

AN ABSTRACT OF THE DISSERTATION OF

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Title: Costs, Benefits, and Participation in Online Knowledge Sharing in Communities of Practice for Faculty.

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Community college and university faculty members changing their practice of teaching have reported benefits to participating in peer support within communities of practice that offer an online knowledge sharing space. The ability of such online knowledge sharing to provide opportunities for collaborative knowledge building has made fostering a viable online knowledge sharing space within a community of practice a goal of instructional innovation projects. However, motivating members to participate in knowledge sharing and generating sufficient member commitment to sustain the online knowledge sharing has proven difficult to accomplish. This study therefore addressed the question “How do cost and benefit factors relate to participation in online knowledge sharing in communities of practice meant to support efforts to improve instruction?”

Kankanhalli, Tan, and Wei’s (2005) model of knowledge sharing as an individual cost and benefit analysis decision influenced by institutional context was applied to online knowledge sharing within communities of practice supporting faculty innovation. Online knowledge sharing was defined as members posting information to the online site for a community of practice. Registrants to the National Science Foundation’s Advanced Technological Program’s 2011 Principal Investigator’s Conference were invited by email to complete an online version of the original study’s survey modified for the new population. A total of 174 recipients (24.4% of the 712 invited) started and 153 (21.5%)

finished the survey. The hypotheses were assessed with Moderated Simultaneous Regression. Participation in online knowledge sharing was significantly increased among contributors who identified knowledge self-efficacy (adjusted Beta = .18, $p = .047$) and enjoyment in helping others (adjusted Beta = .24, $p = .011$) with participation. However, reciprocity and generalized trust did not moderate the influence of pro-sharing norms and participation effort on the respondent's participation. These findings suggest research is needed to identify other benefits to participation for the participants. Understanding what motivates participation may aid managers of communities of practice and projects supporting faculty innovation to improve participant support so as to more effectively increase and sustain participation.

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Costs, Benefits, and Participation in Online Knowledge Sharing in Communities of
Practice for Faculty

by
Jane Christina Ostrander

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I understand that my dissertation will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my dissertation to any reader upon request.

Jane Christina Ostrander, Author

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To my rock, my husband of 35 years, John Bolten Farrow, who kept my world in order and believed in me always, I owe you London for this one.

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Costs, Benefits, and Participation in Online Knowledge Sharing in Communities of Practice for Faculty

INTRODUCTION

The potential ability of online knowledge sharing to provide opportunities for collaborative knowledge building and dialogue independent of location and time has made fostering a viable online knowledge sharing space within a community of practice a goal of instructional innovation projects (Daniel, Schwier, & McCalla, 2003). However, motivating members to actively participate in knowledge sharing has proven difficult to initiate (Bock, Zmud, Kim, & Lee, 2005) and sustain (Farooq, Schank, Harris, Fusco, & Schlager, 2007). Research has shown that while designing, building, and managing a community based on research-based practices may improve online participation at that moment, it does not necessarily generate sufficient member commitment to sustain the online knowledge sharing (Barab, Kling, & Gray, 2004; Derry, Seymour, Steinkuehler, Lee, & Siegel, 2004). Yet member participation in knowledge sharing is needed for a community of practice to flourish.

A community of practice is a learning partnership among individuals willing to share their knowledge, learn from each other, and make sense of collective and individual challenges within a domain. The community builds and disseminates knowledge and values and develops norms and meanings through member interactions—online in a collaboration space on the World Wide Web (see Figure A1 in Appendix A) or face-to-face at formal or informal meetings (Wenger, Trayner, & de Laat, 2011). Furthermore, shared beliefs and a sense of belonging to such a community can support the achievement motivation needed by faculty to persevere in implementing innovations in instruction (Cox, 2004; Walton & Cohen, 2011). Research has developed numerous guidelines on the design and management of the online technology and community space (Farooq, Schank, Harris, Fusco, & Schlager, 2007; Sherer, Shea, & Kristensen, 2003), and flourishing communities of practice for educators with online knowledge sharing spaces do exist (e.g., Bio-Links, MERLOT). However, little has been written on how to improve participation in fledgling online knowledge sharing within communities of

practice for faculty. Similarly, member activities and requirements that increase participation in online community activities (e.g., blog comments, threaded discussions) (see Figure A2), are well researched by the computer mediated instruction community as applied to student-to-student and faculty-to-student knowledge sharing, (Derry, Seymour, Steinkuehler, Lee, & Siegel, 2004; Kimble, Hildreth, & Bourdon, 2008; Palloff & Pratt, 2007) but not for faculty-to-faculty or researcher-to-faculty knowledge sharing.

This research study applied Kankanhalli, Tan, and Wei's (2005) model of knowledge sharing as an individual cost and benefit analysis decision influenced by institutional context to online knowledge sharing within communities of practice supporting faculty innovation. The model was developed through a 2002 survey in Singapore of 400 knowledge management practitioners who had contributed to electronic knowledge repositories (EKR's) in the course of their work. Understanding what benefit factors motivated a member to actively participate in the electronic knowledge sharing in a community of practice and what perceived costs discouraged participation could help community managers design activities that promoted benefit factors and minimized cost factors. More participants might then perceive benefits outweighing the costs and decide to participate in knowledge sharing, thus contributing to a more self-sustaining knowledge sharing community (Bock & Kim, 2002; Kankanhalli, Tan, & Wei, 2005; Lin, Lee, & Wang, 2009; Wenger, McDermott, & Snyder, 2002).

That foundational study found that EKR usage significantly increased among contributors who identified knowledge self-efficacy and enjoyment in helping others with participation. In addition, generalized trust and reciprocity moderated the influence of codification effort and pro-sharing norms on the subject's EKR participation. Codification effort was defined as the effort of adding knowledge into the EKR. Reciprocity was the expectation that other members would in turn add their own knowledge to the EKR (Kankanhalli, Tan, & Wei, 2005). The current study asked if those results also held true for online knowledge sharing in communities of practice for innovative educators. In addition, although the original study only questioned community members who were known to have participated in the knowledge building activities of

the community, the present study included participating and non-participating members of knowledge-sharing communities with online knowledge sharing. Including both populations in the study was necessary to reveal the differences, if any, in their cost and benefit perceptions as related to participation.

Research Purpose and Question

An improved understanding of the benefit and cost factors that influence participation in online knowledge sharing could focus the efforts of communities to better support participation. With that aim in mind, this study examined the relationship between selected cost and benefit factors and faculty participation in online knowledge sharing in communities of practice supporting innovations in instruction. The research addressed the question: “How do cost and benefit factors relate to participation in online knowledge sharing in communities of practice meant to support efforts to improve instruction?”

Theoretical Model

The Kankanhalli, Tan, and Wei (2005) study found through moderated multiple regression analysis that respondents’ self-reported participation in their organization’s electronic knowledge sharing repository (EKR) was positively impacted (in order from high to low) by enjoyment in helping others, knowledge self-efficacy, organizational reward, codification effort moderated by generalized trust, and pro-sharing norms moderated by reciprocity. In addition, their control variables (age, gender, education, work experience, and community size) did not significantly increase the variance in the moderated multiple regression model incorporating all the constructs and the interaction terms. Standardized coefficients for the foundational study are incorporated into the discussion comparing results in the next chapter.

A modified version of that research model, summarized in Figure 1, guided the data collection and analysis of the current study. The model anticipated that participation would be positively related to knowledge-self-efficacy and enjoyment in helping others. While participation effort’s negative relationship with participation would be moderated

by generalized trust and pro-sharing norms' positive relationship with participation would be moderated by reciprocity.

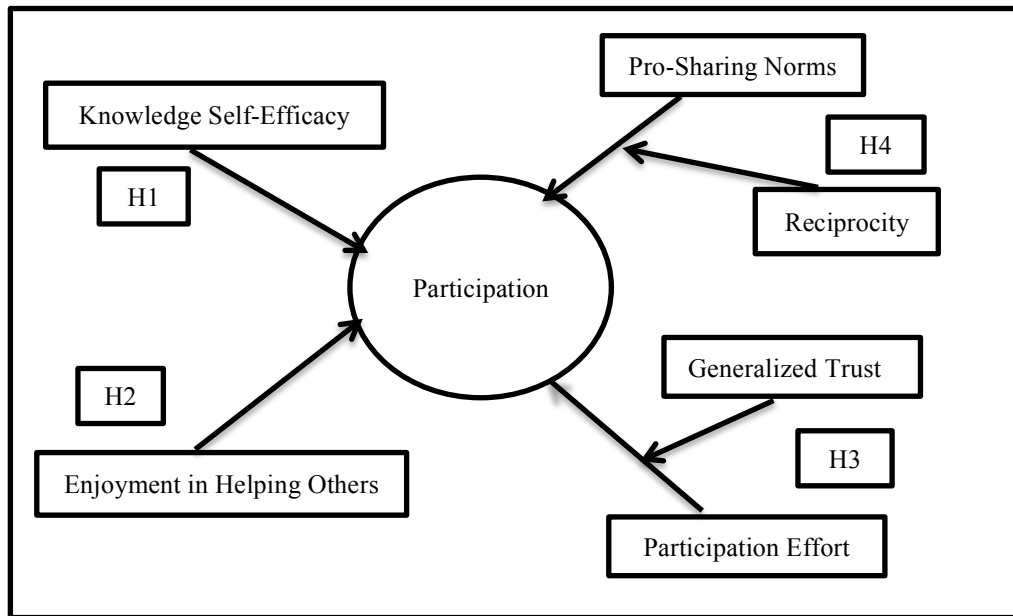


Figure 1. Research Model for Current Study

Adapted with permission from "Contributing knowledge to electronic knowledge repositories: An empirical investigation," by A. Kankanhalli, B. Tan, and K. Wei, 2005, *MIS Quarterly*, 29(1), p. 132. Copyright 2005 by Regents of the University of Minnesota..

Hypotheses

The selection of factors to be examined for their relationship to participation in online knowledge sharing in communities of practice was supported by the findings of a preliminary literature review focused on online knowledge sharing in communities of practice, cost and benefit factors, and participation in such communities (Bock, Zmud, Kim, & Lee, 2005; Kankanhalli, Tan, & Wei, 2005; Lim & Chan, 2003; Lin, 2007; Sahin, 2008). Since this literature is extensive and substantive, the factors considered are stated in the form of hypotheses to be tested. These hypotheses considered the inter-relationship of costs, benefits, and context on the decision to participate. The study examined the following hypotheses:

Null Hypothesis 1: Participation in online knowledge sharing is not related to knowledge self-efficacy. *Alternate Hypothesis 1: Participation in online knowledge sharing is positively related to knowledge self-efficacy.*

Self-efficacy is a belief in one's own capacity to succeed in an endeavor. Bandura (1977, 1993, 1997, 2002, 2011) argued that individuals with a high sense of efficacy would persist through difficulties, for they are able to visualize their own success and perceive setbacks as a challenge rather than a barrier. Knowledge self-efficacy reflects a belief that the knowledge to be shared is of value and the sharing of benefit to the community (Kankanhalli, Tan, & Wei, 2005; Wasko & Faraj, 2000). Thus the act of sharing useful expertise has been shown to increase the sharer's confidence in her/his ability to be of use to the community. This increased confidence increases self-efficacy that, in turn, increases participation in knowledge sharing (Kankanhalli et al., 2005) (see Figure 2). Participation and knowledge self-efficacy thus share a positive relationship.

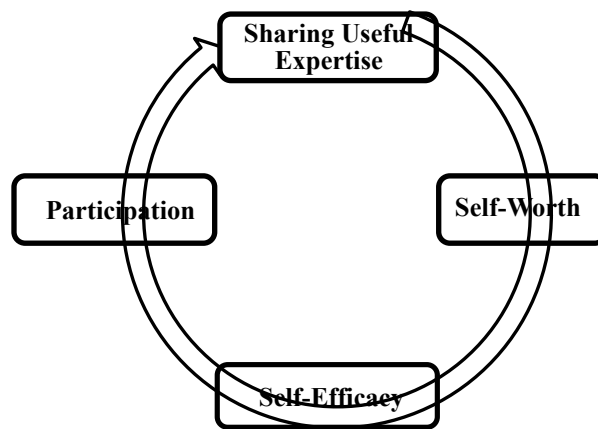


Figure 2. Cycle of Knowledge Self-Efficacy and Participation

Null Hypothesis 2: Participation in online knowledge sharing is not related to enjoyment in helping others. *Alternate Hypothesis 2: Participation in online knowledge sharing is positively related to enjoyment in helping others.*

Wenger (1998) argued that an economy of meaning—the process of negotiating ownership, inclusion, and the meaning of the knowledge library of the community—is an essential component of a knowledge sharing community. The currencies of this economy of meaning can include power, influence, reputation, and the satisfaction of helping others. McLure-Wasko and Faraj (2005) argued that sharing happens when an individual finds a personal reward in the sharing. Lin’s research (2007) also supported the premise that enjoyment in helping others can motivate knowledge sharing in individuals who find pleasure in knowing their actions have aided another. Therefore enjoyment in helping others and participation would be positively related.

Null Hypothesis 3: Participation in online knowledge sharing is not related to participation effort as moderated by generalized trust. *Alternate Hypothesis 3: Participation in online knowledge sharing is negatively related to participation effort as moderated by generalized trust.*

Generalized trust is a belief that the knowledge contributed to the organization will be put to good use (Kankanhalli, Tan, & Wei, 2005). Research has shown that instructors interested in using educational technology will have strong intentions to do so when they anticipate that an outcome of greater value will result from using it than not using it (Sahin, 2008). However, if generalized trust is low and the anticipation that knowledge will be put to good use by the community is consequently low, the cost of overcoming any technical challenges is seen as higher than the value in participation (Kankanhalli et al., 2005). “When the activities being advocated require the investment of time and resources, and failures can be costly, people seek verification from other sources before they act” (Bandura, 1986, p. 145). This study attempted to verify that relationship with respect to faculty participating in online knowledge sharing.

Null Hypothesis 4: Participation in online knowledge sharing is not related to pro-sharing norms as moderated by reciprocity. *Alternate Hypothesis 4: Participation*

in online knowledge sharing is positively related to pro-sharing norms as moderated by reciprocity.

Reciprocal relationships, cultural norms, and organizational climate have been shown to significantly influence attitudes towards knowledge sharing in organizations (Bock, Zmud, Kim, & Lee, 2005; Kankanhalli, Tan, & Wei, 2005; Lin, 2007; Noe & Wilk, 1993; Wasko & Faraj, 2000). Specifically, Kankanhalli and colleagues found reciprocity to be a factor in knowledge sharing when pro-sharing norms were weak, but not when pro-sharing norms were strong. This research study therefore assessed the relationship of reciprocity, pro-sharing norms, and knowledge sharing by faculty in the education work environment.

Significance of Research

The significance of this study is based on the following reasons:

1. Learning and improving a professional practice is a socio-cultural experience.
2. Online knowledge sharing in a community of practice is a socio-cultural experience and therefore a promising strategy to support the adoption of instructional innovation.
3. Participation is key to the sustainability of such communities.
4. Participation is a cost and benefit decision.
5. There is a lack of sound research that improves our understanding of the cost and benefit factors influencing the decision to participate in online knowledge sharing in communities of practice for faculty.

These statements are further discussed in the paragraphs below.

