investigate the perceptions of the participants (n = 59). Using the survey results, the findings, limitations, recommendation and implications are discussed in the following sections.

Summary of Key Findings

The respondents were primarily over age 50 years, work fulltime as instructors, and had more than 10 years of experience. Over 72% of the participants work as professors, lecturers, instructors, or adjuncts. The class environment in which they taught was fairly balanced across online, face-to-face, and blended.

The postsecondary instructors accepted the use of tablets in instruction and the use of collaborative tools with tablets. Their responses indicated a positive relationship between the implementation of collaborative learning in instruction and tablet acceptance and the use of collaborative tools. Finally, the instructor data supported a relationship between the implementation of collaborative learning and the perception that collaborative learning positively impacts the development of student critical thinking dispositions.

Interpretation of the Findings

The interpretation of the findings is provided through the lens of the literature review and the conceptual framework (see Figure 7).

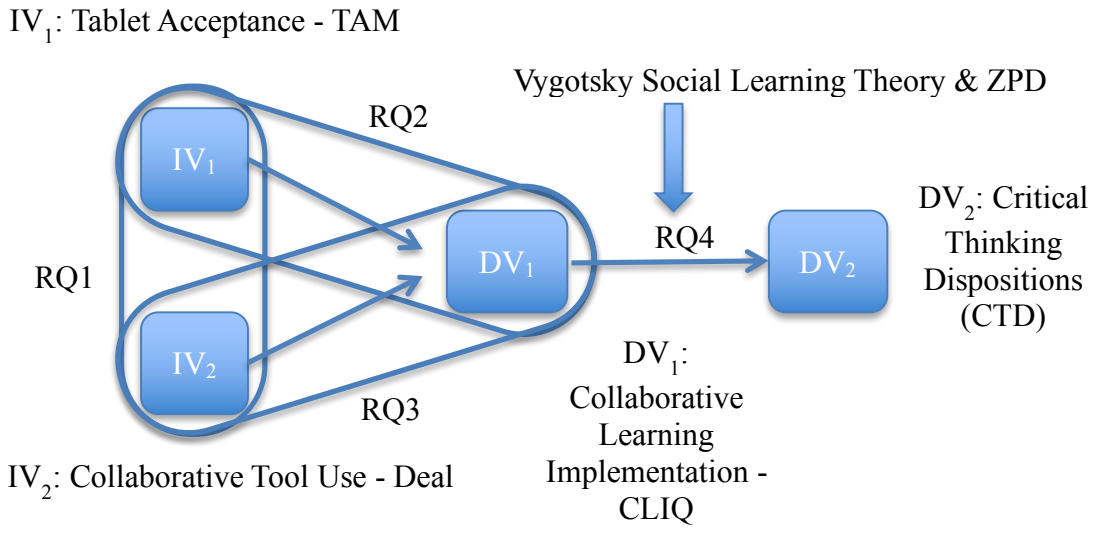

Figure 7. Conceptual framework.

Research Question 1

The research question analysis indicated that postsecondary instructors accepted tablet use in instruction, and sometimes used collaborative tools with tablets (RQ1). Tablets use was accepted as a collaborative tool and the responses indicated a positive attitude toward tablet use by students and instructors. Participant indications were that they intended to use tablets if they were available for instruction and according to Alharbi and Drew (2014), their intention is an influence to use the tablet as a collaborative tool. Additionally, the perceived usefulness of the tablet as a collaborative tool is a good indicator of predicting actual use. This insight was supported in Davis (1993) and Venkatesh and Davis (1996) where usefulness of a technology and a user's self-efficacy

positively influenced its implementation. The results of the TAM analysis indicated that acceptance of the tablet as a collaborative instructional tool influences its use in learning environments. As recognized in the conceptual framework, this is significant to understanding actual use and intent to use instructional tools like the tablet, and the effect acceptance has on technology implantation.

Although instructor intent and perceived usefulness were strong indicators of using tablets as a collaborative tool, when implementing tasks on tablets through applications (Deal, 2009) they were only sometimes used to complete these tasks. Examining the results of the questionnaire, applications associated with group presentations, project tasks, and co-creating were more commonly used over collaborative tasks associated with creating wikis, user profiles, and concept maps. When interpreting the finding of tablet use with Deal's (2009) framework for using technology to support collaboration, the results indicate that project-based tasks (e.g., develop presentations, co-create assignments, manage project tasks) were used more often than the tasks associated with social engagement (e.g., consensus building, shared user profiles, developing group cohesion through networking) (Jeong & Hmelo-Silver, 2016; Stahl et al., 2006). Similar to technology acceptance, the types of collaborative applications and the instructor perceptions about these applications influenced how a collaborative tool could be used within a collaborative learning classroom environment. An indication in this population of instructors is that task related applications were more likely to be accepted over social engagement applications. These predispositions toward a type of application could influence how collaborative learning is implemented in the

postsecondary classroom with technology. Finally, understanding the influence instructors' acceptance, intent to use, and bias toward tablet technology and learning applications provides useful information in developing training focused on the implementation of a collaborative learning environment. Vygotsky (1978) approach to learning appears to support the use of tablets and applications as a way to resolve (mediate) a task as a "conductor of human influence" to connect cognitive thought to the social environment through words and action (p. 55).

Research Question 2

The instructors indicated that acceptance of tablets in instruction had a positive relationship to collaborative learning implementation when the instructor perceived value in the use of tablets in the classroom and as useful in the subscales of collaborative teaching practices (RQ2). Similar to Wakefield and Smith (2012), instructors that recognized value in using tablets in the classroom indicated they were more likely to use collaborative teaching. The instructors that specified that collaborative learning was consistent with their teaching philosophy believed tablet use in the classroom was a good idea. Additionally, Wakefield and Smith's (2012) research recognized the tablet as a tool to enhance learning. The instructor's attitudes and opinions in Wakefield and Smith's (2012) study indicated tablet use in collaborative learning may increase academic achievement, improve social skills, motivate students and raise self-esteem. Similarly, in this study tablet use positively correlated with group members actively working together, group member participation and sharing of group tasks, which was supported in Fabian and MacLean (2014) study of improved student engagement and by the findings of

Noroozi et al. (2013) related to group learning. Conversely, in this study some instructors that plan to use tablets in the future and who felt tablet use was important indicated a disagreement that students tend to veer off task, tablets could interfere with academic progress, and gave too much responsibility to the student when engaged in collaborative learning. This finding is interesting in review of Chung et al. (2013) suggesting social interaction may be negatively affected when used in face-to-face learning. The instructors in this study perceived a significant negative relationship between the ease of use of tablets (becoming skillful and flexibility to interact) and student academic progress in collaborative learning engagement (r = -.278, p = .033). These findings indicate that technology acceptance has a significant relationship to the implementation of collaborative learning as visually indicated in the conceptual framework. Additionally, instructor acceptance (negative or positive) of the tablet technology could influence their interaction as a guide to encourage student engagement in the Zone of Proximal Development during collaborative learning coursework.

Research Question 3

The results indicated that collaborative tool use associated with social networking, creating shared user profiles, project management (tasks and progress), consensus building and co-creating were significantly positively related to collaborative learning implementation. The instructors' perspectives supported the use of tools on tablets for collaborative learning activities to ensure that all group members actively work together, to improve social skills through social networking, and shared user profiles which was consistent with Tlhoaele et al. (2014). Project management of tasks and progress using

collaborative tools were identified as ways to implement collaborative learning (working together) in the literature (Gan, Menkhoff, & Smith, 2015) and these uses were also supported by these postsecondary instructors.

Participants also identified collaborative tool use as an effective way to encourage collaborative assignment activities for consensus building and co-creation. A tool found to encourage both consensus building (Vivian, Falkner, & Falkner, 2013) and simultaneous creation or co-creation (Carroll et al., 2013) is the wiki. Additionally, instructors that currently implement tablets for collaborative learning, reported to some extent they do this for increasing academic achievement, which was suggested in Mohan's (2012) research. The results for collaborative tool use and collaborative learning supported the research of Dehler et al. (2011) concerning the use of tools to influence communication and student interactions. In addition to instructor acceptance of collaborative applications as useful tools, the findings indicated that using applications that encouraged student interaction, social networking, and group problem solving were significant in the implementation of collaborative learning environments with tablets. Finally, when examining the results of the first three research questions, collaborative learning implementation with tablet technology has a positive significant relationship to acceptance of technology and collaborative applications being used by instructors that currently practice collaborative learning. The relationships indicate that tablets and collaborative tools could work in collaborative learning environments as a way to resolve task (Vygotsky, 1978) to help a student better understand new or complex ideas (higher order thinking).

Research Question 4

The acceptance of using tablets with learning tools to encourage collaborative implementation offers an environment for instructors to encourage social interaction and group problem solving tasks. These learning opportunities may include consensus building (Eklöf, 2013) and co-creation (Maria, Dimitris, Garifallos, Athanasios, & Roumeliotis, 2015), where students analyze and present information to their peers and instructors (Dehler et al., 2011). In the interaction with others, postsecondary students were challenged to identify alternate experiences and views (Waite & Davis, 2006), and to reflect on their beliefs during social interaction (Kirschner et al., 2015). It is in the interaction between knowledge development and peer-instructor collaboration where critical thinking is affected by Vygotsky's (1978) social cognitive learning theory and Zone of Proximal Development (ZPD). This is represented in the conceptual framework (see Figure 7) between critical learning implementation (CLIQ) and critical thinking dispositions (CTD).

Vygotsky's (1978) social cognitive learning theory, which includes the Zone of Proximal Development, identified the benefits of peer and instructor involvement in developing higher mental functions in cooperative learning environments. In the collaborative environment, the interaction between peers and instructors with varying levels of knowledge encourages a student to develop critical thinking and expand their ZPD. Kingpum et al. (2015) and Wynn et al. (2014) indicated that encouraging students to resolve problems through social skills and knowledge development in collaborative learning engagement supported the development of critical thinking skills.

The results of this study support a relationship between the implementation of collaborative learning and the development of critical thinking dispositions. I found a strong positive relationship *(p* < .01) to exist for collaborative teaching practices and the dispositions of systematic, analytical, truth seeking, confidence in reasoning and open mindedness. Additionally, I found a solid positive relationship (*p* < .05) to exist for instructor professional views of collaborative learning to the dispositions of judiciousness, confidence in reasoning and open mindedness, and collaborative teaching practices to the disposition of judiciousness. Participants reported use of collaborative teaching practices with tablets to encourage group members to work together and actively participate equitably. A majority believed collaborative learning can increase academic achievement, improve social skills, and motivate students. Respondents also indicated they believed the development of the dispositions of clarity, trust, well informed, flexibility, and persistence for students would occur in collaborative learning implementation. Lastly, participants agreed that the implementation of collaborative learning was effective in encouraging students to consider alternatives while learning to understand the opinions of others, and being willing to reconsider and revise views through honest reflection.

Limitations of the Study

The limitations of this study include factors related to generalizability, reliability, and selection. The generalizability of the study is limited by the number of participant surveys that were completed by the postsecondary instructors. The planned number of respondent surveys based on a G*Power calculation (see Table 3) was 321. The final

number of participants for this research was 59 respondent surveys, resulting in decreased generalizability of results and limiting the value of the study in representing the population (Field, 2013; Frankfort-Nachmias, & Nachmias, 2008) of education technology professionals or others in like technology-based learning environments (i.e., different settings, larger populations).

