I, Anita M Todd, hereby submit this original work as part of the requirements for the degree of Doctor of Education in Curriculum & Instruction.

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Measuring the Effect of an Online Learning Community on Engineering Cooperative Education Students' Perceived and Measured Learning

Student's name: Anita M Todd

This work and its defense approved by:

Committee chair: Janet Zydney, Ph.D.
Committee member: Patricia Linn, Ph.D.
Committee member: Karen Davis, Ph.D.
Committee member: Kay Seo, Ph.D.
Measuring the Effect of an Online Learning Community on Engineering Cooperative Education

Students’ Perceived and Measured Learning

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By

Anita M. Todd, M.Ed.

University of Cincinnati

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Committee Chair: Janet Mannheimer Zydney, Ph.D.
Abstract

This quasi-experimental, static-group comparison study of two non-equivalent groups examined how Work-Integrated Learning (WIL) community participation of at-work, cooperative education students affected student perceived performance, perceived learning, and measured learning with student grade point average (GPA) and work term as covariates. The relationship between student social-media use and community participation was examined. The study included 47 matched pairs of electrical engineering students, primarily Caucasian male, from a large urban research university. The treatment and control groups completed the existing curriculum, the treatment group participated in the WIL community in Blackboard® and completed a social-media use survey and community evaluation questions.

I found a significant negative correlation between students’ who perceived themselves as having strong leadership skills and the level of participation in the wiki. I found no significant correlations (with bloggers) and a negative significant correlation (without the bloggers) in the relationship between social media use and the level of blogging and the overall participation in the WIL community. The level or type of WIL community participation did not affect perceived performance, perceived learning, or measured learning. Students did not believe the community enhanced their learning nor did they enjoy participating; however, they liked to read about or comment on other students’ experiences. They did not like Blackboard® or the weekly posting requirement and suggested these items change in the future.

Implications for instructional designers/distance educators are the perceived difficulty using Blackboard® potentially affecting student use, the need for tools/interfaces that notify the user of new community content or participants, and that instructional technology should be piloted for student ease of use and perceived usefulness. Experiential learning practitioners need
to promote the academic focus of work experiences to frame assignments, such as an online community and assessment, as important for student learning through work.
CO-OP ONLINE LEARNING COMMUNITY
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# Table of Contents

1. Rationale for Research, Purpose and Research Questions, and Conceptual Framework ................................................................. 1  
   - Rationale for research .......................................................................................... 1  
   - Purpose and research questions ...................................................................... 4  
   - Conceptual framework ...................................................................................... 5  

   Summary .............................................................................................................. 10

2. Review of the Literature, Prior Research, Purpose, and Expected Outcomes ................................................................. 11  
   - Review of literature ............................................................................................ 11  
   - Prior research ..................................................................................................... 32  
   - Purpose ............................................................................................................... 35  
   - Expected outcomes ............................................................................................ 36  

   Summary .............................................................................................................. 36

3. Methodology .................................................................................................... 37  
   - Participants and setting .................................................................................... 37  
   - Research design and measures ......................................................................... 47  
   - Procedure .......................................................................................................... 53  

   Summary .............................................................................................................. 54

4. Data Analysis and Results .............................................................................. 56  
   - Treatment of data .............................................................................................. 56  
   - Data analysis ..................................................................................................... 57  

   Summary .............................................................................................................. 73

5. Discussion ....................................................................................................... 75
CO-OP ONLINE LEARNING COMMUNITY

Overview ................................................................................................................. 75
Summary .................................................................................................................... 83
Limitations of this study ............................................................................................ 84
Contributions to the literature ................................................................................. 88
Future research ......................................................................................................... 90
Conclusion ............................................................................................................... 92
References .............................................................................................................. 95
Appendix A: Control Group-Treatment Group Matched Pairs ................................. 109
Appendix B: Student Project: Organizational Culture .............................................. 113
Appendix C: Student Project: Ethics ......................................................................... 114
Appendix D: Student Project: Social Responsibility ................................................. 115
Appendix E: Student Project: Theory and Practice .................................................. 116
Appendix F: Student Report Performance and Learning Assessment ...................... 117
Appendix G: Definitions and Examples of Substantive Posting Based on Incidental and Intentional Discourse ...................................................................... 118
Appendix H: Social Media Questionnaire ............................................................... 119
Appendix I: Student Project Grading Rubric ........................................................... 120
Appendix J: Additional Community Evaluation Questions ....................................... 121
List of Tables

Table 1. *Sample gender and ethnicity by quarter* ................................................................. 38

Table 2. *Sample cooperative-education work-term by quarter* ............................................. 39

Table 3. *Projects completed in the study by treatment and control sample* ......................... 51

Table 4. *Perceived performance means (standard deviations) overall and by work-term* ........ 60

Table 5. *Wilcoxon rank-sum test results for perceived performance with covariates noted* ............................................................................................................................... 62

Table 6. *Perceived learning means (standard deviations) overall and by quarter* for treatment and control groups ............................................................................................................... 63

Table 7. *Measured learning means (standard deviations) overall and by quarter* for treatment and control groups ............................................................................................................... 64

Table 8. *Spearman correlation for social media use and level and type of WIL community participation* .......................................................................................................................... 65

Table 9. *Level and type of participation means (standard deviations) overall and by quarter* ............................................................................................................................................... 66

Table 10. *Spearman correlation for level and type of participation and perceived performance, perceived learning and measured learning with bloggers (except where noted)* .................................................................................................................. 67
List of Figures

Figure 1. Screen shot of WIL community in Blackboard® .................................................. 47
Chapter 1

Rationale for Research, Purpose and Research Questions, and Conceptual Framework

This chapter presents the rationale for this research study, including some of the gaps found in the literature that informed the direction of this study. The purpose of this study is presented, the research questions are introduced, and the conceptual framework used to design the online community is discussed. The chapter closes with a summary.

**Rationale for research.** Work-integrated learning is an important educational model that has been utilized for many years. Apprenticeships, internships, practica, and cooperative education are common models of work-integrated learning. These models typically require students to participate in full-time, career-related work experiences for one or more terms as part of the students’ formal education. Historically, the experience gained through work-integrated learning was valuable to many fields and trades, but as Dewey (1938) noted, experience alone is not an education. The problem with many work-integrated learning programs is that the work experience is an autonomous entity that is not thoughtfully integrated into the students’ overall education. Students experience a lack of theory/practice integration (Marsh & Triseliotis, 1996). Even as its own entity, the work component is not fully realized as a learning mechanism. Eames (2000) noted that the inability to place cooperative education on a sound educational foundation has prevented the recognition of work-experience components as a learning opportunity. Johnston, Angerelli, and Gajdamaschko (2004) believed that the field of experiential education risks becoming “nothing more than a job placement mechanism with limited intentional and mediated educational value--nonessential to the goals and objectives of the institution in which we reside” (p. 158) if the field continues to ignore the pedagogical aspects of work-integrated learning. This begs the question of how educators can enhance the educational value of work-integrated learning.
Research has shown that student interaction and reflection are factors that can affect students learning through work (Canale & Duwart, 1999; Eames, 2000; Parsons, Caylor, & Simmons, 2005). Therefore, if an online tool could be designed for at-work students that would increase student interaction, collaboration, and reflection, an increase in student learning through work could become evident. One possible method to do this could be to bridge the gap between industry and academia by creating an online tool to connect students with each other and the university while at work. Current technology makes connecting online a viable task whether students are working locally or remotely.

Many technologies are available to facilitate online connections with students in a variety of ways. Researchers have used e-mail, discussion boards, chat rooms, blogs--a journal written online (Blog, 2013)--and more encompassing virtual learning communities to connect students at work. These connections have shown many benefits, such as: linking colleagues and friends, and creating networks (Maidment, 2006; Mayer, 2002; Roberts-DeGennaro, Brown, Min, & Siegel, 2005); linking university and curriculum lecturers to students (Mayer, 2002; Roberts-DeGennaro et al., 2005); creating a venue for seeking advice, strategies, resources, cognitive support, and psychological and emotional support (Hatton & Smith, 1995; Maidment, 2006; Mayer, 2002; Paulus & Scherff, 2008; Roberts-DeGennaro et al., 2005); providing a venue for students to compare and contrast experiences (Keegan, 2007; Mayer 2002); providing an additional method of reflection (Hayward, DiMarco, Kranz, & Evans, 2001); and supporting a collective process of learning (Keegan, 2007). However, only a few studies (Canale & Duwart, 1999; Chu, Chan, & Tiwari, 2012; Hayward et al., 2001; Witmer, 1998) examined the effect of these online connections on learning through work, all with positive results.
Researchers (Canale & Duwart, 1999) have found that although making connections has benefits as students want to keep links to the university open, students also want to develop their own self-sufficiency. Students are concerned that too many academic responsibilities assigned while at work might detract from their work-based learning experience. Yet, many studies have found that students may feel isolated, disengaged, and disconnected from their peers or their institution (Casey, Bloom, & Moan, 1994; Cohen, 2000; Mayer, 2002; Scherff & Paulus, 2006; Schlagal, Trathen, & Blanton, 1996). Therefore, a balance is needed to ensure the online connections are designed and assessed by their ability to enhance student learning without detracting from the overall student work experience.

Performance and learning appear to be important measures to assess when studying learning through work. Performance and learning outcomes were both perceived by students (Cook, Parker, & Pettijohn, 2004; Eames, 2000) and measured by researchers (Hayward, Blackmer & Raelin, 2007; Van Gyn, Cutt, Loken, & Ricks, 1997). Social interaction and reflection influenced performance and learning in the broader literature review and in literature specifically about using technology to connect with students at work (Canale & Duwart, 1999; Eames, 2000; Hayward et al., 2001; Hayward et al., 2007). The literature review also exposed gaps in the research about using technology to connect students with each other and the university. Studies using different types of technology, such as e-mail, discussion boards, blogs, course management systems, and virtual communities were examined (Hatton & Smith, 1995; Paulus & Scherff, 2008; Roberts-DeGennaro et al., 2005); however, none of these studies used an informed design process to develop or enhance the use of the technology. The majority of the studies only considered one technology (e.g., e-mail, discussion board, blog) (Hew & Knapczyk, 2007; Maidment, 2006) and not an online tool that incorporated multiple technologies. Researchers did not indicate the
CO-OP ONLINE LEARNING COMMUNITY

theoretical frameworks in which they grounded the research. The research samples tended to be female-dominated, non-technical programs such as teaching, social work, or physical therapy (Goos & Bennison, 2004, 2005; Hough, Smithey, & Evertson, 2004; Keegan, 2007).

Based on a literature review, I was interested in examining if student performance and learning were affected by the use of a theory-informed online tool to connect students with each other and the university, particularly using a sample of male students or students in technical majors. An online learning community for students at work could be this online tool and provide a venue for increased social interaction, collaboration, and reflection, which could ultimately affect student learning through work.

Given the need, an online community was designed for engineering cooperative education students at work called the Work-Integrated Learning (WIL) community. The WIL community was designed to enhance student interaction, collaboration, and reflection while at work. Through an iterative process that included incorporating student, faculty, field expert, and employer feedback, a theoretically grounded WIL community was designed. The resulting WIL community included discussion boards, blogs, wikis--websites that allow visitors to add or edit content (Wiki, 2013)--student resources, and other features to connect with students while at work and enhance their social interaction, collaboration, and reflection.

**Purpose and research questions.** The primary purpose of this study was to assess if participation in the WIL community affected student-perceived performance and learning, and measured learning. This study focused on the following research questions:

1. What is the effect of participation in the WIL community on student-perceived performance, perceived learning, and measured learning through work, while controlling for the covariates of grade point average (GPA) and work-term?
2. Within the treatment group, what is the relationship between the level of social media use and level and type (blog, wiki, discussion board) of community participation in the WIL Community?

3. Within the treatment group, what is the relationship between level and type (blog, wiki, discussion board) of community participation in the WIL community and student-perceived performance, perceived learning, and measured learning through work?

**Conceptual framework.** Work-integrated learning has been an educational practice for centuries. Even with this long history, very little theoretically based, empirical research about work-integrated learning was found. Most published research was practical not theoretical, was not grounded in theory, and did not refine existing theory or contribute to the development of new theory. An examination of the literature agreed with previous work-integrated learning literature reviews (Bartkus, 2007; Bartkus & Stull, 1977; Wilson, 1988). Wilson (1988) provided one explanation in that most literature addressed practical issues for practitioners seeking to establish, strengthen, or expand their own programs. Branton et al. (1990) suggested that no one existing theory has the breadth to embrace all aspects of a model as complex as cooperative education. However, it is important to ground research in theory because not only will it assist in driving the process, but it also will provide a framework in which to interpret the results (Eames & Cates, 2004).

Work-integrated learning is complex; coupling it with the WIL community added further to the complexity of the learning environment. Because students typically view the workplace as the learning environment and not the reflection and assessment tools associated with work-integrated learning, it may be a challenge for students to understand the additional value of a WIL community and to engage actively in the community.
To design an online community to meet these challenges, the community-based online learning model (Palloff & Pratt, 2003) suggested three elements to consider with the intended outcome to be reflective/transformative learning. This model built on and included elements that defined a community of practice and was based in social/constructivist learning theory.

**Communities of practice.** Community of practice is a phrase first used by Lave and Wenger (1991). A community of practice is a community that “share[s] a concern or passion for something they do and learn how to do it better as they interact regularly” (Wenger, 2006, para. 4). The primary focus of this theory is on learning as social participation. Participation is the broader idea that encompasses being active in the practices of social communities and constructing identities in relation to the communities. Participation shapes who people are, what they do, and how they interpret. A community of practice incorporates four elements that characterize social participation as a process of learning (Wenger, 1999).

1. **Meaning:** Learning by experiencing life and the world as meaningful.
2. **Practice:** Learning by doing. Engagement in action through shared historical and social resources, frameworks, and perspectives.
3. **Community:** Learning by belonging to something worth pursuing in which participation is recognized as competence.
4. **Identity:** Learning by becoming who we are and the personal histories created within the context of our community.

A community of practice should include these four methods of learning and must include domain, community, and practice.

**Domain.** The domain is the identity of the community, the shared commonality of its members (Wenger, 2006). Membership in the community implies a commitment to the domain and
having community-perceived expertise or competence in the domain. The WIL community domain for this study was electrical engineering, career-related experience in a work-based setting. The shared competence of the members was not only their knowledge of their engineering major, but also how to professionally and personally learn through and succeed at the engineering work.

Community. The community is not only the venue in which participants create interactions, but it is the collective feeling of belonging and the desire and willingness to interact and learn together (Wenger, 2006). To nurture the interest of the domain, members engage in activities and discussions, assist each other, and share information. Members build relationships to learn from each other. The WIL community was designed for discussion and interaction. For example, topics of relevance to the domain were incorporated into threaded discussion boards. Members built wikis about employers relevant to the domain. Members uploaded or linked to resources for access by other members.

Practice. Members must be practitioners. They create a shared bank of resources that include experiences, stories, cases, and tools, which become a knowledge base for their practice (Wenger, 2006). The WIL community was designed for students participating in career-related work experiences. Although they are learners, they are learning through professional practice. The WIL community came to be the location where participants created, stored, and accessed the knowledge base. This was a unique benefit of an online community. By design, the WIL community was not the only venue that brought participants together, but it became the complete record of all member interactions and the living history of the participant’s experiences.

The community-based online learning model. The community of practice model promotes learning by social participation. The model addresses the element of community, but the specific question of how to create community, particularly a virtual community, is not addressed. The
The community-based online learning model brings the communities of practice elements together with elements specific to virtual communities with an emphasis on social collaboration and reflection. The model evolved from the ongoing research on virtual distance education by Palloff and Pratt (2003). The authors believed that “community is the vehicle through which online courses are most effectively delivered regardless of content” (p. 4). The model addresses the people, purposes, and process that work together to create an online community.

**People.** People create a community. To build a community, the people need a social presence in the community (Palloff & Pratt, 2007). A moderator models behavior in the community and empowers the members to build the community and explore the content to initiate social presence. To promote participant social presence in the WIL community, the students were required to introduce themselves with the focus on their academic and work interests and experiences within the WIL community. The participants in the WIL community determined the level of intimacy desired beyond the introduction. I was present as the moderator and encouraged participation and interaction by participants, and participated and interacted to model expected behavior in the WIL community.

**Purpose.** Purpose goes beyond the element of domain in the community of practice model. It is not only the commonality of the community members, but it includes the goal of the community (Palloff & Pratt, 2007). Purpose also includes the policies and guidelines for participation and interaction in the community. The fundamental purpose of the WIL community was to enhance learning through work. The WIL community had minimum participation levels. Proper netiquette was described in the WIL community and students started with a netiquette quiz.
prior to participation. I held members to the proper social protocols and resolved disputes to maintain trust and support the autonomy of the members.

Process. There are two important elements associated with the process of constructing knowledge: social interaction and collaboration, and reflection (Palloff & Pratt, 2007). The member interaction and collaboration is the process that is critical to community development and creates the social context for members to create knowledge and meaning. Knowledge construction through social interaction, collaboration, and reflection in the community are the processes through which learning occurs. Participants engaged with and reflected on the community resources and discourse.

An online community for learning must include elements to promote social interaction and collaboration for the purpose of knowledge construction. Learners build new knowledge on the foundation of previous knowledge. It is active learning because learners are constantly considering new knowledge, judging its relevancy, and modifying their understanding accordingly.

The WIL community was designed to promote collaborative learning. Discussion boards, blogs, wikis, and resources were available for collaboration. Discussion boards allowed for active and ongoing discussion among members through a variety of different discussions on topics generated by members as well as by me. Some topics, such as situations at work, different jobs or employers, and engineering classes and their relevance to different employment types were included. Members created wikis about different employers. Several participants’ blogged in the community to provide more in-depth stories that could lead to topics of discussion; however, individual blogging was not required. I promoted collaboration without dominating communication and encouraged members to further discuss or comment on other members’ contributions.
CO-OP ONLINE LEARNING COMMUNITY

The second elements in the process of learning through online community participation are reflection and transformative learning. Reflection is a thought process that includes looking backward and asking questions, self-assessment of competence in a given situation, and recognizing learning or development needs. Transformative learning is learning based on reflection. It is the interpretation of experiences, ideas, and assumptions gained through prior learning (Mezirow, 1990). Transformative learning is rooted in constructivism.