Learning and Improving a Professional Practice

Opportunities for faculty to build and share their knowledge, reflect on their shared practices, and explore new research (Cross, 1997; Kreber & Castleden, 2009) are integral to widespread adoption of instructional innovation. This experience of shared reflection and knowledge building is important, because learning how to redefine a

professional practice is a social endeavor shared by members of that professional practice (Chaiklin & Lave, 1996; Cross, Parker, Prusak, & Borgatti, 2001; Hutchins, 1995; Lave, 1996; Lave & Wenger, 1991). The adoption of innovation requires the members of a practice to collaborate so as to combine the old and the new ways of practice into new combinations (Brown & Duguid, 2002), thus changing the shared definition of expertise in that practice (Simon, 1991). Communicative learning involves working with fellow practitioners to build a mutual understanding of the shared practice (Kreber & Castleden, 2009). Mezirow (1991) suggested that transformative learning requires that the learner experience communicative forms of learning in order to move beyond instrumental learning and achieve the emancipatory learning that questions core beliefs. Thus learning that transforms the learner's conceptual structure needs to incorporate reflection on existing process and premises before change can occur (Kreber & Castleden, 2009; Mezirow, 1991; Thompson, Windschitl, & Braaten, 2013). Therefore, if an instructional innovation is to be deeply integrated into the practice of teaching, opportunities for reflective collaboration amongst the larger community intent on adapting and adopting the innovation are essential.

Online Knowledge Sharing as a Promising Strategy

Improvements in instruction often happen locally but fail to scale up to a wider, larger audience (Bandura, 1986; Coburn, 2003). Scaling up has been traditionally viewed as a process of pushing the innovation out from the original site to adopting sites. While the push model allowed for users to add local variations to some elements of the intervention, the overall theme is of the researcher being the expert providing instruction to the local practitioner (Baker, 2007; Schneider & McDonald, 2007). Success was often defined as increasing the number of sites that adopted the innovation as defined by the originators of the innovation (Godin, 2006). Over time the push model evolved to a more iterative push/pull process that conceptualized scaling up as a dialogue between researcher and practitioner. The iterative model for scaling up requires that: (a) project leaders and practitioners gain an understanding of the essential elements of the

innovation; (b) the project provide professional development opportunities for faculty interested in adopting instructional innovations; (c) ongoing dialogue between the project researchers and the faculty adopting the innovation is encouraged; and (d) a willingness on the part of the project's leaders and researchers to surrender ownership and control of the innovation to the practitioners exists (Coburn, 2003; Dede & Rockman, 2007).

A community of practice with an online knowledge sharing space for faculty focused on scaling up innovations in instruction would involve faculty in just such a knowledge building dialogue (Wenger, 1998). The distributed effort and shared responsibility for success could increase the faculty's ownership of the innovation as well as expand the resources available to the teaching community (Hoadley & Kilner, 2005; Lin, 2007; Wasko & Faraj, 2000; Wenger, 1998). Therefore the creation and support of a community of practice with online knowledge sharing is a potential strategy for effective faculty development (Hoadley & Kilner, 2005; Lin, 2007; Wasko & Faraj, 2000). A knowledge sharing community could provide a Web-based collaborative space to serve as a center for support and knowledge sharing anywhere, anytime (Farooq, Schank, Harris, Fusco, & Schlager, 2007; Wasko & Faraj, 2000; Wenger, 1998).

Faculty members of a community of practice with online knowledge sharing for instructional innovation can log into the community at their own convenience. They could then use the community's online tools to access existing knowledge, participate in online discussions, post questions to be answered by other members of the community, participate in knowledge building, and form personal and professional connections with faculty from any computer connected to the World Wide Web. Learning would be transacted in a real-world context with social relationships, critical discourse, and opportunities for apprenticeship. Membership would gain in value as individuals invested their time and professional identity in building the community (Wenger, 1998). The community could attract and inspire members willing to share their personal knowledge and participate in the building of the knowledge base from a distance. Such online knowledge sharing communities of practice are therefore a potential strategy to support faculty knowledge sharing independent of time or location.

Participation and Sustainability

To prosper, a community of practice needs to keep building and improving the shared body of knowledge that informs the practice. This requires members who are active participants in the generation, sharing, and practice of that communal knowledge (Brown & Duguid, 1991; Wasko & Faraj, 2000; Wenger, McDermott, & Snyder, 2002). However, fostering enthusiasm and commitment to a community across distances requires specialized knowledge and skills (Barab, MaKinster, & Scheckler, 2004). Despite a considerable financial investment by the National Science Foundation Advanced Technological Education program (NSF ATE) in instructional improvement projects, the project managers and researchers have struggled to foster such communities with limited success (A. Beheler, J. Johnson, & K. Morneau, personal communication, 2007; G. Salinger, personal communication, 2009, 2010, 2012). A deeper understanding of the factors influencing the decision to participate in online knowledge sharing in communities of practice could focus community-building efforts and provide a first step for research directed towards developing healthy and sustainable communities for faculty.

Participation as Cost and Benefit

A cost and benefit decision weighs the perceived potential cost of taking an action against the perceived potential benefit to be realized as a result of that action (Kankanhalli, Tan, & Wei, 2005; Lin, 2007; Tversky & Kahneman, 1974, 1981). Thus, from a cost and benefit perspective, a faculty member will participate in online knowledge sharing if the perceived benefit outweighs the expected cost (McLure-Wasko & Faraj, 2005; Tversky & Kahneman, 1974, 1981). Perceived costs considered in such decisions include the effort and knowledge required to successfully participate. Perceived benefits include increased knowledge self-efficacy, the enjoyment gained from helping others, and the promise of reciprocity (Kankanhalli et al., 2005).

Lack of Sound Research

The intention of this study is to add to the body of knowledge on participation in online knowledge sharing in communities of practice that support instructional innovation. Research on participation in knowledge-building communities in the business environment is abundant (Bock, Zmud, Kim, & Lee, 2005; Kankanhalli, Tan, & Wei, 2005; Lin, 2007; Taylor, 2006; Wasko & Faraj, 2000). Considerable case research exists on member experience and technical design issues in individual online professional communities focused on teaching (Bottoms, 2007; Schlager & Fusco, 2004; Sherer, Shea, & Kristensen, 2003). However, research correlating benefit factors with participation in online knowledge sharing in communities of practice in higher education in support of instructional improvement is lacking.

Summary of Focus and Significance

A community of practice builds and disseminates knowledge through member interactions. The potential ability of a community of practice to provide online opportunities for the collaborative knowledge sharing and dialogue needed to achieve successful scale up of innovations in instruction has made fostering a viable online collaborative space on the World Wide Web a goal of instructional innovation projects. However, increasing participation has been a challenge for advocates of online knowledge sharing. An improved understanding of the benefit and cost factors that influence faculty participation in online knowledge sharing could focus the efforts of such communities of practice to better support participation. With that aim in mind, the purpose of this study was to examine the relationship between selected cost and benefit factors and faculty participation in online knowledge sharing in communities of practice designed to support innovations in instruction. The research addressed the question: “How do cost and benefit factors relate to faculty participation in online knowledge sharing in a community of practice meant to support their efforts to improve instruction?” This research study applied Kankanhalli, Tan, and Wei’s (2005) model of knowledge sharing as an individual cost and benefit analysis decision influenced by institutional

context to online knowledge sharing within communities of practice for innovative instruction.

The significance of this study centers on the potential improvement in the quality of education made by online knowledge sharing in communities of practice for instructional innovation. Research is lacking on how to improve online knowledge sharing in fledgling communities of practice for instructional innovation and member activities and requirements that increase participation in online community activities supporting faculty-to-faculty or researcher-to-faculty knowledge sharing (Derry, Seymour, Steinkuehler, Lee, & Siegel, 2004; Kimble, Hildreth, & Bourdon, 2008; Palloff & Pratt, 2007). This research study applied Kankanhalli, Tan, and Wei's (2005) model of knowledge sharing as an individual cost and benefit analysis decision influenced by institutional context to online knowledge sharing within communities of practice for innovative instruction. The model correlates participation with members' self-reported perceptions of participation costs and benefits (see Figure 1). Furthermore, it accounts for the influence that context has on that participation. Given that the goal of this research study was to improve participation in online knowledge-sharing in communities of practice for faculty, and those communities fall under the jurisdiction of varied organizations and institutions, this study diverged from the foundational study and left the consideration of the influence of organizational rewards and identity on participation to future research.

Accordingly, the following null hypotheses and their alternates were tested:

Null Hypothesis 1 (H_{01}): Participation in online knowledge sharing is not related to knowledge self-efficacy. *Alternate Hypothesis 1 (H_{A1}): Participation in online knowledge sharing is positively related to knowledge self-efficacy.*

Null Hypothesis 2 (H_{02}): Participation in online knowledge sharing is not related to enjoyment in helping others. *Alternate Hypothesis 2 (H_{A2}): Participation in online knowledge sharing is positively related to enjoyment in helping others.*

Null Hypothesis 3 (H_{03}): Participation in online knowledge sharing is not related to participation effort as moderated by generalized trust. *Alternate*

Hypothesis 3 (H_{A3}): Participation in online knowledge sharing is negatively related to participation effort as moderated by generalized trust.

Null Hypothesis 4 (H_{04}): Participation in online knowledge sharing is not related to pro-sharing norms as moderated by reciprocity. *Alternate Hypothesis 4 (H_{A4}): Participation in online knowledge sharing is positively related to pro-sharing norms as moderated by reciprocity.*

The next section reviews the literature on knowledge building and online knowledge sharing in communities of practice. Benefit and cost factors associated with participation in such communities are also discussed.

REVIEW OF LITERATURE

The research study investigated the relationship between cost and benefit factors, context, and faculty participation in online knowledge sharing in communities of practice supporting instructional innovation in higher education. Online knowledge sharing communities are complex entities. They support a culture of learning and require members who are able to use the technology housing the community, hold a shared intention to build and learn a particular body of knowledge, and are willing to share and govern so as to sustain the community. This literature review explores related research from the perspective of online knowledge sharing in communities of practice dedicated to support faculty scaling up innovations in instruction in higher education.

Organization of the Review of Literature

This review of literature, as shown in Table 1, begins with an overview of how knowledge of a practice is built and shared. Next, the characteristics of a community of practice offering online knowledge sharing community are reviewed. Finally the costs and benefits of participation in online sharing are discussed.

Table 1

Organization of the Review of Literature

“How do cost and benefit factors relate to participation in online knowledge sharing in communities of practice meant to support efforts to improve instruction?”		
How is knowledge of a practice built and shared?	What is a community of practice with online knowledge sharing?	What are the costs and benefits associated with participation in online knowledge sharing?

Approach to the Review of Literature

The literature review was broad in scope until the essential themes for the study were identified. Suggestions for authors, theories, and specific work to investigate came from explorations of books on the online environment, knowledge sharing communities, and innovation. Conversations with experts in scaling up innovations (e.g., Dearing,

Dede), online environments (e.g., Hamel, Schank), and knowledge sharing communities (e.g., Fusco, Schank) provided key authors and sources. Following the trail through reference lists in articles and books as well as the “Sources that Cite This Article” and “Similar Articles” features in the online databases proved more fruitful than keyword searches because: (a) the literature on knowledge building, communities of practice, cost benefit analysis, and decision theory cross multiple domains and fields of research served by different databases; (b) the terms learning communities, knowledge building communities, communities of practice, and online communities are often used interchangeably; and (c) the list of possible articles to sort through was large due to the extensive literature on those general topics.

Databases queried through the Oregon State University Library’s online search features included ACM Digital Library, Academic Search Premier, Education Research Complete, ERIC, Professional Development Collection, and Psychology and Behavioral Sciences Collection. The library’s database of dissertations, the online SpringLink’s database, and the SAGE online journals were also queried. Keywords included community of practice, online, faculty, community, professional development, knowledge theory, scaling, knowledge sharing, innovation, diffusion, instructional reform, decision frame, cost benefit analysis, and utility theory.

International studies were included to reflect the global nature of an online community and expand the research perspective beyond the researcher’s Euro-American worldview. Research on technical and user interface design articles were not included, since this research study is focused on the decision process and participation rather than the technical environment of online knowledge sharing communities. Literature on the online environment was predominantly restricted to post 1999 in consideration of the changing nature of technology. A few key sources from the early years of the World Wide Web were consulted to introduce the initial vision of online community that continues to influence the metaphors of computer interface. The results of the search are discussed in the next sections.

How is Knowledge of a Practice Built and Shared?

Human cognition is a social and cultural process that builds knowledge of a practice in the context of that practice (Billett, 2001; Hutchins, 1995). The practitioners use the tools and cultural forms of the practice's past to shape a collective future (Levine, Resnick, & Higgins, 1993). Practice and knowledge are interconnected—out of practice comes knowledge which, in turn, improves the practice, adding to the body of knowledge shared by the practitioners. The learning and changing of a practice is thus about practitioners interacting with the new knowledge and bringing that newly acquired knowledge into their personal world definition through negotiations of meaning and values (Reeves & Forde, 2004; Wenger, 1998) in conversations with experts (Brown & Duguid, 1991; Chaiklin & Lave, 1996; Cross, Parker, Prusak, & Borgatti, 2001; Hutchins, 1995; Lave, 1996). Communities of practice are one framework for building and sharing knowledge between practitioners who have expertise and those striving to acquire competency (Hutchins, 1995; Lave, 1996; Lave & Wenger, 1991). This section discusses the roles such communities, particularly communities offering online knowledge sharing, can play in supporting the scale up of instructional innovation.

What Role Does Knowledge Sharing Play in Learning?

The scale up of instructional innovation begins with faculty learning new ways of teaching. Mezirow (1991, 2000) characterized learning as having three forms: (a) instrumental learning, (b) communicative learning, and (c) emancipatory learning. In instrumental learning, hypotheses are proposed and tested to validate knowledge claims with the goal of understanding current assumptions. Communicative learning requires developing a shared understanding of what constitutes knowledge through engagement in a community dialogue. Emancipatory learning involves critical reflection that questions the core beliefs around the knowledge and practice shared by the community. Such reflection can transform the learning, learner, and knowledge (Kreber & Castleden, 2009; Mezirow, 2000). Thus, opportunities for reflection and knowledge sharing are needed to

fuel the learning and resulting transformation within the practice shared by the community.

Reeves and Forde (2004), reflecting on their earlier study of the impact on the practice of aspiring head teachers from participation in the Scottish Qualification for Headship program, theorized that changing practice requires not just learning and reflection but a shared aspiration for an envisioned future that would follow the change in practice. They argued that changing professional practice requires negotiating a merging of work, learner, and changing identities of self within the individual's personal, institutional, and innovation spaces. This change comes about through internal and external dialogue that supports exploration and development of a shared language around the new or changing practice.

Similarly, research in knowledge management within organizations has shown that those who hold knowledge must first be willing and able to share that knowledge with others and contribute their expertise in a useable form to a communal knowledge repository (Brown & Duguid, 1991, 2002; Kankanhalli, Tan, & Wei, 2005). Those seeking the knowledge must have access to and a willingness to invest resources (e.g., time, effort, power) in retrieving the target knowledge (Brown & Duguid, 1991). Therefore, the goal of a knowledge sharing community is to develop a system for sharing and organizing pieces of knowledge about an organization or practice's work so that the knowledge repository will be populated with knowledge from the practitioners which is then successfully shared within the community of practice (Kankanhalli et al., 2005).

How Is Teaching a Practice?

A practice is the application of knowledge in pursuit of a collectively defined and shared accomplishment in a context (Hutchins, 1995; Wenger, 1998). A chef applies recipes and skills learned through a combination of training and on-the-job experience to deliver gourmet meals to clients. A navigator charts safe passage across novel territory using knowledge gained in formal training, information learned from interaction with other navigators, and lessons learned from personal experience (Hutchins, 1995).

Similarly, a network security instructor shares knowledge gained from books, professional experience, and personal knowing with her students. Expertise thus comes out of the intersection of the individual and the domain's knowing in practice—a blending of the domain-wide expertise, the individual's personal perspective on expertise, and the local practice within the domain (Billett, 2001, Hutchins, 1995).

Teaching is such a knowing situated in practice developed through interaction between the practitioner, the surrounding culture, and the activity (Orlikowski, 2002). Therefore, learning opportunities to improve the quality of teaching and learning need to:

- Build on the participants' existing knowledge
- Include participants in the development of instructional innovations, and
- Reinforce the learning with ongoing support (Knowles, Holton, & Swanson, 2005) and educational leadership (Reeves & Forde, 2004).