The survey was measured as meeting statistical reliability at Cronbach's Alpha range above .70 (Frankfort-Nachmias & Nachmias, 2008). The respondent data assumed that the participants had used tablet technologies to develop collaborative learning environments and that their self-reporting was accurate in terms of both their practices and their perceptions. This limitation may have affected the relationships of the variables and the overall generalizability of the research to similar populations.

Finally, selection for this study was not random. The selection of the participants was limited to a specific professional organization; this organization may not have been representative of similar professional organizations that use or advocate technology in higher education environments or of instructors who are not members of a technology oriented organization. The settings used by the participants were not controlled and the various testing environments could have affected how the participants responded to the 61 questions in the survey. A recommendation in the survey description was included to encourage the instructors to find a quiet place to complete the questions. Testing may have affected external validity by generating a measure with excessive questions. This survey was limited to 61 questions with the expectation that the questionnaire would be completed in 20 minutes to reduce the effects of excessive testing.

Recommendations

Since this study was limited to the AECT organization, providing this survey to instructors that received intentional coaching and instruction on the use of tablets and tools to support critical thinking dispositions may provide insight into how instructor perceptions influence the application of these methods in other disciplines. This research would provide additional understanding of the benefits of using tablet technology in collaborative learning environments to improve social interaction, academic performance, and student productivity.

Next, understanding how instructors use technology to implement collaborative learning offers postsecondary instructors knowledge on potential pedagogical methods within the classroom. A future study on how proficiency in instructional tablet use affects the learning outcomes in collaborative environments compared to basic knowledge of tablet application would provide data for assessing if the implementation of collaborative learning is impacted significantly by the instructor's professional views, and how this might impact collaborative teaching practices. Further research in this relationship between perceived ease of use and collaborative learning implementation could inform future instruction in education technology programs and instructor preparation within postsecondary institutions.

Another focus for further research would be on how instructors with different experience levels or in different faculty positions accept the use of technology and collaborative tools. Understanding the perceptions of teachers at different experience levels could inform future in-service professional development. The opinions and

attitudes from different faculty positions could offer an opportunity to understand how these instructors with diverse experiences apply collaborative applications to enhance the learning experience and support the application of critical thinking dispositions. Exploring these groups of instructors may provide insights to why correlations were higher with collaborative teaching practices than they were for perceptions of collaborative learning in my study.

Additional research in the application of Deal's collaborative tools use in a project-based collaborative learning would provide additional understanding of how postsecondary instructor perceptions (professional views) influence how these tools could be used in higher education. This study was restricted to an education technology organization. Conducting a similar study within a focused major (i.e., marketing, engineering, management) would offer insights as to how collaborative tools could be used to expand the implementation of collaborative learning across program disciplines.

Implications

Positive Social Change

Academic success is one indicator of performance and a measure used to help college graduates obtain jobs. More importantly, if cultivated, academic achievement prepares the student to be a lifelong learner and positive contributor to a community, organization or culture through personal awareness. A way of improving academic achievement is refining a student's ability to think critically (Nargundkar et al., 2014). Applying the findings in this study, an instructor could implement the conceptual framework to design a course that uses tablet technology in a collaborative learning

environment with applications that reinforce the dispositions toward critical thinking. This learning environment could contribute to developing confident students able to resolve challenges through a systematic method of acquiring and analyzing information into knowledge for use in diverse situations.

Methodology

The design of this study provides a framework for understanding the application of technology, collaborative learning tools and collaborative learning to develop critical thinking. Although the questionnaire needs to be implemented with a larger number of participants (e.g., greater than 300), the survey offers a multi-dimensional tool for assessing complex collaborative learning environments. This study adds to the body of knowledge for practicing professionals in postsecondary settings and provides understanding about the relationships that postsecondary instructors' perceptions have toward collaborative learning and the development of critical thinking.

Future Research

Further research could expand on how collaborative learning implementation relates to the application of critical thinking dispositions and how collaborative practices affect the development of critical thinking in students. This study examined relationships between acceptance of tablets in instruction (TAM), implementation of collaborative learning (CLIQ), the use of collaborative applications on tablets (CTU), and development of critical thinking dispositions (CTD). A future step would be to design a study using comparative groups taught using tablet technology and Deal's framework for collaborative tool use by experienced vs. inexperienced instructors with a positive

professional view of collaborative learning. The study could use a pre- post-questionnaire like the California Critical Thinking Skills Test (CCTST) (Insight Assessment, 2015) to assess the development of critical thinking.

Theory

This study adds to the body of knowledge and informs the gap in current research concerning the implementation of collaborative learning using tablet technology to improve the development of critical thinking in postsecondary institutions. The study provides a framework for future studies to examine how technology and learning theories influence, or do not influence, instructional techniques or designs in the classroom. Finally, this study connects tablet technology, collaborative applications, collaborative learning, and critical thinking in a quantitative study with a collective view about technology integration using a social development theory.

Practice

This study applies frameworks and theory from previous work to understand how they may be applied to current postsecondary programs. By understanding how instructors' perceptions may influence their methods of teaching with technology or their use of certain types of applications, they could identify areas to improve or enhance current course designs. Providing awareness about Facione's critical thinking dispositions is a strategy to encourage their use in an instructor's coursework toward the development of critical thinking. Finally, the findings in this study could inform how higher education coursework in instruction technology is designed to implement collaborative learning to develop critical thinking in academic instruction.

Conclusion

The intentional application of technology in education reinforces the implementation of collaborative learning to enhance or develop critical thinking, while providing support to improve academic performance in college students. The instructional goal is to create environments where students can interact formally and informally with a collaborative tool that encourages the development of new knowledge while engaging in group discourse that allows for constructive reflection. Technology-based collaborative learning environments offer a dynamic opportunity for students to evaluate their personal bias(es) and to encourage new thought while growing in a social environment that encourages the development of critical thinking skills. Understanding how instructors accept and use technology like tablets and applications, informs higher education institutions about the challenges associated with constructing these complex learning environments. Awareness of the challenges informs the development of solutions through instructional design and instructor training (i.e., academic, in-service professional development). Developing critical thinking can help prepare students to be productive change agents who develop beneficial solutions to societal problems. They can transition academic successes to life goals while continuing to seek opportunities to learn in technology driven environments. The expectation is that critical thinking in collaborative groups prepares students to be socially ready to engage as a relational leader at any organizational level, and to be able to work in diverse environments.

References

Abrahams, D. A. (2010). Technology adoption in higher education: A framework for identifying and prioritising issues and barriers to adoption of instructional technology. *Journal of Applied Research in Higher Education*, *2*(2), 34-49.

Abrami, P. C., Poulsen, C., & Chambers, B. (2004). Teacher motivation to implement an educational innovation: Factors differentiating users and non-users of cooperative learning. *Educational Psychology*, *24*(2), 201-216.

Achieve. (2015). Rising to the challenge: Views on high school graduates' preparedness for college and careers. Retrieved from http://www.achieve.org

Alharbi, S., & Drew, S. (2014). Using the technology acceptance model in understanding academics' behavioural intention to use learning management systems. *International Journal of Advanced Computer Science and Applications (IJACSA)*, *5*(1).

Al-rahmi, W. M., Othman, M. S., Yusof, L. M., & Musa, M. A. (2015). Using social media as a tool for improving academic performance through collaborative learning in Malaysian higher education. *Review of European Studies*, *7*(3), 265-275. doi: 10.5539/res.v7n3p265

Anderson, G., & Piro, J. (2014). Conversations in Socrates café: Scaffolding critical thinking via Socratic questioning and dialogues. *New Horizons for Learning*, *11*(1), 1-9.

Armatas, C., & Vincent, A. (2011). Leveraging the collaborative and interactive potential of 21st Century learning spaces: Victoria University's student business innovation and incubation space. *International Journal of Learning*, *18*(2), 133-142.

Ary, D., Jacobs, L., Sorensen, C. & Walker, D. (2013) Introduction to Research in Education (9th Edition). Belmont, CA: Cengage.

Banerjee, A., Chitnis, U. B., Jadhav, S. L., Bhawalkar, J. S., & Chaudhury, S. (2009). Hypothesis testing, type I and type II errors. *Industrial psychiatry journal*, *18*(2), 127-131. doi: 10.4103/0972-6748.62274

Benjamin, R., Klein, S., Steedle, J., Zahner, D., Elliot, S., & Patterson, J. (2013). The case for critical-thinking skills and performance assessment. Retrieved from http://cae.org/images/uploads/pdf/The_Case_for_Critical_Thinking_Skills.pdf

Bin, J. (2014). Web-based cooperative learning in college chemistry teaching. *International Journal of Emerging Technologies in Learning (iJET)*, *9*(2), 45-47.

Bloom, B. S. (Ed.), (1956). Handbook I: Cognitive domain. *Taxonomy of educational objectives: The classification of education goals.* New York, NY: Longman.

Bodemer, D., & Dehler, J. (2011). Group awareness in CSCL environments. *Computers in Human Behavior*, *27*(3), 1043-1045.

Bowers, K. W., Ragas, M. W., & Neely, J. C. (2009). Assessing the value of virtual worlds for post-secondary instructors: A survey of innovators, early adopters and the early majority in Second Life. *International Journal of Humanities and Social Sciences*, *3*(1), 40-50.

Briscoe, C. (1991). The dynamic interactions among beliefs, role metaphors, and teaching practices: A case study of teacher change. *Science education*, *75*(2), 185-199. doi.org/10.1002/sce.3730750204

Brooks, D. C. (2015) *ECAR study of faculty and information technology, 2015. Research report*. Louisville, CO. Available from http://www.educause.edu/ecar

Burke, B. L., Sears, S. R., Kraus, S., & Roberts-Cady, S. (2014). Critical analysis: A comparison of critical thinking changes in psychology and philosophy classes. *Teaching of Psychology*, *41*(1), 28-36. doi: 10.1177/0098628313514175

Burkholder, P. (2014). A content means to a critical thinking end: Group quizzing in history surveys. *History Teacher*, *47*(4), 551-578.

Carroll, J. A., Diaz, A., Meiklejohn, J., Newcomb, M., & Adkins, B. (2013). Collaboration and competition on a wiki: The praxis of online social learning to improve academic writing and research in under-graduate students. *Australasian Journal of Educational Technology*, *29*(4), 513-525.

Cape, P., & Phillips, K. (2015). *Questionnaire length and fatigue effects: The latest thinking and practical solutions*. Retrieved from http://www.surveysampling.com

Chen, X., Wu, J., & Tasoff, S. (2010). *Academic preparation for college in the high school senior class of 2003− 04*. Retrieved from http://nces.ed.gov/pubs2010/2010169.pdf

Cheung, R., & Vogel, D. (2013). Predicting user acceptance of collaborative technologies: An extension of the technology acceptance model for e-learning. *Computers & Education*, *63*(1), 160-175.

Choi, E., Lindquist, R., & Song, Y. (2014). Effects of problem-based learning vs. traditional lecture on Korean nursing students' critical thinking, problem-solving, and self-directed learning. *Nurse Education Today*, *34*(1), 52-56. doi: 10.1016/j.nedt.2013.02.012

Chung, C. W., Lee, C. C., & Liu, C. C. (2013). Investigating face to face peer interaction patterns in a collaborative Web discovery task: the benefits of a shared display. *Journal of Computer Assisted Learning*, *29*(2), 188-206. doi: 10.1111/j.1365-2729.2012.00493.x

Cohen, J. & Cohen, P. (1983). *Applied multiple regression/correlation analysis for the behavioral sciences.* Hillsdale, NJ: Erlbaum.