To encourage reflective thought and posting, I challenged WIL community participants to participate substantively in discussions. Members had a minimum posting requirement, but the expectation was that the members of the WIL community would generate good discussion without significant prompting. A section that included the WIL community policies and procedures discussed how to share experiences in a substantive way. Students were encouraged to blog. By having a few members blog in the community, other members benefited from reading and commenting on the included blogs. Blogging, similar to journaling, provided an excellent opportunity for self-reflection. The WIL community included resources about reflective practice and its importance to learning in a professional environment.

Summary

This chapter discussed the rationale for the study, the need for more research about student performance and learning, and an online environment, the WIL community, which could enhance the performance and learning. The purpose of the study and the research questions were shared. The chapter ended with an explanation of the community-based online learning model, the conceptual framework in which the WIL community design was grounded.
Chapter 2

Review of Literature, Prior Research, Purpose, and Expected Outcomes

This chapter presents the review of literature, prior research, purpose, and expected outcomes of this study. The review of literature examines student-perceived performance and learning through work, factors that affect learning through work, the use of technology to connect students with each other and the university while at work, and the perceived usefulness and perceived ease of use of technology. The prior research section discusses the design-based research study used to create the WIL community. The purpose and expected outcomes sections review the purpose and research questions and the expected outcomes of this study.

Review of literature. This literature review focused on several themes, including learning through work, factors that affect learning through work, use of technology to connect with students at work, and the perceived usefulness and perceived ease of use of technology. The articles about experiential learning included in this literature review were limited to those articles that examined student participation in full-time work experiences during an extended time (1 quarter or semester to 1 year) that were formally or informally part of the students’ overall education. The search terms used to find literature about these types of experiences included cooperative education, internship, work-integrated learning, experiential education, practicum, and student teaching. When looking for articles that used technology to connect students with each other and the university, the work-experience terms were combined with terms such as online learning, distance learning, e-learning, discussion boards, blogs, wiki, and online community. My university has a search engine that can search many online journal databases. This search engine, along with Google Scholar, was used. There are two journals specific to publications in experiential education: The Journal of
CO-OP ONLINE LEARNING COMMUNITY

Cooperative Education and Internships and The Asia Pacific Journal of Cooperative Education. These journals were specifically searched.

The first section of the review examined how and what performance and learning outcomes were measured and concluded with a discussion of factors that affect student performance and learning through work. The second section focused more specifically on research about how technology has been used to connect students at work with each other and the university, including literature gaps in the application of different types of technology, the samples used, and the effects of online engagement on learning. The third section examined research about perceived usefulness and perceived ease of use of technology, factors that affect technology adoption.

**Learning.** Work-integrated learning programs, such as cooperative education, were developed to enhance student learning. Therefore, it is surprising that there is limited research on this topic. The need for more research has been a topic of discussion in the cooperative education literature for years (Dawson, 1975; Ricks, Cut, Branton, Loken, & Van Gyn, 1993). The professional/vocational nature of work-integrated learning generates many studies about career-related benefits of work-integrated learning, such as salary or income (Fuller & Schoenberger, 1991), job satisfaction (Delorenzo, 2000), or career progression (Calway & Murphy, 2000). These studies attempt to link these benefits to increased student development or learning; however, very few studies actually attempt to measure student development or learning. Other articles present program models/attributes expected to enhance learning (Dawson, 1989; Heinemann, DeFalco, & Smelkinson, 1992) but the articles do not evaluate these claims.

**Perceived performance and learning.** The intent of this portion of the literature review was to examine research about student learning through work. This was more difficult than expected. Many articles claimed to evaluate student learning through work; however, when the assessment
instruments used were examined, the researchers appeared to be measuring a combination of performance (Parsons et al., 2005) and learning (Nasr, Pennington, & Andres, 2004). Most articles discussed student perceptions of performance and learning; very few actually discussed measured learning.

Studies indicated (Nasr et al., 2004, Parsons et al., 2005) that participants perceive opportunities for or changes in performance and learning through work. To measure perceived performance, participants were typically asked to indicate at what level they perform and if work affected their performance. To measure perceived learning, participants were asked if learning occurred through work. Most studies were quantitative and used survey or post-experience evaluation-based measures of perceived performance and learning. However, these studies did not use an experimental design with a comparison to control groups of students in standard educational programs (Cook, et al., 2004; Eames, 2000). A few researchers did qualitative studies (Eames, 2000). Most studies did not report the major (Cook et al., 2004) or gender (Canale & Duwart, 1999; Eames, 2000) of the participants. In all studies, students indicated that they had improved performance or learned through work, but no instrument measuring performance or learning verified student perceptions.

Due to the nature of work-integrated learning, researchers examined a wide variety of perceived performance and learning outcomes. Several studies (Canale & Duwart, 1999; Cook et al., 2004; Eames, 2000) collected more qualitative data on student learning outcomes, having the students indicate what they learned. Other studies (Nasr et al., 2004; Parsons et al., 2005) used an evaluation tool asking students about specific learning outcomes. To assess student learning outcomes qualitatively, Eames (2000) mailed open-ended surveys to students who completed work experiences through a Bachelor of Science in technology program. The participants were asked
what outcomes they achieved and how they achieved them. The participants reported learning theoretical knowledge and technical skills (the knowledge and skills were not specified in the article), and to a lesser extent, soft skills such as communication and time management. Eames did not report gender and ethnicity of the participants.

Another qualitative learning-outcome study by Canale & Duwart (1999) examined the use of technology to integrate academic and work-based learning. Students used e-mail and asynchronous discussion to participate in and complete assignments throughout their work experience. Participants were first and second-year electrical and computer engineering students. The researcher did not report gender and ethnicity. At the completion of the term, students indicated learning items they did not receive in the class or lab (the researchers did not specify the items learned in the article) and learning problem solving and adaptability. The students also reported maturing from the experience.

The last example of a qualitative learning-outcome study was conducted by Cook et al. (2002). These researchers completed a longitudinal study of intern expectations on the benefits of participating in a program and their perceptions of the realization of the benefits. The large sample of students worked for the same company during a 10-year period and included interns from different schools. The researchers did not report the majors, gender, and ethnicity of the participants. Students in this study reported maturing, learning how to get along with people in a work situation, and how to relate theories learned in class to the work environment.

In contrast, several studies used an evaluation instrument based on the Accreditation Board for Engineering and Technology (ABET) outcomes as a result of the prevalence of work-integrated learning in engineering programs. In 2000, the ABET determined a set of 11 outcomes required for engineering and technology graduates (Engineering Accreditation Commission, 2012). These
outcomes were both academic and professional. Engineering programs across the U.S. adopted senior surveys that asked about the new ABET outcomes and many engineering work-integrated learning programs recognized the need to measure the new ABET outcomes and changed their work-integrated learning evaluation forms to support this measure. The studies reported here measured student perceptions of performance in the ABET outcomes through their work experiences (on a Likert-scale instrument). Two studies (Nasr et al., 2004; Parsons et al., 2005) reported that students perceived that they achieved the ABET outcomes through work experiences. Both of these studies reported positive student-perceived performance in all of the ABET areas, with the greatest performance in the areas of “use of techniques, skills, and modern technical tools necessary for practice” and “understanding professional and ethics responsibility.” Nasr et al. (2004) additionally found “identifying, formulating, and solving engineering problem” as one of the greatest areas of learning. Parsons et al. (2005) found the items with the lowest change in performance reported were “design and conduct experiments” and “effective written communication.” Nasr et al. (2004) found the items with the lowest change in performance to be “knowledge of contemporary issues” and “ability to design a system, component, or process.” The researchers also noted that students had trouble interpreting the ABET outcomes terminology, which limited the results.

Other factors limited the four studies cited. The researchers did not discuss how they determined the reliability or validity of the instruments used, so it is uncertain if these items were measured. Additionally, the samples used were engineering students with no gender or major noted; therefore, the studies cannot be generalized across all populations. To address this issue, this study on the WIL community clearly identified the majors and genders of the participants and used a validated instrument to measure student outcomes.
**Measured learning.** Two studies (Hayward et al., 2007; Van Gyn et al., 1997) attempted to measure actual learning through work using pretest and posttest scores from two different outcome measurement instruments. The first study (Van Gyn et al., 1997) compared cooperative education and non-cooperative education students’ pretest and posttest scores on the objective form of the College Outcomes Measure Program (COMP) developed by the American College Testing Program (ACT). The large sample was primarily engineering and science students. The researchers did not report the participants’ gender or ethnicity. The researchers found the posttest scores of the cooperative education students to be significantly higher versus the non-cooperative education students when matched to pretest scores. All scores decreased from pretest to posttest. The researchers believed it was due to a ceiling effect occurring from very high pretest scores (higher than all reference group scores cited by ACT) and changes to the posttest form by ACT to counteract perceived cultural biases. Regardless, the significant difference in the posttest scores led the researchers to believe that there was an educational benefit to participating in cooperative education. Upon closer examination of the differences in the sub-scores, “problem solving” and “functioning in a social institution” were the only two sub-categories with significant differences. The pretest to posttest score decrease, the small difference in the posttest scores, and test anomalies limited the results of this study.

The purpose of the second study (Hayward et al., 2007) was to determine if teaching a model of reflection to physical therapy students would increase learning outcomes through work. Additionally, the study served to validate a practice-based, learning outcomes instrument. The researchers did not indicate the gender and ethnicity of the participants. Hayward et al. used pre- and posttests on two cohorts of students: One cohort was taught a model of reflective practice and the other was not. The instrument included two scales: an extension scale and an origination scale.
CO-OP ONLINE LEARNING COMMUNITY

The extension scale assessed students’ ability to use existing knowledge to inquire about and make sense of workplace phenomena. The origination scale assessed students’ ability to develop new knowledge through interaction with others to inquire about and make sense of workplace phenomena. Neither the treatment (learning a model of reflective practice) nor the work experience had an effect on the extension, with one exception. Students with high academic achievement were more likely to exhibit extension in their work-integrated learning. The treatment had a significant effect on learning as measured by the origination scale. This study showed that teaching students’ reflective practice while participating in work-integrated learning could increase their ability to develop new knowledge from the work interaction. Although the sample was small and convenient, initial tests of reliability and validity suggested that the practice-based outcomes instrument appeared to measure the development of new knowledge; however, it was not clear if the instrument could more specifically discern what type of new knowledge was learned.

When looking at perceived performance and learning versus measured learning outcomes in the literature, it was found that the outcomes assessed were either the ABET outcomes or very similar outcomes. Only a few studies were found and limited empirical data were available. Ultimately, students perceived a positive effect on performance and learning through work, and the limited research on measured learning also showed a positive effect. Cooperative-education assessment tools that align with the ABET outcomes could ground work-integrated learning in the same outcomes required by engineering programs further validating the importance of work-integrated learning to an overall engineering education. To address this research need, this study on the WIL community used outcomes based on ABET measured with a reliable and validated instrument. It also used an instrument to measure student learning to add to the limited literature in this area.
Factors within work-integrated learning programs that affect learning. The goal of work-integrated learning programs is to enhance the overall student education; therefore, it is important to understand what can influence student learning during work experience. Research tends to focus on identifying outcomes but not how outcomes are achieved (Fletcher, 1989). Two factors that continually appeared to affect measured or perceived learning were reflection and social interaction.

Reflection. Several researchers found that the opportunity for students to reflect on experiences contributed to their learning (Canale & Duwart, 1999; Eames, 2000; Hayward et al., 2001, 2007). Canale and Duwart (1999) used e-mail and computer conferencing for ongoing virtual reflection throughout a first-time, cooperative-education work experience. Reflection allowed students to better synthesize the differences between work and classroom learning. Former cooperative education students completed a survey to determine what work-based activities affected their learning (Eames, 2000). The ability to reflect on their experiences through self-assessment was one method reported. Tele-mentoring of underclass cooperative-education students by senior cooperative-education students was investigated (Hayward et al., 2001). Mentees became aware of their personal growth and learning through reflection on their work experiences. Hayward et al. (2007) specifically sought to determine the effect of learning a method of reflection on work-based learning outcomes. Students who learned a method of reflection were more predisposed to originate knowledge through their experience when measured on the origination scale of the practice-based learning outcomes instrument. Hayward et al. (2007) were the only researchers who specifically measured the effect of reflection on learning; all other studies reported students’ perceptions that reflection impacted their learning. With the importance of reflection on learning
through work, educators could create tools or opportunities for students to reflect on their work experience to enhance student learning.

*Social interaction.* Learning through interactions with co-workers and supervisors was another area reported by students in a qualitative study where students were asked how they learned through work (Eames, 2000). These findings were further supported by other researchers (Parsons et al., 2005) who surveyed students at the completion of their work experience. Parsons et al. studied the role of individual differences and early employment experiences on learning outcomes for first-term cooperative education students. The study aimed to determine how students achieved learning outcomes during their work experiences and what role individual socialization factors, organizational socialization factors, and individual motivational traits had on learning outcomes. Student social behaviors in the workplace, such as building a boss relationship and networking, affected both engineering core and non-technical performance outcomes. Early socialization experiences, such as role modeling, receiving support, receiving positive feedback, having timetables, and sequencing of employment opportunities contributed to non-technical performance outcomes. Researchers could explore how to incorporate more opportunities for student social interaction while at work and examine how this affects student learning. These studies provide examples of important factors that affect performance and learning, which need to be considered in research. This study on the WIL community addresses this need by incorporating tools that enhance reflection and encourage positive social interaction.

*Using technology to connect students with each other and the university while participating in work-integrated learning.* One method of enhancing social interaction and promoting reflection through work is by connecting working students with each other and with the university while at work. Because working students may be located locally, nationally, or
internationally, technology was used to connect with students. The purpose of this portion of the literature review is to address literature that examines specifically how technology was used to connect students and enhance learning through work experiences and to identify gaps in the areas of the technology applied, the samples selected, and the research regarding the community’s potential impact on learning.

*Application of technology.* A variety of technologies engaged students participating in work-integrated learning. E-mail or listservs were the initial technology applied either alone (Canale & Duwart, 1999; Hayward et al., 2001; Witmer, 1998) or in combination with a resource webpage (McLoughlin & Luca, 2002). As technology advanced, other types of technology emerged. Asynchronous discussion boards became the prominent model of online engagement, either alone (Goos & Bennison, 2004, 2005; Hew & Knapczyk, 2007; Maidment, 2006), or as part of an overall virtual environment (Kelly, Gale, Wheeler, & Tucker, 2007; Mayer, 2002; Stacey, Smith, & Barty, 2004). Blackboard® and Web CT®, course management systems, were frequently used as overall virtual environments for students (Kelly et al., 2007; Roberts-DeGennaro et al., 2005).

The most recent studies applied blogging to experiences (Chu et al., 2012; Keegan, 2007; Lucas & Fleming, 2012). Only one set of researchers (Makinster, Barab, Harwood, & Andersen, 2006) developed their own virtual community Inquiry Learning Forum (ILF). This community was used to compare three different methods of social context on student teaching reflections and did not focus on the impact of ILF community participation on learning.

Most studies focused on one element of online engagement, such as e-mail, discussion boards, or blogs. The one study (Makinster et al., 2006) that used a full virtual community did not examine student learning. Individual types of online engagement showed promise and raised the
question of how different types of online tools used in combination could influence learning, especially if incorporated into a virtual community specifically designed to enhance learning through work. To examine this question, this study incorporated multiple technologies into the WIL community. None of the studies indicated an evaluation of participants’ previous experience with the technologies chosen or the participants’ overall level of experience with similar technologies. To address this, this study measured participants’ social media use.

Student majors/fields of study. The identified research had samples that included a variety of different majors; however, all samples were of either college undergraduate (Bulgar, 2006; Canale & Duwart, 1999; McLoughlin & Luca, 2002) or graduate students (Hew & Knapczyk, 2007; Scherff & Paulus, 2006; Stacey et al., 2004). None of the studies addressed high school or earlier grade-level students. This could be an area for future research, but it is not the focus of this research. The research samples were primarily in teacher education (Goos & Bennison, 2004, 2005; Hough et al., 2004; Scherff & Paulus, 2006). Those studies not in teacher education were in a variety of fields such as nursing (Chu et al., 2012; Keegan, 2007), a variety of sport and recreation majors (Lucas & Fleming, 2012), social work (Maidment, 2006; Roberts-DeGennaro et al., 2005), physical therapy (Hayward et al., 2001), multi-media development (McLoughlin & Luca, 2002), a mix of non-technical majors (Witmer, 1998), information management (Chu et al., 2012), and engineering/computer science (Canale & Duwart, 1999). Of the studies presented, only three majors were technical in nature (multi-media development, information management, and engineering/computer science), and only one specifically used engineering students as part of the study. Technical and non-technical students may participate or perform differently using technology to connect with each other or the university, therefore, research is needed using a
sample of technical students while at work. Thus, this study on the WIL community used a sample of engineering students.

Gender. While reviewing the sample of students utilized in research where technology was student to connect students with each other or the university participating in work-integrated learning, it became apparent that participant gender could have an effect on community development, use, or learning. Of the studies examined, only three studies specifically identified the gender breakdown of the population (Hough et al., 2004; Paulus & Scherff, 2008; Scherff & Paulus, 2006). Makinster et al. (2006) did not specifically identify gender; however, it could be determined based on the data analysis shared. Two additional studies indicated that gender in their sample was representative of the overall population; however, the researchers did not provide the gender breakdown of the population (Kelly et al., 2007; Stacey et al., 2004). Of the studies that indicated the actual gender breakdown, females represented a far greater sample size than males. Engineering and computer science were the only typically male-dominated fields represented in these studies. None of the studies looked at gender differences. Gender could also have a significant effect on student performance or participation while using technology to connect with each other or the university while at work. Research is needed using primarily male populations or to compare populations of different or mixed genders and how that might affect the use of technology to connect with each other or the university. To address this research need, the sample for this study on the WIL community was primarily male.