What Challenges Do Innovative Faculty Face?

Zimmerman (2006), in her exploration of the organizational change and leadership literature, focused on resistance to educational reform. She identified seven faculty attitudinal barriers to change in the practice of education: (a) failure to recognize the need for change; (b) habit; (c) previous failure of reform efforts; (d) fear of the unknown; (e) fear of loss of what they have; (f) perceived threats to their expertise, power relationships, social relationships, or resource allocations; and (g) fear of assuming a new self-identity.

Additional barriers to instructional change include the lack of a shared understanding by the educators of the terminology around curriculum (Fraser & Bosanquet, 2006), faculty inexperience in reflecting on their own teaching practice, inadequate resources to support the curriculum and professional development needed to adapt and adopt the reform (Gold, 2002), a failure to acknowledge the emotionality of teaching and learning and the importance of workplace culture and conditions as “integral threads in the larger web” (DiPardo & Potter, 2003, p. 338), and student resistance to unfamiliar learning experiences (Savin-Baden, 2003; Yarnall, Toyama, Gong, Ayers, &

Ostrander, 2007). A culture of change that addresses these fears, positively influences self-efficacy for participants, and improves their willingness to risk change can be created through professional development experiences based on peer collaboration (Zimmerman, 2006).

What Faculty Development Experiences Support Instructional Innovation?

In a study of 15 successful education reform movements, Rand Corporation researchers found that effective scale-up projects supported widespread implementation, deep changes in classroom practices, sustainability, and a sense of ownership among practitioners (Glennan, Bodilly, Galegher, & Kerr, 2004). Successful projects' professional development opportunities were found to be iterative, interactive, adaptive, collaborative, locally situated, and nonlinear. Leaders of successful projects worked to change the system to support good teaching practices and good teachers rather than imposing a set of practices on instructors.

An exemplary professional development program therefore:

- Actively involves instructors in the learning.
- Provides opportunities for faculty to teach each other what they know.
- Includes opportunities for faculty to become learners as well as teachers.
- Builds community and collaboration.
- Supports the conditions for faculty to become leaders of other instructors.
- Accommodates differences in length of experience.
- Enriches professional development by including the study and critique of research and other literature.
- Ensures that professional development is long-term, rather than sporadic and short-term (McDonald, Buchanan, & Sterling, 2004; National Writing Project, 2008).

Similarly, Coburn's (2003) and Dede and Rockman's (2007) investigations of the successful scaling up of instructional improvements found that the successful projects supported an interactive dissemination cycle, wherein the original developers supported

faculty as they adopted the innovation through a cycle of training, dialogue, revision, and adaptations to their instructional practices. The ongoing communication between the innovation's authors and the adopters as equal participants in the process of innovation was essential to successful scaling up of the innovation.

Summary

Teaching is a professional practice learned through an iterative socio-cultural process of learning, doing, reflecting, and revising (Knowles, Holton, & Swanson, 2005; Mezirow, 1991; Orlikowski, 2002). Faculty development supporting instructional innovation requires the new knowledge be situated in the practice of teaching so innovations may be folded into the existing organizational values and views shared by the faculty community (Brown & Duguid, 1991, 2002), an emotionally supportive climate of mutual trust and learning is established (DiPardo & Potter, 2003; Zimmerman, 2006), a shared vision of the future and a language of the practice are negotiated by participants in the innovation (Reeves & Forde, 2004), and the innovation is introduced through learning experiences designed to support a sense of ownership amongst participants (Glennan, Bodilly, Galegher, & Kerr, 2004). Knowledge sharing communities of practice can provide the needed socio-cultural support as well as the resources to build a shared body of knowledge (Bottoms, 2007; Brown & Duguid, 1991; Cho, 2002; Glennan et al., 2004; Lave & Wenger, 1991; Wenger, McDermott, & Snyder, 2002).

The next section characterizes knowledge sharing communities and communities of practice. It includes an explanation of the importance of participation and this study's use of the term community of practice.

What is a Community of Practice?

Communities of practice build a shared understanding of the practice that is the central focus of the community—what it is, how to do it, and how it relates to practices of other communities (Brown & Duguid, 2002; Wenger, 1998). The purpose of this section is to discuss the characteristics of such a community.

What Are the Characteristics of a Community of Practice?

The tradition of learning situated within a craft formed the foundation for Lave and Wenger's (1991) theory of situated learning as a generative social practice that occurs in communities of practice. A community of practice is defined as "people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis" (Wenger, McDermott, & Snyder, 2002, p. 4). It is a focused group of individuals working together to build knowledge and expertise in their practice and who share that knowledge with novice practitioners. The framework, culture, and rules of the community of practice evolve from and are sustained by the intentions and collaborative work of the community. Therefore, although such a community can be initiated and funded by a sponsoring organization, to be sustainable it must grow from within the community through the activities and effort of its members (Lave & Wenger, 1991; Wenger et al., 2002).

A community providing mutual support and knowledge building for faculty seeking to adopt an innovative instructional practice becomes a community of practice when the participants assume responsibility for the management and continued existence of the community. This requires sufficient participation to provide the knowledge and work needed to build and sustain a community. This study's intention was to add to the knowledge about participation available to managers of communities of practice supporting innovative instruction. Specifically, the study examined faculty members' perceptions of the presence or absence of certain cost and benefit factors in their community of practice's online knowledge sharing.

What Does Online Knowledge Sharing Look Like?

A community of practice with online knowledge provides a dedicated space on the World Wide Web where files can be uploaded and shared; conversations conducted through online threaded discussions; announcements, standards of practice, and research posted; suggestions for improvements shared; and connections made between members regardless of their actual physical location (Dede, Ketelhut, Whitehouse, Breit, &

McCloskey, 2009; Farooq, Schank, Harris, Fusco, & Schlager, 2007). Such communities provide tools and pathways for members to discuss and evaluate new ideas and space for novice/expert interaction that is visible and therefore part of the shared knowledge (See Appendix A, Figures A1 & A2) The tools and space serve the collective creation of knowledge around a practice (Farooq et al., 2007). Online knowledge sharing in a community of practice thus provides individuals with the opportunity to join in knowledge sharing communities external to their local environment (Bell, 2006).

An individual with access to the World Wide Web can belong to multiple communities and can participate in multiple practices, both on and off line. This moving in and out of communities potentially strengthens the individual's competencies in multiple domains. Communities with online knowledge sharing provide access to activities and knowledge that meet the needs of individuals at a particular moment in their lives without requiring the usual long-term commitment demanded by a physical community (Bell, 2006). This ingress and egress of members, in turn, strengthens the community, building connections between members as knowledge of the practice is passed from old-timers to novices and new ideas are incorporated into the practice of the community. Eventually the novices move into increasing levels of responsibility and involvement in the community and the influence of the old-timers decreases (Lave & Wenger, 1991; Wenger, McDermott, & Snyder, 2002).

In addition, online collaboration has been found to be more productive than face-to-face collaboration among problem-solving teams (Kerr & Murthy, 2004). Graduate student problem-solving teams working in a computer mediated learning environment supported by online collaboration support tools (e.g., chat, online threaded discussions) produced a larger number (9.7 versus 7.2) of effective solutions than the same teams working face-to-face. The percentage of quality solutions was greater in the face-to-face collaboration, but given that the number of solutions proposed was greater in the online collaboration, the total number of quality solutions was also greater. Interestingly, the participants in the study were generally less satisfied with their online

than their face-to-face experience. This failure to recognize success in online activities is a topic for future research.

Summary

In a community of practice a group of professionals work together to build an understanding of what a practice is and how that practice is accomplished (Brown & Duguid, 1991, 2002; Lave & Wenger, 1991; Wenger, McDermott, & Snyder, 2002). Furthermore, a community of practice with a web-based space for collaboration expands potential collaboration and increases learning opportunities available to faculty (Bell, 2006; Kerr & Murthy, 2004). A goal of the study was to better understand how to support collaboration and learning opportunities for faculty implementing innovations in instruction. An online knowledge sharing community could provide such support. The study consequently focused on participation in communities of practice with online knowledge sharing. The next section discusses the costs and benefit factors associated with participation in such a community.

What Are the Costs and Benefits for Participating in Online Knowledge Sharing?

A community of practice gathers to share information and to build and pass on a body of knowledge about their practice. This self-management and motivation is what makes a knowledge sharing community so attractive as a tool for self-sustained innovation and improvement of a professional practice (Farooq, Schank, Harris, Fusco, & Schlager, 2007). Theoretically, a knowledge sharing community will continue to exist beyond the lifespan of the research project, becoming self-sustaining once the cycle of participation and knowledge building is established. Therefore the dissemination of the innovation supported by the community can potentially continue after the funding ends. However, sustaining such participation in communities and innovation movements has been a challenge (Farooq et al., 2007; Scheirer & Dearing, 2011).

For a community to grow and prosper, member participation must be persistent and enduring (Wenger, McDermott, & Snyder, 2002). As members learn the culture of the community and acquire expertise in the shared knowledge, they move from what

Lave and Wenger (1991) term legitimate peripheral participation to full participation. Legitimate peripheral participation is the state when newcomers are allowed limited access to the members, knowledge, and tools of the community. As their competency in the practice increases, their level of participation deepens, and they progress from novice to expert. Meanwhile, the knowledge the newcomers bring with them and the new knowledge built through interaction with the community's collective knowledge is added to the knowledge base of the community. Thus innovations are introduced and the community's knowledge expands through the interaction of novice and experienced members within the context of the shared practice. As the incoming participants bring new knowledge to the existing knowledge base, they gain power within the community, and the central participants move outward to the periphery of the community.

Over time this movement in participation between the periphery and center of the community becomes embedded in the culture of the community. The body of community knowledge itself is transformed as the responsibility for knowledge building passes between generations of participants (Lave, 1996; Lave & Wenger, 1991; Osterlund & Carlile, 2005; Wenger, 1998). This shifting spiral of knowledge and power within the community reflects the propensity of those invested in strong existing ties in an organization to resist investing resources in creating new ties, thus limiting their exposure to new ideas. Peripheral participants have less invested in the existing status and are therefore more likely to create new ties and welcome new ideas (Cho, 2002; Granovetter, 1973). The resistance of the central knowledge holders to change can on occasion serve as a needed filter, protecting the community's knowledge from flawed new ideas. The challenge for community builders is to temper the resistance of the old members with a willingness to welcome the participation of the new.

In addition, in traditional communities of practice, members are visible to each other even when taking the time to listen and getting to know the other members. In contrast, in an online community space, members are invisible when taking time to get to know others. Only when they participate actively in the knowledge sharing by posting a discussion thread or replying to someone else's posting do they become visible to the

community (Markham, 1998). In online knowledge sharing a community's knowledge is thus shared voluntarily in the face of uncertain reciprocity among members who often do not know each other.

Furthermore, online knowledge sharing offers the advantage of any place any time access but demands that participants tangle with technology to have that access. Participation in an online environment requires knowing enough about the rules of the community and the technology to interact with and navigate through the community space so as to be able to post a reply, create a blog, or start a new discussion and become visible to the other members (Barab, MaKinster, Scheckler, 2004; Dyson, 1997; Markham, 1998; Rheingold, 1993). Lurkers can access the knowledge shared by others but do not contribute to the building of that knowledge themselves. It can be easier for potential participants to log off without posting than to struggle to gain expertise in the technology with the hope of some eventual payoff (Barab, MaKinster, & Scheckler, 2004). They log into the community but do not post and so remain invisible to the other members. Nonetheless, online knowledge sharing spaces do provide the possibility of access to knowledge that persists independent of the physical presence of any community members (Bell, 2006). A major challenge in fostering online knowledge sharing is supporting community leaders in their efforts to support members to become participants in building and maintaining this body of knowledge across time and distances. This research study addressed this challenge, focusing on the benefits and costs members associate with participation in their community.

How Is a Decision to Participate Influenced by Context?

The influence of context on the motivation factors in cost/benefit analysis form the basis of Tversky and Kahneman's (1981) decision frame theory. They argued that a decision frame surrounds and influences each decision problem. The decision maker's norms, habits, and personal characteristics combine with the outcome to frame the decision and create the decision frame. The options or actions available, the possible consequences of these actions, and the probabilities that relate outcomes to actions define

the decision problem. This decision frame model is in contrast to the traditional utility model explanation of decision-making. In the utility model, a decision maker assigns values to outcomes and makes a decision to act if the probable benefits resulting from the action are of greater value than probable costs to the decision (Tversky & Kahneman, 1981). The options or actions available, the possible consequences of these act, and the probabilities that relate outcomes to acts make up the decision problem (Cronbach & Gleser, 1965). The surrounding context is not considered relevant to the decision process.

The decision frame model reflects a constructivist approach to identity and social practice as a negotiated truth (Holland, Lachicotte, Skinner, & Cain, 1998), and is supported by recent empirical research in social psychology and cognitive science on the contextualized nature of decision making, identity-building, and learning as social-cultural processes (Cohen & Garcia, 2008; Walton & Cohen, 2011; Yeager & Walton, 2011). Yeager and Walton (2011), in their review of social-psychological interventions designed to impact students' attitudes towards school, argued that the seemingly minor interventions had large, lasting impacts on students because they rearranged students' perceptions of the balance of the forces that promoted or restrained their success. Similarly, Bandura (1977) argued that an individual chooses behavior based on an expectation of consequences developed through observation of the reward/punishment patterns in the context of personal experiences—not the immediate consequence but the pattern of consequences triggered by the behavior.

The empirical findings of researchers investigating employee participation in knowledge building within the corporate environment also supported the decision frame model (Bock & Kim, 2002; Bock, Zmud, Kim, & Lee, 2005; Kankanhalli, Tan, & Wei, 2005). In the foundational study for the present research, Kankanhalli, Tan, and Wei (2005) surveyed 400 knowledge management practitioners in Singapore and found that an environment of collaboration and cooperation encouraged knowledge sharing in the absence of reciprocity. However reciprocity needed to be present for knowledge sharing to occur in the absence of pro-sharing norms. This study built on the earlier exploratory work of Bock and Kim (2002) on the relationship between an individual's salient beliefs

(e.g. expected rewards, expected associations, and expected contribution) for knowledge sharing attitude and their knowledge sharing behavior.

A 36 item survey developed from prior studies and theories was first pretested by Bock and Kim (2002) for discriminant validity and internal consistency during a pilot test. After two questions were eliminated due to a low level of internal consistency, the survey was distributed to 900 employees of the four largest public organizations in Korea. The organizations produce and distribute natural gas, provide district heating, operate the subway, and provide banking service as well as process and distribute the farm products. The 467 respondents worked in 75 department, were predominantly male (413), university graduates (326), held the position of chief (222), and had 0-6 years with the company (279). The results were evaluated for construct validity through item analysis and factor analysis with varimax rotation. The item-to-total correlation was calculated to evaluate convergent validity, resulting in three additional items being dropped. Factor analysis confirmed the discriminant validity of the remaining survey.

The data analysis revealed that an individual's intention to share knowledge was highly correlated with that individual's actual knowledge sharing behavior, as was the individual's expectation that knowledge sharing will lead to improved relationships with other employees. The positive attitudes towards knowledge sharing formed from the employees' beliefs in their individual ability to contribute to the improvement of organizational performance and by their expectations of reciprocal knowledge sharing.