Concordia. (1998). Cooperative learning implementation questionnaire. Retrieved from https://www.concordia.ca

Conley, D. T. (2007). Redefining college readiness. *Educational Policy Improvement Center (NJ1)*. Retrieved from http://eric.ed.gov

Conley, D. T. (2010). Replacing remediation with readiness. An NCPR working paper. *National Center for Postsecondary Research*. Retrieved from http://eric.ed.gov/

Conley, D. T. (2012). A complete definition of college and career readiness. *Educational Policy Improvement Center (NJ1)*. Retrieved from http://eric.ed.gov

Conley, D. T., & Darling-Hammond, L. (2013). *Creating systems of assessment for deeper learning*. Retrieved from http://scee.groupsite.com

Conley, D. T., & French, E. M. (2014). Student ownership of learning as a key component of college readiness. *American Behavioral Scientist*, *58*(8), 1018-1034.

Creswell, J. W. (2009). *Research design: Qualitative, quantitative, and mixed methods approaches*. Thousand Oaks, CA: Sage Publications.

Dahlstrom, E., Brooks, D. C., Grajek, S., & Reeves, J. (2015). *ECAR study of students and information technology*. Retrieved from http://www.educause.edu

Damşa, C. I. (2014). The multi-layered nature of small-group learning: Productive interactions in object-oriented collaboration. *International Journal of Computer-Supported Collaborative Learning*, *9*(3), 247-281.

Davis, F. D. (1986). *A technology acceptance model for empirically testing new end-user information systems: Theory and results* (Doctoral dissertation, Massachusetts Institute of Technology). Retrieved from www.researchgate.net

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, *13*(3), 319-340

Davis, F. D. (1993). User acceptance of information technology: system characteristics, user perceptions and behavioral impacts. *International Journal of Man-Machine Studies*, *38*(3), 475-487.

Deal, A. (2009). A teaching with technology white paper: Collaboration tools. *Office of Technology for Education, Carnegie Mellon University*. Retrieved from http://www.cmu.edu/teaching/technology/whitepapers/CollaborationTools_Jan09.pdf

Dehler, J., Bodemer, D., Buder, J., & Hesse, F. W. (2011). Guiding knowledge communication in CSCL via group knowledge awareness. *Computers in Human Behavior*, *27*(3), 1068-1078. doi: 10.1016/j.chb.2010.05.018

Dewey, J. (1910). *How we think*. Boston, MA: D.C. Heath.

Dewey, J. (1938/1997). *Experience and education*. New York, NY: Simon & Schuster.

Eklöf, A. (2013). A long and winding path: Requirements for critical thinking in project work. *Learning, Culture and Social Interaction*, *2*(2), 61-74. doi: 10.1016/j.lcsi.2012.11.001

El-Shaer, A., & Gaber, H. (2014). Impact of problem-based learning on students critical thinking dispositions, knowledge acquisition and retention. *Journal of Education and Practice*, *5*(14), 74-85.

Ennis, R. H. (1993). Critical thinking assessment. *Theory into Practice*, *32*(3), 179-186. doi: 10.1080/00405849309543594

Fabian, K., & MacLean, D. (2014). Keep taking the tablets? Assessing the use of tablet devices in learning and teaching activities in the further education sector. *Research in Learning Technology*, *22*. doi: 10.3402/rlt.v22.22648

Facione, P. A. (1990). *Critical thinking*: *A statement of expert consensus for purposes of educational assessment and instruction. Research findings and recommendations*. Retrieved from http://eric.ed.gov

Facione, P. A. (1991). *Using the California Critical Thinking Skills Test in research, evaluation, and assessment*. Retrieved from http://eric.ed.gov

Facione, P. A. (2000). The disposition toward critical thinking: Its character, measurement, and relationship to critical thinking skill. *Informal Logic*, *20*(1), 61-84.

Facione, P. A. (2013). *Critical thinking: What it is and why it counts*. Measured Reasons and The California Academic Press: Millbrae, CA. Retrieved from https://www.nyack.edu

Farag, D. M., Park, S., & Kaupins, G. (2015). Faculty perceptions of the adoption and use of clickers in the legal studies in business classroom. *Journal of Education for Business*, *90*(4), 208-216. doi: 10.1080/08832323.2015.1014459

Faragher, L., & Huijser, H. (2014). Exploring evidence of higher order thinking skills in the writing of first year undergraduates. *International Journal of the First Year in Higher Education*, *5*(2), 33-44. doi: 10.5204/intjfyhe.v5i2.230

Field, A. (2013). *Discovering statistics using IBM SPSS statistics* (4th ed.). London: Sage.

Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention, and behavior: An introduction to theory and research*. Retrieved from http://people.umass.edu/aizen/f&a1975.html

Fleischmann, K. (2014). Collaboration through Flickr & Skype: Can Web 2.0 technology substitute the traditional design studio in higher design education? *Contemporary Educational Technology*, *5*(1), 39-52.

Frankfort-Nachmias, C., & Nachmias, D. (2008). *Research methods in the social sciences* (7th ed.). New York, NY: Worth.

Frisch, J. K., Jackson, P. C., & Murray, M. (2013). WikiED: Using Web 2.0 tools to teach content and critical thinking. *Journal of College Science Teaching, 43*, 70-139.

Fullan, M., & Hargreaves, A. (1996). *What's worth fighting for in your school?* (2nd ed.). New York, NY: Teachers College Press.

Gan, B., Menkhoff, T., & Smith, R. (2015). Enhancing students' learning process through interactive digital media: New opportunities for collaborative learning. *Computers in Human Behavior*, *51*, 652-663. doi: 10.1016/j.chb.2014.12.048

Glaser, E. (1942). An experiment in the development of critical thinking. *The Teachers College Record*, *43*(5), 409-410.

Gokhale, A. A. (1995). Collaborative learning enhances critical thinking. *Journal of Technology Education, 7*(1), 22-30. doi: 10.21061/jte.v7i1.a.2

Goral, T. (2011). Take II tablets. *University Business*, *14*(1), 46-49.

Granitz, N., & Koernig, S. K. (2011). Web 2.0 and marketing education: Explanations and experiential applications. *Journal of Marketing Education*, *33*(1), 57-72. doi: 10.1177/0273475310392539

Hart Research Associates. (2015). *Falling short? College learning and career success*. Washington, DC: Association of American Colleges and Universities. Retrieved from https://www.aacu.org

Hsu, Y. C., & Ching, Y. H. (2013). Mobile computer-supported collaborative learning: A review of experimental research. *British Journal of Educational Technology*, *44*(5), E111-E114. doi: 10.1111/bjet.12002

Hsu, Y. C., Ching, Y. H., & Grabowski, B. L. (2014). Web 2.0 applications and practices for learning through collaboration (p.747-758). In J. M. Spector, M. D. Merrill, J. Elen & M. J. Bishop (Eds.), *Handbook of Research on Educational Communications and Technology* New York, NY: Springer. doi: 10.1007/978-1-4614-3185-5_60

Hwang, G. J., & Tsai, C. C. (2011). Research trends in mobile and ubiquitous learning: A review of publications in selected journals from 2001 to 2010. *British Journal of Educational Technology*, *42*(4), E65-E70. doi: 10.1111/j.1467-8535.2011.01183.x

IBM Corp. (2016). IBM SPSS Statistics for Windows, Version 24.0. Armonk, NY: IBM Corp.

Iinuma, M., Matsuhashi, T., Nakamura, T., & Chiyokura, H. (2014). Collaborative learning using integrated groupware: A case study in a higher education setting. *International Journal of Information & Education Technology*, *4*(4), 351-355. doi: 10.7763/IJIET.2014.V4.428

InfocusMarketing. (2016). Association for Educational Communications and Technology member mailing & email lists -June 24, 2016. Retrieved from www.infocusmarketing.com

Insight Assessment. (2015). *California Critical Thinking Skills Test (CCTST).* Retrieved from http://www.insightassessment.com

Ishler, A. L., Johnson, R. T., & Johnson, D. W. (1998). Long-term effectiveness of a statewide staff development program on cooperative learning. *Teaching and Teacher Education*, *14*(3), 273-281. doi:10.1016/S0742-051X(97)00039-5

Jeong, H., & Hmelo-Silver, C. E. (2016). Seven affordances of computer-supported collaborative learning: How to support collaborative learning? How can technologies help? *Educational Psychologist*, *51*(2), 247-265. doi: 10.1080/00461520.2016.1158654

Jeong, H., Hmelo-Silver, C. E., & Yu, Y. (2014). An examination of CSCL methodological practices and the influence of theoretical frameworks 2005–2009. *International Journal of Computer-Supported Collaborative Learning*, *9*(3), 305-334.

Johnson, D. W., & Johnson, R. T. (1996). Cooperation and the use of technology (p. 785-811). In D. H. Jonassen (Ed.), *Handbook of research for educational communications and technology: A project of the Association for Educational Communications and Technology*. London: MacMillan.

Jonassen, D. H., Carr, C., & Yueh, H. P. (1998). Computers as mindtools for engaging learners in critical thinking. *TechTrends*, *43*(2), 24-32. doi: 10.1007/BF02818172

Joo, J., & Sang, Y. (2013). Exploring Koreans' smartphone usage: An integrated model of the technology acceptance model and uses and gratifications theory. *Computers in Human Behavior*, *29*(6), 2512-2518.

Joyce, B., & Showers, B. (1988). *Student achievement through staff development*. New York, NY: Longman.

Kek, M. Y. C. A., & Huijser, H. (2011). The power of problem-based learning in developing critical thinking skills: preparing students for tomorrow's digital

futures in today's classrooms. *Higher Education Research & Development*, *30*(3), 329-341. doi: 10.1080/07294360.2010.501074

Kim, K. J., & Bonk, C. J. (2006). The future of online teaching and learning in higher education. *Educause Quarterly*, *29*(4), 22-30.

Kim, K., Sharma, P., Land, S. M., & Furlong, K. P. (2013). Effects of active learning on enhancing student critical thinking in an undergraduate general science course. *Innovative Higher Education*, *38*(3), 223-235. doi: 10.1007/s10755-012-9236-x

Kingpum, P., Ruangsuwan, C., & Chaicharoen, S. (2015). A development of a collaborative blended learning model to enhance learning achievement and thinking ability of undergraduate students at the Institute of Physical Education. *Educational Research and Reviews*, *10*(15), 2168-2177.

Kirik, O. T., & Markic, S. (2012). The self-efficacy of pre-service elementary teachers using cooperative learning in science teaching. *Procedia-Social and Behavioral Sciences*, *46*, 5005-5009. doi: 10.1016/j.sbspro.2012.06.376

Kirschner, P. A., & Erkens, G. (2006). Cognitive tools and mindtools for collaborative learning. *Journal of Educational Computing Research*, *35*(2), 199-209. doi: 10.2190/R783-230M-0052-G843

Kirschner, P. A., Kreijns, K., Phielix, C., & Fransen, J. (2015). Awareness of cognitive and social behavior in a CSCL environment. *Journal of Computer Assisted Learning*, *31*(1), 59-77. doi: 10.1111/jcal.12084

Krathwohl, D. R. (2002). A revision of Bloom's taxonomy: An overview. *Theory into Practice*, *41*(4), 212-218. doi: 10.1207/s15430421tip4104_2

Kuhn, D. (1999). A developmental model of critical thinking. *Educational Researcher*, *28*(2), 16-46. doi: 10.3102/0013189X028002016

Kyndt, E., Raes, E., Lismont, B., Timmers, F., Cascallar, E., & Dochy, F. (2013). A meta-analysis of the effects of face-to-face cooperative learning. Do recent studies falsify or verify earlier findings? *Educational Research Review*, *10*, 133-149. doi: 10.1016/j.edurev.2013.02.002

Lai, E. R. (2011). Critical thinking: A literature review. *Pearson's Research Reports*, *6*, 40-41.