Learning. There is limited research about the effect of different types of technology used to connect students with each other and the university on learning through work. Research focused on describing the development of a virtual community or a discussion board (Bulgar, 2006; Keeghan, 2007; Kelley et al., 2007), how a community was established and maintained (Goos & Bennison,
2004, 2005), discussion content as a mechanism for student psychological support (Paulus & Scherff, 2008), whether and how asynchronous discussions were used (Scherff & Paulus, 2006), multi-community participation effects on other communities (Stacey et al., 2004), and benefits and challenges of online community use (Maidment, 2006; Mayer, 2002). Two studies measured levels of student reflection (Hough et al., 2004; Makinster et al., 2006); however, neither linked reflection to learning through the work experience. In the studies that addressed learning, three themes emerged: the practical knowledge gained through the experience, the impact of interaction and reflection in the community, and student learning through community participation.

Participation in a technology-based community allowed students to learn practical knowledge about computer-mediated communication and e-learning (Canale & Duwart, 1999; Hayward et al., 2001; Stacey et al., 2004). These studies represented some of the older research reviewed. Computer-mediated communication, such as e-mail, chat rooms, discussion forums, and instant messaging, is common today. Student use of technology has increased significantly in the short time since these studies were completed; therefore, it is not expected that today’s students, particularly in engineering, would have a need to learn about computer-mediated communication. Connecting through e-mail, listserv, or discussion forums provided an opportunity for students to improve written communication skills (Hayward et al., 2001), understand the needed level and importance of professionalism of their e-mails (Hayward et al., 2001), and ultimately improve the quality of their written internship assignments through constant feedback (Witmer, 1998).

Communication skills are a common learning outcome for academic programs. Further research could be considered about how the use of technology for connecting students with each other and the university at work might affect student communications skills.
The collaborative nature of learning through online connection and interaction with peers, mentors, or faculty enhanced student learning in a number of ways. Student-to-student interaction allowed students to compare and contrast experiences with their peers, allowing students to discover ways to overcome obstacles (Keegan, 2007) or to challenge or change stances regarding professional issues in their day-to-day practice (Kelley et al., 2007). Using asynchronous discussion boards provided students time to consider their views and try them out with colleagues (Mayer, 2002). The access to mentors, faculty, and online resources provided many benefits. Students benefited from just having a mentor to which they could voice feelings or concerns (Hayward et al., 2001) and having timely and immediate instructional support (Scherff & Paulus, 2006). Mentors provided professional advice about complexities of practice/work (Hayward et al., 2001). Peers and faculty provided support students may otherwise not have received at work (Kelly et al., 2007; Scherff & Paulus, 2006; Stacey et al., 2004) and allowed students to discuss a difficult topic that could not be fully addressed or realized from classroom instruction (Hayward et al., 2001). Student-to-tutor and student-to-student communication enhanced academic, practical, social, and psychological support, particularly for those students located at a distance to the university (Keegan, 2007). This builds on the findings discussed in the previous section and confirms that social interaction can influence student perceived learning through work and research is needed to examine ways to increase social interaction and further examine its effect on student learning.

In addition to the influence of social interaction, reflection was shown to affect learning through work-integrated learning. Studies where technology enhanced reflection and whether student learning was affected, not affected, or not examined are discussed here. Two studies (Canale & Duwart, 1999; Hayward et al., 2001) utilized student mentors to connect with students
through phone or e-mail while participating in work experiences. The researchers found that the student mentors realized they were engaged in problem solving when devising mentee e-mails (Canale & Duwart, 1999) and that their reflection was stimulated by connecting their personal past experiences with the current experiences of their mentees (Hayward et al., 2001). Reflection occurred as a result of the increased communication and discussion using technology and it augmented learning (Hayward et al., 2001) and made learning explicit (Canale & Duwart, 1999; Hayward et al., 2001). It enabled students to become aware of their personal growth and learning through their experience (Hayward et al., 2001), and their professional growth (Canale & Duwart, 1999). One study (Chu et al., 2012) incorporated blogging into internship activities. Students indicated the blogs were useful for creating reflection, knowledge construction, and problem solving. The study did not link reflection to learning, but did assess the different blog comments for evidence of different learning processes. These studies showed that increased student interaction through technology while at work created opportunities for reflection. More studies are needed to examine how reflection that is created through online interaction and connection of students at work can affect student learning. Thus, this study examined how a variety of methods of online interaction within the WIL community affected student learning.

The last theme of student learning through community participation was only examined by four sets of researchers. For example, Hayward et al. (2001) measured the perceived impact on learning by students engaged in a tele-mentoring community. The researchers also questioned whether mentors and mentees perceived learning differently. Hayward et al. found that, through reflection, cooperative-education students became aware of personal growth and learning. Students indicated they had learned effective communication, problem solving, self-assessment, reflection, and professionalism through participation in tele-mentoring. Mentors learned effective written
communication skills and augmented their problem-solving skills. The researchers found some similarities and differences in perceived mentor/mentee learning through this experience.

Another researcher (Witmer, 1998) examined perceived learning using computer-mediated communication to enhance communication students’ experiences during a summer internship. Findings discussed how the students’ written assignments greatly improved in both structure and conceptual understanding because of participation, and most students managed to apply concepts from the classroom to their work experiences. Connection with faculty also allowed for ongoing instruction in communication concepts and theories. No data or analysis demonstrated the improvement in these factors or the effect of these factors on the overall student education.

The third study to address learning (Canale & Duwart, 1999) had a goal to better integrate student cooperative-education experiences with their academic coursework through participation in communities. After a qualitative analysis of the student assignments, the researchers reported that students indicated that they could make better sense of the differences between cooperative-education learning and classroom learning due to cooperative-education experiences and formal reflection. The researchers also raised a concern from students that too many academic responsibilities while at work could detract from overall cooperative-education learning.

The fourth study (Chu et al., 2012) used two cohorts of students (information management and nursing) who were blogging as part of their internship activities. It was required for the information management students and optional for the nursing students. The researchers had students rate the usefulness of blogging as a platform for learning and the researchers qualitatively examined the users posts for comments linking blogging and learning--both positively and negatively. Students perceived the blogs to be a useful platform for learning in their ratings and
indicated that the blogs allowed them to learn from others’ problem-solving experiences, and learn more about different jobs or fields learn from others’ experiences, among other items.

Although only a few studies link online interaction and connection with student learning, there is evidence that using technology to connect with and create interaction among students at work has many benefits and could affect performance or learning through work. None of these studies compared cohorts using technology to cohorts who were not, nor did any of the studies attempt to measure learning. More research is needed to assess how online interaction and connection affects student learning. Thus, this study included a comparison group to try to determine the effect of participation in the WIL community on student learning.

*Perceived usefulness and perceived ease of use of technology.* The need arose to understand how and if this technology would be adopted by students because the practice of using technology to connect students at work with their peers and with the university is fairly new. Significant research has been done in the area of technology adoption or acceptance. The two most common factors affecting technology acceptance cited in the literature were perceived ease of use and perceived usefulness. These two factors are fundamental to the Technology Acceptance Model (TAM), the most widely used and cited model for technology acceptance (Davis, 1989). TAM is rooted in the Theory of Reasoned Actions (TRA) in psychology research (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975). The TAM model proposed that external factors affect perceived usefulness and perceived ease of use, which affect a person’s attitude toward technology, which then leads to a behavioral intention to use and ultimately affects technology usage.

The TAM Model (Davis, 1989), defined perceived usefulness as “the degree to which a person believes that using a particular system would enhance his or her productivity,” and perceived ease of use as “the degree to which a person believes that using a particular system
would be free of effort” (p. 320). Attitude toward behavior is “an individual's positive or negative feelings (evaluative affect) about performing the target behavior” (Fishbein & Ajzen, 1975, p. 216). In his research, Davis found that perceived usefulness is more strongly linked to usage than ease of use, as it both directly affects actual use and indirectly affects attitude toward use. In addition, Davis posited that perceived usefulness would be influenced by perceived ease of use because, other things being equal, the easier a technology is to use, the more useful it could be. Since its initial development, the TAM has been applied to numerous studies with a variety of technologies applied to education such as online courses (Arbaugh & Duray, 2002), e-learning systems (Marchewka, Liu, & Kostiwa, 2007; Masrom, 2007; Park, 2009), wikis (Liu, 2010) and blogs (Hsu & Lin, 2008). If students perceived technology to be difficult to use or they did not perceive it as useful, these perceptions affected the use of technologies such as wikis (Cole, 2009; Ebner, Kickmeier-Rust, & Holzinger, 2008), virtual communities (Hossain & de Silva, 2009; Lin, 2007; Wang, Chung, Park, Mclaughlin, & Fulk, 2012), and discussion boards (Lee, Kim, & Hackney, 2011), among other technologies. Converse to these finding, researchers found that the perceived usefulness of blogging technology did not affect the student frequency of blogging in a study where blogging was added as an internship activity (Chu et al., 2012). The researchers believed that high usage was due to the versatility of the software to allow for social interaction and information exchange as well as blogging.

In a study to validate the TAM model, Davis (1993) found that a technology that had strong perceived usefulness had the most powerful effect on usage, both directly and indirectly, affecting attitudes toward use when compared with the effect of the perceived ease of use of the technology. This is consistent in literature about virtual communities. It was found that technology that was perceived useful had a stronger impact on intention to use an online learning community than
perceived ease of use (Arbaugh & Duray, 2002; Liu, Chen, Sun, Wible, & Kuo, 2010).

Conversely, when technology is not easy to use it has been found to be the primary behavior
deterrent in mandated use situations (Brown, Massey, Montoya-Weiss, & Burkman, 2002).

Factors that affect perceived ease of use include the quality of information (Lin, 2007; Park, 2010; Preece, 2001; Venkatesh, Morris, Davis, & Davis, 2003), the quality of service (Kuo, 2003; Lin, 2007; Park, 2010; Preece, 2001; Venkatesh et al., 2003), the quality of the system (Lin, 2007; Park, 2010; Venkatesh et al., 2003), and website usability (Kuo, 2003; Preece, 2001). For virtual communities, social ties within the community affect both perceived usefulness and perceived ease of use (Hossain & de Silva, 2009; Malhotra & Galletta, 1999). Researchers have examined factors that affect users’ perceptions of usefulness and ease of use of technology, such as attitude about the technology (Hossain & de Silva, 2009), prior experience with technology, and user personality (Devaraj, Easley, & Crant, 2008).

Attitude is another factor identified by researchers. Attitude has been defined as “an individual’s positive or negative feelings (evaluative affect) about performing the target behavior” (Fishbein & Ajzen, 1975, p. 216). Attitude affecting technology adoption has been examined with e-learning systems (El-Gayar & Moran, 2006; Sumak, Polancic, & Hericko, 2010), and virtual communities (Hossain & de Silva, 2009). Attitude is a key factor affecting technology adoption; if participants have a positive attitude toward the technology they are more likely to use the technology (El-Gayar & Moran, 2006, Hossain & de Silva, 2009; Lin, 2006; Sumak et al, 2010). Attitude is considered a relevant factor in both mandatory (Davis, 1989) and voluntary (Saade & Galloway, 2005) technology use.

In a study (Devaraj et al., 2008) using eproject (a system similar to Blackboard® or other educational content management systems) personality was found to be a factor affecting
technology use. Individuals high in personality traits such as agreeableness and conscientiousness were found to be more likely to perceive new technology useful and individuals with high neurotic traits were less likely to perceive it useful. Based on a study that compared Wikipedia® contributors to non-contributors (Amichai-Hamburger, Lamdan, Madiel, & Hayat, 2008), people who contribute to wikis have personality traits that were found to be lower in agreeableness and openness, male contributors were lower in conscientiousness, and females contributors were lower in extroversion, as compared with people who do not contribute to Wikipedia®. Personality characteristics also influenced how users viewed Facebook®. Users with the trait of extroversion were positively influenced by both the perceived usefulness and the perceived ease of use of Facebook® (Rosen & Kluemper, 2008) while users with the trait of conscientiousness were only influenced by the perceived ease of use.

Prior experience with technology has also been found to affect perceived usefulness or ease of use of a technology. Direct experience with a system affected users’ system-specific perceptions about the ease of use of the system (Venkatesh & Davis, 1996). A positive relationship between prior similar experience and perceived ease of use of IT systems was found in research by Agarwal and Prasad (1999). In a study comparing experienced and inexperienced users (Taylor & Todd, 1995), researchers found that for inexperienced users the perceived usefulness of a technology was the strongest predictor of intention to use. This was contrary to their expectations as they had hypothesized that inexperienced users would be more affected by the perceived ease of use of a system.

Based on the literature found, a technology must be easy to use and be perceived useful to increase students’ willingness to adopt the technology. Researchers need to examine users’ perceptions of ease of use and usefulness of new technology. Students were asked to provide
feedback about their experiences, positively and negatively in the community, which addressed some student technology perceptions.

**Summary of literature.** This literature review first documented research that attempted to assess learning through participation in work-integrated learning programs with a further focus on the use of technology to connect students at work with each other and the university and its potential effect on student learning through work, closing with a review of literature about the perceived usefulness and perceived ease of use of technology.

Limited theoretically based empirical research has been completed in the field of work-integrated learning. The research that focused more generally on student performance and learning through participation in work-integrated learning confirmed that work-integrated learning contributes to perceived and measured learning outcomes. ABET outcomes were the most common outcomes measured (Nasr et al., 2004). Only two studies (Hayward et al., 2007; Van Gyn et al., 1997) attempted to measure actual learning with mixed outcomes. In one study (Van Gyn et al., 1997), “problem solving” and “functioning in a social institution” showed significant differences when measured pre- and post-work experience. In the second study (Hayward et al., 2007), by teaching students a method of reflection, there was a significant effect on students’ ability to develop new knowledge through interaction with others to inquire about and make sense of workplace phenomena. Activities reported by students to affect learning, both in general and when students were connected through technology while at work, included reflection and social interaction.

When reviewing literature specific to online connections with students at work with each other and the university, several gaps were found. A variety of different technologies, such as e-mail, discussion boards, blogs, course management systems, and virtual communities were
examined. No analysis or comparisons of the effect of different types of technology or combinations of technology on student interaction or reflection were completed. Students reported gaining practical knowledge and indicated that social interaction, reflection, and learning occurred as a result of participation in a community while at work, but only four studies attempted to link online connections and learning. The results cannot be generalized across all student populations because the samples tended to be in female-dominated, non-technical majors.

When considering elements that affect student adoption of new technology, users’ perceptions of usefulness and ease of use are key factors that affect technology use. These factors may in turn be affected by user attitude, user personality, and prior experience with technology.

**Prior research.** The initial step in this research project was to design the online learning community for engineering cooperative education students as the treatment for this research study (Todd, Zydney, & Keller, 2011). A design-based research method was employed to develop the community. Designed-based research is a methodology by which a learning environment, such as an online learning community, is created through an informed-design process while simultaneously examining and refining those learning theories on which the new environment is based (Design-based Research Collective, 2003). Design-based research allows the researcher to engage both teachers and learners in an iterative process of design, use, analysis, and redesign (Cobb, 2001; Collins, 1992) in an authentic educational setting and has the potential to generate well-supported design theories about learning and instruction (Collins, Joseph, & Bielaczyc, 2004) and a deeper understanding of complex learning environments (Cobb, Confrey, diSessa, Lehrer, & Schauble, 2003). The theoretical framework used to develop the initial design of the online learning community was the model for community-based online learning developed by Palloff and Pratt (2007) as discussed in the conceptual framework section of this dissertation.
The online learning-community design process was two cycles (Todd et al., 2011). In the first cycle, data were collected to develop a prototype online learning community. In the second cycle, participants reviewed the prototype online learning community to provide feedback for further enhancements. After the second cycle, the online learning community design was finalized.

The study (Todd et al., 2011) used a convenience sample of engineering students, professional practice and electrical engineering department faculty, field experts (cooperative education and internship professionals at other colleges and universities not limited to engineering), and engineering employers. The sample consisted of 93 participants who completed Cycle 1, and 54 who completed Cycle 2. Participants in Cycle 1 completed a survey or participated in a focus group to discuss their experiences with different forms of online engagement (e.g., social networking, distance education), and provide ideas and suggestions for the design of the prototype community. Content analysis was used to organize the data into the community-based online learning model categories of people, process, and purpose. Themes emerged in each category.

A prototype online community (Todd et al., 2011), the Work-Integrated Learning (WIL) community was built based on the findings from the first cycle. The design feedback was organized by the community-based online learning model elements of purpose, process, and people. To address the findings in the purpose categories about privacy and security and the need for a purpose to the community, the WIL community was designed with learning objectives clearly stated, netiquette defined, and the system built as part of a current assessment system to allow it to flow more seamlessly with the required assessments completed by students at work currently and to ensure privacy and security. To address findings in the process element, the design of the prototype community provided collaborative features including discussions boards, blogs,
resources, a calendar, and a wiki to allow students to build or contribute knowledge collaboratively about companies and careers.

To support the findings about the desire to be connected and in the know in the people element, the design of the prototype community (Todd et al., 2011) included a process for students to create a profile, an internal message system, resources, and a calendar to allow students to have access to the information they wanted or needed through the work term. Feedback from Cycle 2 allowed the design of the community to be refined, primarily in regard to the look and flow of the material presented. Overall, the participants expressed satisfaction with the collaborative elements and particularly the resources. This study resulted in the design of a theory-informed prototype online learning community for engineering cooperative-education students at work.

The prototype WIL community was built within the existing online cooperative-education assessment system because it made the community secure and ingrained in an academic website the students were required to access to register and assess their work experiences. This assessment system was designed and built internally at the university. This new, internally-design system was chosen instead of Blackboard®. Blackboard® is the content management system used by this university to house all courses and course materials. It is an online system where course materials and resources can be stored, grades can be posted, and social networking technology is available for use within a course. Every student has access to Blackboard® and each course is assigned an associated Blackboard® course content area. At the time of the design-based research study, the Blackboard® content management system did not have the capability for blogging, wikis, and other features desired in the prototype community design.