Similarly, Bock, Zmud, Kim, and Lee (2005) found that among the 154 managers from 27 Korean organizations that they surveyed, intentions to share were affected by attitudes toward sharing and organizational norms. Attitudes towards sharing were impacted by anticipated reciprocal relationships, and organizational norms were influenced by a sense of self-worth and organizational climate. In contrast, anticipated extrinsic rewards exerted a negative influence on knowledge-sharing attitudes of individuals. The survey used in data collection was developed from a literature review and interviews of the chief knowledge officer or chief information officer at five Korean organizations. The interviews were intended to deepen the researchers' understandings of

the factors that shape an individual's intention to share knowledge. The motivational forces found through thematic analysis of the interview scripts and notes included (a) the existence of incentives for knowledge sharing; (b) the relationship of the knowledge recipient with the knowledge sharer; (c) feedback on shared knowledge; (d) commitment to knowledge-management by corporate management; and (e) an institutional climate of fairness, innovativeness, and affiliation. The research team grouped the interview themes and the findings from the literature review into three categories of motivational drivers that influence an individual's willingness to share knowledge: (a) economic (anticipated extrinsic rewards), (b) social-psychological (anticipated reciprocal relationships and sense of self-worth), and (c) sociological (fairness, innovativeness, and affiliation) (Bock, Zmud, Kim, & Lee, 2005). A research model, hypotheses, and survey were developed from these categories, relevant theories, and prior studies. The items were further refined after a pre-test with 61 respondents from 13 organizations in Korea. Then internal consistency and discriminant validity of the survey were tested, and two items were eliminated. Ten copies of the self-administered questionnaire were sent to each of 30 organizations selected from 300 organizations participating in the Chief Knowledge Officer Training Program at the university employing one of the authors of the study. Incomplete data disqualified 105 of the 259 responses. The remaining 154 responses from 27 organizations across 16 industries were analyzed using PLS-Graph Version 3.00 in a two-stage analytical procedure.

The measurement model was first assessed with confirmatory factor analysis and then the structural relationships were examined. Content validity was confirmed by interviewing senior practitioners and conducting a pilot test. Convergent validity was confirmed by examining composite reliability, calculating the average variance extracted from the measures, and comparing the results to established standards of acceptability and significance. Correlations between constructs were examined to confirm discriminant validity and the hypotheses were tested with partial least squares (PLS) analysis.

Based on the findings from the data analysis, the authors recommended that knowledge-management leaders foster a corporate climate that supports mutual social

relationships, provides appropriate feedback in support of knowledge sharing, and does not incorporate extrinsic rewards as a motivator to knowledge sharing. The current study further investigates the influence of social-cultural norms on knowledge sharing in a professional organization.

What Roles Do Trust and Enjoyment Play in Knowledge Sharing?

Wasko and Faraj (2000) argued that when knowledge is viewed as an intangible resource built for the public good, not for private good, individuals will share their knowledge as a pro-social behavior in expectation of generalized reciprocity. The study first identified members who had participated in the knowledge building by posting messages to online bulletin boards of three online communities developing programming knowledge in rapidly changing fields. Participants were invited in an emailed survey to respond to open-ended questions about their reasons for participating in the knowledge sharing community. Members reported participating because it was fun, challenging, interesting, the right thing to do, and a good way to improve the community.

In their later mixed methods study of an online knowledge sharing community of a professional association, McLure-Wasko and Faraj (2005) argued that knowledge exchange happens, because individuals are willing to share knowledge with others within their community—they find a personal reward in the sharing. Reward may be found in the intellectual pursuit of solving the challenge posed by other members' questions or in contributing something of use to others (McLure-Wasko & Faraj, 2005; Wasko & Faraj, 2000). Data collected for the 2005 study included a survey of participants in the online discussions, social network analysis, text analysis of message postings, and demographic data mined from the association's website. Data were analyzed for helpfulness and volume of knowledge contributions, individual motivations, and social capital. Enjoyment in helping others was found to relate to sharing of useful knowledge, though not as strongly as the perception that participation will enhance one's professional reputation. McLure-Wasko and Faraj (2005) suggested that the fact that the member's name is identified in each post might discourage some participants from posting in a

community with high professional visibility. Researching the value placed on professional reputation within a professional knowledge sharing community for faculty is a potential topic for future research.

For those members who do choose to post, computer-mediated communication engenders a strong need for a swift response—an acknowledgement that the poster is indeed visible. A response to a posting is seen as an endorsement from another person that the initial message is worth taking the risk of joining in the knowledge sharing. Virtual teams that create an initial focus on communication around the task and support social interaction that does not interfere with that focus swiftly build the trust needed to efficiently complete their work (Jarvenpaa & Leidner, 1998). Building an online knowledge sharing community thus requires acknowledgement of the effort involved while fostering a culture of response and respect.

Lin (2007) built on McLure-Wasko and Faraj's work and surveyed 172 employees from 50 randomly selected large organizations in Taiwan about why they shared knowledge. Reciprocal benefits, knowledge self-efficacy, and enjoyment in helping others were associated with employee sharing attitudes and intentions. Lin's findings therefore also supported the premise that enjoyment in helping others can motivate knowledge sharing in individuals who find pleasure in knowing their actions have aided another. To better understand the relative importance individuals placed on the individual factors, Lin, Lee, and Wang (2009) conducted a literature review that identified 16 factors that influenced knowledge sharing. They then asked employees of 50 organizations in Taiwan to complete a questionnaire and indicate to what extent the 16 factors influenced their decision to share knowledge. The researchers created a hierarchy of four factors (see Table 2). They then applied a fuzzy analytic hierarchy process evaluation model to determine the relative importance of the factors to decision makers based on rankings of the factors by respondents from within the shipping industry in Taiwan. They found that the four dimensions of factors affecting knowledge sharing and the leading attributes within each dimension were ranked in importance as:

1. Corporate culture (interpersonal trust)

2. Employee motivations (knowledge self-efficacy)
3. Leadership (open leadership climate)
4. Information technology (knowledge networks)

Table 2

Hierarchy of Factors Influencing Knowledge Sharing

Level 1: Goal	Level 2: Dimensions	Level 3: Attributes
Factors Influencing knowledge sharing	Corporate culture	Social networks
		Interpersonal trust
		Sharing culture
		Learning orientation
		Organizational rewards
	Employee motivations	Reciprocal benefits
		Knowledge self-efficacy
		Enjoyment in helping others
		Reputation
	Leadership	Vision and goals
		Top management support
		Top management encouragement
		Open leadership climate
	Information technology	Technology infrastructure
		Database utilization
		Knowledge networks

Note. Adapted from Lin, H.-F., Lee, H.-S., Wang, D.W. (2009). Evaluation of factors that influence knowledge sharing based on a fuzzy AHP approach. *Journal of Information Science* 35(1), p 32. Copyright 2009 by Chartered Institute of Library and Information Professionals (CILIP). Reprinted with permission.

The results further supported the Kankanhalli, Tan, and Wei (2005) finding that context, culture, and trust impact knowledge sharing. Table 3 summarizes the three dimensions of motivations found in the literature in support of this study's research model.

Table 3

Key Dimensions Found in the Literature to Influence Knowledge Sharing

Dimension	Supporting Citations
Organizational norms (context and tools)	The context influences cost/benefit decisions (Tversky & Kahneman, 1981) The expectations of consequences based on the pattern of reward/punishment within the context influences the decision (Bandura, 1977). Organizational norms influenced by organizational climate support knowledge sharing (Bock, Zmud, Kim, & Lee, 2005). If context includes collaboration and cooperation then reciprocity is not needed (Kankanhalli, Tan, & Wei, 2005). Open leadership climate is the most impactful attitude within leadership ranks, the third of four dimensions impacting knowledge sharing (Lin, Lee, & Wang, 2009). Knowledge networks is the most impactful item within information technology, the fourth dimension impacting knowledge sharing (Lin, Lee, & Wang, 2009).
Interpersonal norms (reciprocity and trust)	Reciprocity is needed if context is not supportive of knowledge sharing (Kankanhalli, Tan, & Wei, 2005). Anticipated reciprocity impacts attitudes towards sharing (Bock, Zmud, Kim, & Lee, 2005). Knowledge considered to be for the public good with a cultural expectation of generalized reciprocity is shared (Wasko & Faraj, 2000). Swift response encourages sharing (Jarvenpaa & Leidner, 1998). Reciprocal benefits encourage knowledge sharing (Lin, 2007). Interpersonal trust is the most important attitude influencing knowledge sharing (Lin, Lee, & Wang, 2009).
Personal norms (beliefs and attitudes)	Personal attitudes towards sharing and a sense of self-worth impact intentions to share (Bock, Zmud, Kim, & Lee, 2005). Knowledge sharing is fun, challenging, interesting, the right thing to do, and a good way to improve the community (Wasko and Faraj, 2000). Personal reward is in the sharing (intellectual challenge) along with enjoyment in helping others (McLure-Wasko & Faraj, 2005). Professional reward (reputation enhanced) is an anticipated outcome to the sharing (McLure-Wasko & Faraj, 2005). Knowledge self-efficacy and enjoyment in helping others supports knowledge sharing (Lin, 2007). Knowledge self-efficacy is the most important attitude impacting knowledge sharing in the dimension of employee motivation (Lin, Lee, & Wang, 2009).

Summary

Communities of practice with online knowledge sharing provide a place for knowledge sharing independent of time and place (Bell, 2006). To become visible within

the online community, a member must first master the technology and participate in the knowledge sharing (Dyson, 1997; Markham, 1998; Rheingold, 1993). Thus, the sharing might precede interaction between individuals and is influenced by context (Tversky & Kahneman, 1981). As shown in Table 3, factors such as trust in the community, expectations of reciprocity, enjoyment in helping others, participation effort, and a culture of sharing have been found to affect knowledge sharing and the intention to share (Bock & Kim, 2002; Bock, Zmud, Kim, & Lee, 2005; Jarvenpaa & Leidner, 1998; Kankanhalli, Tan, & Wei, 2005; Lin, 2007). Building a community of practice with online knowledge sharing therefore requires building trust and a culture of respect through supporting respectful behavior, collaboration, and communication (McLure-Wasko & Faraj, 2005; Wasko & Faraj, 2000).

Summary of the Review of Literature

This study applies Kankanhalli, Tan, and Wei's (2005) theoretical model of motivation factors impacting knowledge sharing in electronic knowledge repositories to online knowledge sharing in communities of practice for faculty with the intention of expanding the research on this topic. In support of that goal, this literature review addressed three questions:

1. How is the knowledge of a practice built and shared?
2. What is a community of practice with online knowledge sharing?
3. What are the costs and benefits associated with participating in online knowledge sharing?

The findings of the literature review are discussed in the following paragraphs.

Knowledge of a practice is built through a socio-cultural cycle of learning through interaction between novice and experts (Brown & Duguid, 1991; Chaiklin & Lave, 1996; Cross, Parker, Prusak, & Borgatti, 2001; Hutchins, 1995; Lave, 1996). Needed opportunities for learning, knowledge sharing, and knowledge editing can be provided by a knowledge sharing community of practice through ongoing, meaningful, social interaction and support (Cho, 2002). In addition, a community with online knowledge

sharing provides a geographically dispersed community with an interactive website equipped with tools to build and share knowledge. Often such spaces are built and sustained by grant-funded projects or organizations for a limited amount of time in the expectation that the community will eventually become a self-sustaining community of practice (Wenger, McDermott, & Snyder, 2002). Given that the community needs to become self-sustaining to survive beyond the initial funding and member participation is essential to attaining that goal, increasing participation in knowledge sharing is therefore a goal of such communities.

However, interacting across technology is inherently different than interacting in a face-to-face community (Barab, MaKinster, & Scheckler, 2004; Bell, 2006). Research has shown that an environment of reciprocity and communication can foster knowledge sharing in online settings despite the absence of the visual clues found in face-to-face interactions (Jarvenpaa & Leidner, 1998; McLure-Wasko & Faraj, 2005; Wasko & Faraj, 2000).

Furthermore, research on participation in knowledge sharing in corporations has found that context moderated the influence of selected benefits and costs on the decision to participate (Bock & Kim, 2002; Bock, Zmud, Kim, & Lee, 2005; Kankanhalli, Tan, & Wei, 2005; Lin, 2007). Benefit factors identified included enjoyment in helping others, trust in the community, expectations of reciprocity, and a culture of sharing. The effort involved in participating was identified as a cost that moderated benefit factors (Bock & Kim, 2002; Bock, Zmud, Kim, & Lee, 2005; Kankanhalli, Tan, & Wei, 2005; Lin, 2007).

This study followed the example of the prior studies and collected data through a survey administered to individual members of a community of practice. However, in contrast to the above studies, the present study used an existing survey delivered electronically to a geographically dispersed community. The target industry to be surveyed and cultural context also differed in the new study. The prior studies focused on populations that were fairly homogenous and employed in large public organizations in Korea and Singapore, traditionally collectivist cultures (Bock, Zmud, Kim, & Lee, 2005). In contrast, this study applied the prior research to a new, more diverse population—

community college faculty in the United States of America, an individualistic culture. Nonetheless, the prior and current studies shared a belief that knowledge resides in individuals and that the success of organizations and institutions depends to some extent on the sharing of that knowledge. In addition, the belief by the individual that the benefits gained from sharing knowledge outweigh the anticipated costs was seen as a requirement for that knowledge sharing to occur. Table 4 provides a comparison of the foundational and current studies.

Table 4

A Comparison of Current and Foundational Studies

Comparison	Current Study	Foundational Study
Community Participation Process	Upload resources or post comments	Code information and post
Cost defined as	Posting to online community	Codification effort
Institution	Higher Education	Public Organization
Population	Faculty and Administrators	Business managers
Online Tools	Threaded discussions, blogs, file repositories	File repositories
Community owner/manager	Education project or center	Public organization
Terminology for community	Community of Practice	Electronic Knowledge Repository
Location	U. S. A.	Singapore
Selection	All members of a community	Nominated by colleagues
Data Collection Method	Online survey (link distributed by email through automated online service)	Paper survey distributed by colleague and returned by mail

The next section of this dissertation applies the knowledge gained from the literature review, addresses the question asked by the study, and considers the philosophical approach of the researcher to develop the research design. The process of collecting the data, including efforts to assure reasonable reliability and validity of the survey and the data collection process, are discussed. In addition, as overview of the data analysis is provided.

RESEARCH DESIGN

Research brings knowledge and ideas from the mind of a scholar to the eyes of the public. To make that connection happen, a research design should consider the purpose of the research, the philosophical approach of the researcher, the intended audience, and the best design for answering the research questions. This section discusses the philosophical approach that provided a framework for the study, the research design, and the data collection and analysis process. Procedures for assuring the truth of the results, quality control of the data, and the protection of participants are also presented.

The Philosophical Approach

The philosophical approach defines how knowledge is structured and known, the research is conducted, and truth is established (Bettis & Gregson, 2001; Coomer & Hultgren, 1989; Neuman, 2003). In support of that process, this section explores the fundamental beliefs, core concepts, major assumptions about reality and truth, and major proponents of postpositivist research—the philosophical approach that guided the research.

Postpositivism

The tenets of positivism were principally outlined and elaborated by August Comte, John Stuart Mills, and Emil Durkheim in the mid-19th century in a move away from the prevailing metaphysical and theological explanations of the world. Comte (1875) sought to gain a deeper understanding of society through the application of thorough reasoning and observation so as to improve the human condition (Neuman, 2003).

The postpositivist philosophers questioned the positivist belief in an absolute truth, arguing instead for truth as an individual experience that through negotiation could become part of a shared truth. Popper (1959, 1962) took particular exception to the positivist view that the scientist's knowledge of truth is based solely on perceptual experience and, once defined, is accepted into perpetuity. He argued that, while a

definition may be true at the moment it is defined, it is not necessarily true for all moments. Since researchers can never discover all instances of a concept, proving truth is therefore impossible – the instance that proves it false might be just around the corner, awaiting discovery. Therefore, for a postpositivist, the rules of scientific procedure must allow all statements to be tested.