Laird, T. F. N., Seifert, T. A., Pascarella, E. T., Mayhew, M. J., & Blaich, C. F. (2014). Deeply affecting first-year students' thinking: Deep approaches to learning and three dimensions of cognitive development. *The Journal of Higher Education*, *85*(3), 402-432. doi: 10.1353/jhe.2014.0017

Larwin, K., & Larwin, D. (2011). A meta-analysis examining the impact of computer-assisted instruction on postsecondary statistics education: 40 years of research. *Journal of Research on Technology in Education*, *43*(3), 253-278. doi: 10.1080/15391523.2011.10782572

Lombardi, A. R., Conley, D. T., Seburn, M. A., & Downs, A. M. (2013). College and career readiness assessment validation of the key cognitive strategies framework. *Assessment for Effective Intervention*, *38*(3), 163-171. doi: 10.1177/1534508412448668

Lu, J., & Churchill, D. (2014). The effect of social interaction on learning engagement in a social networking environment. *Interactive Learning Environments*, *22*(4), 401-417. doi: 10.1080/10494820.2012.680966

Mäkimattila, M., Junell, T., & Rantala, T. (2015). Developing collaboration structures for university-industry interaction and innovations. *European Journal of Innovation Management*, *18*(4), 451-470. doi: 10.1108/EJIM-05-2013-0044

Maleyko, G., & Gawlik, M. A. (2011). No child left behind: What we know and what we need to know. *Education, 131*(3), 600-624.

Maria, T., Dimitris, P., Garifallos, F., Athanasios, G., & Roumeliotis, M. (2015). Collaboration learning as a tool supporting value co-creation. Evaluating students learning through concept maps. *Procedia-Social and Behavioral Sciences*, *182*, 375-380. doi: 10.1016/j.sbspro.2015.04.796

Masek, A., & Yamin, S. (2012). The impact of instructional methods on critical thinking: a comparison of problem-based learning and conventional approach in engineering education. *ISRN Education*, *2012*, 1-6. doi: 10.5402/2012/759241

Mathison, S. (1992). An evaluation model for inservice teacher education. *Evaluation and Program Planning*, *15*(3), 255-261. doi: 10.1016/0149-7189(92)90089-D

Mendenhall, A., & Johnson, T. E. (2010). Fostering the development of critical thinking skills, and reading comprehension of undergraduates using a Web 2.0 tool coupled with a learning system. *Interactive Learning Environments*, *18*(3), 263-276. doi: 10.1080/10494820.2010.500537

Mercer, N. (2008). Talk and the development of reasoning and understanding. *Human Development, 51*(1), 90–100. doi: 10.1159/000113158

Mirriahi, N., Dawson, S., & Hoven, D. (2012). Identifying key actors for technology adoption in higher education: A social network approach. *Proceedings of Australasian Society for Computers in Learning in Tertiary Education (ASCILITE) Wellington* (pp. 664-674). New Zealand. Retrieved from http://www.ascilite.org

Mohan, F. (2012). Teaching using the ONBSblue approach: Something old, something new, something borrowed and something blue. *International Journal of Learning*, *18*(4), 71-78.

Muis, K. R., & Duffy, M. C. (2013). Epistemic climate and epistemic change: Instruction designed to change students' beliefs and learning strategies and improve achievement. *Journal of Educational Psychology*, *105*(1), 213-225. doi: 10.1037/a0029690

Nargundkar, S., Samaddar, S., & Mukhopadhyay, S. (2014). A guided problem-based learning (PBL) approach: Impact on critical thinking. *Decision Sciences Journal of Innovative Education*, *12*(2), 91-108. doi: 10.1111/dsji.12030

National Governors Association Center for Best Practices [NGACBP]. (2010). *Common core state standards.* Retrieved from http:// www.corestandards.org

National Center for Public Policy and Higher Education [NCPCHE]. (2010). *Beyond the rhetoric: Improving college readiness through coherent state policy*. Retrieved from http://www.highereducation.org/

Niu, L., Behar-Horenstein, L. S., & Garvan, C. W. (2013). Do instructional interventions influence college students' critical thinking skills? A meta-analysis. *Educational Research Review*, *9*, 114-128. doi: 10.1016/j.edurev.2012.12.002

Noroozi, O., Teasley, S. D., Biemans, H. J., Weinberger, A., & Mulder, M. (2013). Facilitating learning in multidisciplinary groups with transactive CSCL scripts. *International Journal of Computer-Supported Collaborative Learning*, *8*(2), 189-223. doi: 10.1007/s11412-012-9162-z

Ohlhausen, M. M., Meyerson, M. J., & Sexton, T. (1992). Viewing innovations through the efficacy-based change model: A whole language application. *Journal of Reading*, *35*(7), 536-541.

Orique, S. B., & McCarthy, M. A. (2015). Critical Thinking and the Use of Nontraditional Instructional Methodologies. *Journal of Nursing Education*, *54*(8), 455-459. doi: 10.3928/01484834-20150717-06

Padilla-MeléNdez, A., Del Aguila-Obra, A. R., & Garrido-Moreno, A. (2013). Perceived playfulness, gender differences and technology acceptance model in a blended learning scenario. *Computers & Education*, *63*, 306-317. doi: 10.1016/j.compedu.2012.12.014

Panitz, T. (1999). *Collaborative versus cooperative learning: A comparison of the two concepts which will help us understand the underlying nature of interactive learning*. Retrieved from http://files.eric.ed.gov

Park, E., & del Pobil, A. P. (2013). Technology acceptance model for the use of tablet PCs. *Wireless Personal Communications*, *73*(4), 1561-1572. doi: 10.1007/s11277-013-1266-x

Paul, R. W., Elder, L., & Bartell, T. (1997). *California teacher preparation for instruction in critical thinking: Research findings and policy recommendations*. Retrieved from http://eric.ed.gov

Paul, R., & Elder, L. (2001). *The miniature guide to critical thinking: Concepts & tools*. Santa Rosa, CA: Foundation for Critical Thinking. Retrieved from http;//www.criticalthinking.org

Paul, R., & Elder, L. (2006). Critical thinking: The nature of critical and creative thought. *Journal of Developmental Education*, *30*(2), 34-35.

Pelton, J. A. (2014). How our majors believe they learn student learning strategies in an undergraduate theory course. *Teaching Sociology*, *42*(4) 277–286. doi: 10.1177/0092055X14542351

Phielix, C., Prins, F. J., Kirschner, P. A., Erkens, G., & Jaspers, J. (2011). Group awareness of social and cognitive performance in a CSCL environment: Effects of a peer feedback and reflection tool. *Computers in Human Behavior*, *27*(3), 1087-1102. doi: 10.1016/j.chb.2010.06.024

Piergiovanni, P. R. (2014). Creating a critical thinker. *College Teaching*, *62*(3), 86-93. doi: 10.1080/87567555.2014.896775

Pinsonneault, A., & Kraemer, K. (1993). Survey research methodology in management information systems: an assessment. *Journal of management information systems*, *10*(2), 75-105. doi: 10.1080/07421222.1993.11518001

Rich, Y. (1990). Ideological impediments to instructional innovation: The case of cooperative learning. *Teaching and Teacher Education*, *6*(1), 81-91. doi: 10.1016/0742-051X(90)90009-T

Rickles, M. L., Schneider, R. Z., Slusser, S. R., Williams, D. M., & Zipp, J. F. (2013). Assessing change in student critical thinking for introduction to sociology classes. *Teaching Sociology*, *41*(3), 271-281. doi: 10.1177/0092055X13479128

Roni, S. M. (2014). Introduction to SPSS. *Edith Cowan University, SOAR Centre, Australia*. Retrieved from https://www.researchgate.net/

Ross, J. A. (1994). The impact of an inservice to promote cooperative learning on the stability of teacher efficacy. *Teaching and Teacher Education*, *10*(4), 381-394. doi: 10.1016/0742-051X(94)90020-5

Ruys, I., Van Keer, H., & Aelterman, A. (2010). Collaborative learning in preservice teacher education: an exploratory study on related conceptions, self‐efficacy and implementation. *Educational Studies*, *36*(5), 537-553. doi: 10.1080/03055691003729021

Saeger, K. J. (2014). The Development of Critical Thinking Skills in Undergraduate Students. *Culminating Projects in Higher Education Administration.*

Salisbury, M. H., Pascarella, E. T., Padgett, R. D., & Blaich, C. (2012). The effects of work on leadership development among first-year college students. *Journal of College Student Development*, *53*(2), 300-324. doi: 10.1353/csd.2012.0021

Santiprasitkul, S., Sithivong, K., & Polnueangma, O. (2013). The first year nursing students' achievement and critical thinking in local wisdom course using problem based learning process. *Wireless Personal Communications*, *69*(3), 1077-1085. doi: 10.1007/s11277-013-1067-2

Scheuer, O., McLaren, B. M., Weinberger, A., & Niebuhr, S. (2013). Promoting critical, elaborative discussions through a collaboration script and argument maps. *Instructional Science*, *41*(3), 2.

Schmid, R. F., Bernard, R. M., Borokhovski, E., Tamim, R. M., Abrami, P. C., Surkes, M. A., Wade, C. A., & Woods, J. (2014). The effects of technology use in postsecondary education: A meta-analysis of classroom applications. *Computers & Education*, *72*, 271-291. doi: 10.1016/j.compedu.2013.11.002

Schoonenboom, J. (2014). Using an adapted, task-level technology acceptance model to explain why instructors in higher education intend to use some learning management system tools more than others. *Computers & Education*, *71*, 247-256. doi: 10.1016/j.compedu.2013.09.016

Shah, J., & Higgins, E. T. (1997). Expectancy× value effects: Regulatory focus as determinant of magnitude and direction. *Journal of personality and social psychology*, *73*(3), 447. doi: 10.1037/0022-3514.73.3.447

Sharples, M. (2013). Mobile learning: research, practice and challenges. *Distance Education in China, 3*(5), 5–11.

Shepperd, J. A. (1993). Productivity loss in performance groups: A motivation analysis. *Psychological bulletin*, *113*(1), 67. doi: 10.1037/0033-2909.113.1.67

Shinsky, E. J., & Stevens, H. A. (2011). Teaching in educational leadership using web 2.0 applications: Perspectives on what works. *Journal of Research on Leadership Education*, *6*(5), 195-215. doi: 10.1177/194277511100600507

Sleeter, C. E. (1992). Restructuring schools for multicultural education. *Journal of Teacher Education*, *43*(2), 141-148. doi: 10.1177/0022487192043002007

Slof, B., Erkens, G., Kirschner, P. A., & Helms-Lorenz, M. (2013). The effects of inspecting and constructing part-task-specific visualizations on team and individual learning. *Computers & Education*, *60*(1), 221-233. doi: 10.1016/j.compedu.2012.07.019

Snyder, J. J., & Wiles, J. R. (2015). Peer led team learning in introductory biology: Effects on peer leader critical thinking skills. *PloS One*, *10*(1), 1-18. doi: 10.1371/journal.pone.0115084

Song, Y. (2014). Methodological issues in mobile computer-supported collaborative learning (mCSCL): What methods, what to measure and when to measure? *Educational Technology & Society*, *17*(4), 33–48.