In the 2 years since the design of the prototype community, Blackboard® was upgraded significantly and most of the needed community features became available. Blackboard® also
provided analytics, data about systems usage. Additionally, one of the findings from the study to develop the community (Todd et al., 2011) was that students were concerned about using too many different social networks. By moving the WIL community to Blackboard®, it was still able to have all the features needed for the WIL community in a secure comprehensive system with which students were familiar without adding a new and additional system. Therefore, the decision was made to move the final community into the Blackboard® course management system. All students on cooperative education were enrolled in Blackboard®, so it still met the design initiatives from the design-based research study. Additionally, Blackboard® was relatively easy to organize, upload, and manage by a non-programmer, so I was able to update the design easily. Blackboard® had the needed features, so I believed that even though the look was slightly different due to the aesthetic constraints in Blackboard®, the navigation and content was similar.

**Purpose.** The purpose of this study was to assess the effect of the WIL community on engineering cooperative-education students’ perceived performance and learning and measured learning through work. The WIL community was designed to enhance social interaction and reflection through work, which was expected to enhance student learning. The treatment group completed all the traditional coursework for cooperative education in addition to participating in the community and completing a social media survey and a small post participation survey. A control group of electrical engineering students from a previous work-term who did not participate in the online community while at work was used for comparison.

The research study focused on the following research questions:

1. What is the effect of participation in the WIL community on student-perceived performance, perceived learning, and measured learning through work, while controlling for the covariates of GPA and work-term?
2. Within the treatment group, what is the relationship between the level of social media use and level and type (e.g. blog, wiki, discussion board, etc.) of community participation in the WIL community?

3. Within the treatment group, what is the relationship between level and type (e.g. blog, wiki, discussion board, etc.) of community participation in the WIL community and student-perceived performance, perceived learning, and measured learning through work?

**Expected outcomes.** The WIL community was designed to enhance social interaction and reflection, which research has shown to enhance student learning through work. Therefore, it was hypothesized that the treatment group would have greater perceived performance and learning and measured learning than the control group, even when controlled for student GPA or work-term. Within the treatment group, it was hypothesized that students with higher levels of social media use would have higher levels of community participation and students with higher levels of participation would have greater perceived performance and learning and measured learning.

**Summary**

This chapter presented the review of literature to support the study. This literature review documented research that discussed learning through participation in work-integrated learning programs, including perceived performance, perceived learning, and measured learning. Literature about the use of technology to connect students at work with each other and the university was then presented and the review closed with literature about the perceived usefulness and perceived ease of use of technology. The next section of this chapter shared the prior research that informed the design of the WIL community. The chapter closed with the purpose and expected outcomes of the study.
Chapter 3

Methodology

This chapter discusses the methodology of the study. This includes a discussion of the participants and setting, the research design and measures, and procedures. The chapter closes with a summary.

This study used a quasi-experimental, static-group comparison design using two non-equivalent groups (Fraenkel & Wallen, 2003). Electrical engineering students participated in the WIL community as part of their required assignments and assessments for cooperative education. The treatment group was comprised of students who had consented to participate in this study during the 2011 summer or fall cooperative-education work-term. The comparison group consisted of electrical engineering students who completed a cooperative-education work-term during summer or fall in 2009 or 2010. The community was assessed for its effect on perceived performance and learning and measured learning.

Participants and setting. The study took place through an urban research university where cooperative education is a mandatory program in the College of Engineering and Applied Science. Cooperative education is an academic program in which a student will alternate quarters of classroom study with quarters of paid, progressive, career-related work experience. The engineering students complete a 5-year program. During the 1st and 5th years, students are in class full-time. During the 3 middle years, the students alternate quarters of classroom study with quarters of experience in business, government, industry, or academia (research). Students complete four to six work experiences totaling 12-18 months of work prior to graduation. The students in the population were physically located at a variety of companies locally and nationally. The students registered for cooperative education, a full-time academic program. Table 1 presents
the sample gender and ethnicity by cooperative-education quarter. Although some engineering majors may have a higher percentage of female students, it is typical for electrical engineering programs to have a low percentage of female students and for all engineering undergraduate programs to have a low percentage of students of diverse ethnicities. The samples were very similar. The largest differences were in the number of female participants and participants in the “other/not given ethnicity category.”

Table 1

Sample Gender and Ethnicity by Quarter

<table>
<thead>
<tr>
<th></th>
<th>Summer</th>
<th>Fall</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Treatment</td>
<td>Control</td>
<td>Treatment</td>
</tr>
<tr>
<td>Total</td>
<td>28</td>
<td>35</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>(59.57%)</td>
<td>(74.46%)</td>
<td>(40.42%)</td>
</tr>
<tr>
<td>Male</td>
<td>28</td>
<td>33</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>(100.00%)</td>
<td>(94.29%)</td>
<td>(94.74%)</td>
</tr>
<tr>
<td>Female</td>
<td>0</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>(0.00%)</td>
<td>(5.56%)</td>
<td>(5.26%)</td>
</tr>
<tr>
<td>Caucasian/Non-Hispanic</td>
<td>24</td>
<td>30</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>(85.71%)</td>
<td>(85.71%)</td>
<td>(57.89%)</td>
</tr>
<tr>
<td>African American</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>(0.00%)</td>
<td>(0.00%)</td>
<td>(10.53%)</td>
</tr>
<tr>
<td>Asia/Pacific-Islander</td>
<td>1</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>(3.57%)</td>
<td>(11.43%)</td>
<td>(10.53%)</td>
</tr>
<tr>
<td>Hispanic/Latino</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>(0.00%)</td>
<td>(2.86%)</td>
<td>(0.00%)</td>
</tr>
<tr>
<td>Other/Not Given</td>
<td>3</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>(10.71%)</td>
<td>(0.00%)</td>
<td>(21.05%)</td>
</tr>
</tbody>
</table>

Table 2 presents the sample cooperative-education work term by quarter. Cooperative-education work term was important as it determines if and which student project is required (to be discussed in more detail in the research design and measures section). The biggest work-term difference between the treatment and control groups was in the first work term, particularly in the fall quarter.
### Table 2

**Sample Cooperative-education Work-term by Quarter**

| Level   | Work-term | Summer |  |  | Fall |  |  | Total |  |  |
|---------|-----------|--------|  |  |      |  |  |       |  |  |
|         | Treatment | Control| Treatment | Control | Treatment | Control | Treatment | Control |
| Pre-Junior | 1 | 1 | (3.57%) | 1 | (2.86%) | 6 | (31.58%) | 1 | (8.33%) | 7 | (14.89%) | 2 | (4.26%) |
|          | 2 | 7 | (25.00%) | 11 | (31.43%) | 8 | (42.11%) | 7 | (58.33%) | 15 | (31.91%) | 18 | (38.30%) |
| Junior   | 3 | 0 | (0.00%) | 2 | (5.71%) | 2 | (10.53%) | 1 | (8.33%) | 2 | (4.26%) | 3 | (6.38%) |
|          | 4 | 9 | (32.14%) | 11 | (31.43%) | 3 | (15.79%) | 3 | (25.00%) | 12 | (25.53%) | 14 | (29.79%) |
| Senior   | 5 | 3 | (10.71%) | 2 | (5.71%) | 0 | (0.00%) | 0 | (0.00%) | 3 | (6.38%) | 2 | (4.26%) |
|          | 6 | 8 | (28.57%) | 8 | (22.86%) | 0 | (0.00%) | 0 | (0.00%) | 8 | (17.02%) | 8 | (17.02%) |

**Treatment group.** The treatment participants were a convenience sample recruited from a population of electrical-engineering, cooperative-education students at work. The overall population consisted of 130 students that worked at 60 different companies. None of the students in the population were on a cooperative-education work-term in both summer and fall quarters. All students in the population were asked to participate in the study.

Initially, 56 students consented to participate in the study. Of the students who consented, one student who did not complete the cooperative-education assessment on time was eliminated as there were no assessments for this student. There were eight students eliminated because an adequate match was not found from the control group. Ultimately, the treatment sample was 47 total participants who worked at 26 different companies.

The student level and cooperative-education work-term of the sample by quarter was representative of the population. The cooperative-education work-term determined if the students were required to complete a project and which project the students completed. Projects were
required in cooperative-education terms one through four and were used in this study to measure student learning. Thirty-six of the treatment participants, about 75%, were required to complete a project.

**Control group.** The control group was a population represented by historical student data from a convenience population of electrical-engineering, cooperative-education students who completed a work-term in summer or fall 2008, 2009, or 2010. To ensure the control group was as similar as possible to the treatment group, an independent research assistant matched the control group to the treatment group based on work-term (first experience, second experience, etc.), employer, quarter (summer or fall), GPA, gender, and ethnicity in this hierarchy or matching order, if possible (see Appendix A for the final matches). Sample matching reduces the selection effect on internal validity (Fraenkel & Wallen, 2003). The work-term schedule determined if the student completed a project and which project was completed. Since the project was the instrument for measured learning, it was important that the number and types of projects were as consistent as possible across the treatment and control groups. The employer was important because in working with students, it has been observed that the type of employer and job can have a bearing on student job satisfaction and student outcome assessment. Therefore, the research assistant was instructed to consider the work-term and employer as the most important matching criteria. If there was no work-term and employer match, the research assistant first tried to find a student at a similar company with a matching work-term. For example, the research assistant matched employers where students were involved in electrical hardware/software design and development, or employers where students would participate in manufacturing and control systems. If a similar company could not be found with a matching work-term, then the assistant would match the employer/similar employer to within one work-term (i.e., matching a first with a second work-
term). Once the assistant accounted for these two factors, all other factors were matched as closely as possible. The research assistant was able to match all but eight students using these criteria. These eight students were not included in the study.

In order to ensure the sample size was adequate to support the results, an a priori power analysis was completed. Because a pilot study was not completed from which to determine effect size, literature was reviewed to find a similar study or meta-analysis from which to estimate effect size. A meta-analysis and review of online learning students was completed by the U.S. Department of Education (Means, Toyama, Murphy, Bakia, & Jones, 2009) and screened more than 1000 empirical studies of online learning from 1996 through July 2008. Of the empirical studies screened, 176 articles met the meta-analysis criteria of being relevant content, meeting basic quality criteria, including reporting sufficient data for effect size calculation or to estimate and effect size. From these articles, 50 independent effect sizes were extracted. Twenty-three of these were in studies in Category 2, or studies that assessed if supplementing face-to-face instruction with online instruction enhanced learning (somewhat similar to this research study). The mean effect size of +0.35 for Category 2 was significant (p<.0001). The a priori power analysis for the Wilcoxon rank-sum test (Borm, Fransen, & Lemmens, 2007; Desu & Raghavarao, 1990; Keppel, 1991; Kirk, 1982) indicated that 30 or more participants in the treatment and control group will have 80% or greater power for detecting an effect size of +0.30 to +0.40 when employing the traditional .05 criterion of statistical significance (Cohen, 1992). The a priori power analysis for the Spearman correlation (Zar, 1984) indicated that 40 or more participants will have 80% or greater power. This confirms that the sample size of 47 in the treatment group and 94 total participants exceeds the minimum number expected to attain 80% or greater power.
Existing curriculum. All students in the study used the existing curriculum. Each quarter students participated in a cooperative-education work-term, they registered for a zero-credit course. In order to get a passing grade for this course, students successfully completed their work experience (i.e., were not fired, not poorly assessed by their employer, and so forth), completed a set of assessments, and met with their faculty advisor upon return to campus. While at work, the students had limited connection with the university. The students were sent several e-mail reminders throughout the work-term to help them stay on track to complete their assessments, and the assessments were designed to be completed over the course of the work-term, but no other formal or consistent connections occurred. All students were required to complete a set of online assessments for each work-term. Students completed the assessments through an internally-built online assessment system. These assessments included three instruments: learning objectives, student project, and student report.

Learning objectives. At the beginning of each work-term, students met with their at-work supervisor and set two learning objectives for the work-term. The students also indicated an activity or activities they could complete while at work to support meeting the learning objectives. The at-work, co-op supervisor reviewed and assessed these objectives at the end of the work-term. Learning objectives were part of the existing curriculum but were not an instrument for this study.

Student project. The students completed a different small project in each of their first four work-terms. The four projects were: first work-term--organizational culture (see Appendix B), second work-term--ethics (see Appendix C), third work-term--social responsibility (see Appendix D), and fourth work-term--theory/practice integration (see Appendix E). Students completed the projects through the quarter. The projects required the student to investigate the topic, discuss it, and put it into the context of the work experience or with the employer. At the end of the term, the
at-work, supervisor reviewed the project and added comments. As the faculty advisor, I also graded the project when the student returned to campus.

*Student report.* The student report combined a self and an employer/position evaluation (See Appendix F). Students evaluated their performance and learning and appraised the position. This report consisted of primarily Likert-scale questions with room for comments and a few open-ended questions. The employers could not view the student report (by design). This allowed the student to be completely honest about the employer and the position appraisal, particularly if there were problems or concerns.

In addition to the assessments completed by the student, the at-work, supervisor was asked to evaluate the student performance on cooperative education. When the student returned to campus at the end of the work-term, the student turned in all assessments and met with me, their cooperative-education faculty advisor. When this was complete, I assigned a failing or passing grade for the work-term. If the student did not complete the assessments and/or meet with me, I assigned them an incomplete. The incomplete would revert to a failure if the assessments were not completed within 1 year.

*Environment.* The treatment group used the WIL community throughout the work-term. The WIL community was designed to enhance student interaction (Parsons et al., 2005) and reflection (Canale & Duwart, 1999; Eames, 2000), which have been shown to enhance student learning through work (see the prior research section for a discussion on the design process used). The WIL community was hosted in Blackboard®, the content management system for academic course work at this university. The community enrollment consisted of the instructor/facilitator/researcher (me) and all students enrolled in the electrical engineering
undergraduate program at a Midwest urban research university. The entire potential treatment population for this study participated in this community.

The community was created in the organization section of Blackboard®, allowing the community to be continuous and not constrained to only one school term. This also allowed the activity and data to be maintained instead of being deleted at the end of each school-term, which would happen if it were normal course content. Blackboard® administration at the university automatically enrolled all students in electrical engineering in the WIL community.

All electrical engineering students actively enrolled in a cooperative-education work-term were required to participate in the WIL community throughout their work-term as part of their requirements to earn a passing grade for cooperative education. The overall community included a netiquette section, a social media survey, a section describing the learning objectives, and requirements for participation for the community. An instructional section was also included with resources and information about the different student projects for each work-term, discussion boards, a wiki, blogs, announcements, and resources that include other relevant curricular information.

The netiquette section described the proper netiquette for the community. It had instructional materials about proper netiquette and a netiquette quiz that all participants were required to pass to ensure understanding. The quiz was not an instrument for this study; it was just a tool to make sure students read and understood the community netiquette.

Students completed a social media survey within the community in the first 2 weeks. This survey included three questions to determine the type and level of social media use of the student participants. The learning objectives, goals, and requirements section outlined the goals of the community, the expected learning objectives for participation, and the minimum requirements for
CO-OP ONLINE LEARNING COMMUNITY

participation in the community. The instructional section included resources for the four projects to which students would not otherwise have easy access: organizational culture, ethics, social responsibility, and theory/practice integration. Each project had resources about the main topics, such as copies of the projects, links to web resources, and a discussion board associated with the topic.

Along with the discussion boards associated with the instructional sections, students could interact in many additional discussion boards. One was dedicated to students introducing themselves; others were dedicated to topics, such as: questions, advice, housing, engineering-in-the-news, technical tips, and other topics as instigated by the students. Specific discussion threads about research experience, networking with colleagues, unanticipated insights, and using technology could relate back to some of the learning outcomes we hope students to achieve. Students were required to enter the discussion forum and introduce themselves in the first 2 weeks on the discussion forums. Students were required to post a minimum of two threads each week; the threads were to be substantive and could be either new postings or comments/responses to other postings in the forums. Intentional and incidental discourse variables were used (Daniel, Schwier, & Ross, 2007) to develop a chart to define substantive posting (see Appendix G). Students were emailed information with instructions for participation in the WIL community (e.g., minimum required posts, examples of substantive posts) and the instructions and examples were posted in the community. I modeled substantive posting behavior in the WIL community.

Students participated in a wiki with the intention that students were to collaborate and create a knowledge base about companies and job types for electrical engineers. Students were required to contribute to the wiki by creating, adding to, or editing a topic. Blackboard® was supposed to have wiki capability by the time the WIL community was released, but it was not
activated. Therefore, an external wiki was used, housed in university electronic file space that was password protected. This wiki had a direct link from Blackboard®, and students were required to make one addition or edit to the wiki during the work-term.

The blog function was set up such that any student who wished to blog in the community could create a blog within the community. Creating a blog was not required; however, a few students wrote one or two blog entries. Because I wanted to have student’s blog in the community to create content and discussion, each quarter students were solicited and paid a nominal honorarium of $75.00 for the quarter to blog each week, respond to comments on their blog, and also to start discussions and post in the forums as a way of encouraging others in the community. In the summer, four students volunteered to blog; in the fall, only one student volunteered to blog, even after several requests. The students were at different levels and at different companies. I not dictate the blog topics, but the bloggers were directed to focus on work, school, or engineering related topics; I also blogged in the WIL community each week. I discussed a variety of topics with the hopes that it would encourage interest and discussion in the community. The rest of the students were asked to follow the blog postings and make a minimum of five substantive comments on the blogs or other students’ blog comments throughout the term (this was part of their total posting requirement). The announcements section provided timely information and announcements about course deadlines, events, or employers.

The WIL community was for the benefit of student learning so students were encouraged to suggest changes and additions to the community as it grew throughout the term. For example, some curriculum resources, such as information about semester conversion and discussion board topics, such as interview questions and expectations, were added because of student suggestions.
Figure 1 is a screen shot of the home page of the WIL community. The menu to the left shows the list of tools and resources included in the community.

Figure 1. Screen Shot of WIL Community in Blackboard®

**Research design and measures.** The study was a quasi-experimental, static group comparison design using two non-equivalent groups (Fraenkel & Wallen, 2003). The treatment group completed a social media survey and participated in the learning environment. All participants completed a post work-term assessment; 79% of the participants (in both the treatment and control groups) completed a post work-term graded project as only those students on one of their first four cooperative-education work-terms are required to complete a project, students completing a 4th or 5th work-term do not complete projects, per the curriculum.