As philosopher of science Popper has emphasized, a good theory is characterized by the facts that it makes a number of predictions that could in principle be disproved or falsified by observation. Each time new experiments are observed to agree with the predictions the theory survives, and our confidence in it is increased but if ever a new observation is found to disagree, we have to abandon or modify the theory (Hawking, 1996, p. 17).

Researchers begin with stating a hypothesis to be tested and then proceed to focus their efforts on proving their hypothesis to be false (Hawking, 1996; Miller, 1985; Popper, 1959, 1962). If duly diligent research fails to yield proof that the hypothesis is false, then the researcher can state that the concept appears to be true at that moment. Truth is thus the absence of falsification only up to that point in time. No assumptions are made about future truth. Everything must be tested and retested to verify continued truth (Campbell & Stanley, 1966; Hawking, 1996; Miller, 1985; Popper, 1959, 1962).

Although some authors extend the postpositivist umbrella to incorporate all the interpretative paradigms of research design (Bettis & Gregson, 2001), the postpositivism of this research study remains centered on Popper's concept of falsification and negotiated truth (Miller, 1985; Neuman, 2003; Popper, 1959, 1962). Thus objectives for the study are in the form of hypotheses stating relationships within the data, not the experience of individuals. Interpretive research's focus on the individual's perception of personal experience is rejected in favor of a collective truth.

The Intended Audience and the Researcher

In addition to keeping the postpositivist goal of objectivity in mind, the research design needed to consider the guiding interests of the intended audience (Addams, 1990; Brown, 1989). The intended audience for this research study was the community of

researchers and educators managing National Science Foundation grant-funded projects or centers that foster innovation in teaching and learning in community colleges, specifically participants in the Advanced Technological Education Program (ATE). To respond to critical evaluations of the programs' data collection practices (Evaluation Center, 2002) as well as increasingly stringent evaluation and research standards for educational research (e.g., American Educational Research Association, 2008; Institute of Education Sciences, U.S. Department of Education, & National Science Foundation, 2013) this research study matches the evidence-based reform perspective of the intended audience through a postpositivist approach.

As discussed above, the research design also builds on the experience, goals, and philosophy of the researcher. I am currently the principal investigator for Destination: Problem-Based Learning (DPBL), a National Science Foundation Advanced Technological Education grant funded project. This work built on my experience as a project leader, instructional designer, and technology trainer on four previous grant projects, a community college instructor in computer literacy and web site development, and an owner and manager of a computer customer service business. The DPBL project extends the work of prior NSF ATE grants focused on problem-based learning in community college technology courses. A community of practice with an online knowledge sharing website was created by the project's leaders to support DPBL faculty, promote project activities, and disseminate information. The project team intended for the community to become self-sufficient and thereby continue to exist after the project ended. However, motivating faculty to actively participate in the building of the online community proved to be a challenge. The goal of a self-sustaining community has not yet been realized. The current project continued that work and added a faculty inquiry component designed to engage faculty in classroom research and deepen the collective understanding of problem-based learning. While the community of practice for PBL faculty has expanded over time, participation in online communication and knowledge sharing has declined. The research design thus met with the needs of the intended audience and aligned with the personal beliefs and interests of the researcher.

Standards of Truth

Good research builds on and contributes to the body of research and abides by the standards of the selected philosophical approach (Locke, Spirduso, & Silverman, 2007; Miller, 1985; Popper, 1959, 1962). In keeping with the relevant standards of truth of postpositivism, within this study: (a) the research question regarded reality as both objective and discoverable; (b) hypotheses were proposed to address that question; (c) replicable, independent, and precise facts were obtained to test the hypothesis; (d) explanations were logical and consistent with observed facts; and (e) disconfirming evidence was sought and examined (Miller, 1985; Neuman, 2003; Popper, 1959, 1962).

In the next section correlation analysis, the research method followed to implement these standards, is discussed. The variables and their operational definitions are also delineated.

The Research Method

As discussed in the previous section, this research study incorporated hypothesized postpositivist statements of truth tested through rational observation (Miller, 1985). In this study, the statements took the form of hypotheses designed to answer a central question: “How do cost and benefit factors relate to faculty participation in online knowledge sharing in a community of practice meant to support their efforts to improve instruction?” The purpose of this section is to discuss the research method selected to test these hypotheses. In addition, procedures used to collect and analyze the data so as to address the research question and test the hypotheses are discussed.

The correlation method selected for this study follows the postpositivist tradition of seeking truth through observation and measurements. Correlation measurements describe the relationship between two variables (Cohen, Cohen, West, & Aiken, 2003; Osborne, 2010; Vogt, 2007). Since the intention of this research study was to compare the relationship between selected cost and benefit factors and the self-reported participation by members of a community of practice with an online knowledge sharing space, a correlation method was appropriate. Furthermore, a prediction research design

was followed given that the study explored the impact of the select cost and benefit factors on participants' actions (Cohen, Cohen, West, & Aiken, 2003; Creswell, 2005).

Population

This study examined the relationships between costs and benefit factors and faculty participation in online knowledge sharing communities supporting the scaling up of innovations in instruction. The target population was the educators who registered for the 2011 National Science Foundation Advanced Technological Education (NSF ATE) Principal Investigator's Conference in Washington, DC, had not previously chosen to opt out of surveys delivered through SurveyMonkey®, and self-reported they belonged to a community of practice with an online knowledge sharing space.

The ATE program was created by the NSF in response to the passage by Congress of the Scientific and Advanced-Technology Act of 1992. The act mandated that the NSF create programs that would improve the competitiveness of the U.S. workforce by increasing the supply of skilled technicians in selected advanced technological fields. Advanced technological applications were defined as those that provide productivity improvements in manufacturing, communication, transportation, security, and other commercial activities. The ATE program works principally with two-year colleges (Wingate, Smith, Westine, & Gullickson, 2012). Per the annual ATE survey of 2012 that reported on activities in 2011, there were 250 principal investigators (PIs) of projects, centers, or targeted research grants that year. All NSF ATE PIs are required to attend the conference each year their projects or centers are funded. Each project and center is allocated a limited number of tickets for co-PIs or others to attend on behalf of the projects and centers.

Consequently, the registration list may have included faculty who served in fall 2011 as principal investigators (PI's), co-PI's, administrators, students, and evaluators involved in ATE funded projects and centers. It does not include all of the faculty who participated in such projects and centers. A list of all of the faculty participating in ATE projects does not exist and would take time and resources not available to this dissertation

project to compile. The email list of registrants to the 2011 ATE PI Conference was provided for this research project by the ATE PI conference organizers (AACC) who removed the emails of NSF ATE employees and AACC employees who attended. The list they provided consisted of 712 email addresses.

Since individuals can be members of the online community and have access to using the knowledge yet not participate in the sharing of knowledge, respondents to the survey potentially included both participants and non-participants. However, since the survey assumed access to an online space for knowledge sharing within the respondent's community of practice, the survey included a question to filter out respondents without such access (see Appendix C for the Survey and Appendix D for a list of Variables and Questions).

In keeping with the original study and the postpositivist approach to research, specifically Popper's arguments against inductive reasoning (Popper, 1959, 1962), the target population for the current study included all 712 registrants. The collection of the data from that population is discussed in the next section.

Data Collection Instrument

As discussed previously, the study data were collected at the individual level, in keeping with the focus of the study on the relationship between an individual's perception of cost and benefit factors and participation in online knowledge sharing in a community of practice. Since data for a research study are collected with the purpose and parameters of the data analysis in mind (Russ-Eft & Preskill, 2001) and surveys are an appropriate means to obtain information from individuals for analysis (Campbell & Stanley, 1966), a survey developed by Kankanhalli, Tan, and Wei (2005) formed the basis of the data collection. See Appendix C to read the survey.

The survey was self-administered online to invitees who followed a link keyed to their individual email addresses. Advantages to a self-administered online survey include that: (a) information can quickly be obtained from a geographically diverse population (Fink, 2009); (b) reminders to respond can be targeted to non-responders and easily

revised to appeal to different interests (Groves, Singer, & Corning, 2000); (c) links to definitions and other clarifying information can be made available electronically within the survey instrument; and (d) data can be downloaded to a data analysis tool, thus bypassing the need for data input by researchers and thereby improving quality control (Fink, 2009). Disadvantages include that: (a) different browsers may display the survey items differently; (b) the level of expertise and ease of use with online technology varies with a population and between researchers and participants (Fink, 2009); and (c) if not designed correctly, the transfer of data from survey to data analysis tool may corrupt the data. To address these issues the study used SurveyMonkey, an online survey delivery service that provides tools for data collection, data transfer to analytic tools, discrepancies between browsers, and tracking responses.

Strategies to Assure Soundness of Data

A survey that is reliable produces information that is consistent—the data collected are stable and the findings replicable (Fink, 2009; Vogt 2007). Potential threats to the reliability and validity of this research study and planned solutions could have originated from threats to the validity and reliability of the measurement instruments as well as threats to the internal and external validity of the research design. Reliability and validity together address the accuracy of the data measurement and collection. Consumers of research are more confident of research findings if the research design explicitly includes measures to protect against threats to validity and reliability (Creswell, 2005; Vogt, 2007). Consequently, both the foundational and current studies addressed issues of validity and reliability.

To improve validity in the foundational study, the questions themselves were either adapted from previous studies or developed based on a literature review (Kankanhalli, Tan, & Wei, 2005). To determine if the different items measured the same construct as planned (Cronbach & Meehl, 1956), Cronbach's alpha, a coefficient alpha, was calculated for the survey by the Kankanhalli, Tan, and Wei research team. One question each was eliminated from the survey for the four constructs that did not meet the

threshold of a Cronbach's Alpha of 0.70. The remaining constructs achieved a Cronbach's Alpha of 0.85 to 0.96 (Kankanhalli, Tan, & Wei, 2005), thus establishing reliability of the constructs. Results for the current study's Cronbach's alpha statistical analysis are included in the next chapter.

Kankanhalli and colleagues confirmed conceptual validation of their survey using a two-stage sorting exercise. In the first stage, an unstructured sorting exercise, 51 questions were placed into categories by each sorter who then labeled each category. The labels created by the sorters closely matched the constructs labeled by the researchers, and 86% of the questions were placed into the correct construct. Four questions were dropped for ambiguity at the recommendation of the sorters.

In the second stage, a structured sorting exercise, the remaining 47 questions were sorted by four other graduate students into constructs that were defined and named by the researchers. Sorters also had the option of placing questions into another category. The sorts averaged a 98.86 % agreement. The two questions that were placed in the other category were eliminated from the survey. Two new questions were added to the reciprocity construct at the suggestion of the sorters (Kankanhalli, Tan, & Wei, 2005). Although the current study used an abbreviated version of the original survey, the constructs were intended to remain intact, thus maintaining the conceptual validation of the survey from the original study.

Convergent and discriminant validity were also checked by both studies using factor analysis with principal components analysis and varimax rotation. The reliability of the codification effort construct in the foundational study was 0.91 after two questions that flowed into other constructs were eliminated from the survey. The results for the current study are discussed in the next chapter.

Pilot Test

A pilot test using a smaller but similar target population was conducted prior to the formal data collection phase of the current study so as to:

- Confirm that the questions make sense to the reader and elicit the expected type and quality of response (Fink, 2009; Russ-Eft & Preskill, 2001; Tuckman, 1972).
- Test the process of importing the data from the measurement instrument to the data analysis software.

The four individuals recruited for the pilot study were colleagues of the student researcher. The pilot participants did not make any suggestions for changes in the survey. In retrospect, it might have been advisable to have a more extensive pilot study with a follow-up interview with the pilot participants about their experience completing the survey. Perhaps the redundancy in the participation questions discussed later in this report would then have surfaced earlier and the survey could have been changed in time to improve the data collection and analysis. The next section discusses why and how leverage saliency was considered in the plan for soliciting participation in the survey.

Improving Response Rate in the Current Study

It is important that survey data is collected from an entire population or a representative sample of that population and that the response rate is as high as possible so as to avoid non-response bias in the results and improve credibility with consumers of the research. One approach to improving response rate is to consider leverage saliency. Groves, Singer, and Corning (2000) argued that the influences on the decision to participate in surveys were additive—the outcome varied with different combinations of influences. The effect of a single survey design attribute would vary by subgroup depending on the different leverages assigned by the potential participant and across designs due to the different salience exhibited. Thus for a subgroup valuing community involvement, financial incentive might have little effect in the decision to participate in a survey on an issue of importance to the community since financial incentive has less saliency for the civic-minded group.

Roose, Lievens, and Waege (2007) designed a quasi-experimental study of audience members attending cultural events to test the leverage-saliency. They

hypothesized that topic interest and follow-up procedures would impact participation positively, and that as interest increased, the impact of follow-up procedures would decrease. Their results confirmed the hypothesis and the potential danger in limiting results to the first responses to a survey. If first responders are also those most interested in the topic, their answers could potentially skew the results. Investing in solid follow-up procedures could increase the response numbers and expand the pool of responders to include those less interested in the survey. The concept of leverage saliency is particularly important in this study, because people who are more comfortable answering an online survey may also be more likely to participate in online knowledge sharing in a community of practice. In consideration of leverage-saliency and technology issues, the second and third emails were designed to motivate non-participants to complete the survey. The process for collecting data is reviewed in the next section.

Data Collection Process

The data collection process began after the survey quality had been assessed. Data were collected over a 20-day period and once from each participant, thus avoiding threats to validity from changes over time yet allowing time for a series of follow-up reminders (Groves, Singer, & Corning, 2000). A series of three emails inviting recipients to follow a link to complete the survey were sent through SurveyMonkey's automated process. The first email was sent on September 30, 2012 to all individuals on the email list of registrants to the ATE PI Conference 2011 who had not previously opted out of receiving emails from SurveyMonkey. The invitation went to 712 recipients and was titled "Take a short survey & help a colleague & grad student—Please!" The subsequent invitations went to non-respondents on October 9th and 16th. The second was titled "Share your ideas & help a colleague—Please!" and went to 609 recipients. The final invitation, "Last Chance—Short Survey!" was emailed to 563 addresses. A total of 174 recipients (24.4% of the total emailed) started the survey and 153 finished the survey (21.5% of the total emailed). Table 5 compares the numbers of emails sent, responses received, and surveys completed. In retrospect, the time frame was not optimal for the intended audience.

Proposals for new grants were due at that time and final preparations were underway for the 2012 ATE PI Conference, so many recipients were extremely busy. Waiting until the last week in October would have coincided with a less frantic time of year for the ATE community. In addition, the researcher had a prominent role in that conference and could have asked colleagues and other attendees to be on the look out for the survey, thus potentially improving the response rate.

Table 5

Response Rate Analysis

	N	%
Invitations emailed	712	100.0
Less bounced emails	12	1.5
Less opted out	3	0.4
Invitations delivered	697	98.0
Surveys started	174	24.4
Less incomplete surveys	21	2.9
Less insufficient data	13	1.8
Imported to SPSS 20 for analysis	140	19.7

As discussed earlier, data were collected from faculty registrants to the 2011 ATE PI conference with an online survey based on Kankanhalli, Tan, and Wei's (2005) survey to managers in Singapore. To minimize the time of participants and minimize the risk that participants may not complete a survey if it took too much of their time (Fink, 2009), the survey was limited to 30 forced-choice questions. Forced-choice questions have the advantage of being scored objectively, are best at measuring complex behavior, and are less threatening than open-ended questions (Fink, 2009).

The survey used a Likert Scale—a multi-step equal-appearing interval scale (Tuckman, 1972) for the remaining questions. The original study used a seven-point scale but this one was limited to five intervals due to the technical requirements of SurveyMonkey. For each statement, respondents selected from five options ranging from “Strongly Disagree” to “Strongly Agree”. See Appendix B for the complete survey. The

scale was scored as: Strongly Disagree = 1, Disagree = 2, Neutral = 3, Agree = 4, Strongly Agree = 5.