Stahl, G. (2005). Group cognition in computer-assisted collaborative learning. *Journal of Computer Assisted Learning*, *21*(2), 79-90. doi:10.1111/j.1365-2729.2005.00115.x

Stahl, G., Koschmann, T., & Suthers, D. (2006). Computer-supported collaborative learning: An historical perspective. In R. K. Sawyer (Ed.), Cambridge handbook of the learning sciences (pp. 409–426). Cambridge, UK: Cambridge University Press. http://dx.doi.org/10.1017/cbo9780511816833.025

Summers, J. J., Gorin, J. S., Beretvas, S. N., & Svinicki, M. D. (2005). Evaluating collaborative learning and community. *The Journal of Experimental Education*, *73*(3), 165-188. doi: 10.3200/JEXE.73.3.165-188

Svenningsen, L., & Pear, J. J. (2011). Effects of computer-aided personalized system of instruction in developing knowledge and critical thinking in blended learning courses. *Behavior Analyst Today*, *12*(1), 33-39. doi: 10.1037/h0100709

Swart, R. (2013). An inquiry-based approach to developing critical thinking in high-fidelity simulation. In T. Bastiaens & G. Marks (Eds.), *Proceedings of E-Learn: World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education 2013* (pp. 1592-1597). Chesapeake, VA: Association for the Advancement of Computing in Education (AACE). Retrieved from http://www.editlib.org

Teo, T. (2011). Factors influencing teachers' intention to use technology: Model development and test. *Computers & Education*, *57*(4), 2432-2440. doi: 10.1016/j.compedu.2011.06.008

The National Task Force on Civic Learning and Democratic Engagement [NTFCLDE]. 2012. *A crucible moment: College learning and democracy's future.* Washington, DC: Association of American Colleges and Universities.

Thalheimer, W., & Cook, S. (2002). How to calculate effect sizes from published research: A simplified methodology. *Work-Learning Research*, 1-9.

Tlhoaele, M., Hofman, A., Winnips, K., & Beetsma, Y. (2014). Exploring the relationship between factors that contribute to interactive engagement and academic performance. *Journal of Education and Training*, *2*(1), 61-80. doi: 10.5296/jet.v2i1.6577

Torenbeek, M., Jansen, E. P. W. A., & Hofman, W. H. A. (2011). Predicting first-year achievement by pedagogy and skill development in the first weeks at university. *Teaching in Higher Education*, *16*(6), 655-668. doi: 10.1080/13562517.2011.560378

Trolian, T. L., & Fouts, K. S. (2011). No child left behind: Implications for college student learning. *About Campus, 16*(3), 2–7. doi: 10.1002/abc.20061

Venezia, A., & Jaeger, L. (2013). Transitions from high school to college. *The Future of Children*, *23*(1), 117-136. doi: 10.1353/foc.2013.0004

Venkatesh, V., & Davis, F. D. (1996). A model of the antecedents of perceived ease of use: Development and test. *Decision sciences*, *27*(3), 451-481. doi: 10.1111/j.1540-5915.1996.tb01822.x

Venkatesh, V., & Davis, F. D. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management Science*, *46*(2), 186-204. doi: 10.1287/mnsc.46.2.186.11926

Vivian, R., Falkner, K., & Falkner, N. (2013). Building consensus: Students' cognitive and metacognitive behaviours during wiki construction. *Preceedings of the*

Learning and Teaching in Computing and Engineering (LaTiCE), 154-16. doi: 10.1109/LaTiCE.2013.22

Vygotsky, L. (1978). *Mind in society: The development of higher psychological processes*. Cambridge: Harvard University Press.

Wagner, T., Baum, L., & Newbill, P. (2014). From rhetoric to real world: fostering higher order thinking through transdisciplinary collaboration. *Innovations in Education and Teaching International*, *51*(6), 664-673. doi: 10.1080/14703297.2013.796726

Waite, S., & Davis, B. (2006). Collaboration as a catalyst for critical thinking in undergraduate research. *Journal of Further and Higher Education*, *30*(4), 405-419. doi: 10.1080/03098770600965417

Wakefield, J., & Smith, D. (2012). From Socrates to satellites: iPad learning in an undergraduate course. *Creative Education,* 3(5), 643–648. doi: 10.4236/ce.2012.35094

Wass, R., Harland, T., & Mercer, A. (2011). Scaffolding critical thinking in the zone of proximal development. *Higher Education Research & Development*, *30*(3), 317-328. doi: 10.1080/07294360.2010.489237

Wertsch, J. V., & Tulviste, P. (1992). LS Vygotsky and contemporary developmental psychology. *Developmental Psychology*, *28*(4), 548. doi: 10.1037/0012-1649.28.4.548

Wu, Y.-T., Hou, H.-T., Hwang, F.-K., Lee, M.-H., Lai, C.-H., Chiou, G,-L., Lee, S. W.-Y., Hsu, Y.-C., Liang, J.-C., Chen, N.-S., & Tsai, C.-C. (2013). A review of

intervention studies on technology-assisted instruction from 2005-2010. *Educational Technology & Society, 16(3)*, 191–203.

Wynn Sr, C. T., Mosholder, R. S., & Larsen, C. A. (2014). Measuring the effects of problem-based learning on the development of postformal thinking skills and engagement of first-year learning community students. *Learning Communities Research and Practice*, *2*(2), 1-31.

Yu, W. C. W. (2013). Nursing professionals' evaluation in integrating the computers in English for nursing purposes (ENP) instruction and learning. *Turkish Online Journal of Educational Technology*, *12*(4), 124-139.

Zheng, B., Niiya, M., & Warschauer, M. (2015). Wikis and collaborative learning in higher education. *Technology, Pedagogy and Education*, *24*(3), 357-374. doi: 10.1080/1475939X.2014.948041

Zhou, W., Simpson, E., & Domizi, D. P. (2012). Google Docs in an out-of-class collaborative writing activity. *International Journal of Teaching and Learning in Higher Education*, *24*(3), 359-375.

Appendix A

AECT Policy on Member Participation in Research Studies

Policy on Requesting AECT Member Participation in Research Studies

From time to time, AECT receives formal requests for email or mailing lists for the purpose of soliciting AECT members to participate in surveys and other studies. In some cases, these requests ask AECT Headquarters to help draw random or purposeful samples. Additionally, the requested sample sometimes seems best derived from the total membership and other times might best be drawn from a division or cluster of divisions.

As an international organization, AECT is an active supporter of research and wishes to facilitate research studies and sharing of results that may benefit the field. At the same time, AECT is responsible for assuring that its members receive no more requests for participation than are reasonable and that such participation requests are appropriate. AECT also has the responsibility of assuring its membership rolls are properly protected.

In order to help identify whether a request for a sample is appropriate for member participation and to facilitate deriving the proper sample, those requesting samples should provide the following information as part of their requests:

1. The title of the study for which a sample is requested.
2. The name, affiliation, title, and contact information of the requesting person or organization.
3. Whether the requester is a member of AECT, and if so, any divisions with which affiliated.
4. The size and nature of the requested sample.
5. Why AECT member participation is appropriate.
6. Specifics on those for whom participation might be most appropriate (for instance, age, gender, race, rank, experience, content area, type of employment, etc.)
7. Why the study is important to the field and why its results would be of interest/benefit to AECT members.
8. A description of how the results are to be used.
9. The name, affiliation, title, and contact information for advisors, chairs, or other supervisors involved.
10. An assurance statement that confirms the researcher(s) involved will not share participant data or participant addresses or emails, that contact information for participants will be retained under lock and key, and that such contact information will be destroyed upon completion of the research.

Upon receipt of such a request, the Executive Committee of the AECT Board will discuss the merits of the research and decide whether AECT should facilitate member participation in the proposed research. If participation does seem appropriate, the Executive Committee –in consultation with division officers and headquarters staff— will decide whether sampling is most reasonable at the organizational level or the divisional level, or some other level (for example, Special Interest Forum, Task Force, or Work Group). If the Exec feels the request needs modification before AECT can facilitate participation or if AECT needs further information (such as confirmation by the requester's affiliated organization), the requester may be asked to make such modifications or supply such additional information prior to approval.

Once AECT agrees to supply a sample list, the researcher needs to file the following materials with AECT Headquarters prior to release of the member-sampling list to the researcher:

11. A copy of approval by appropriate certifying panels or committees (such as Human Subjects Review or Institutional Research Boards), when such panels or committees have authority over the research.
12. Copies of all instruments to be used with AECT members.

Appendix B

Instrument Sections and Relationship to Research Questions

Each instrument section is aligned with the research questions here. In the SurveyMonkey form, the sections italicized were included in the final survey but were included here for IRB reference.

RQ1: TO what extent do postsecondary instructors accept tablet use in instruction (IV_1: TAM) and use collaborative tools with tablets (IV_2: CTU)?

IV_1: Tablet Acceptance = Technology Acceptance Measure – TAM (adapted)

TAM measures 5 components: (1) ease of use, (2) usefulness, (3) attitude toward use, (4) intent to use, and (5) job relevance

Response Scale: 5=Strongly Agree, 4=Agree, 3=Undecided, 2=Disagree, 1=Strongly Disagree

For purposes of this study the term tablet refers to an iPad or other similar tablet technology. Please select your level of agreement with these 14 items related to tablet use.

Perceived Ease of Use (PEU) – 4 items

1. I feel that using tablet technology in my class would be easy
2. I feel that it would be easy for students to become skillful at using a tablet
3. Students would find a tablet to be flexible to interact with
4. It would be easy for students to get a tablet to do what I want them to do

Perceived Usefulness (PU) – 4 items

5. Using tablets would improve student performance
6. Using tablets would increase student productivity
7. Using tablets would make tasks easier to accomplish for students
8. I would find tablets useful in my classroom

Attitude Toward Usage (ATU) -2 items

9. I believe it is a good idea to use tablets in my class
10. I like the idea of using tablets in my class

Behavioral Intention to Use (BIU) – 2 items

11. I plan to use tablets in the future in my class
12. Assuming that I and my students have access to tablets, I intend to use them

Job Relevance (JR) – 2 items

13. In my teaching, the usage of tablets is important
14. In my teaching, the usage of tablets is relevant

IV_2: Collaborative Tool Use = Deal Framework Measure (2009) (adapted)

Researcher designed items developed based on Deal's (2009) framework for using technology to support collaboration including (1) team definition, cohesion, and participation, (2) project management, (3) co-creation and ideation, (4) consensus building, and (5) presentation with media)

Response Scale: 5=Extensively, 4=Typically, 3=Sometimes, 2=Rarely, 1=Not at all

For purposes of this study the term tablet refers to an iPad or other similar tablet technology. Please respond to these 12 items by selecting the frequency of using tablets in your instruction to accomplish the following tasks.