**Community participation and work-term.** The first measure was participation in the community. Community participants, the treatment group, were coded 1, and the control group was coded 2. Because there were differences in the level and type of participation in the community from summer to fall and the student level (e.g., sophomore) was different, it was
decided to code students by cooperative-education work quarter as well. Summer students were coded as 1; fall students were coded as 2.

**Student use of social media.** The treatment group was given an online survey to determine their level of social media use. The social media survey (see Appendix H) was a simple three-question survey to determine the level of social media use by students in the treatment group. Two of the three questions on the survey were derived from a survey developed by the Pew Research Center for the Internet and American Life Project (Lenhart, Purcell, Smith, & Zickuhr, 2010). Since 2004, the Pew Research Center has been tracking Internet usage in the timeframes: daily, weekly, and less often. For this study, the Internet usage categories were retained, but the questions were modified to ask about accessing social media instead of about accessing the Internet in general. Additionally, Pew Research developed a question asking about the types of Internet use. This question was modified to ask about only those items that could be categorized as social media. The content validity of the survey was confirmed by an IT expert review in which members of the university and division IT committees were asked to review the survey. Several minor text changes were suggested, but overall, the survey was considered appropriate. Students were categorized as daily, weekly, or less often users based on their responses to the survey. These categories were coded 3, 2, and 1 respectively.

**Student GPA.** Student GPA was recorded as the cumulative GPA at the completion of the school-term directly preceding the work-term. Student GPA was pulled from the university records and was measured on a 4.00 un-weighted scale.

**Student level of community participation.** The treatment group was categorized by the level and type of participation in the community. Level of participation was measured in different ways. In the discussion boards and blogs, the number of substantive posts by the student
determined participation. In the wiki, a word count was used to determine the level of participation.

A research assistant and I evaluated the posts for substantive content and counted the number of substantive posts. After the posts were counted, an inter-rater reliability analysis was performed using the Kappa statistic to determine consistency between our ratings. The inter-rater reliability for the blog posts was found to be Kappa = 0.833 (p < 0.001). A Kappa value between 0.81 and 0.99 is considered “almost perfect” agreement (Viera & Garret, 2005). The inter-rater reliability for the discussion board was found to be Kappa = 0.357 (p < 0.001). A Kappa value of 0.21-0.40 is considered a fair agreement. Because a similar “almost perfect” agreement was desired, a discussion transpired regarding these two discrepancies, the posts not in agreement were re-reviewed, and the counts were adjusted accordingly. Once the adjustments were completed the inter-rater reliability was once again calculated. The inter-rater reliability for the discussion board was found to be Kappa = 0.872 (p < 0.001). The number of words posted per student was counted to determine participation in the wiki. Because it was a straight count with no evaluation, only one research assistant did the count.

A z-score was calculated for the discussion board, blog, and wiki participation totals. Calculating a z-score is a statistical method by which to standardize data on one scale (Gravetter & Wallnau, 2007). The calculation of the z-score allowed the participation scores to be totaled to create a total participation score to go along with the participation scores by section.

**Perceived performance and learning.** The student report was used to measure perceived performance and learning. The participants completed this report by at the end of the work-term. The student report was a comprehensive assessment tool that has been used by this university since 1999. Starting in 2006, all cooperative education assessment tools were posted online; therefore,
the data were downloaded from the online assessment system for analysis. The student report was designed through a lengthy process that included examining other university student evaluations, gathering data from the colleges about the criteria they wanted to measure, reviewing the university general education requirements, having a full cooperative-education faculty review, and employer and student reviews and focus groups. The development process established the content validity.

To measure perceived performance, the Likert-scale questions in the Performance Skills Assessment section of the student report were used (see Appendix F). The performance skills section contained nine questions. The topics were communication, conceptual/analytical ability, learning/theory and practice, professional qualities, teamwork, leadership, technology, work culture, and organization/planning. Students were asked to evaluate their performance in these categories. The responses for the performance skills questions were also averaged together giving an overall perceived performance average. To measure perceived learning, one Likert-scale question in the Learning Assessment Section of the student report was used (see Appendix F). The question asked the value of learning from the work-term. The instrument was found to be highly reliable (10 items; $\alpha = .805$).

**Measured learning.** The student project was used to measure student learning. Students in the first four work-terms were assigned a project. Students in one of the last two work-terms were not assigned a project (projects are only assigned in the first four of the six work-terms). The type of project assigned was based on student cooperative-education level (discussed previously). Although each project was different, they all followed a similar structure of topic exploration, observation, and discussion. Table 3 shows the number of participants that completed each project.
or were not assigned a project. The largest difference in projects between the treatment and control were with the organizational culture model, which is assigned during the first term.

Table 3

Projects Completed in the Study by Treatment and Control Sample

<table>
<thead>
<tr>
<th>Project</th>
<th>Organizational Culture</th>
<th>Ethics</th>
<th>Social Responsibility</th>
<th>Theory and Practice</th>
<th>No Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
<td>7</td>
<td>15</td>
<td>2</td>
<td>12</td>
<td>11</td>
</tr>
<tr>
<td>Control</td>
<td>2</td>
<td>18</td>
<td>3</td>
<td>14</td>
<td>10</td>
</tr>
</tbody>
</table>

A research assistant and I graded the student projects. The projects were identified by a student ID; therefore, we had no indication of which projects belonged to the treatment or control groups. Instead of the typical A-F grade scale used by faculty advisors to grade the projects, a grading rubric based on Bloom’s taxonomy (Pohl, 2000) was developed and used (see Appendix I). The rubric had a 1-6 grade scale with 1 representing understanding through 6 representing creating. Two research assistants, long standing faculty members and part of the original team that designed the projects, and I developed the rubric as they were very familiar with the projects. Once the study was completed, the projects for each participant were printed and organized by project type. The student ID code identified each project. A research assistant and I graded three to four of each project together to make sure there was an agreement. Once we were comfortable that there was a common understanding of the rubric and process, all of the projects were graded independently. We gave each project a grade based on the highest level of Bloom’s taxonomy achieved by the student as determined by reading the project.

After the first round of grading, a reliability analysis was completed and the inter-rater reliability was found to be Kappa = 0.492 (p < 0.001). A Kappa value of 0.41-0.60 is considered a “moderate agreement” (Viera & Garrett, 2005), and again, “almost perfect” agreement was desired for this research study. Therefore, the research assistant and I reviewed the discrepancies. The
theory/practice project was where the most differences in grading were found. The rubric in this category had subtle differences between levels 2, 3, and 4. The grade was determined by differentiating between “stating an example,” “indicating a basic connection,” and “explaining the connection.” These differences were discussed, examples were reviewed, and agreement was reached. The project asked students to identify and describe three specific examples to document the use of classroom learning in their cooperative-education assignment and three specific examples to document the use of cooperative-education learning in the classroom. We determined that “stating” involved just stating a class name or concept (e.g., “I used Electronics I on co-op”). We determined “indicating a basic connection” was when a class or concept was linked to its counterpart (e.g., “I used Electronics I when I built a circuit board”) and that “explaining the connection” was discussing in more detail the concept or project in terms of its counterpart (e.g., “I learned soldering and how to read a wiring diagram in Electronics I, I used these skills when building and testing a circuit board on co-op”). We were then able to use this clarification to re-grade these projects independently. A second reliability analysis was completed and the inter-rater reliability was found to be Kappa = 0.825 (p < 0.001), an “almost perfect” agreement.

**Community evaluation questions.** In order to gather additional data about student opinions of the community, five questions were added to the end of the student report (See Appendix J). Participants were asked if the community enhanced their learning through work, if they enjoyed participating in the community, and to provide feedback on the community. Participants in the treatment group completed these questions at the end of the work-term. The responses were compiled and the open-ended question responses were organized by themes.

**Researcher’s reflection.** My observations throughout the study were used as a measurement. I was the researcher, professor, and moderator for the WIL community and was
intimately involved in the activities within the community. Through these three roles, the research study was observed and a narrative of the observations was written and organized linearly throughout the study. Once the study was complete, my reflections were considered when discussing the results of the study.

**Procedure.** All electrical engineering students who participated in a full-time work experience during summer and fall 2011 were required to participate in the WIL community as an academic requirement of their work-term. At the start of the work-term, students received an e-mail about the requirement for participation in the community and the minimum standards of participation. Some students responded with questions and concerns, to which they received quick responses. All students registered for “Cooperative Education Registration,” the zero-credit pass/fail course required for all students at work in the cooperative-education program. The participants then received an e-mail that included the consent information. The students were directed to enter the WIL community and first-time users were directed to a page that walked them through the requirements to get started. This page included links to the online consent document, the netiquette quiz, the social media survey and then the overall WIL community communication and resource sections. Due to the small number of participants consenting after the first e-mail, two additional e-mails were sent out to solicit consent. I was not aware of the identity of the consenting participants until after grades were assigned for each quarter, only the number of students that consented.

The students worked approximately 12 weeks each work-term. During the course of the work-term, they participated in the community per the following participation standards:

1. Students introduced themselves, completed the netiquette quiz, and social media survey in the first week or two of each quarter.
2. Students were required to post two threads each week. The posts were either new threads or comments on existing threads or blogs.

3. At least five threads (of the total required throughout the term) were required to be posted against the blogs to encourage students to read the blogs each week.

4. Students were required to make a minimum of one contribution to the wiki during the work-term.

All other processes and requirements for the students throughout the work-term were identical to the existing curriculum; however, the student report contained the four new questions about the community.

At the end of the fall work-term the community participation data, all student written communication, and the results of the social media survey were downloaded from the online community. All assessment data were downloaded from the online assessment system. All data from students who did not consent to participate were removed. Student identifying information from the remaining data were removed and replaced with a numerical code such that all data from each student could be linked via the identifying code. Profiles of the consenting students were available; therefore, the matching control group was developed and all assessment data from the control group were compiled. A database was created and all data were pulled together into this database for analysis. I wrote the researcher’s reflection about the study.

Summary

This chapter discussed the methodology of the study. The treatment and control groups, existing curriculum and study environment were discussed in the participants and setting section. The research design and measures section detailed the type of study and the measures and
measurement instruments used. The chapter closed with a discussion of the procedure followed to complete the study.
Chapter 4

Data Analysis and Results

This chapter begins by discussing the treatment of data, which includes the process for data cleaning and handling outliers. The next section describes the data analysis, which includes a reminder of the research questions followed by the results of the study as related to the research questions. The chapter closes with a summary of the major findings.

Treatment of data. This section discusses the process for cleaning the data and handling the outliers. Data cleaning was used to ensure participants that did not complete the required assessments by the close of the study were not included and that unmatched participant data were removed from the study. When outliers were found in the study, a process (discussed below) was used to determine how to handle the outliers in the data analysis.

Data cleaning. When the data collection was completed, all data were downloaded from the WIL community and the assessment database. As noted in the methodology section, eight participants were excluded from the study because a reasonable match was not available from the control group population to create a matched pair. One participant was removed from the study for not having completed the perceived participation, perceived learning, and measured learning assessment instruments. All other participants who were matched and completed the assessment instruments were included in the data analysis. Some of the included participants did not complete the social media survey or the community evaluation questions. In those instances only the data that was collected was used; therefore, the samples for the analyses using the social media and community evaluation questions were slightly smaller than the total number of participants.

Outliers. Exploratory statistics showed that outliers were present in some of the datasets; therefore, a determination had to be made about how to handle these outliers. The outliers present
were either low grades on the student project or low assessment ratings by students in different perceived performance or learning categories. From my experience as a cooperative-education faculty advisor, it is not uncommon to see these lower values in student grading or rating, so the inclination was to use the outliers. To ensure the outliers did not affect the data distribution, the data were graphed with and without the outliers to see if the outliers affected the distribution. The data did not follow a normal distribution and skewed toward the higher values whether or not the outliers were included in the analysis. A decision was made to continue the analysis with the inclusion of the outliers. Because of the distribution-free property of the data, a nonparametric data analysis was chosen. Non-parametric tests tend to be less sensitive to outliers than their parametric counterparts (Hollander & Wolfe, 1999).

Data analysis. The data used to measure perceived performance, perceived learning, and measured learning were interval level and did not follow a normal distribution; therefore, non-parametric tests were selected (Siegel & Castellan, 1988). I completed the majority of the data analysis. A statistician assisted with the a priori power analysis and acted as a consultant when questions arose. The data were analyzed using three statistical programs, Statistical Package for the Social Sciences (SPSS®), Stata®, and StatXact®. The statistician used Stata® for the power analysis and StatXact® for the Wilcoxon analysis with covariates. SPSS® was used for all other statistical analysis.

To determine the effect of community participation on perceived performance, perceived learning, and measured learning, a Wilcoxon rank-sum test was used with an extension for covariates. A Wilcoxon rank-sum test was chosen because it was the non-parametric equivalent of a t-test for use with ordinal data (Siegel & Castellan, 1988). GPA and work-term were selected as covariates because they have a strong or moderate relationship to the measured value (Tabachnick
CO-OP ONLINE LEARNING COMMUNITY

& Fidell, 2001). Work-term and GPA were chosen as the covariates because my experience with student assessments over the past 10 years has demonstrated that both student GPA and student work-term can affect the student assessment. GPA also correlated to higher levels of extension in work integrated learning (Hayward et al., 2007). A Spearman correlation was completed between each covariate and student perceived performance, perceived learning, and measured learning to determine which, if either, covariate to use in the analysis (Tabachnick & Fidell, 2001). The Spearman correlation measures the association between two variables when both variables use ordinal scales (Siegel & Castellan, 1988).

A Spearman correlation was used to determine the relationship between the level of social media use and the level and type of community participation within the treatment group. A Spearman correlation was also used to determine the relationship between level and type (blog, wiki, discussion board) of community participation in the WIL community and student perceived performance, perceived learning, and measured learning through work within the treatment group.

The means and standard deviations were calculated for the Likert-scale community-evaluation questions and content analysis was used to analyze the qualitative responses to the open ended questions about the community. For these questions, the content analysis process involved categorizing the data and using themes to organize and synthesize the data.

Five students’ blogged in the community, four of which chose to participate in the study. These students were required to write a blog post each week, respond to blog comments, and were asked to start some discussions in the community to assist in the community getting started. Because these students had higher participation scores due their willingness to blog and lead discussions, I completed the data analysis with a dataset that included the bloggers and one that did not. For most research questions, there were no significant differences in the data with or without...
the inclusion of the bloggers. Therefore, the data is reported with the bloggers included in all datasets except for the analyses where the results had a significant difference. In these instances, the results with both datasets are reported.

**Effect of community participation on perceived performance.** The performance assessment questions (see Appendix F) from the student report were used to measure perceived performance. Table 4 shows the means and standard deviations for the eight variables for the treatment and control samples by quarter and overall. Most variables had means greater than 4.00 out of a 5.00 scale. Only students’ perceived performance of leadership had means below 4.00 for both treatment and control groups overall and in summer and fall. The fall treatment group’s perceived performance of communication and the fall control group’s perceived performance of organization and planning were the only other instances of means below 4.00. The fall treatment group’s perceived performance of technology and perceived performance of organization/planning were the only groups with standard deviations equal or greater than 1.00.
To determine the effect of community participation on perceived performance, a Wilcoxon rank-sum test was used with an extension for covariates. Student GPA and work-term were the selected covariates. The reason covariates were selected was because they have a strong or moderate relationship to the measured value (Tabachnick & Fidell, 2001). In order to determine if there was a correlation between the covariates chosen and perceived performance, perceived learning or measured learning, a Spearman correlation was completed.

The Spearman correlation indicated there was a significant correlation ($r_s(93) = .25, p = .01$) between the student perceived performance of their professional qualities and GPA. There were no other correlations between the student perceived performance and GPA. There were significant negative correlations found between student perceived performance for learning and
integrating theory and practice \( r_s(91) = -0.24, p = .02 \), and student perceived performance of their professional qualities \( r_s(93) = -0.26, p = .01 \) and work-term. There were no other significant correlations found between the student perceived performance variables and work-term. As a result of the Spearman correlation, work-term was used as the covariate for the analysis of perceived performance of learning and integrating theory and practice. For the analysis of perceived performance of professional qualities, since both covariates correlated to the data, the covariate with the stronger relationship is typically used for the analysis (Tabachnick & Fidell, 2001). However, the correlations were very close; with one positive and one negative. As a precaution, the Wilcoxon rank-sum test was completed using each covariate. No significant effect was found with either covariate.

Although the use of covariates, if any, varied slightly without the inclusion of the bloggers, the overall significance of the results of the Wilcoxon Rank-sum test was not affected. Table 5 shows the results of the Wilcoxon rank-sum test and what covariates were used, if any.
Table 5

*Wilcoxon Rank-Sum Test Results for Perceived Performance with Covariates Noted*

<table>
<thead>
<tr>
<th>Perceived Performance Variables</th>
<th>Covariate</th>
<th>Z</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication</td>
<td>none</td>
<td>-0.79</td>
<td>0.43</td>
</tr>
<tr>
<td>Conceptual/Analytical Ability</td>
<td>none</td>
<td>-0.40</td>
<td>0.69</td>
</tr>
<tr>
<td>Learning / Theory and Practice</td>
<td>work-term</td>
<td>-1.57</td>
<td>0.12</td>
</tr>
<tr>
<td>Professional Qualities</td>
<td>work-term</td>
<td>0.61</td>
<td>0.55</td>
</tr>
<tr>
<td>Professional Qualities</td>
<td>GPA</td>
<td>1.12</td>
<td>0.38</td>
</tr>
<tr>
<td>Teamwork</td>
<td>none</td>
<td>-0.10</td>
<td>0.92</td>
</tr>
<tr>
<td>Leadership</td>
<td>none</td>
<td>-0.19</td>
<td>0.85</td>
</tr>
<tr>
<td>Technology</td>
<td>none</td>
<td>-0.06</td>
<td>0.95</td>
</tr>
<tr>
<td>Work Culture</td>
<td>none</td>
<td>-0.29</td>
<td>0.77</td>
</tr>
<tr>
<td>Organization/Planning</td>
<td>none</td>
<td>-0.22</td>
<td>0.83</td>
</tr>
</tbody>
</table>

*Effect of community participation on perceived learning.* The assessment question for student perceived learning on the student report (see Appendix F) was analyzed. The significance of results were not affected by inclusion or exclusion of the bloggers in the datasets. Table 6 shows the mean and standard deviation of the perceived learning variable for the treatment and control groups by quarter. All means were greater than 4.00 on a 5.00 scale. All standard deviations were less than .90.
To determine the effect of WIL community participation on student perceived learning, a Wilcoxon rank-sum test was used. The GPA and work-term were the planned covariates. A Spearman correlation was completed to determine if the covariates should be used. The Spearman correlation showed no significant correlation between student perceived learning and GPA or work-term. The Wilcoxon rank-sum was conducted with no covariates and the results indicate no significant difference in perceived learning, $Z = -0.07, p < 0.94$.