Respondents who followed the link to the survey had to formally consent to participate before the SurveyMonkey allowed them to continue beyond the consent page. In addition, two multiple-choice questions were included to gather participation data and two others to gather demographic data. The questions were:

Was the October 2011 ATE PI conference the first you attended?

Option = Yes or No

What US state or territory was your primary place of work in October 2011?

Option = A drop down of states and territories (provided by SurveyMonkey).

Operational Definitions

Clear consistent operational definitions of the construct variables of a study improve the clarity of the questions and therefore the quality and consistency of the data collection process. The operational definitions for this study appear in Table 6.

Differences between the current and foundational studies (see Table 4) precluded an exact replication of the foundational study. Therefore, the survey items from the foundational study were modified for the current study. Specifically, codification effort as experienced by participants in the electronic knowledge repositories (EKRs) studied by Kankanhalli, Tan, and Wei (2005) involved coding data to upload to a shared database. In contrast, as shown in Figure A2, participation in online knowledge sharing in a community of practice involved posting a text message to a threaded discussion or blog or otherwise sharing resources. The codification question was therefore modified in the study to refer to participation in online knowledge sharing.

Table 6

Operational Definitions of Variables

Dependent Variables
<i>Participation Prior Month (PAR1) or Prior Six Months (PAR2)</i> is the frequency of posting a new thread or reply to an online threaded discussion (Herring, 2004)
Predictor Variables
<i>Knowledge Self-Efficacy (KSEF)</i> is the confidence in one's ability to provide knowledge that is valuable to the practice via the knowledge sharing community (Constant, Sproull, & Kiesler, 1996). Intrinsic motivator
<i>Enjoyment in Helping Others (EHLP)</i> is the perception of pleasure obtained from helping others through knowledge contributed to the knowledge sharing community (Wasko & Faraj, 2000). Intrinsic motivator
<i>Participation Effort (PEFF)</i> is the effort required to participate in the online knowledge sharing (Barab, MaKinster, & Scheckler, 2004; Sahin, 2008). Contextual motivator
<i>Reciprocity (RECP)</i> is the belief that current contribution to the knowledge sharing community would lead to future requests for knowledge being met (Davenport & Prusak, 1998; Fishman, 2003). Contextual motivator
Moderator/Interacting Variables
<i>Generalized Trust (GTRU)</i> is the belief in the good intent, competence, and reliability of colleagues with respect to contributing and reusing knowledge (Irwin, 2009). Extrinsic motivator
<i>Pro-Sharing Norms (PSNM)</i> is the prevalence of norms intended to facilitate knowledge sharing in the practice (Nahapiet & Ghoshal, 1998; Orlikowski, 2002). Extrinsic motivator
<i>Note.</i> Adapted from "Contributing knowledge to electronic knowledge repositories: An empirical investigation," by A. Kankanhalli, B. Tan, and K. Wei, 2005, <i>MIS Quarterly</i> , 29(1), 123. Copyright 2005 by Regents of the University of Minnesota. Adapted with permission.

Variables

The 25 five-point Likert Type scale questions provided the data for the six independent variable constructs—participation effort (PEFF), reciprocity (RECP), knowledge self-efficacy (KSEF), generalized trust (GTRU), pro-sharing norms (PSNM), and enjoyment in helping others (EHLP). Two multiple-choice questions addressed participation, the dependent construct. A list of the variable names assigned to the questions within each construct can be found in Appendix D. To simplify comparison of results, whenever possible, variable names that matched with variable names used in the foundational study were assigned to the responses to each question. All scores of KSEF3

(It doesn't really make any difference whether I add to the knowledge others are likely to share) and KSEF4 (Most other members can provide more valuable knowledge than I can) were reversed (1=Strongly Agree, 5= Strongly Disagree) and variable names (KSEF3r and KSEF4r) assigned to those columns. Two questions from the original survey were inadvertently left off the current survey, hence the absence of variables RECP3 (When I contribute knowledge, I expect to get back knowledge when I need it) and GTRU1 (I believe that people in my organization give credit for other's knowledge where it is due).

Dependent variables. The first participation question (PAR1) asked about posting over the last month, while the second (PAR2) asked about posting over the last six months. Response options were: (a) 0; (b) 1-5; (c) 6-11; (d) more than 11; and (e) My community does not have an online discussion area. Responses were scored by SurveyMonkey as a = 1, b = 2, c = 3, d = 4, and e = 5. A response of PAR1 = 5 (e) would trigger a forced exit from the survey. See Table 5 for a list of the construct definitions and Appendix D for the questions.

In addition, at the beginning of the cost/benefit questions, the participants were instructed as follows:

In answering the following questions, please think about the community of practice you spent the most time participating in over the last six months that has an online collaboration space (e.g. threaded discussion, blog that allows comments, place for posting resources). Please indicate your level of agreement with each statement.

Predictor variables. The independent variables and intrinsic motivators, knowledge self-efficacy and pro-sharing norms, were found in the earlier study to be direct predictors of knowledge sharing. In contrast, the independent variables and contextual motivators, participation effort and pro-sharing norms, were found to interact with the moderator variables and extrinsic motivators.

Moderator variables. As shown in Figure 1, the moderator variables and extrinsic motivators, generalized trust and reciprocity, were found by the foundational

study team to impact the relationship between the predictor variables participation effort and pro-sharing norms.

Data types. Although the survey scale had five options rather than being continuous, the psychological distance between options on the Likert Scale were considered equal, and the data consequently treated as scale or interval data (Thompson, 2006). The PAR1 and PAR2 were also considered to be scale or interval data, since participation was conceptualized as continuous, with the participation questions' five options defining levels of choice along a continuum.

Since the initial analysis was designed to follow the foundational study's model for data analysis and construct design and the statistical tests selected for that study required scale or interval data, the scale PAR2 variable was used in the correlational and linear regression analysis. During the analysis a new dichotomous variable PARy (participation = True = 1) was calculated in Excel from the PAR1 and PAR2 scores for respondents' self-reported participation. This variable was used in the descriptive comparisons of participants and nonparticipants that called for a dichotomous variable. The data analysis began once the variables were clearly defined and their roles and data types established. The next section discusses that process. The results of the analysis process are in the next chapter.

Data Analysis

The data analysis in the current study also followed the model of the Kankanhalli, Tan, and Wei (2005) study. The relationships of the predictor and independent variables were analyzed through multiple regression analysis. The influence of these interaction effects on participation was analyzed using moderated multiple regression analysis. However, before the hypotheses could be tested, pre-analysis data screening investigated the characteristics and quality of the data collection and the data. In addition validity and reliability assessment investigated the conceptual validation, construct validity, factor analysis, and discriminant validity of the data.

Pre-Analysis Data Screening

Pre-Analysis data screening provided an introduction to the data, explored the characteristics of the respondents and their responses, and confirmed that the respondents (the sample) were somewhat representative of the registrants (the population). If the demographics of the respondents differed from the demographics of the population as a whole, the findings might have exhibited a response bias because the responding population was not representative of the target population. Therefore nonresponse rate analysis compared the demographics of the respondents to the demographics of the subject population.

Descriptive Statistics

The goal of the descriptive statistics analysis was to determine if the data met the assumptions of the planned statistical analysis and the expectations of the researcher, given the questions asked on the survey. Responses outside of the anticipated range would indicate an error in data collection. Basic descriptive statistics calculated for each of the predictive variables included the mean, standard deviation, range, and skewness.

Reliability and Validity Assessment

Potential threats to the research study could originate from issues with the measurement instruments as well as threats to the internal and external validity of the research design. Attention to validity and reliability in the foundational and current studies included tests for conceptual and construct validity. Additionally, the current study conducted a pilot test to confirm content and face validity and sent multiple email invitations written to appeal to different interests to increase response rate and lessen selection and volunteer bias.

Cronbach's Alpha tests were run for each construct to check that the variables within the construct were related to each other. Standard acceptable levels of Cronbach's Alpha and the alternate value, Alpha Based on Standardized Score if Means and SD of the variables are varied, should be greater than 0.60 if there are a small number of items

(as is the case in this study) or greater than 0.70 if there are a large number of items in the scale. The Corrected Item Total Correlation for each scale should be greater than 0.30. The Alpha if Item Deleted for each variable should be less than the scale's Alpha.

Testing the Hypotheses

Since the study looked at the relationship between a dependent variable (participation) and multiple independent variables (IV's, the predictors), multiple regression analysis and moderated multiple regression analysis were used to determine the predictive properties of the variables individually and as interacting pairs (Cohen, Cohen, West, & Aiken, 2003; Fink, 2009; Leech, Barrett, & Morgan, 2011; Thompson, 2006). Multiple regression is a complex associational statistical method designed to answer the following questions:

- How well does a group of IV's or predictor variables estimate the Y or dependent variable?
- How much does any one variable contribute to that estimation?
- If other variables hold constant, what is Y's contribution? (Cohen, Cohen, West, & Aiken, 2003).

Linear regression. Stepwise linear regression was appropriate for the original study in that there were a large number of variables and the relationships amongst the variables were as yet unknown. The current study focused on the existing model developed from the findings of the foundational study rather than a proposed model. Consequently, the number of variables under consideration in this study was considerably smaller. Therefore simultaneous rather than stepwise linear regression was preferred for the current study.

Moderated multiple regressions. The model developed from the foundational study also identified two interacting pairs of variables—generalized trust with participation effort and reciprocity with pro-sharing norms. Consequently, moderated multiple regression was chosen for the analysis of the full model. Moderated multiple regression analyzes interaction effects by first calculating interaction terms by

multiplying the component variables. Then the relationship between independent and dependent variables is calculated. Next the relationships between the interaction terms and the dependent variables are calculated. Finally, the change in explanatory power between the two relationship calculations is calculated. If there is a significant difference in the F value for the two relationship calculations, then a moderating effect is present (Cohen, Cohen, West, & Aiken, 2003; Kankanhalli, Tan, & Wei, 2005). For example, in the Kankanhalli, Tan, and Wei study, the change in F was sufficient and statistically significant ($\Delta F = 3.23$, $p = < .01$) to justify testing the effects of the variables separately and then in interacting pairs. These findings indicated that the least impact in participation came from codification effort moderated by generalized trust and pro-sharing norms moderated by reciprocity. The most significant impact came from enjoyment in helping others. Results from the foundational study are included in Table 16.

Calculated variables. As discussed earlier, for the current study PAR2 was selected as the dependent variable in the regression analysis since six months of participation includes the previous month's participation. The independent or predictor variables were calculated from the mean of the variable items in each construct. The interaction variables were calculated as the product of the two interacting constructs. The foundational study researchers centered the variables before conducting moderated regression analysis. However, since centering variables for moderated multiple regression is done to limit multicollinearity and the construct variables for the current study did not appear to be highly correlated, the construct variables were not centered.

Statistical assumptions. The mathematical equations used in regression analysis are linear in nature therefore linearity between the dependent and predictor variables being compared is a fundamental statistical assumption of regression analysis. Consequently if linearity is not present, the results of the analysis are questionable and any inferences made from those results are suspect (Kelley & Maxwell, 2010).

Assumptions of Linear Regression for Dependent (DV) and Independent (IV) Variables include:

- Are the data appropriate (DV = continuous, interval or ratio, unbounded; IV = continuous or dichotomous)?
- Is there a range of values?
- Is the $N >$ number of variables?
- Were the data collected so as to support independence?
- Is there linearity between variables?
- Is the distribution normal? (Boslaugh, 2013; Cohen, Cohen, West, & Aiken, 2003)

In addition to confirming the quality of the data collection and data, the quality of the procedures to protect the rights of the respondents were addressed. Those procedures are reviewed in the next section.

Strategies for Protection of Human Subjects

In addition to ensuring the accuracy of the study's results, the design of the research study must ensure the safety of the participants in the study. With that aim in mind, this researcher completed the Oregon State University course in the Protection of Human Research Subjects (CITI) in June 2007 and the University of Nevada, Reno course in 2011. In accordance with the Oregon State Human Subjects policy, approval from the Oregon State Institutional Review Board (IRB) was obtained before undertaking the study (OSU IRB Study 5289). Anonymity of participants was maintained through separating identifying information from email addresses and email addresses from responses. Individual informed consent forms were built into the online survey. SurveyMonkey was configured to automatically eject a respondent from the survey if the option to decline to participate was selected. Selecting the option to agree to participate also confirmed the respondent was 18 years of age or older (as self reported).

No identifying information was collected from the respondents through the survey questions. The survey was administered through SurveyMonkey© online survey service. The researcher uploaded the list of email addresses to SurveyMonkey's Email Collector. The Collector tracked responses and automatically sent invitations and reminders. SSL

encryption was enabled so that responses were transmitted over a secure, encrypted connection. SurveyMonkey recorded respondents' time stamps. To support the respondents' rights to exercise their freedom of choice to not answer a question, survey questions did not require an answer for the respondent to continue in the survey. A respondent who exited the survey before completing it was considered to have withdrawn from the survey, and the data were not included in the analysis. The number of withdrawals was counted. Data were secured in SurveyMonkey's SAS70 Type II certified facility. Any data downloaded to the researcher's computer have been stored in password-protected directories. All printouts and digital files of the results will be stored in a locked file cabinet in the principal investigator's private office for three years post study termination. Direct identifiers have not been recorded.

Summary of Design of the Study

The study addressed the question of how cost and benefit factors relate to faculty participation in online knowledge sharing in communities of practice meant to support their efforts to improve instruction. The postpositivist philosophical approach provided a framework for the research. Proposing a tentative explanation for an observation, testing it, and then rejecting or temporarily accepting it as true, forms the foundation of postpositivist research (Miller, 1985; Popper, 1959, 1962). The hypotheses tested were therefore subject to falsification based on data obtained through objective observation and sound analysis (Neuman, 2003; Miller, 1985). A postpositivist approach was also aligned with the personal philosophy of this researcher and supported the needs of the intended audience—managers of grant funded projects developing an online knowledge sharing community.

Data were collected in Fall 2012 through a self-administered online survey of registrants to the ATE PI Conference in October 2011. The survey was an edited version of the survey developed and validated by Kankanhalli, Tan, and Wei (2005) for their study of participation in electronic knowledge repositories by employees of public corporations in Singapore. The survey was evaluated for validity and reliability in both

the foundational and current research studies, designed for a correlational analysis, and based on a review of the literature that was in keeping with the purpose of the study. Three email invitations were delivered over the course of 20 days to 698 of the registrants to the 2011 ATE PI conference. The registrants included participants and non-participants in online knowledge sharing within communities of practice. SurveyMonkey filtered the emails to eliminate recipients who had previously opted out of receiving surveys from them. In addition the second and third emails were only sent to individuals who had not followed the email link to the survey. Surveys were started by 24.4% (174) of the 712 invitees. See Appendix B for invitation emails

For this study, all respondents who reported membership in a community of practice may or may not have had access to an online knowledge sharing space within their communities. As shown in Figure 3, members designated as participating members will have shared their own knowledge with the community by posting to an online discussion or blog, and may or may not have used the additional knowledge available on the site. In contrast, non-participating members will not have shared their own knowledge with the community and may or may not have used the knowledge available on the site.