As part of my instruction, I have students use tablets to:

Team Definition, Cohesion and Participation
15. Develop group cohesion through social networking
16. Create shared user profiles

Project Management
17. Collaboratively manage project tasks
18. Track project progress

Co-Creation and Ideation
19. Co-create collaborative assignments
20. Conduct collaborative editing
21. Create wikis
22. Develop shared concept maps

Consensus Building
23. Build consensus
24. Do polling

Presentation and Archiving
25. Develop presentations with media sharing
26. To archive materials and media presentations

RQ2: Is there a relationship between postsecondary instructor tablet acceptance (IV_1 – TAM – see above) and implementation of collaborative learning (DV_1 - CLIQ)?

DV1: Collaborative Learning Implementation= Collaborative Learning Implementation Questionnaire - CLIQ (adapted)

CLIQ Measures 2 things: (1) professional views on collaborative learning, (2) current collaborative teaching practices. This study is not using the third section of the CLIQ (Tell us about yourself).

Collaborative learning is an instructional strategy in which students work actively and purposefully together in small groups to enhance both their own and their teammates' learning. Please respond to these 12 items by selecting your level of agreement with each statement related to collaborative learning:

Professional Views of Collaborative Learning (reduced from 48 items to 12)
Scale: 5=Strongly Agree, 4=Agree, 3=Undecided, 2=Disagree, 1=Strongly Disagree

27. If I use collaborative learning, the students tend to veer off task.
28. Collaborative learning is consistent with my teaching philosophy.
29. Collaborative learning is a valuable instructional approach.
30. If I use collaborative learning, too many students expect other group members to do the work.
31. Engaging in collaborative learning enhances students' social skills.
32. It is impossible to evaluate students fairly when using collaborative learning.
33. There is too little time available to prepare students to work effectively in collaborative groups.
34. Engaging in collaborative learning interferes with students' academic progress.
35. Collaborative learning helps meet my instructional goals.
36. Using collaborative learning fosters positive student attitudes towards learning.
37. I feel a personal commitment to using collaborative learning.
38. Collaborative learning gives too much responsibility to the students.

Extent: Current Collaborative Teaching Practices (CLIQ scale 2 – adapted – added tablets)
Response Scale: 5=Extensively 4=Largely, 3=Somewhat, 2=Slightly, 1=Not at all

Tablets refer to iPads or similar tablet technologies. Please indicate to what extent and how you use tablets for instruction for the next 8 questions.

39. Rate the extent to which tablets are used for collaborative learning in your CURRENT class instruction.
40. Rate the extent to which you use tablets for collaborative learning activities to ensure that all group members actively work together.
41. In a typical tablet based collaborative learning activity in your class, rate the extent to which group members actively participate.
42. In a typical tablet collaborative learning activity in your class, rate the extent to which your students complete their share of the group task.
43. Rate the extent to which you implement tablets for collaborative learning in order to increase academic achievement.
44. Rate the extent to which you implement tablets for collaborative learning in order to improve social skills.
45. Rate the extent to which you implement tablets for collaborative learning in order to motivate students.

46. Rate the extent to which you implement tablets for collaborative learning in order to raise self-esteem.

RQ3: Is there a relationship between postsecondary instructor use of collaborative tools on the tablet (IV_2 – CTU = see above) and implementation of collaborative learning (DV_1 – CLIQ – see above)?

RQ4: What is the relationship between postsecondary instructor implementation of collaborative learning (DV_1 – CLIQ – see above) and perception of student development of critical thinking dispositions (DV_2 - CTD)?

DV2: Critical Thinking Dispositions (CTD) = Facione's (2013) Critical Thinking Dispositions

Critical Thinking Perceptions of dispositions toward critical thinking (Facione, 2013). Scale; 1=Strongly Disagree, 2=Disagree, 3=Undecided, 4=Agree, 5=Strongly Agree

Based on your experience, indicate what impact you believe collaborative activities using tablets in instruction have on the development of the following dispositions for students for these 15 questions:

Systematic

47. Clarity in stating questions or concerns.
48. Diligence in seeking relevant information.

Analytical

49. Trust in the processes of reasoned inquiry.
50. Reasonableness in selecting and applying criteria.

Inquisitive

51. Inquisitiveness with regard to a wide range of issues.
52. Concern to become and remain well-informed.

Judicious

53. Prudence in suspending, making or altering judgments.
54. Flexibility in considering alternatives and opinions.

Truth seeking

55. Honesty in facing one's own biases, prejudices, stereotypes, or egocentric tendencies.
56. Understanding of the opinions of other people.

Confident in reasoning

57. Self-confidence in one's own abilities to reason.
58. Persistence though difficulties are encountered.

Open minded

59. Willingness to reconsider and revise views where honest reflection suggests that change is warranted.
60. Open-mindedness regarding divergent worldviews.
61. Overall disposition toward critical thinking.

Instructor Experience and Demographic Data (Format)
Use the questions below to tell us a little bit about yourself.

Are you currently teaching:*
( ) Full-time
( ) Part-time
( ) I am not currently teaching, but have taught in the past.

How many years of experience do you have in postsecondary teaching?
Years in a full-time position: ____
Years in a part-time position: ____

What is your current faculty position? _____

Do/did you work with…(select all that apply)
[ ] Undergraduate students
[ ] Graduate students
[ ] Professional students
[ ] Postsecondary students
[ ] I don't typically work directly with students.

Your gender?
( ) Male
( ) Female
( ) Other

What is your age?
[ ] Less than 25
[ ] 25-30
[ ] 30-40
[ ] 40-50
[ ] Over 50 years old

What is your ethnic background? Select all that apply.
[ ] White
[ ] Black/African American
[ ] Hispanic/Latino
[ ] American Indian/Native American/Alaskan native
[ ] Asian/Pacific Islander
[ ] Other
[ ] Prefer not to answer

Typical class environment
[ ] Online
[ ] Face to Face
[ ] Blended

Geographic area(s) in which you taught (check all that apply)
( ) Africa
( ) Asia
( ) Europe
( ) North America (U.S. & Canada)
( ) Pacific Islands
( ) South America
( ) Other

Appendix C

SurveyMonkey Survey

Study Information and Participant Consent

Study Description

As an instructional technology professional teaching (or having taught) in a postsecondary setting, you are invited to participate in a research study conducted by Jerry Hubbard, a doctoral candidate in Educational Technology at Walden University. This study will supplement the current gap in the availability of quantitative research that examines the use of portable tablet technology as a tool to promote collaboration in an effort to develop dispositions toward critical thinking in postsecondary student learning environments. Using this survey, the study seeks to understand how you (postsecondary instructors) perceive the incorporation of tablet technologies in instruction, how you have incorporated such technologies to support collaboration, and your perceptions of the relationship between collaboration and the development of critical thinking dispositions in students.

Conditions and Stipulations

1. I agree to voluntarily complete this online survey for research purposes and that the data derived from this anonymous survey may be made available in aggregate formats to the general public in the form of a dissertation, public presentations, reports, journals or newspaper articles, and/or in books.

2. Beyond some limited demographic information, I understand the online survey involves questions about my experiences in postsecondary instruction and my use of tablet technology as it relates to collaborative learning and critical thinking development.

3. I understand that this survey is expected to take up to 20 minutes to complete. I understand that my participation in this survey is totally voluntary and that declining to participate will involve no penalty. If I choose, I may discontinue my participation at any time without penalty. I also understand that if I choose to participate, I may decline to answer any question that I am not comfortable answering.

4. I understand that I can contact the researcher at jerry.hubbard@waldenu.edu if I have questions about the study. If I have any questions about my rights as a participant, I can contact the Walden University research Participant Advocate (1-612-312-1210 or irb@waldenu.edu). I understand that the survey does not contain any more than minimal risks similar to the risks of everyday life, such as fatigue from completing the survey. I am aware that my consent will not directly benefit me other than perhaps gaining more understanding of my own instructional practices through reflection on the questions, and that there is no direct compensation for participating in this study. The provided data will inform research and practice on how to use tablet technologies to support instruction for students and expand knowledge of how faculty view technology as it applies to collaborative

learning and/or critical thinking development.

5. I understand that my survey responses are completely anonymous; once responses are submitted, the researcher will not be able to identify me. The data will be collected online by SurveyMonkey and provided to the researcher as anonymous data by systems that are in password-protected cloud-based data centers. Only the account holder (researcher) can access the data contained within the account. The research data will remain on a password secure computer and an external storage device protected in a locked firebox. All data for this study will be destroyed at the end of 5 years from the completed research date.

6. I understand that the results of the study can be retrieved using the researchers name (Jerry D. Hubbard) and the study title (Examining the Attitudes and Opinions of Instructional Technology Professionals About Using Tablets for Group Collaboration as a Way to Facilitate Critical Thinking in Postsecondary Instruction) following the completion of the research. Additionally, I understand the results will be provided using the following links:

https://drive.google.com/drive/folders/0BwV8fqBAEXdHSHptVDJsRGlsRjA?usp=sharing;
or
https://www.researchgate.net/profile/Jerry_Hubbard.

* By selecting “I agree” below I freely provide consent and acknowledge my rights as a voluntary research participant as outlined above and provide consent to use my survey responses in the technology research in the academic community projects.

You must be an adult (at least 18 years old, in most jurisdictions) and currently employed as a postsecondary instructor or have previously taught at a post-secondary institution to participate in this survey. Once you have indicated you agree to participate, you may click the link to the survey. Please print a copy of the consent form to keep for your records Link.

- ◯ I Agree
- ◯ I Disagree

Technology Acceptance Model

For purposes of this study the term tablet refers to an iPad or other similar tablet technology. Please select your level of agreement with these 14 items related to tablet use.

I feel that using tablet technology in my class would be easy

Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
○	○	○	○	○

I feel that it would be easy for students to become skillful at using a tablet

Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
○	○	○	○	○

Students would find a tablet to be flexible to interact with

Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
○	○	○	○	○

It would be easy for students to get a tablet to do what I want them to do

Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
○	○	○	○	○

Using tablets would improve student performance

Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
○	○	○	○	○

Using tablets would increase student productivity

Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
○	○	○	○	○

Using tablets would make tasks easier to accomplish for student

Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
○	○	○	○	○

* **Please check that you have answered all the questions.**

○ All questions answered.

○ Keep answers without changes.

Technology Acceptance Model (Continued)

Please select your level of agreement with these items related to tablet use.

I would find tablets useful in my classroom

Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
◯	◯	◯	◯	◯

I believe it is a good idea to use tablets in my class

Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
◯	◯	◯	◯	◯

I like the idea of using tablets in my class

Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
◯	◯	◯	◯	◯

I plan to use tablets in the future in my class

Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
◯	◯	◯	◯	◯

Assuming that I and my students have access to tablets, I intend to use them

Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
◯	◯	◯	◯	◯

In my teaching, the usage of tablets is important

Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
◯	◯	◯	◯	◯

In my teaching, the usage of tablets is relevant

Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
◯	◯	◯	◯	◯

* **Please check that you have answered all the questions.**

◯ All questions answered.

◯ Keep answers without changes.

Collaborative Tool Use

For purposes of this study the term tablet refers to an iPad or other similar tablet technology. Please select your level of agreement with these 12 items related to the frequency of using tablets in your instruction to accomplish the following tasks.