**Effect of community participation on measured learning.** The student projects (see Appendices B-E) were used to measure student learning. The significance of results were not affected by inclusion or exclusion of the bloggers in the datasets. Table 7 shows the means and standard deviations for measured learning for the treatment and control groups by cooperative-education quarter. The means and standard deviations have more variability than either student perceived performance or perceived learning.
Table 7

*Measured Learning Means (Standard Deviations) Overall and by Quarter for Treatment and Control Groups*

<table>
<thead>
<tr>
<th>Measured Learning</th>
<th>Overall</th>
<th>Summer</th>
<th>Fall</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Treatment</td>
<td>Control</td>
<td>Treatment</td>
</tr>
<tr>
<td></td>
<td>3.89(1.26)</td>
<td>4.05(0.94)</td>
<td>4.12(0.78)</td>
</tr>
</tbody>
</table>

A Wilcoxon rank-sum test was used to determine the effect of WIL community participation on measured learning. GPA and work-term were the planned covariates. The Spearman correlation showed no significant correlation between measured learning and GPA or work-term with or without the bloggers in the dataset. The Wilcoxon Rank-Sum was conducted with no covariates and the results indicated no significate difference in measured learning, \( Z = -0.42, p < 0.68 \).

Relationship between the level of social media use and the level and type of WIL community participation. A Spearman rank order correlation was used to determine the relationship between social media use and the level and type of WIL community participation. Table 8 shows the results. No significant correlations were found with the bloggers. Significant negative correlations were found between social media use and the level of blog posting \( (r_s(28) = -0.37, p = .05) \) and the total participation score \( (r_s(28) = -0.44, p = .02) \) for the dataset without the bloggers.
Table 8

Spearman Correlation for Social Media Use and Level and Type of WIL Community Participation

<table>
<thead>
<tr>
<th>Variables</th>
<th>Social Media Use</th>
<th></th>
<th></th>
<th>Social Media Use</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>n</td>
<td>rs</td>
<td>p</td>
<td>n</td>
<td>rs</td>
</tr>
<tr>
<td>Discussion Board - count of posts</td>
<td>31</td>
<td>-32</td>
<td>0.08</td>
<td>29</td>
<td>-36</td>
<td>0.06</td>
</tr>
<tr>
<td>Blog - count of posts</td>
<td>31</td>
<td>-25</td>
<td>0.18</td>
<td>29</td>
<td>-37</td>
<td>0.05</td>
</tr>
<tr>
<td>Wiki - count of words</td>
<td>31</td>
<td>-18</td>
<td>0.33</td>
<td>29</td>
<td>-25</td>
<td>0.20</td>
</tr>
<tr>
<td>Total Participation - sum of Z-scores</td>
<td>31</td>
<td>-29</td>
<td>0.11</td>
<td>29</td>
<td>-44</td>
<td>0.02</td>
</tr>
</tbody>
</table>

Relationship among level and type of community participation and perceived performance, perceived learning, and measured learning. Student participation in the WIL community was tallied in the discussion board, blog and wiki. Because the counting method was different for the three categories, a z-score was calculated and used to create a sum for a total participation score. A z-score or standard score is calculated using the mean and standard deviation to transform a raw value into a standard value (Gravetter & Wallnau, 2007). Table 9 shows the means and standard deviations for level and type of participation for the treatment and control groups by project and quarter.
Table 9

Level and Type of Participation Means (Standard Deviations) Overall and by Quarter

<table>
<thead>
<tr>
<th>Variables</th>
<th>With Bloggers</th>
<th></th>
<th>Without Bloggers</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Overall</td>
<td>Summer</td>
<td>Fall</td>
<td>Overall</td>
</tr>
<tr>
<td>Discussion Board -</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>count of posts</td>
<td>18.96</td>
<td>19.04</td>
<td>18.84</td>
<td>18.00</td>
</tr>
<tr>
<td></td>
<td>(14.73)</td>
<td>(15.71)</td>
<td>(13.57)</td>
<td>(13.70)</td>
</tr>
<tr>
<td>Blog - count of posts</td>
<td>3.38</td>
<td>3.68</td>
<td>2.95</td>
<td>1.69</td>
</tr>
<tr>
<td></td>
<td>(6.21)</td>
<td>(7.24)</td>
<td>(4.43)</td>
<td>(2.23)</td>
</tr>
<tr>
<td>Wiki - count of words</td>
<td>72.06</td>
<td>79.36</td>
<td>61.32</td>
<td>69.86</td>
</tr>
<tr>
<td></td>
<td>(119.26)</td>
<td>(145.58)</td>
<td>(65.98)</td>
<td>(122.16)</td>
</tr>
<tr>
<td>Total Participation -</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>sum of z-scores</td>
<td>0.07</td>
<td>0.20</td>
<td>-0.11</td>
<td>-0.48</td>
</tr>
<tr>
<td></td>
<td>(2.24)</td>
<td>(2.59)</td>
<td>(1.67)</td>
<td>(2.23)</td>
</tr>
</tbody>
</table>

A Spearman rank order correlation was run to determine the relationship between individual section participation and total participation and perceived performance, perceived learning, and measured learning (see Table 10). There was a statistically significant negative correlation between the level of wiki participation and students’ perceived performance of leadership with the bloggers ($r_s(37) = -0.38, p = .02$) and without the bloggers ($r_s(34) = -0.45, p = .01$). There was also a statistically significant negative correlation between overall participation and leadership without the bloggers ($r_s(34) = -0.37, p = .02$). These were the only significant correlations found.
Table 10

*Spearman Correlation for Level and Type of Participation and Perceived Performance, Perceived Learning and Measured Learning with the Bloggers (except where noted)*

<table>
<thead>
<tr>
<th></th>
<th>Discussion Board</th>
<th>Blog</th>
<th>Wiki</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived Performance Variables</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communication</td>
<td>46</td>
<td>0.11</td>
<td>.48</td>
<td>0.02</td>
</tr>
<tr>
<td>Conceptual/Analytical Ability</td>
<td>47</td>
<td>0.02</td>
<td>.91</td>
<td>0.04</td>
</tr>
<tr>
<td>Learning / Theory and Practice</td>
<td>46</td>
<td>0.16</td>
<td>.29</td>
<td>-0.22</td>
</tr>
<tr>
<td>Professional Qualities</td>
<td>47</td>
<td>0.03</td>
<td>.82</td>
<td>0.16</td>
</tr>
<tr>
<td>Teamwork</td>
<td>46</td>
<td>-0.08</td>
<td>.60</td>
<td>-0.21</td>
</tr>
<tr>
<td>Leadership</td>
<td>39</td>
<td>-0.23</td>
<td>.17</td>
<td>-0.12</td>
</tr>
<tr>
<td>Leadership (with Bloggers)</td>
<td>36</td>
<td>-0.31</td>
<td>.07</td>
<td>-0.23</td>
</tr>
<tr>
<td>Leadership (without Bloggers)</td>
<td>47</td>
<td>-0.09</td>
<td>.55</td>
<td>-0.04</td>
</tr>
<tr>
<td>Technology</td>
<td>44</td>
<td>-0.15</td>
<td>.34</td>
<td>-0.13</td>
</tr>
<tr>
<td>Work Culture</td>
<td>46</td>
<td>-0.23</td>
<td>.13</td>
<td>-0.15</td>
</tr>
<tr>
<td>Organization/Planning</td>
<td>36</td>
<td>0.20</td>
<td>.24</td>
<td>0.18</td>
</tr>
</tbody>
</table>

*Community Evaluation Questions.* The five community evaluation questions (see Appendix J) were analyzed to collect additional data about student opinions of the community. The first two questions were Likert scale questions. The five responses were assigned the following associated values: strongly agree (5), agree (4), neither agree nor disagree (3), disagree (2), and strongly disagree (1). There were 31 responses to each Likert scale question. The first question asked students to indicate if the online community participation enhanced their learning experience. The mean for the response was 2.74 (SD = 1.06). The second question asked if the
students enjoyed participating in the online community. The mean for the response was 2.68 (SD=1.67).

The third question asked the students to indicate the strengths and most enjoyable aspects of the community. The 27 responses were reviewed and compiled by content. Students indicated (20 responses) that they liked the opportunity to see and hear about other student experiences and liked providing, getting, or reading advice. Some examples of these statements:

- “Learned what other students were going through and what type of work they did.”
- “Enjoyed learning about other co-ops jobs”
- “I enjoyed reading about other peoples’ experiences.”
- “I was able to learn from someone and teach something new to others. I also like the diversity of the topics anybody could participate [sic] and very useful information could be obtained about almost anything.”
- “I got to keep in touch with class mates and learn about how other see [sic] their co-ops.”

The fourth question asked students to indicate the weaknesses or least beneficial or least enjoyable aspects of the community. The 28 responses were compiled and sorted into categories. Three main themes arose with the most prevalent being the difficulty in using Blackboard® as a platform. Example comments included:

- “1) The online community 2) Blackboard [sic]”
- “Platform, i.e. Blackboard [sic].”
- “The interface could use some help (check the topics about this in the forum).”
- “The main thing that wasn’t enjoyable was the user-interface. Which was the subject of many discussion boards [sic].”
Secondly, students did not like the mandatory requirement to post and felt it affected the quality of posts. Some example comments:

- “The mandatory number of posts made participation more of a chore than a spare time event.”
- “Too required participation [sic], so forced discussions”
- “Many of the posts made were simply to fill the required quota.”
- “Mandatory requirement removes almost all of the sincerity from posts.”

Finally, a few students indicated they did not think it was valuable or useful. Some example posts:

- “Not a lot of useful information.”
- “It was not as beneficial to me as a Senior [sic] on my final co-op, but I can see where it would help younger students/co-ops.”
- “Not very much new material for Seniors [sic], we already knew most of what was discussed online.”
- “I didn't see much value in the wiki or blog portion of it.”

The fifth question asked the students for recommendations or suggestions for changes to the community. The 22 responses were compiled and sorted into categories. These responses were similarly themed as the responses to the previous question. The students suggested changing to a new platform and eliminating the mandatory requirement. Some example comments:

- “Not adhering to a strict weekly schedule, but rather simply gauging whether or not an individual participated. This would help it feel more like a community and less like work.”
• “I felt that the online community required too much involvement, and while it was interesting to read, I feel that it would be the most useful for new students that have questions about co-op.”
• “Do not require so many entries/threads per week. Maybe 1 thread and 2 comments per week.”
• “A better platform than Blackboard would create more interest in posting without the constant fighting with Blackboard’s interface.”

**Researcher’s reflection.** The researcher’s reflection was a narrative written by me to capture some of my thoughts about the study as it was progressing:

There was concern about the study from the beginning due to the immediate negative response to the initial WIL community and participation e-mail. Many students questioned the additional work and raised concerns about the time it would take. Students view cooperative education as a break from classes and most are not interested in having homework. I responded politely about the reason for using the WIL community, why it was important, and asked that they give it a try. This appeased most students and they logged in and started to participate. However, I knew that even though cooperative-education faculty actively reinforces the fact that cooperative education is a learning experience, cooperative-education faculty (and other faculty and staff) often present cooperative-education experiences as a break from classes, so many students view cooperative education as a break from traditional academics.

At the start of the summer term, a problem was found with the social media survey. The survey function on Blackboard® did not maintain data by respondent, only as a cohort. I did not realize this until about a week into the study when I went in to see who had completed the survey and to send a reminder. Because survey data by student was needed, this survey had to be recreated...
in the test feature of Blackboard® and students had to be asked to complete it again. Even with several reminders, the students did not complete the survey at the same rate the second time. Through the summer I followed the postings, responded to questions, commented on the blogs, and referred students to the included reference material. A question came up about anonymous posts being truly anonymous. I assumed they were, but contacted Blackboard® support for confirmation. I learned that posts marked as anonymous are anonymous to other readers but if I wanted to find out the author, it could be done. I did not do this (the process was quite complicated even if I wanted to) but the students were informed that it was possible.

The summer students were active in the community and the four bloggers did an excellent job. I provided some written instructions to the bloggers regarding my expectations for their posting. I asked them to not only write about their work experiences, but also about their company culture, reasons why they chose that particular job, and unique aspects of their company. Because I knew the bloggers and their cooperative education history, I would ask them to write about topics unique to their experiences, for example, one student was located in Boston, so I asked him to talk about choosing to relocate, another student worked for a very small company with a unique culture, I asked him to talk about working for a small company and to discuss the culture of that company. I also asked them to start a few discussions in the community so that the discussion boards would not be empty or intimidating to the other students. Regular reminders were sent about participation throughout the term and students were directed with questions outside of the community (via e-mail) to content in the community that could answer their questions. Toward the end of the quarter, some of the bloggers were not sure of topics to write about, so I made some suggestions based on my knowledge of the bloggers and their previous experiences. All in all, I felt the summer went as well as could be expected.
The number of students in the fall population was much smaller than the summer population, resulting in a smaller sample in fall. Only one student agreed to blog, even with multiple requests. The fall blogger was not as strong as the summer bloggers. His posts were shorter and more matter-of-fact about what he was doing rather than trying to create discussion.

In the fall term, several personal issues arose that caused unexpected out of town travel, and affected my ability to focus on the WIL community. At work, the university was converting to semesters from quarters. As the associate director, the conversion took a significant portion of my time. On top of all this, my student load grew due to a large transfer population to electrical engineering. Work and home took precedence over the research.

In the fall term, it appeared that the students were not as active as the students were in the summer. It was difficult to use Blackboard® analytics to identify students who were not meeting the participation requirements. I did run a search and the results it gave allowed me to contact students who were not meeting the guidelines. I e-mailed them a specific reminder to participate. Several students contacted me to inform me that they were meeting the guidelines. I contacted Blackboard® to understand that problem with the data and learned I had misread the data that was presented. It was indicating the number of discussion boards students posted against, not the number of individual posts. I apologized to the students for the incorrect e-mail. Students understood, but I was concerned that little errors such as this affected the credibility of the community.

During both terms, students noted concerns with Blackboard®. They indicated it was not user friendly, it was difficult to find and follow the blogs, and it was difficult to locate threads to which there were previous posts. I created a discussion board about the community to gather
CO-OP ONLINE LEARNING COMMUNITY

opinions within the community more formally and most of the comments were about the dissatisfaction with the community due to its difficulty and the mandatory posting requirements.

Overall, I felt the blogs were very positive and the bloggers did a great job, but I agreed with the students that it was difficult to find new blog postings. Certain discussion boards were very active. One board where students supplied technical tips to other students had a lot of activity and many good tips and tricks. Discussion about success in the job search and interview process was very interesting. Some students assisted with recruiting for their company, so they were able to provide a company perspective. The summer discussion was much better than the fall discussion because there were more students engaged in the community and participating in the discussion.

The external wiki functioned properly, but it was not as easy to access as it would have been if it were part of Blackboard®. It was external to Blackboard® and accessed by a link internal to the platform.

Overall, there were both positives and negatives throughout the study. The positives were that the community was created, resources and information were available, and students were participating. The negatives were that the students were not happy with the additional work, the mandatory community requirement, and Blackboard® was challenging to use.

Summary

The data were analyzed using three statistical programs, SPSS®, Stata®, and StatXact®. The Wilcoxon analysis of the effect of the community on perceived performance, perceived learning, and measured learning showed no significant effects. The Spearman correlation to determine the relationship between the level and type of participation and perceived performance, perceived learning, and measured learning found a significant negative correlation between students’ perceived performance of leadership and participation in the wiki for both datasets and a
significant negative correlation between students’ perceived performance of leadership and overall participation for the dataset that included the bloggers. A Spearman correlation found no significant correlations in the relationship between social media use and level and type of WIL community participation for the dataset including the bloggers, but found a significant negative correlation between social media use blog and overall community participation. Students, for the most part, did not believe the community enhanced their learning and they did not enjoy participating; however, they liked the opportunity to read about other students’ experiences. They did not like the platform used for the community (Blackboard®) or the requirement for posting each week and suggested that these items change in the future.
Chapter 5

Discussion

This chapter provides an overview of the study and a discussion of the results. A summary of the findings, the limitations of the research, contributions to the literature, and future research are also discussed. The chapter conclusion includes a summary and implications for instructional designers and cooperative education practitioners.

Overview. The goal of this study was to determine if participation in general or the level and type of participation in an online community (the WIL community) for at-work, cooperative-education students affected student perceived performance, perceived learning, and measured learning through work. The GPA and work term were examined as covariates. Student social-media use was also examined to see if there was a relationship with level and type of community participation. The study included 47 matched pairs (94 total participants) of electrical engineering students from a large urban research university. Students at work through cooperative education were engaged in full-time, career-related experiences in business, industry, government, or academia located locally, nationally, and internationally. The sample, which was representative of the population, was primarily Caucasian male students.

The control group consisted of students who participated in work terms in previous summer or fall quarters that were matched to the treatment group based on quarter worked (summer or fall), cooperative-education company, GPA, gender, and ethnicity as closely as possible. The control group completed the existing curriculum, which consisted of setting learning objectives and completing a student project and a student report. The treatment group consisted of students who consented to participate in the study and were at work in either summer or fall 2011. The treatment group completed the existing curriculum with the addition of participation in an online community
through the work term, completing a social-media use survey, and completing four additional questions about the community participation on the student report.