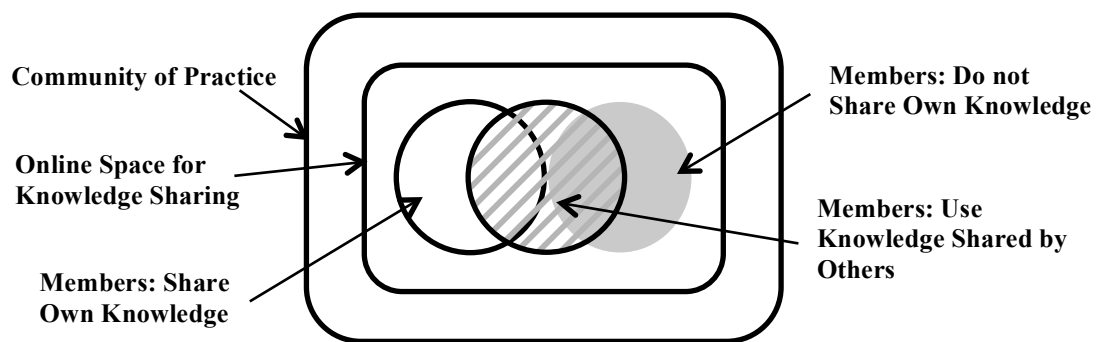


Figure 3. Varieties of Knowledge Sharing and Use in Communities of Practice

The research question was a complex/multivariate associational question that explored the relationship between multiple cost/benefit constructs (the four independent variables), participation (the one dependent variable), and the influence of the two mediator variables on that relationship (Leech, Barrett, & Morgan, 2011). The data

analysis for the study included a correlation analysis of variables through simple and moderated multiple regressions. The results have been displayed in data tables and plotted onto scatter diagram to visually display the relationships in the data. Measures to improve validity and reliability included the selection of a survey that has already been validated, conducting a pilot study, a comparison of the demographic profile of the respondents with a profile of the community as a whole, factor analysis, and Cronbach's alpha analysis. To protect the rights of the participants in this research, the Oregon State Human Subjects policy and IRB regulations were followed. Options available in SurveyMonkey to increase the privacy of the respondents were also utilized.

The next chapter of this dissertation discusses the findings of the analysis of the data collected in the survey. The findings are discussed in more detail in the final chapter.

FINDINGS

As discussed earlier, this study examined the research question “How do cost and benefit factors relate to participation in online knowledge sharing in communities of practice meant to support efforts to improve instruction?” The purpose of the study was to contribute to the body of knowledge available to managers or leaders of communities of practice with options for online knowledge sharing (or considering adding online knowledge-sharing options) interested in increasing member participation. This study was an exploratory first-step in a research agenda directed at improving support for faculty adopting innovative instructional practices. Specifically this phase of the research addresses how to sustain online knowledge sharing in communities of practice for faculty through increased participation by faculty. Therefore findings of practical significance to managers of online knowledge sharing in communities of practice are of particular interest to the researcher. With that purpose in mind, the hypotheses addressed were:

Null Hypothesis 1: Participation in online knowledge sharing is not related to knowledge self-efficacy. *Alternate Hypothesis 1: Participation in online knowledge sharing is positively related to knowledge self-efficacy.*

Null Hypothesis 2: Participation in online knowledge sharing is not related to enjoyment in helping others. *Alternate Hypothesis 2: Participation in online knowledge sharing is positively related to enjoyment in helping others.*

Null Hypothesis 3: Participation in online knowledge sharing is not related to participation effort as moderated by generalized trust. *Alternate Hypothesis 3: Participation in online knowledge sharing is negatively related to participation effort as moderated by generalized trust.*

Null Hypothesis 4: Participation in online knowledge sharing is not related to pro-sharing norms as moderated by reciprocity. *Alternate Hypothesis 4: Participation in online knowledge sharing is positively related to pro-sharing norms as moderated by reciprocity.*

The following sections review the findings of the statistical analysis of the data. The pre-analysis data screening, validity and reliability assessment, and finally the testing of the hypotheses are examined. The findings are then compared with the foundational study's results. The results are discussed in more detail in the next chapter.

Pre-analysis Data Screening

Pre-analysis data screening was conducted to identify missing data and establish a process for dealing with it, to assess the data's accuracy, evaluate the impact of outliers on the data, and determine how well the data meet the statistical assumptions and conditions of the planned statistical procedures. In addition, since it is important to the integrity of the findings that the sample analyzed is representative of the population, response rate analysis, descriptive statistics, crosstab statistics, and nonresponse analysis were run to gain a deeper understanding of the data provided by the survey respondents and their characteristics.

Missing Data

As discussed earlier, the raw data downloaded from SurveyMonkey into Microsoft Excel consisted of 174 cases. The data were filtered in Microsoft Excel® in preparation for importing the data into IBM SPSS. Then extensive exploratory analysis was performed in SPSS 20 on a MacBook Pro.

Incomplete surveys were identified through visual inspection of the Excel spreadsheet sorted on the first question beyond the consent question. By design the survey did not require an answer to any question other than the consent question. Cases with no answers from that point forward were deleted. A total of thirty-four cases were deleted—14 for reported lack of an online space in their community of practice and 20 for lack of data. This was 13 more than the 21 incomplete surveys reported by SurveyMonkey. This suggested that 13 respondents clicked through the survey to the end but failed to answer any questions beyond the initial participation questions.

Missing data points from partially completed questions were considered user entry errors and left with the SPSS missing data indicator (-). Whenever possible, the

statistics analysis was limited to complete cases. Next the characteristics of the respondents as participants and non-participants were investigated.

Exploring the Characteristics of Participants and Non-Participants

A frequency analysis found survey respondents were from 38 states, with 12 states having no respondents, 13 states having only 1, and 1 state (CA) having 16. Table 7 compares the number of states and frequency of respondents.

Table 7

Frequency of Number of Respondents per State

# Respondents	# of States
0	12
1	13
2	6
3	6
4	2
5	4
6	2
7	1
8	1
10	1
15	1
16	1

A cross tab analysis comparing participation in online knowledge-sharing to first time attendance at the conference found that 53.7% of repeat attendees and 36.6% of the new attendees reported participating in online knowledge-sharing in the previous six months. Although the finding was not of statistical significance in this analysis (Pearson Chi-Squared = 2.458, df = 1, p = .117, 2-sided), the findings suggest a direction for further research into the participation in online knowledge sharing of novice members of the ATE PI community.

Once the initial pre-analysis was completed, the distribution of the data was investigated through descriptive statistics.

Descriptive Statistics Analysis

As shown in Table 8, the minimum, maximum, and mean values were within the expected range of 1-5. The skewness scores, an indication of normal distribution, were within the approximately normal range of an absolute value 1 for all variables with the exception of Pro-Sharing Norms 2 (PSNM2, “There is a norm of collaboration.”) which had an absolute value of 1.030, somewhat outside the range of normalcy assumed for inferential statistics.

A boxplot created to investigate the distribution of the PSNM2 variable confirmed that the distribution of the variable PSNM2 might not be normal (Morgan, Leech, Gloeckner, & Barrett, 2013). To remedy this situation, an outlier case (13269) was deleted. New descriptive statistics run for PSNM2 showed the skewness (-.839) was now within acceptable limits, indicating that the data distribution was now approximately normal and inferential statistics could be run on the data set.

In summary the data met the expectations of the researcher and the statistical assumptions for inferential statistics after case 13269 was identified and eliminated. The next section discusses the missing cases analysis.

Missing Cases Analysis

A visual examination of the data at this point revealed several missing data points. As shown in Table 9 a missing cases analysis identified three cases (72, 71, and 74) that were missing more than 50% of the answers. Those cases were eliminated, leaving 136 cases in the data set. The remaining cases were missing 0-6.4% of the data.

Table 8

Initial Descriptive Statistics for Variables, N, Minimum, Maximum, Mean, Standard Deviation, Skewness, N=140.

Listwise N = 115	N	Min	Max	Mean	Std. Deviation	Skewness
Participation effort 1	140	1	5	2.51	.948	.344
Participation effort 2	139	1	4	2.69	.969	.077
Participation effort 3	139	1	5	2.91	.977	.095
Participation effort 4	138	1	5	2.44	.952	.504
Participation effort 5	133	1	5	2.56	.972	.471
Knowledge self-efficacy 1	138	2	5	3.88	.633	-.597
Knowledge self-efficacy 2	135	1	5	3.90	.766	-.631
Knowledge self-efficacy 3r	135	1	5	3.33	.773	-.164
Knowledge self-efficacy 4r	138	1	5	3.14	.842	-.207
Enjoyment in helping others 1	134	1	5	4.03	.660	-.829
Enjoyment in helping others 2	135	3	5	4.04	.531	.049
Enjoyment in helping others 3	132	3	5	4.17	.555	.055
Enjoyment in helping others 4	137	1	5	3.95	.721	-.760
Generalized trust 2	136	1	5	2.83	.830	-.067
Generalized trust 3	136	1	5	3.52	.709	-.648
Generalized trust 4	135	1	5	3.67	.800	-.675
Reciprocity 1	134	1	5	3.13	.780	-.226
Reciprocity 2	135	2	5	3.45	.720	-.316
Reciprocity 4	135	1	5	3.28	.834	-.336
Pro-sharing norms 1	136	2	5	3.65	.694	-.475
Pro-sharing norms 2	135	1	5	3.72	.729	-1.030
Pro-sharing norms 3	136	2	5	3.57	.767	-.276
Pro-sharing norms 4	135	1	5	3.57	.749	-.624
Pro-sharing norms 5	134	1	5	3.28	.810	-.650
Pro-sharing norms 6	136	1	5	3.26	.789	-.309

Table 9

Missing Data Analysis by Case (N=139)

Case (row #)	Missing	
	#	%
9, 77, 115, 39, 68, 21, 98, 41, 69, 18, 80, 30, 83, 57, 97, 65, 125, 133	1	3.4
84, 86, 19, 78, 73	2	6.9
72	18	62.1
71	19	65.5
74	26	89.7

Nonresponse Rate Analysis: Do the Respondents Represent the Population?

Nonresponse rate analysis compares the survey respondents (the sample) to the registrants on the conference email list (the population) to determine that the respondents are a sample representative of the population. If the demographics of the respondents differed from the demographics of the population as a whole, the findings might have exhibited a response bias because the responding population was not representative of the target population. The data included in the registration list from AACC limited the points available for comparison. The email list was created from information provided by registrants on their registration form for the conference. Other than name, email, mailing address, and project number, the form only included a question identifying new attendees. A similar question, “[w]as the October 2011 ATE PI conference the first one you attended? (Y/N)” was therefore included in the survey. However, the responses to the question were not included in the email list provided by the conference organizers, the AACC. Upon request they provided the information that 169 (20.2%) of the total 838 registrants responded “yes” to the “first time” question in 2011 (personal communication, Ellen Hause, May 13, 2013). The 838 total registrants for the conference differed from the 712 total registrants on the email list of registrants provided by AACC because the registrants from the National Science Foundation, AACC, and industry were deleted from the list before it was shared with the researcher.

Of the 140 respondents, 30.7% ($n = 43$) reported they were first-time attendees. The respondents to the survey thus appeared to be approximately 10.5% more likely to be first-time attendees than the registrants. However, the accuracy of the comparison is questionable because the AACC's number was derived from a list that unlike the study's list included NSF and AACC staff. The NSF and AACC staffs are likely to be repeat attendees, thus elevating the number of repeat attendees.

Given that the name, email, and mailing address would tie the responses to individuals, thus violating the privacy terms of the study, the respondents and the population were compared on only one additional variable, STAT, the postal abbreviation of the state where the registrant worked as self-reported on the registration form and the survey. First a frequency analysis was run to calculate the number of respondents or registrants for each state. That data was exported to Excel where the lists of states were compared. A state missing from one of the lists was added and assigned a frequency of 0. That data was imported into SPSS 20. Descriptive statistics confirmed the minimum and maximum were approximately normal but distribution was not. Ten outlier cases detected from boxplots (see Figure 4) were eliminated until the data was approximately normally distributed, as shown in Figure 5.

A correlation analysis ($N=38$) then compared the number of registrants per state for the registered and the respondent variables. The state names were the case IDs and the frequency count for each state the data for each of the two variables for that case. The results ($r = .630$, $p < .001$) suggested that the registrants and respondents were somewhat geographically dispersed in similar proportions across the United States and territories.

Once the sample (the respondents) was confirmed as somewhat representative of the population, at least for geographic dispersion, the reliability and validity were explored. The following sections discuss the reliability and validity analysis findings for the benefits and cost factor items.

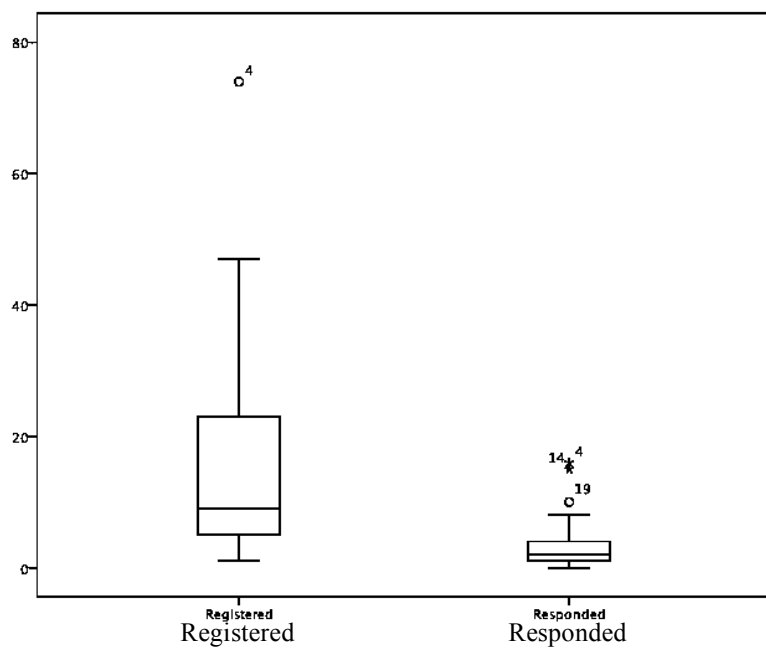


Figure 4. Initial Boxplot Comparing Frequency of Registered State and Responded State, N = 48

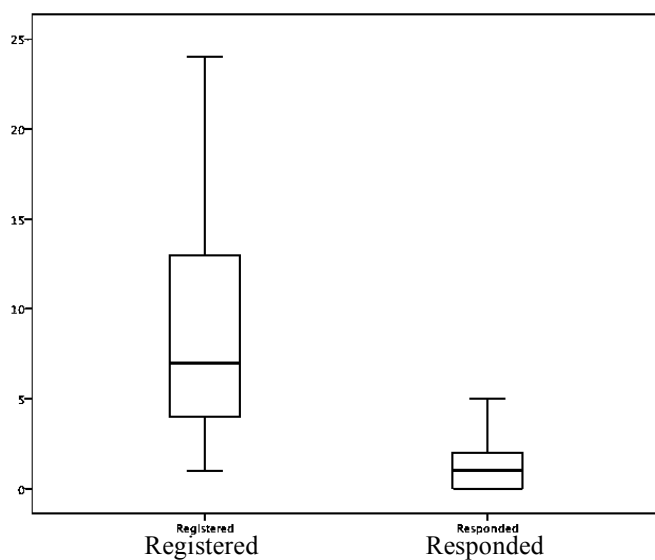


Figure 5. Final Boxplot Comparing Frequency of Registered State and Responded State with Ten Outliers Deleted, N = 38

Validity and Reliability Assessment

Potential threats to the reliability and validity of this research study could originate from threats to the validity and reliability of the measurement instruments as well as threats to the internal and external validity of the research design. The two-stage conceptual validity as tested by the foundational study team was accepted since the current study did not have the resources (e.g., graduate students) to conduct the sorting test. However the current study did assess convergent validity with factor analysis and reliability with Cronbach's alpha.

Factor Analysis Testing for Convergent Validity of the Constructs

The cost/benefit components were assessed with Principal Component Factor Analysis selecting Varimax Rotation with Kaiser Normalization on the independent variables. The component variables as six criteria factors were confirmed as most robust after several trial iterations. See Appendix D for a list of the constructs, variables, and questions. The variables in the participation effort (PEFF), reciprocity (RECP), enjoyment in helping others (EHLP), and general trust (GTRU) loaded together as anticipated. Pro-Sharing norm 4 (PSNM4), "There is a willingness to value and respond to diversity," loaded with GTRU so was dropped from the subsequent analysis. The remainder of the PSNM items loaded strongest with each other. However, the variables PSNM5, "There is a norm of openness to conflicting views," and PSNM6, "There is a norm of tolerance of mistakes," also loaded somewhat with GTRU. The knowledge-self efficacy (KSEF) variables loaded together as anticipated. However, the variable KSEF1 also loaded to a lesser degree with EHLP.