As part of my instruction, I have students use tablets to:

	Not at all	Rarely	Sometimes	Typically	Extensively
Develop group cohesion through social networking	◯	◯	◯	◯	◯
Create shared user profiles	◯	◯	◯	◯	◯
Collaboratively manage project tasks	◯	◯	◯	◯	◯
Track project progress	◯	◯	◯	◯	◯
Co-create collaborative assignments	◯	◯	◯	◯	◯
Conduct collaborative editing	◯	◯	◯	◯	◯
Create wikis	◯	◯	◯	◯	◯
Develop shared concept maps	◯	◯	◯	◯	◯
Build consensus	◯	◯	◯	◯	◯
Do polling	◯	◯	◯	◯	◯
Develop presentations with media sharing	◯	◯	◯	◯	◯
To archive materials and media presentations	◯	◯	◯	◯	◯

*** Please check that you have answered all the questions.**

◯ All questions answered.

◯ Keep answers without changes.

Collaborative Learning Implementation Questions

Collaborative learning is an instructional strategy in which students work actively and purposefully together in small groups to enhance both their own and their teammates' learning.

Please select your level of agreement with these 12 items related to collaborative learning:

	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
If I use collaborative learning, the students tend to veer off task.	○	○	○	○	○
Collaborative learning is consistent with my teaching philosophy.	○	○	○	○	○
Collaborative learning is a valuable instructional approach.	○	○	○	○	○
If I use collaborative learning, too many students expect other group members to do the work.	○	○	○	○	○
Engaging in collaborative learning enhances students' social skills.	○	○	○	○	○
It is impossible to evaluate students fairly when using collaborative learning.	○	○	○	○	○
There is too little time available to prepare students to work effectively in collaborative groups.	○	○	○	○	○
Engaging in collaborative learning interferes with students' academic progress.	○	○	○	○	○
Collaborative learning helps meet my instructional goals.	○	○	○	○	○
Using collaborative learning fosters positive student attitudes towards learning.	○	○	○	○	○

	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
I feel a personal commitment to using collaborative learning.	◯	◯	◯	◯	◯
Collaborative learning gives too much responsibility to the students.	◯	◯	◯	◯	◯

*** Please check that you have answered all the questions.**

◯ All questions answered.

◯ Keep answers without changes.

Current Collaborative Teaching Practices

Tablets refer to iPads or similar tablet technologies.

Please select from the next 8 questions to indicate to what extent and how you use tablets for instruction.

	Not at all	Slightly	Somewhat	Largely	Extensively
Rate the extent to which tablets are used for collaborative learning in your CURRENT class instruction.	○	○	○	○	○
Rate the extent to which you use tablets for collaborative learning activities to ensure that all group members actively work together.	○	○	○	○	○
In a typical tablet based collaborative learning activity in your class, rate the extent to which group members actively participate.	○	○	○	○	○
In a typical tablet collaborative learning activity in your class, rate the extent to which your students complete their share of the group task.	○	○	○	○	○
Rate the extent to which you implement tablets for collaborative learning in order to increase academic achievement.	○	○	○	○	○
Rate the extent to which you implement tablets for collaborative learning in order to improve social skills.	○	○	○	○	○
Rate the extent to which you implement tablets for collaborative learning in order to motivate students.	○	○	○	○	○
Rate the extent to which you implement tablets for collaborative learning in order to raise self-esteem.	○	○	○	○	○

*** Please check that you have answered all the questions.**

○ All questions answered.

○ Keep answers without changes.

Critical Thinking Dispositions

Based on your experience, indicate what impact you believe collaborative activities using tablets in instruction have on the development of the following dispositions for students from these 15 questions:

Clarity in stating questions or concerns.

Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
○	○	○	○	○

Diligence in seeking relevant information.

Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
○	○	○	○	○

Trust in the processes of reasoned inquiry.

Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
○	○	○	○	○

Reasonableness in selecting and applying criteria.

Strongly Disagree	Disagree	Undecided	Agree	Strongly Disagree
○	○	○	○	○

Inquisitiveness with regard to a wide range of issues.

Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
○	○	○	○	○

Concern to become and remain well-informed.

Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
○	○	○	○	○

Prudence in suspending, making or altering judgments.

Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
○	○	○	○	○

Flexibility in considering alternatives and opinions.

Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
○	○	○	○	○

* **Please check that you have answered all the questions.**

○ All questions answered.

○ Keep answers without changes.

Critical Thinking Dispositions (Continued)

Based on your experience, indicate what impact you believe collaborative activities using tablets in instruction have on the development of the following dispositions for students.

Honesty in facing one's own biases, prejudices, stereotypes, or egocentric tendencies.

Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
○	○	○	○	○

Understanding of the opinions of other people.

Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
○	○	○	○	○

Self-confidence in one's own abilities to reason.

Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
○	○	○	○	○

Persistence though difficulties are encountered.

Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
○	○	○	○	○

Willingness to reconsider and revise views where honest reflection suggests that change is warranted.

Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
○	○	○	○	○

Open-mindedness regarding divergent worldviews.

Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
○	○	○	○	○

Overall disposition toward critical thinking.

Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
○	○	○	○	○

* **Please check that you have answered all the questions.**

○ All questions answered.

○ Keep answers without changes.

Instructor Experience and Demographic Data

Use the questions below to tell us a little bit about yourself.

Are you currently teaching?

- ◯ Full-time
- ◯ Part-time
- ◯ I am not currently teaching, but have taught in the past

How many years of experience do you have in postsecondary teaching?

Years in a full-time position: _____

Years in a part-time position: _____

What is your current faculty position?

_____

Do/did you work with…(select all that apply)

- ☐ Undergraduate Students
- ☐ Graduate Students
- ☐ Professional Students
- ☐ Postsecondary Students
- ☐ I don't typically work directly with students.

Your Gender?

- ◯ Male
- ◯ Female
- ◯ Other

What is your age?

- ◯ Less than 25
- ◯ 25 - 30
- ◯ 31 - 40
- ◯ 41 - 50
- ◯ Over 50 years old

What is your ethnic background? Select all that apply.

- ☐ White
- ☐ Black/African American
- ☐ Hispanic/Latino
- ☐ American Indian/Native American/Alaskan Native
- ☐ Asian Pacific Islander
- ☐ Other
- ☐ Prefere not to answer

Typical class environment

- ◯ Online
- ◯ Face to Face
- ◯ Blended

Geographic area(s) in which you teach or taught (check all that apply)

- ☐ Africa
- ☐ Asia
- ☐ Europe
- ☐ North America (U.S. & Canada)
- ☐ Pacific Islands
- ☐ South America
- ☐ Other

Appendix D

AECT Research Request Letter

February 21, 2017

To: AECT Executive Committee

Subject: Request Member Participation in Research Study

Good Afternoon,

My name is Jerry Hubbard, and I am a Ph.D. student at Walden University. I am writing this letter to introduce my research study and to request member participation to complete a 61 item Likert-scale survey questionnaire (SurveyMonkey). I can be contacted at jerry.hubbard@waldenu.edu or 760-900-3162.

The contact information for my Walden University committee:

Chair:	Dr. Christine Sorensen	christine.sorensen@waldenu.edu
Methodologist:	Dr. Kay Persichitte	kay.persichitte@waldenu.edu
URR:	Dr. Rob Foshay	wellesley.foshay@waldenu.edu

The title of the study is: Examining the Attitudes and Opinions of Instructional Technology Professionals About Using Tablets for Group Collaboration as a Way to Facilitate Critical Thinking in Postsecondary Instruction.

I currently serve on the AECT Leadership Committee and am a member of the Graduate Student Assembly.

The preferred sample size for the study is 321 participants. A smaller sample would be acceptable, but it reduces the generalizability of study to the population of instructional technology professionals.

The purpose for requesting AECT member participation is the organization provides an international population of instructional technology professionals that can provide an educated perception of the attitudes/opinions of applying technology-based collaborative learning in higher education.

The target participants are those that serve in higher education or industry where there is a reasonable opportunity to use collaborative learning and instructional technology to educate postsecondary students. The study does not include instructors who are primarily K-12. The sample size is not limited by age, gender, race, rank, experience, employment or nationality. The study seeks to understand the opinions of the organization's diverse population of instructors regarding the use of tablet technology to support collaborative

instructional activities and their perceptions of how such use influences critical thinking dispositions.

The importance of the study to the AECT membership is it seeks to understand how collaborative learning facilitated by technology could be used to encourage the development of critical thinking in postsecondary students. By using technologies like tablets, the study would inform future application of similar tools and technology to encourage collaborative learning focused on developing pedagogies to foster critical thinking dispositions. The positive social benefit of examining the use of tablet technologies to support collaboration as a strategy to improve critical thinking is a better understanding of strategies that faculty may implement to improve student outcomes. Improving the critical thinking of students could provide citizens who contribute to their communities and society in positive ways.

The results of the survey will be used to understand how instructor perceptions of collaborative learning and the usefulness (Alharbi & Drew, 2014) of tablet technologies influences the application of collaborative learning design (Deal, 2009) as a way to foster dispositions towards critical thinking (Facione, 2013). Using SPSS, the study will examine the data using descriptive and inferential statistics.

The data collected via SurveyMonkey will be anonymous, and will be destroyed after 5 years. Email and contact information will not be requested for this survey. The survey data will be maintained on a password protected data storage device or computer hard drive. The storage device will be maintained in a locked firebox, and the hard data will be secured using a network password and security.

I have attached a current draft of the research survey aligned with the research questions. The final format will be a printed out copy of the SurveyMonkey survey.

I appreciate your consideration of this study. I understand that final approval will be requested following Walden University's IRB approval of the proposal. Once approved, I will submit a copy of the final survey and SurveyMonkey link with a copy of the IRB approval paperwork.

Thank you for your time.

Respectfully,

Jerry D. Hubbard
Ph.D. Candidate
Walden University
jerry.hubbard@walendnu.edu

Appendix E

Permission: Technology Assessment Model Questionnaire

Gmail by Google

Jerry Hubbard <jerry.hubbard@waldenu.edu>

Questionnaire Use from Alharbi & Drew 2014

Saleh Alharbi <saleh.alharbi@griffithuni.edu.au> Thu, Aug 18, 2016 at 10:59 AM
To: Jerry Hubbard <jerry.hubbard@waldenu.edu>
Cc: Steve Drew <s.drew@griffith.edu.au>

Dear Jerry,

I am delighted that you have found the paper helping you towards completing your PhD. Please feel free to make use of the paper and the questionnaire. To let you know, we have more of this aspect to communicate. It will be such a great idea if we can work together on a paper or a research project. I also have noticed that you are talking about the use of iPads in education. We wrote papers on the topic of mlearning! Have a look here:

https://scholar.google.com/citations?user=VDQ5nUsAAAAJ&hl=en

Looking forward to further collaboration.