The WIL community was designed to enhance social interaction and reflection through a design-based research study (Todd et al., 2011). The community was located in Blackboard®, the content management system used by this university. A Blackboard® organization was used and all students in the electrical engineering program were added to the community. The community included netiquette information and a quiz, resources, discussion boards, blogs, and a link to an external wiki. All students on cooperative education in summer or fall 2011, regardless of whether they consented to participate in the study, were required to participate in the community. Minimum participation guidelines were set for the students with the requirements that the students introduce themselves, complete the netiquette quiz and social media survey, make one contribution to the wiki, and post a minimum of two threads per week to either the discussion boards or the blogs. Five students were paid to blog in the community and to assist in starting community discussions. Four of these students consented to participate in the research study. Analyses were done with and without these students.

The following sections discuss the results of this study. The discussion of findings about the community participation is followed by a discussion of the relationship between social media use and level and type of participation, and finally a discussion about the relationship between the level and type of participation and student perceived performance, perceived learning, and measured learning. The sections discuss possible reasons for the findings and how the literature may or may not support the findings.

**Community participation.** A significant positive effect was expected to be found on student perceived performance, perceived learning, and measured learning from participation in
the WIL community, as well as a correlation between the level of student participation within the WIL community and student perceived performance, perceived learning, and measured learning. The intent of creating the WIL community was to provide more opportunities for student interaction and reflection to enhance student learning because existing research had demonstrated that reflection and social interaction were factors that affect student learning through work (Canale & Duwart, 1999; Eames, 2000; Hayward et al., 2001, 2007). The findings regarding the level of community participation and community participation in general did not meet expectations as no significant differences were found between the treatment and the control groups, and a correlation between the level of community participation and student perceived performance, perceived learning, and measured learning within the treatment group was not evident. The level of community participation was not as high as was expected. Students participated, on average, slightly below the minimum expected (see Table 9). The sum of the average number of student posts against the discussion board and the blogs equaled 22.34 posts per student including the bloggers and 19.69 posts per student excluding the bloggers; an average of 24 posts per student was expected assuming the student would meet the minimum of two posts per week (a work term is 12-13 weeks in length).

One possible reason that WIL community participation did not affect student perceived performance, perceived learning, or measured learning could be the effect of the negative student attitude toward the additional work associated with participation and use of the community. Many students have indicated in the past that work experiences provide a break from classes and particularly academic homework. The university and the cooperative-education office indicate that the break from academic course work is a benefit to participation in a cooperative education program and uses this as one selling point for the program. By adding in a requirement for WIL
community participation to the work term, students may have felt as if they had academic homework at a time when they were expecting relief from university study. Most participants in this study viewed the additional work of participating in the WIL community negatively. This was evident from the start of the study when the initial e-mail was disseminated explaining the community and its use to students. There were questions and concerns fielded from the students about required participation. Students also posted concerns about the additional work in the discussion boards in the community.

The negative student feedback aligned with the limited research about student community participation at work. Students were concerned that too many academic responsibilities assigned while at work through might detract from their work-based learning experience when they wanted to develop their own self-sufficiency (Canale & Duwart, 1999). This also aligned with research about technology adoption. Attitude was found to be a key factor affecting technology adoption; if participants had a positive attitude toward the technology they were more likely to use it. Conversely, if students had a negative attitude toward technology, the less likely they were to use it (El-Gayar & Moran, 2006; Hossain & de Silva, 2009; Lin, 2006; Sumak et al., 2010).

The WIL community platform (Blackboard®) proved difficult to use. This difficulty caused participation to take more time than expected, adding to the students’ overall concerns with the additional work. The difficulty using the platform was noted both in the community (in discussion boards) and in the responses to the additional questions asked about the community in the student report. The challenge in finding past threads on both the blogs and the discussion boards was one of the greatest concerns. It was difficult to follow discussions without significant searching. Other problems arose with the community and my inexperience using the blog and discussion board features may have caused the students to lack confidence in the technology. The
student concerns with the difficulties of the WIL community platform may have detracted from the overall experience and affected the student evaluation of their perceived performance and learning.

The possibility of student dissatisfaction with the technology affecting participation aligns with the available research. A technology acceptance model, TAM (Davis, 1989), cited ease of use as one of the two most significant factors affecting technology adoption. The TAM is a foundational technology acceptance model and has been verified by many researchers (Lee et al., 2011; Wang et al., 2012). Research has shown a significant correlation between the ease of use of technology and technology adoption. Research on virtual communities (Hossain & de Silva, 2009; Lin, 2007; Wang et al., 2012) has shown that the more difficult a virtual community was to use, the less likely it was to be adopted by users. In mandatory systems like the WIL community, ease of use was found to be the primary factor affecting adoption (Brown et al., 2002). Therefore, it may be that since the system was perceived as difficult to use, students did not post more than the required minimum for WIL community participation.

Another possible reason that participation did not affect learning was that students did not believe the community was useful and this may have affected their level of the community usage. Several written comments in the additional student report questions indicated that some students did not think it was useful. These findings align with research using the TAM model (Davis, 1989). Perceived usefulness is the other key factor affecting technology adoption in this model. In a study to validate the TAM model, Davis (1993), found that a technology that had strong perceived usefulness had the most powerful positive effect on usage. This is consistent in the literature about virtual communities (Arbaugh & Duray, 2002; Liu et al., 2010) where it was found that community technology that was perceived as useful had a strong impact on intention to use an
online learning community. This may suggest that students who do not perceive something as useful are less likely to use it.

Although the community did not significantly affect learning, students perceived some benefit in participating. Students’ comments in the additional student report questions indicated that the positive aspect of the community was the ability to read about other students’ experiences and to communicate with other students through the community. Positive benefits can also be seen in the literature. Research has shown that engagement of students at work benefits students by linking colleagues and friends and creating networks (Maidment, 2006; Mayer, 2002; Roberts-DeGennaro et al., 2005). This may be because the community creates a venue for seeking advice, strategies, resources, cognitive support, and psychological and emotional support (Hatton & Smith, 1995; Maidment, 2006; Mayer, 2002; Paulus & Scherff, 2008; Roberts-DeGennaro et al., 2005), and by providing a venue for students to compare and contrast experiences (Keegan, 2007; Mayer 2002).

**Relationship between the level of social media use and the level of WIL community participation.** A positive correlation was expected between the level of student social media use and the level of WIL community participation. It was expected that students who used social media on a regular basis would be familiar and comfortable with the WIL community technology and would be more inclined to participate. However, this study found no significant correlations between student social media use and level or type of participation in the WIL community with the inclusion of the bloggers. On the other hand, there were significant negative correlations found between social media use and the level of blogging and the overall level of participation for the dataset without the bloggers, meaning that students with high levels of social media use were less likely to blog and less likely to participate in the community overall for this dataset. This
difference in results highlights the fact that the number posts created by those paid to blog in the community had a substantial influence on the number of blog posts and overall posts in the community. This is because, not only were the bloggers tasked with blogging and responding to blog posts each week, they were also asked to start discussions in the discussion board to prompt other students to participate. If you review the means for participation comparing the dataset with the bloggers to the dataset without (see Table 9), the means decrease across all participation categories when looking at the overall population.

It was surprising to find that students who prefer to use social media were less likely to participate in the WIL community. One possible reason may be that students prefer to use social media versus using course management software, such as Blackboard® even if the course management software has social media features. Studies (DiVall, & Kirwin, 2012; Smith, Caruso, & Kim, 2010) in which Blackboard® and Facebook® were compared for educational use, students accessed Facebook® far more frequently than Blackboard®, and for substantially longer time periods. Therefore, even though students may frequently use social media, like Facebook®, they may be less willing to access Blackboard®.

It is also possible that these unexpected results were found for the same reasons that the community was not successful in positively affecting learning. Student negative attitude, student perceived and real difficulty using Blackboard®--particularly finding and following the blogs, and student perception that the community was not useful significantly affected student participation in the community, overriding any potential positive effect from social media experience. These results are contradictory to the published research, which reported that experienced users are more likely to adopt a new technology (Taylor & Todd, 1995). Research has shown that prior experience with similar technology (Agarwal & Prasad, 1999) positively affects perceived usefulness or ease
of use of a technology, which positively affects adoption of that technology. Therefore, had the technology been perceived useful or easy to use, the experienced users should have had higher levels of participation.

Relationship between type of participation and perceived performance, perceived learning, and measured learning. When examining the type of participation (discussion board, wiki, or blog) and its effect on perceived performance, perceived learning, and measured learning, a positive correlation was expected, particularly with the discussion board as it held the most activity of the three sections of the community. The blogs and wikis had limited participation, particularly without the bloggers included in the dataset (see Table 9); however, it was hoped that even if students minimally participated (defined by a count of written comments or words) they were still reading the content of the blogs and wikis, which could also contribute to their learning.

With both inclusion and exclusion of the bloggers in the dataset, a significant negative correlation between student-perceived performance of leadership and wiki participation was found. One possible explanation for this finding is that personality types may vary between people who participate in wikis and those who characterize themselves as leaders; a theory supported by the literature. Wikipedia® contributors’ personality traits were lower in agreeableness, males were lower in conscientiousness, and females were lower in extroversion, as compared with people who do not contribute to Wikipedia® (Amichai-Hamburger et al., 2008). Conversely, personality traits that were strongly related to transformational or ethical leadership include extroversion (Bartone, Eid, Johnsen, Laberg, & Snook, 2009), conscientiousness (Judge & Bono, 2000; Walumbwa & Schaubroeck, 2009), and agreeableness (Walumbwa & Schaubroeck, 2009).

With the exclusion of the bloggers in the dataset, a significant negative correlation between student-perceived performance of leadership and overall participation was found. One possible
explanation is that eliminating the bloggers enhances the tendency towards a negative correlation between leadership and overall participation to a point where it becomes statistically significant. To determine this, I looked closely at the dataset for just the bloggers and found that the bloggers perceive themselves as high in leadership. This is not surprising considering they volunteered to blog and start discussions in the community, an act that could be considered taking a lead role in the community. Additionally, the bloggers were typically the participants with the greatest number of posts. Therefore, by excluding the bloggers, I eliminated the data points that would most strongly influence a positive correlation between leadership and participation.

**Summary.** This study found no significant effect on perceived performance, perceived learning, or measured learning from participation in the community. There was no relationship found between the level of participation and perceived performance, perceived learning, or measured learning. These findings may be a result of student negative attitude toward the additional work, the difficulty using Blackboard®, and the lack of perceived usefulness of the WIL community itself.

No correlation with the bloggers was found between the level of student social media use and level or type of WIL community participation. Two negative correlations without the bloggers were found between the level of student social media use and the level of blogging and the overall level of community participation. Although some research showed that users with experience would be more likely to adopt the technology, the overall issues with student attitude towards the community, lack of perceived ease of use, and usefulness may have had a greater effect on usage. Another possible reason may be that students prefer to use social media versus using course management software, such as Blackboard®.
A significant negative correlation was found between students’ perceived performance of leadership and participation in the wiki with both the inclusion and exclusion of the bloggers. This finding may be a result of the personality differences between people who perceive themselves as leaders and people who participate in wikis. A significant negative correlation was found between students’ perceived performance of leadership and overall community participation with the dataset that excluded the bloggers. This may be due to eliminating those participants from the dataset highest in both leadership and participation, driving a tendency towards a negative correlation into the statistically significant relationship.

Although no significant positive effects were found on student performance or learning from participation in the community, student’s indicated that a positive aspect of the WIL community was the ability to read about other student experiences and to communicate with other students through the community.

**Limitations of the study.** There were several limitations to this study. These include challenges with the student perceptions of the additional assignment, a number of difficulties with Blackboard®, the platform for the WIL community, my multiple roles as a professor, moderator, and researcher, and the lack of variability in the data. The generalizability of the research is also addressed as a limitation to the research.

**WIL community as an additional assignment.** This study may be limited by the fact that students were concerned about having the WIL community as an additional part of their cooperative-education requirements and it affected their attitude toward participation in the WIL community. In working with the cohort of cooperative-education students for more than 10 years, my experience has been that many students do not see the value in the existing cooperative-education curriculum, particularly the student project and assessments. Students have noted this in
past senior surveys and post cooperative-education reflection meetings. While they understand that they are learning through work, students do not always understand why they need to complete all of the assessments about their experience. They think it is too long and somewhat repetitive. Additionally, students view the cooperative-education work-term as a break from classes and do not want to have academic responsibilities while at work. Therefore, there were concerns about students’ perceptions of the additional work from WIL community participation from the beginning of this research study. These concerns were validated when students communicated through e-mail and posted in the community that they did not like mandatory participation and minimum participation requirements for the WIL community. This negativity was apparent throughout the study.

**Difficulty using Blackboard®.** Another limitation of this study was the difficulty that the students and I experienced using Blackboard®. Blackboard® was chosen as a platform for the WIL community because prior research (Todd et al., 2011) indicated that students were concerned with using too many social networks and Blackboard® was the university course management system, which included all cooperative-education student enrollments, was an academic platform, had the features desired for the community, and was familiar to the students. However, some of the key features used in the Blackboard® WIL community, such as blogs and discussion boards, were new to both the students and me. In addition, Blackboard® was supposed to have a wiki feature by the start of community participation. But, it did not, requiring the creation of a separate wiki linked through Blackboard®. This created an additional step for students to access the wiki.

The biggest issues raised by students were the difficulty tracking discussion threads and the absence of notification features to alert students to a new thread or comment. Students had to search for discussion threads in the boards and blogs. This made it difficult for students to
participate continually in a discussion, if so desired. I struggled with these same issues; wanting to revisit a discussion to see what else was posted or where the discussion was leading, I struggled to find the active threads. The difficulties with using Blackboard® added to the time needed for WIL community participation by students, compounding the issue students raised regarding additional work.

The features within Blackboard® for management of the community were challenging. For example, I used a report in Blackboard® to determine number of unique threads posted by students in the discussion boards. I later discovered that the data provided in the report was not the number of unique threads posted by each student, but the number of different discussion boards to which they had posted. This is just one of several examples. As a result, I believed Blackboard® metrics to be unreliable to provide the data needed throughout the study. I spent significant time on the phone with Blackboard® support trying to sort out features and content management issues.

At first thought, Blackboard® was an ideal choice because it was academic, preloaded with the student’s information, and both the students and I were somewhat familiar with its use. However, the difficulty in using features such as the discussion boards, blogs, and metric tools created frustration and added to the amount of time needed for participation in the community.

Professor, moderator, and researcher. During this study, I held three roles: professor, moderator, and researcher. It was very challenging to balance these three roles. On the positive side, the curriculum, the students, and the technology were very familiar. I could easily respond to questions or concerns that came up in the discussions. The companies and the work experiences, in which the students were participating, were familiar so discussions were easily followed. With the changes going on at the university, I could provide significant resources and information. However, there were also limitations.
Our university was going through a major change from quarters to semesters that required significant focus. Holding roles as both a professor and a partial administrative role, I had additional administrative requirements to which to attend. The student program I managed had an unexpected jump in enrollment that added to the demand on time in both the summer and fall. Unfortunately, the resources were not available to provide assistance in my faculty/administrative role. This limited time and energy affected my ability to focus on this research project, particularly in the fall term.

As a professor and moderator, it was difficult to read e-mails and discussions that were critical of the community. I wanted the students to have a positive experience in the community as I was hoping to adopt this as part of the curriculum for the future. It was especially difficult knowing that during the course of the study I could not address or relinquish some of the issues with Blackboard®. I felt very conflicted about the community as a result.

As the moderator and researcher, I struggled with how much I should push certain discussion topics in the WIL community. For example, I knew that one of the measurement instruments was the student project with topics like organizational culture and ethics. Therefore, I wondered if I should try to create more discussion around these topics to push student learning in those areas. I chose not to, but then I wondered whether I should have, as I wanted the students to learn about those topics while on cooperative education. So I sometimes felt confused about what was appropriate moderation and discussion without influencing the study.

**Lack of variability in the data.** The self-reported student data from the student report for measuring perceived performance and learning had minimal variability (see Table 4). The data were skewed towards the high end of the scale with means in most categories of four or greater out
of five points. This left very little room for positive (or negative) change in student scores which could affect the potential for statistical differences to be found in the data.

**Generalizability.** This study was completed at a university where cooperative education is mandatory and very structured. The total sample was comprised of electrical engineering students that were primarily Caucasian male. The sample was not random, it was a convenience sample of students on cooperative education in either summer or fall terms. Therefore, this study is not generalizable across other forms of experiential learning, other majors or fields of study, or samples with different demographics.

**Contributions to the literature.** Although the results of this study were not as expected, the study still contributed to the literature. The sample for this study was primarily Caucasian male and all engineering students. Most studies on using technology to connect students and the university while at work used samples that were primarily female students in non-technical majors, such as teaching and social work (Goos & Bennison, 2004, 2005; Hough, Smithey, & Evertson, 2004; Keegan, 2007). It is possible that gender or field of study could affect the level of student contributions in WIL communities.

The WIL community was developed using a designed-based research study (Todd et al., 2011) and included multiple features to enhance student engagement, such as discussion boards, blogs, wiki, and a resource area. None of the other studies (Bulgar, 2006; Keegan, 2007, Paulus & Scherff, 2008, Scherff & Paulus, 2006) on student engagement at work indicated an informed design was used for the technology. Additionally, the majority of the studies found in the literature only considered one technology such as email, a discussion board, or a blog (Hew & Knapczyk, 2007; Maidment, 2006).
Students’ previous experience using social media was assessed to determine if it had an effect on student learning. None of the studies that discussed connecting with students through technology while at work (Canale & Duwart, 1999; Haywood et al., 2001; Witmer, 1998) indicated an evaluation of participants’ previous experience with the technologies or the participants overall level of experience with similar technologies. Research showed (Taylor & Todd, 1995) that student technical experience could affect their ability or interest in using online tools, which could affect results of studies using technology. I found a significant negative correlation between student social media use and both the level of blogging and overall WIL community participation, and no correlation between student prior experience using social media and level or type of community participation without the bloggers; but as noted previously, any effect may have been overshadowed by the impact of student attitudes about perceived ease of use and perceived usefulness of the community.

The literature review for this study discussed perceived and measured learning through cooperative-education work. Only four studies were found that discussed student use of technology and with a goal of examining student learning (Canale & Duwart, 1999; Chu et al., 2012; Hayward et al., 2001; Witmer, 1998). None of these studies used a comparison group, only one study (Hayward et al., 2001) used a quantitative data analysis, and all four studies examined only student perceived learning. In studies examining student learning through work (not necessarily related to student use of technology), only two studies (Hayward et al., 2007; Van Gyn et al., 1997) were found that attempted to measure learning.

The key goal of this study was to measure student perceived performance, perceived learning, and measured learning. Surprisingly, very few studies about work-integrated learning had the measure of performance or learning as a key focus of the study. Although several studies
examined perceived performance and learning (Cook, et al., 2004; Eames, 2000; Nasr et al., 2004; Parsons et al., 2005), the studies did not discuss the validity of the instrument and only one study (Parsons et al., 2005) presented a statistical analysis of the results. This study provided a validated instrument to measure perceived performance and learning and a rubric and instrument with which to measure learning.

**Future research.** Although the positive results hoped for from this study were not obtained, there is merit in the idea of connecting with students through technology while at work through cooperative education with the goal of enhancing social interaction and reflection. This study could be replicated with the goal to eliminate some of the main limitations noted.

First, with regard to student perceptions about additional work, it would be important to plan for the use of a WIL community from the start of programming for the preparation of students for work experiences. The WIL community could be introduced as an expected part of the student assessments, proper community netiquette and reflective practice could be taught in advance of community participation. The study could be replicated with students during their first cooperative-education experience; therefore, community use would be expected versus being considered an add-on to the workload or different from something previously required. Additionally, a paradigm shift must occur such that students view the work-term similar to an academic class with learning goals and requirements that enhance and assess student learning. This must include the way the university and the cooperative-education program promote cooperative-education experiences to students. Instead of the work experiences being sold as a break from classes, they should be sold as a different type of self-directed learning experience. This can be reinforced in the introduction to cooperative-education course, along with a greater emphasis on
assessment and reflection. This could eliminate the negative attitude about additional work accompanying community participation and increase the perceived usefulness of the community.

The limitation due to difficulties using Blackboard® could be eliminated by using another platform. It was evident that the difficulty using this particular platform had an effect on student attitude and use regarding the WIL community. A study could be conducted to determine which platform would provide the features needed and ease of use for the students and moderators. Both academic and non-academic platforms could be considered.

Future research could include a broader set of majors, both technical and non-technical, which could also increase the gender and ethnicity demographics to allow the study to be more generalizable. The community would be richer with the inclusion of diverse types of students with different experiences at a broader variety of companies. It is possible that gender or student major could affect the level of or type of communication in a community. Previous research was primarily female (Hough et al., 2004; Paulus & Scherff, 2008; Scherff & Paulus, 2006) and non-technical populations (Maidment, 2006; Roberts-DeGennaro et al., 2005; Witmer, 1998). With the inclusion of a more diverse population, studies could be done comparing participation by gender or major field of study.

Future research could use tools that measure perceived ease of use and perceived usefulness of the WIL community using the TAM model. Specific factors could also be considered; such as student attitude toward the WIL community or student personality that may affect perceived ease of use and perceived usefulness of the WIL community.

Future research might look at the effect of participation in a community on student engagement and inclusion versus student learning. Research has shown that students at work may feel isolated, disengaged, and disconnected from their peers or their institution (Casey et al., 1994;
Cohen, 2000; Mayer, 2002, Scherff & Paulus, 2006; Schlagal et al., 1996). This study found that the aspect of the community that students enjoyed most was being able to read about other students’ experiences and communicating with other students through the community.

This study used a WIL community designed to enhance social interaction and reflection (Todd et al., 2011). Because it was assumed the social interaction and reflection would occur in the community, these factors were not measured by this study. Therefore, future research is needed to measure how the level of social interaction and student reflection correlates to student learning. Other studies measuring level of reflection in discussion boards found that the threads in discussion boards were either non-reflective or were at the lowest level of reflection (Whipp, 2003) and discussion boards had the lowest level of reflective comments compared to other asynchronous discussion technology (Makinster et al., 2006). Wiki content, even with instructor feedback and coaching, had superficial levels of self-reflection and the level of reflective postings fell short of the researchers’ expectations (Chou & Chen, 2008). This future research could build on previous work (Hayward et al., 2007) that examined the benefits of teaching a method of reflection, but taking it further by also measuring reflective postings/writing and correlate the level of reflection to student learning.

Conclusion

This study compared matched pairs of students at work, one in a treatment group that participated in the WIL community, and one a control group that was represented by historical data of students who did not participate in the WIL community. Curricular student assessments were used to measure perceived performance and learning and a graded student project was used to measure learning. The effects of GPA and cooperative-education work-term as covariates were examined. Student social-media use was measured to see if there was a relationship with level and
type of community participation. The sample, which was representative of the population, was primarily Caucasian male students.

No significant effect on perceived performance, perceived learning, or measured learning was found as a result of WIL community participation. Student negative attitude about the additional work to participate in the community, the difficulty using Blackboard®, and student perceptions of the usefulness of the community may have affected student participation and ultimately, student learning. A significant negative correlation was found between level of wiki use and student-perceived performance in leadership in the dataset with and without bloggers. The different personality of wiki users versus leaders may have contributed to this finding. A significant negative correlation was found between overall participation and student-perceived performance in leadership with the dataset excluding the bloggers. The bloggers perceived themselves high in leadership and they had the highest participation. By eliminating them from the dataset, it shifted a tendency towards a negative correlation into a statistically significant relationship. Experience with social media did not correlate to greater community participation with the bloggers, and had a negative correlation to the blog and overall participation. This is contradictory to the research (Taylor & Todd, 1995). However, those factors that may have affected participation in general may have also overshadowed any possible increase in participation due to prior experience. Although no significant effect on performance or learning was found, students noted that a benefit of the WIL community was the opportunity to read and comment on other students’ experiences.

An implication for instructional designers and distance educators is that Blackboard does not appear to be user friendly, and this difficulty in use could affect student adoption. Therefore, changes need to be made to make the “social media” functions of Blackboard® such as the blogs...
and discussion boards easier to use. Additionally, whether choosing Blackboard® or another platform, it is important to consider features such as tools and interfaces that either notify or easily indicate to a student that new content is available or that someone else is participating in a discussion in which they are participating or have an interest (Facebook® has many features such as this, for example). It may be important to recognize that even though Blackboard® may include social media features, student may not view it or use it as they would other social media. Lastly, any instructional technologies that are applied to experiential education should be piloted, with an emphasis on ease of use and perceived usefulness to the students.

This study also identified implications for cooperative education/experiential learning practitioners wishing to implement an online learning community component to their student experience. It is important that the experiential component is promoted to students as an academic experience, not just a way to earn money or take a break from classes. This helps frame the importance of any academic assignments that may be required of students. Students should be instructed from acceptance into an experiential education program that academic assignments are an important and required component to their experiential education. The value of these components must be clearly articulated to students.
References


### Appendix A

#### Control Group-Treatment Group Matched Pairs

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<th>ID</th>
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Appendix B

Student Project: Organizational Culture

1. Describe

Identify an official statement(s) relevant to Organizational Culture. This could be a mission statement, a business statement or design philosophy, a statement of corporate goals or objectives, value statement, etc. Please attach a copy of the official statement(s) to the Student Project.

In your own words, describe your organization’s culture based upon your attached statement(s).

2. Articulate

In the space below, cite example(s) of how day-to-day activities reflect the organization’s stated culture. Do your examples support the official statement or contradict it? You could base your analysis on your own observations, discussions with colleagues about their perceptions, daily memos and other correspondence, the interaction that takes place between colleagues as they perform their responsibilities.

3. Analyze

Based upon your understanding of the example(s), which you identified above, explain how the culture that you observed impacts, positively or negatively, the productivity of the organization.
Appendix C

Student Project: Ethics

Preparation

a. Identify

At the beginning of the quarter, identify a “Code of Ethics” that relates to your profession or academic discipline. It is preferred that you use a professional society’s Code of Ethics or Creed. Once you have identified a “Code of Ethics,” attach a copy to the Student Project.

b. Meet

At the beginning of the quarter, meet with your supervisor to discuss Professional Ethics. Show your supervisor this learning module and the “Code of Ethics” that you intend to use for the completion of the module. Have your supervisor confirm that the Code is appropriate for your profession.

c. Discuss/Select

Ask your supervisor to discuss potential ethical decision-making situations that an individual might encounter in your profession. In bullet format, please list at least two situations in the professional workplace where ethical decisions may need to be made. You will base this project on one of these situations.

1. Create

Create a hypothetical scenario based upon one of the situations identified on the previous page.

Don’t try to resolve your scenario at this time, simply tell the story.

What happened?

What is the ethical dilemma caused by the situation?

2. Resolve

How should an ethical professional in your career field resolve the dilemma using the Code of Ethics?

Describe the best course of action to resolve the dilemma.

Identify the potential positive and negative consequences of the course of action.
Appendix D

Student Project: Social Responsibility

1. Identify

Identify issues related to your co-op employer’s capacity to be a corporate citizen. Are there natural alliances that your employer can use to enhance its corporate citizenship? Are there barriers that would prevent your co-op employer from being a good corporate citizen?

2. Describe

In the space below, cite example(s) of activities of corporate citizenship that you have uncovered. You could base your analysis on your own observations, discussions with colleagues, or written communication.

3. Analyze

Considering the issues in your co-op employer’s ability to be a corporate citizen and the activities of corporate citizenship you have uncovered, analyze the impact of corporate citizenship

a) On your co-op employer
b) On society
Appendix E

Student Project: Theory and Practice

1. Theory (classroom to co-op)

   A. Identify and describe three specific examples to document classroom learning in your co-op assignments.

   B. Considering the examples above, how does knowledge gained in the classroom affect practice in your field?

2. Practice (co-op to classroom)

   A. Identify and describe three specific examples to document the use of co-op learning in the classroom.

   B. Considering the examples above, how does co-op learning affect your understanding of knowledge gained in the classroom?
Appendix F

Student Report Performance and Learning Assessment

PERFORMANCE SKILLS ASSESSMENT
The categories below reflect evaluation criteria on the “Employer Assessment Form.” We would like you to evaluate your performance using the same categories as the employer. Please include specific comments, examples and observations to support your ratings.

5 – Excellent  4 – Good  3 – Satisfactory  2 – Poor  1 – Unsatisfactory  N/A – Not Applicable or No Opportunity to Accomplish

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>SCALE</th>
<th>COMMENTS</th>
<th>EXAMPLES</th>
<th>OBSERVATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMMUNICATION</td>
<td>1 2 3 4 5 n/a</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CONCEPTUAL/ANALYTICAL ABILITY</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>LEARNING/THEORY &amp; PRACTICE</td>
<td></td>
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<tr>
<td>PROFESSIONAL QUALITIES</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>TEAMWORK</td>
<td></td>
<td></td>
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<tr>
<td>LEADERSHIP</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>TECHNOLOGY</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>WORK CULTURE</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ORGANIZATION/PLANNING</td>
<td></td>
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</tbody>
</table>

Learning Assessment:
Please assess the value of your learning from this co-op assignment:

<table>
<thead>
<tr>
<th>Significant Professional Growth</th>
<th>Steady Professional Growth</th>
<th>Growth in Some Important Areas</th>
<th>Modest Growth</th>
<th>Very Little Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

117
## Appendix G

### Definitions and Examples of Substantive Posting Based on Intentional and Incidental Discourse

<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Definition</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explicit Information</td>
<td>Providing new ideas or information, or sharing stories without expectation of reciprocity.</td>
<td>“XYZ Company challenged me to learn new software to help me design and test circuits. 123 Software is easy to use and is on the cutting edge. I recommend you get a trial version as it will make your analysis so much easier.”</td>
</tr>
<tr>
<td>Evaluation/Clarification/Elaboration</td>
<td>Judging, assessing, analyzing, or criticizing specific postings, and ideas, providing fresh explanations, extending the meaning of a particular posting, illustrating with examples</td>
<td>“I also worked in power systems and I agree with Joe’s description. But when I worked on the turbine overhaul, I had a far greater combination of mechanical and electrical work because we had to not only develop the control systems for the turbine, but also assess the heat generation.”</td>
</tr>
<tr>
<td>Inquiry</td>
<td>Requesting explanations, questions, asking for help, or expressing doubt about specific ideas and postings.</td>
<td>“Can you tell me more about RF engineering? I am not sure I understand the project you describe.”</td>
</tr>
<tr>
<td>Argumentation</td>
<td>Critically examining knowledge with respect to contrary evidence.</td>
<td>“I also work at XYZ Company and I have not had a similar experience. My supervisor was always available to answer questions and provide me with valuable work. The only time I was not busy was when I did not take the initiative to ask for more work, or let them know I would be done with my current project in time for them to get another project together.”</td>
</tr>
<tr>
<td>Uncertainty</td>
<td>Explicitly expressing doubt.</td>
<td>“I am not sure electrical engineering is for me. I am not enjoying the work I am doing on co-op and it is making me doubt my career choice.”</td>
</tr>
<tr>
<td>Suggestion</td>
<td>Offering alternatives, insights, new solutions and so forth.</td>
<td>“I suggest that you develop a list of talking points about things you hope to learn and use that when you meet with your supervisor, so you feel confident you do not forget anything.”</td>
</tr>
<tr>
<td>Shared Understanding</td>
<td>Building agreement/consensus between two or more participants about meaning of discourse</td>
<td>“Reading the postings about learning through work, I think we can agree that we have not developed significant skills through our EE courses to apply to work place and we are mostly learning on the job until we are into our junior years and the classes start applying directly to the type of work we are doing.”</td>
</tr>
<tr>
<td>Reflection</td>
<td>Considering experience, postings in previous discussions, or situating current discussions in previous events</td>
<td>“Looking back over my last two co-ops with ABC Company, I realize that consulting is a viable career for an electrical engineering student. I do not like micro-electronics, yet that is emphasized in class. I much prefer the opportunity to interact with customers, develop AutoCAD drawings, and bring a building to life at a system versus component level. I am going to pursue full-time opportunities in this field as a result of my experience.”</td>
</tr>
<tr>
<td>Sociability</td>
<td>Offering expressions of courtesy, hospitality, and acknowledgement</td>
<td>“I did not realize we are both at the same location, we should do lunch and discuss our experiences.”</td>
</tr>
</tbody>
</table>

Appendix H

Social Media Questionnaire

1. Do you use social media (e.g. Facebook, Twitter, LinkedIn, YouTube, Blogger, Wikipedia, etc.)?  Yes______  No ______

2. Overall, how often do you access social media:
   a. several times a day
   b. about once a day
   c. 3-5 days a week
   d. 1-2 days a week
   e. every few weeks
   f. or less often?

3. When you access social media, do you (select all that apply):
   a. Use an online social networking site such as MySpace or Facebook
   b. Share something online that you created yourself, such as your own artwork, photos, stories or videos
   c. Use a micro-blogging site such as Twitter
   d. Visit virtual worlds such as Gaia, Second Life or Habbo Hotel
<table>
<thead>
<tr>
<th>Score</th>
<th>Taxonomy</th>
<th>Organizational Culture</th>
<th>Ethics</th>
<th>Social Responsibility</th>
<th>Theory/Practice Integration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Remembering</td>
<td>The student stated the mission statement almost verbatim, not in their own words.</td>
<td>The student identified a code of ethics.</td>
<td>The student indicated a basic knowledge of corporate social responsibility.</td>
<td>The student indicated a basic knowledge of theory/practice integration (the co-op learning model).</td>
</tr>
<tr>
<td>2</td>
<td>Understanding</td>
<td>The student described the organization’s culture or the mission statement in their own words.</td>
<td>The student identified several potential ethical scenarios they could encounter in the workplace.</td>
<td>The student cited examples/activities of corporate social responsibility.</td>
<td>The student stated examples of co-op learning and classroom learning.</td>
</tr>
<tr>
<td>3</td>
<td>Applying</td>
<td>The student cited examples / activities that reflect the organization’s stated culture or mission.</td>
<td>The student more fully articulated one potential ethical scenario and the dilemma that occurs as a result.</td>
<td>The student described issues related to their employer’s corporate social responsibility, alliances organizations can use or barriers they must overcome.</td>
<td>The student indicated basic connections between classroom and co-op learning.</td>
</tr>
<tr>
<td>4</td>
<td>Analyzing</td>
<td>The student identified the impact of the observed activity on the productivity of the organization.</td>
<td>The student described the course of action to resolve the dilemma.</td>
<td>The student identified the impact of the observed activity on the organization or on society.</td>
<td>The student explained the connections between classroom and co-op learning and put the experiences into context.</td>
</tr>
<tr>
<td>5</td>
<td>Evaluating</td>
<td>The student explained the impact of the observed activity on the productivity of the organization and justified their explanation (with concrete examples or by indicating a discussion with colleagues).</td>
<td>The student justified their course of action and clearly linked it to a code of ethics.</td>
<td>The student explained the relationship between the observed activity and its impact on the organization or on society. The student justified their explanation (with concrete examples or by indicating a discussion with colleagues).</td>
<td>The student reflected on their experiences and assessed the integration of theory and practice.</td>
</tr>
<tr>
<td>6</td>
<td>Creating</td>
<td>The student suggested changes to the mission statement or the daily activities of the organization to allow employees to better support the mission statement.</td>
<td>N/A</td>
<td>The student suggested changes for the organization to improve their corporate social responsibility. The student offers suggestion for overcoming barriers or new alliances that can be formed.</td>
<td>The student suggested way to improve theory/practice integration.</td>
</tr>
</tbody>
</table>

(Pohl, 2000)
Appendix J

Additional Community Evaluation Questions

1. Likert scale question:
   a. Participating in the online community enhanced my learning experience:
      Strongly agree, agree, neither agree or disagree, disagree, strongly disagree.
   b. I enjoyed participating in the online learning community:
      Strongly agree, agree, neither agree or disagree, disagree, strongly disagree.

2. Open ended questions (text box provided):
   a. Strengths or the most beneficial or enjoyable aspects of the community
   b. Weakness or the least beneficial or enjoyable aspects of the community
   c. Recommendations or suggestions for changes to the online community or how it was run.