Best regards,
Saleh

On Tue, Aug 16, 2016 at 11:20 PM, Jerry Hubbard <jerry.hubbard@waldenu.edu> wrote:

> Steve and Editor,
>
> Thank you!
>
> I am looking forward to discussing the study with Seleh.
>
> Have a great day.
>
> Respectfully,
>
> Jerry
>
> On Tue, Aug 16, 2016 at 2:10 AM, Steve Drew <s.drew@griffith.edu.au> wrote:
>
> > Dear Editor & Jerry,
> > Saleh will be able to assist Jerry in making this survey available. I leave him to get in contact and hope that some future collaborations are possible to further aspects of this work.
> > Kind regards
> > Steve
> >
> > On Tue, Aug 16, 2016 at 2:04 PM, Editor IJACSA <editorijacsa@thesai.org> wrote:
> >
> > > Dear Saleh/Steve,
> > >
> > > We are forwarding you the request to use the questionnaire that was published in your paper in 2014. Would you like to approve this or have any questions/ comments?
> > >
> > > Please feel free to discuss this with Jerry directly.
> > >
> > > Regards,
> > > Editor

Appendix F

Permission: Cooperative Learning Implementation Questionnaire

Gmail by Google

Jerry Hubbard <jerry.hubbard@waldenu.edu>

CLiQ use

Anne Wade <wada@education.concordia.ca> Wed, Jun 29, 2016 at 2:56 PM
To: jerry.hubbard@waldenu.edu
Cc: cpoulsen@egi.com, Phil Abrami <abrami@education.concordia.ca>

Hello Jerry,

I don't see any problems with your suggested revisions to the CLIQ, however please state on your instrument that it is an adaptation of the CSLP's CLIQ.
I've Cced the authors in the event they have more to contribute.

Best of luck with your research,
Anne

Anne Wade
Manager/Information Specialist/Professor
Centre for the Study of Learning and Performance/Education
Concordia University

Tel: 514-848-2424 x2885
Email: wada@education.concordia.ca
Web: http://www.concordia.ca/cslp
Linkedin: [
https://www.linkedin.com/profile/public-profile-settings?trk=prof-edit-edit-public_profile
]New Link
[Quoted text hidden]

Appendix G

Permission: EDUCAUSE Center for Analysis and Research Survey

Gmail by Google

Jerry Hubbard <jerry.hubbard@waldenu.edu>

ECAR Survey

Eden Dahlstrom <edahlstrom@educause.edu> Thu, Jun 23, 2016 at 9:40 PM
To: "jerry.hubbard@waldenu.edu" <jerry.hubbard@waldenu.edu>
Cc: Study <Study@educause.edu>

Jerry,

You have our permission to use the ECAR faculty study survey instrument in whole or in part for your research Waldon research. In exchange we ask you to cite the EDUCAUSE Center for Analysis and Research as your source AND share your most interesting findings with us at the conclusion of your research project.

-Eden

Eden Dahlstrom Chief Research Officer

Data, Research, and Analytics
E D U C A U S E
Uncommon Thinking for the Common Good
1150 18th Street, NW, Suite 900 Washington, DC 20036
direct: 303.939.0330 | mobile: 530.903.2305 | educause.edu

From: Susan Grajek
Sent: Thursday, June 23, 2016 11:19 AM
To: Eden Dahlstrom
Subject: Fwd: ECAR Survey

Could you help him? Thanks!

Sent from my iPhone

Begin forwarded message:

> **From:** "Jerry Hubbard" <jerry.hubbard@waldenu.edu>
> **To:** "Susan Grajek" <sgrajek@educause.edu>
> **Subject: ECAR Survey**

[Quoted text hidden]

Appendix H

Final AECT Research Request Letter

February 26, 2017

To: AECT Executive Committee

Subject: Member Participation in Research Study

Good Afternoon,

In a previous letter, I requested member participation in a research study. Following the Executive Committee's approval, the study was submitted to Walden University's IRB. The IRB has granted approval for the study.

I have attached a copy of the IRB approval, a final copy of the survey, and a copy of the Executive Board approval letter. Also, the SurveyMonkey link to be distributed to the AECT members is _____.

I appreciate your support.

If you have any questions or concerns, I can be contacted at jerry.hubbard@waldenu.edu or 760-900-3162.

Thank you for your time and patience.

Respectfully,

Jerry D. Hubbard
Ph.D. Candidate
Walden University
jerry.hubbard@waldendu.edu

Appendix I

Collaborative Learning Implementation Questionnaire Items Professional Views

Professional Views of Collaborative Learning	% Strongly Disagree/ Disagree	% Undecided	% Strongly Agree/ Agree	Mean	Standard Deviation
If I use collaborative learning, the students tend to veer off task.	71.20	8.50	20.30	2.390	1.034
Collaborative learning is consistent with my teaching philosophy.	3.40	0.00	96.60	4.373	0.740
Collaborative learning is a valuable instructional approach.	1.70	3.40	94.90	4.492	0.728
If I use collaborative learning, too many students expect other group members to do the work.	61.00	25.40	13.60	2.492	0.838
Engaging in collaborative learning enhances students' social skills.	1.70	6.80	91.50	4.322	0.681
It is impossible to evaluate students fairly when using collaborative learning.	76.30	8.50	15.20	2.254	1.140
There is too little time available to prepare students to work effectively in collaborative groups.	61.00	20.30	18.60	2.372	1.015
Engaging in collaborative learning interferes with students' academic progress.	91.50	5.10	3.40	1.712	0.720
Collaborative learning helps meet my instructional goals.	3.40	6.80	89.80	4.271	0.739
Using collaborative learning fosters positive student attitudes towards learning.	5.10	20.30	74.60	3.983	0.900
I feel a personal commitment to using collaborative learning.	5.10	13.60	81.30	4.051	0.918
Collaborative learning gives too much responsibility to the students.	86.40	6.80	6.80	1.848	0.827

Collaborative Learning Implementation Questionnaire Items Current Practices

Current Collaborative Teaching Practices	% Not at All	% Slightly/ Somewhat	% Largely/ Extensively	Mean	Standard Deviation
Rate the extent to which tablets are used for collaborative learning in your CURRENT class instruction.	44.10	42.40	13.60	2.136	1.196
Rate the extent to which you use tablets for collaborative learning activities to ensure that all group members actively work together.	44.10	37.30	18.70	2.203	1.284
In a typical tablet based collaborative learning activity in your class, rate the extent to which group members actively participate.	32.20	25.40	42.40	2.830	1.440
In a typical tablet collaborative learning activity in your class, rate the extent to which your students complete their share of the group task.	32.20	23.70	44.10	2.898	1.505
Rate the extent to which you implement tablets for collaborative learning in order to increase academic achievement.	39.00	37.30	23.70	2.373	1.285
Rate the extent to which you implement tablets for collaborative learning in order to improve social skills.	44.10	33.90	22.00	2.220	1.287
Rate the extent to which you implement tablets for collaborative learning in order to motivate students.	40.70	20.40	39.00	2.525	1.419
Rate the extent to which you implement tablets for collaborative learning in order to raise self-esteem.	47.50	33.80	18.70	2.102	1.255

Appendix J

Critical Thinking Disposition Items

Critical Thinking Disposition Questions	% Strongly Disagree/ Disagree	% Undecided	% Strongly Agree/ Agree	Mean	Standard Deviation
Clarity in stating questions or concerns.	8.50	40.70	50.90	3.492	0.817
Diligence in seeking relevant information.	8.50	28.80	62.70	3.644	0.846
Trust in the processes of reasoned inquiry.	6.80	44.10	49.20	3.492	0.796
Reasonableness in selecting and applying criteria.	8.50	39.00	52.50	3.458	0.750
Inquisitiveness with regard to a wide range of issues.	8.50	27.10	64.40	3.661	0.843
Concern to become and remain well-informed.	6.80	44.10	49.20	3.492	0.796
Prudence in suspending, making or altering judgments.	10.20	52.50	37.30	3.340	0.822
Flexibility in considering alternatives and opinions.	6.80	32.20	61.10	3.678	0.860
Honesty in facing one's own biases, prejudices, stereotypes, or egocentric tendencies.	18.60	37.30	44.10	3.305	0.895
Understanding of the opinions of other people.	8.50	25.40	66.10	3.661	0.822
Self-confidence in one's own abilities to reason.	6.80	37.30	56.00	3.576	0.814
Persistence though difficulties are encountered.	8.50	32.20	59.30	3.576	0.814
Willingness to reconsider and revise views where honest reflection suggests that change is warranted.	6.80	33.90	59.40	3.610	0.810
Open-mindedness regarding divergent worldviews.	6.80	37.30	56.00	3.542	0.773
Overall disposition toward critical thinking.	10.20	37.30	52.60	3.492	0.838

Appendix K

Full-Time Post-Secondary Instructors (*n* = 27)

Technology Acceptance Model

	% Strongly Disagree/ Disagree	% Undecided	% Strongly Agree/ Agree
PEU	7.40	40.70	51.90
PU	18.50	48.20	33.30
ATU	11.10	18.50	70.40
BIU	14.80	37.00	48.20
JR	25.90	40.70	33.40

Current Collaborative Professional Views

	% Strongly Disagree/ Disagree	% Undecided	% Strongly Agree/ Agree
Professional Views	14.80	85.20	0.00

Current Collaborative Implementation Practices

	% Not at all	% Slightly/ Somewhat	% Extensively/ Largely
Current Practices	44.40	44.50	11.10

Critical Thinking Dispositions

	% Strongly Disagree/ Disagree	% Undecided	% Strongly Agree/ Agree
Systematic	11.10	37.00	51.90
Analytical	7.40	51.90	40.70
Inquisitive	7.40	44.50	48.10
Judicious	11.10	44.50	44.40
Truth Seeking	14.80	44.50	40.70
Confidence in Reason	11.10	40.80	48.10
Open Minded	11.10	48.20	40.70

Appendix L

Part-Time Post-Secondary Instructors (*n* = 18)

Technology Acceptance Model

	% Strongly Disagree/ Disagree	% Undecided	% Strongly Agree/ Agree
PEU	16.70	55.50	27.80
PU	16.70	61.10	22.20
ATU	0.00	33.30	66.70
BIU	0.00	50.00	50.00
JR	33.30	44.40	22.30

Current Collaborative Professional Views

	% Strongly Disagree/ Disagree	% Undecided	% Strongly Agree/ Agree
Professional Views	50.00	50.00	0.00

Current Collaborative Implementation Practices

	% Not at all	% Slightly/ Somewhat	% Extensively/ Largely
Current Practices	61.10	38.90	0.00

Critical Thinking Dispositions

	% Strongly Disagree/ Disagree	% Undecided	% Strongly Agree/ Agree
Systematic	5.60	72.20	22.20
Analytical	5.60	61.10	33.30
Inquisitive	11.10	55.60	33.30
Judicious	5.60	66.60	27.80
Truth Seeking	11.10	55.60	33.30
Confidence in Reason	5.60	61.10	33.30
Open Minded	5.60	66.60	27.80

Appendix M

Not Currently Working Postsecondary Instructors (*n* = 14)

Technology Acceptance Model

	% Strongly Disagree/ Disagree	% Undecided	% Strongly Agree/ Agree
PEU	0.00	50.00	50.00
PU	0.00	57.10	42.90
ATU	0.00	14.30	85.70
BIU	0.00	28.60	71.40
JR	0.00	21.40	78.60

Current Collaborative Professional Views

	% Strongly Disagree/ Disagree	% Undecided	% Strongly Agree/ Agree
Professional Views	0.00	100.00	0.00

Current Collaborative Implementation Practices

	% Not at all	% Slightly/ Somewhat	% Extensively/ Largely
Current Practices	14.30	64.30	21.40

Critical Thinking Dispositions

	% Strongly Disagree/ Disagree	% Undecided	% Strongly Agree/ Agree
Systematic	7.10	21.50	71.40
Analytical	7.10	35.80	57.10
Inquisitive	7.10	28.60	64.30
Judicious	7.10	42.90	50.00
Truth Seeking	0.00	42.90	57.10
Confidence in Reason	0.00	35.70	64.30
Open Minded	0.00	42.90	57.10