Based on the results of the factor analysis, the constructs and their variables were as follows:

- Participation Effort (PEFF) = PEFF1, PEFF2, PEFF3, PEFF4, PEFF5
- Reciprocity (RECP) = RECP1, RECP2, RECP4
- Knowledge Self Efficacy (KSEF) = KSEF1, KSEF2, KSEF3r, KSEF4r
- Enjoyment in Helping Others (EHLP) = EHLP1, EHLP2, EHLP3, EHLP4

- General Trust (GTRU) = GTRU2, GTRU3, GTRU4
- Pro-Sharing Norms (PSNM) = PSNM1, PSNM2, PSNM3, PSNM5, PSNM6

Reliability Assessment with Cronbach's Alpha

Cronbach's Alpha tests were run for each construct to check that the variables within the construct loaded together and not with another construct. The results are shown in Table 10. The participation effort items (PEFF), the reciprocity items (RECP), and the general trust items (GTRU) formed reliable constructs. For the knowledge self-efficacy (KSEF), pro-sharing norms (PSNM), and enjoyment in helping others (EHLP), the Cronbach's Alpha and the Corrected Item Total Correlation for each item were acceptable. However, the KSEF3r ("It doesn't really make any difference whether I add to the knowledge others are likely to share" reversed) item's Alpha if Item Deleted was greater than the scale's alpha. Similarly, for the Enjoyment in helping others construct, the EHLP4 ("Sharing my knowledge with others gives me pleasure") item did not appear to contribute to the scale's reliability. KSEF3r and EHLP4 were consequently deleted from their respective constructs.

Although deleting the PSNM6 item, "There is a norm of tolerance of mistakes" in the Pro-Sharing Norms (PSNM) scale would have potentially improved the Alpha from 0.802 to 0.804, the EHLP6 item was not deleted from the EHLP scale at this time. The improvement would have been minimal, the scale's Alpha was strong, and the Corrected Item total Correlations acceptable.

The six constructs were thus re-structured as:

- Participation Effort (PEFF) = PEFF1, PEFF2, PEFF3, PEFF4, PEFF5
- Reciprocity (RECP) = RECP1, RECP2, RECP4
- Knowledge Self Efficacy (KSEF) = KSEF1, KSEF2, KSEF4r
- Enjoyment in Helping Others (EHLP) = EHLP1, EHLP2, EHLP3
- General Trust (GTRU) = GTRU2, GTRU3, GTRU4
- Pro-Sharing Norms (PSNM) = PSNM1, PSNM2, PSNM3, PSNM5, PSNM6

Next the factor analysis test was rerun to check the reliability of the newly restructured constructs.

Table 10

Results of Cronbach's Alpha Test of Constructs for Costs and Benefits

Parameters	PEFF N = 131	RECP N = 132	KSEF N = 133	PSNM N = 132	EHLP N = 128	GTRU N = 134
Cronbach's Alpha is > .600?	Yes $\alpha = .794$	Yes $\alpha = .736$	Yes $\alpha = .720^*$	Yes $\alpha = .802^*$	Yes $\alpha = .846$	Yes $\alpha = .614^*$
Will deleting an item improve α ?	No	No	Yes KSEF3r $\alpha = .753$	Yes PSNM4 $\alpha = .804$	Yes EHLP4 $\alpha = .878$	No
Corrected item-total correlations are >.3?	Yes	Yes	Yes	Yes	Yes	Yes

* Standard Alpha was reported when Mean and SD varied considerably

Factor Analysis of Restructured Constructs

Principal Component Factor Analysis selecting Varimax Rotation with Kaiser Normalization on all independent variables was run again to check the re-structured constructs. As shown in Table 11, the six constructs loaded as before. In addition to loading on knowledge self-efficacy (0.66), KSEF1 loaded on enjoyment in helping others (EHLP) (0.44). Similarly, PSNM5 and PSNM6 loaded on general trust (GTRU) (0.44, 0.44) as well as on their dominant construct, pro-sharing norms (0.57, 0.51). The six factors explained 67.43% of the variance. The first factor explained twice as much of the variance as the second, and almost three times more than the fourth after rotation. Eigenvalue measures of the variance of the first six loadings were all sufficient. In addition, the communalities, estimates of the variance accounted for by other variables, are sufficiently high to indicate that the extracted components represent the variables. Therefore the constructs were found to be reliable. Next the constructs were assessed for

Table 11

Final Rotated Component Matrix, Commonalities, Eigenvalues, and % of Variance for Revised Constructs (N=136)

	Component						Communalities
	1	2	3	4	5	6	
Participation effort 1			.684				.522
Participation effort 2			.713				.667
Participation effort 3			.751				.649
Participation effort 4			.693				.751
Participation effort 5			.669				.714
Reciprocity 1				.756			.643
Reciprocity 2				.746			.676
Reciprocity 4				.699			.550
Knowledge self-efficacy 1		.402			.703		.696
Knowledge self-efficacy 2					.722		.666
Knowledge self- efficacy 4r					.810		.668
Enjoyment in helping others 1		.822					.846
Enjoyment in helping others 2		.903					.877
Enjoyment in helping others 3		.892					.828
Generalized trust 2						.775	.702
Generalized trust 3						.732	.694
Generalized trust 4						.425	.502
Pro-sharing norms 1	.759						.671
Pro-sharing norms 2	.854						.783
Pro-sharing norms 3	.795						.675
Pro-sharing norms 5	.575					.440	.586
Pro-sharing norms 6	.499						.469
Eigenvalues	5.17	2.77	2.37	1.87	1.43	1.22	
% of variance	23.48	12.59	10.79	8.48	6.56	5.53	

Note. Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. Values were Options selected were Missing listwise, method = correlation, if < 0.4, leave blank.

^a. Rotation converged in 7 iterations.

compliance with the statistical assumptions and conditions for multiple regression analysis.

Testing Assumptions and Conditions for Regression Analysis

Data included in a regression analysis are assumed to have linear relationships with each other, be the appropriate type of data, be independent, have a normal distribution, be homoscedastic, and exhibit independence and normality of the errors (Boslaugh, 2013). Data not meeting the assumptions may impact the accuracy of the results. Consequently, the construct variables were evaluated for compliance with the assumptions.

Although the data were considered independent in that they were collected from individuals responding to emails within a limited span of time, the individuals are all affiliated with the NSF ATE program. Consequently there may be some clustering that needs to be taken into consideration when the findings are interpreted.

Frequency tables confirmed that the skewness of the mean independent variables was normal, the number of cases (133-136) was sufficient to run linear and multiple regression, and the ranges of the independent variables were adequate. However the dependent variable, PAR2, was somewhat skewed (1.075). A histogram of PAR2 confirmed excessive skewness. A boxplot identified four outliers: case 81, 83, 88, and 126. The outliers were each eliminated in turn, the frequency statistic run to test for skewness, and the results compared. The best solution (skewness = 1.007) found was to eliminate the three scores of 1 (cases 83, 88, and 126). Statistics including the skewness are found in Table 12.

The box plot again showed the same pattern of four outliers with one whisker and the line at the bottom. When those outliers were eliminated from PAR2, the skew statistic was 1.107. Therefore they were restored and the dependent variable, PAR2, was transformed as an alternative to eliminating outliers to correct the skewness. PAR2 was transform to $1/\text{PAR2}$, which exhibited a skewness of -0.313, well within the range of approximately normal. The new variable was named invPAR2.

Table 12

Statistics for Par2, Including Skewness, Mean, SD, Min, Max

N	Valid = 133	Missing = 3^a
Mean		1.83
Std. Deviation		1.063
Skewness		1.007
Minimum		1
Maximum		4

^athe 3 outliers removed

Once the reliability and structure of the constructs were found to exhibit reasonable internal consistency, summated mean variables for the six constructs were calculated and named mPEFF (summated mean of participation), mRECP (summated mean of reciprocity), mKSEF (summated mean of knowledge self-efficacy, mEHLF (summated mean of enjoyment in helping others), mGTRU (summated mean of general trust), and mPSNM (summated mean of pro-sharing norms). The summative construct variables were calculated as means because the number of questions per construct differed. Table 13 contains the descriptive statistics for the calculated construct variables.

In summary, the reliability analysis confirmed that the participation effort items, the reciprocity items, and the general trust items formed acceptably reliable constructs. Removing the KSEF3r and EHLF4 items appeared to improve the reliability of the knowledge self-efficacy (KSEF) and enjoyment in helping others (EHLF) constructs. The PSNM6 item in the pro-sharing norms (PSNM) remained despite a minimal potential improvement in the Alpha if it was removed because the other indicators of reliability for the scale were acceptable. The constructs as revised were found to be reliable. Summed means of the 22 variable items were calculated to create the six independent construct variables.

Table 13

Descriptive Statistics for Construct Variables (mPEFF, mRECP, mKSEF, mEHLP, mGTRU, mPSNM)

Valid N (listwise) = 136	Minimum	Maximum	Mean	Std. Deviation	Skewness	
	Statistic				Std. Error	
mPEFF	1.00	4.40	2.63	.713	-.127	.208
mRECP	1.67	5.00	3.29	.632	-.399	.208
mKSEF	1.33	5.00	3.65	.613	-.474	.208
mEHLP	3.00	5.00	4.08	.522	-.037	.208
mGTRU	1.67	4.67	3.34	.565	-.538	.208
mPSNM	1.50	5.00	3.51	.579	-.393	.208

The conditions and statistical assumptions recommended for factor analysis (the variables were somewhat related, sampling was relatively independent, and the pairs of variables shared an approximately linear relationship) were then confirmed in this analysis for most of the variables. Next the hypotheses were tested with linear multiple regression and moderated multiple regression.

Testing the Hypotheses

In the previous section the data were analyzed for reliability and compliance with the assumptions of the planned statistical analysis, multiple regression. The data were judged to be at least minimally compliant.

In this section the tests for the hypotheses are discussed. Multiple regression analysis was selected for hypothesis checking, because it was the method of choice for the foundational study and the recommended approach to comparing scaled data with multiple predictor variables and one dependent variable. The current study used PAR2 as the designated dependent or criterion variable because PAR2 (participation within six months) incorporated PAR1 (participation within one month) by definition. As discussed earlier, before the regression analysis was run statistical assumptions and conditions for regression analysis were investigated. During the course of that analysis, the variable

PAR2 was transformed to invPAR2, the inverse of itself. Consequently the sign of the results will need to be switched.

Testing the Hypotheses

The first two null hypotheses looked at the direct relationship of two predictor variables to the level of participation as follows:

Null Hypothesis 1 (H_{01}): Participation in online knowledge sharing is not related to knowledge self-efficacy. *Alternate Hypothesis 1 (H_{A1}): Participation in online knowledge sharing is positively related to knowledge self-efficacy.*

Null Hypothesis 2 (H_{02}): Participation in online knowledge sharing is not related to enjoyment in helping others. *Alternate Hypothesis H_{A2} : Participation in online knowledge sharing is positively related to enjoyment in helping others.*

The research model theorizes that interactions between the moderator variables reciprocity on the predictor pro-sharing norms and of generalized trust on the predictor participation effort will improve the relationship between the predictor variables and participation. Therefore, the third and fourth null hypotheses looked at the impact of two moderator variables on the relationships between two predictor variables and the level of participation as follows:

Null Hypothesis 3 (H_{03}): Participation in online knowledge sharing is not related to participation effort as moderated by generalized trust. *Alternate Hypothesis 3 (H_{A3}): Participation in online knowledge sharing is negatively related to participation effort as moderated by generalized trust.*

Null Hypothesis 4 (H_{04}): Participation in online knowledge sharing is not related to pro-sharing norms as moderated by reciprocity. *Alternate Hypothesis 4 (H_{A4}): Participation in online knowledge sharing is positively related to pro-sharing norms as moderated by reciprocity.*

First a simultaneous multiple regression was computed in SPSS to assess the best linear model for how knowledge self-efficacy, participation effort, enjoyment in helping others, reciprocity, pro-sharing norms, and generalized trust influenced participation in

knowledge sharing without the presence of the interacting variables. As shown in Table 14, participation was not found to have a statistically significant relationship to knowledge self-efficacy ($p = .057$). In contrast, enjoyment in helping others did have a

Table 14

Simultaneous Multiple Regression Analysis Summary for Model 1 Test of Hypotheses

Model 1, N = 133	UC		SC			
Predictor variables	B^c	SEB	Beta	t	Sig.	95.0% CI
(Constant)	-1.82	.32		-5.61	.000	[1.17, 2.46]
Participation Effort	-.04	.04	-.09	-1.03	.303	[-.04, .12]
Reciprocity	-.03	.04	-.06	-.64	.523	[-.06, .11]
Knowledge self-efficacy	.09	.05	.17	1.92	.057	[-.19, .00]
Enjoyment in helping others	.15	.06	.25	2.60	.011	[-.26, -.03]
Generalized trust	-.04	.05	-.07	-.71	.477	[-.06, .14]
Pro-sharing norms	.14	.05	.25	2.63	.010	[-.24, -.03]

^aDependent Variable: invPAR2

^bCI = Confidence Interval for B; UC = Unstandardized Coefficient; SC = Standardized coefficient

^cSign has been reversed to adjust for inversed dependent variable

statistically significant relationship to participation ($p = .011$) and made a statistically significant contribution to the equation. In addition, contrary to the finding in the foundational study, the level of participation was found to be directly related to pro-sharing norms ($p = .010$), without the anticipated need for interaction between pro-sharing norms and reciprocity (Kankanhalli, Tan, & Wei, 2005). Reciprocity ($p = .523$), generalized trust ($p = .477$), and participation effort ($p = .303$) were not found to have a statistically significant relationship with the level of participation. Their calculated contributions could therefore be the result of chance. The results also indicated that 19% of the variance in participation could be predicted from the combination of the six

variables. As shown in Table 15, at the specified 0.05 level the regression was statistically significant ($F(6, 132) = 6.25, p < .001$). The effect size or multiple correlation coefficient ($R = .48$) was somewhat larger than typical. However, the adjusted R^2 was less than the R^2 , which suggested that the number of variables should be lowered if possible.

Table 15

Summary Statistics for Linear Regression Test of Hypotheses 1 & 2

Dependent: invPAR2	Model 1^a
R	.48
R^2	.23
Adjusted R^2	.19
Std. Error of the Estimate	.28
ΔR^2	.23
ΔF	6.3
df1	6
df2	126
Sig ΔF	.000
Sum of Squares Regression	2.96
Sum of Squares Residual	9.95
df Regression	6
df Residual	126
Mean ² Regression	.49
Mean ² Residual	.08
F	6.25
Sig	.000

^a Predictors: (Constant), mPSNM, mKSEF, mPEFF, mRECP, mGTRU, mEHL

Following the example of the foundational study, a moderated simultaneous multiple regression was computed to assess the effect of the interactions between the moderator variables reciprocity and generalized trust respectively on the predictor

variables pro-sharing norms and participation effort on participation, after controlling for knowledge self-efficacy, participation effort, enjoyment in helping others, reciprocity, pro-sharing norms, and generalized trust. The results are shown in Tables 16 and 17.

Table 16

Model Summaries for Moderated Simultaneous Regression Tests of Hypotheses

	Model 1^a	Model 2^b
R	.48	.49 ^b
R ²	.23	.24
Adjusted R ²	.19	.19
Std. Error of the Estimate	.28	.28
ΔR^2	.23	.01
ΔF	6.3	.62
df1	6	2
df2	126	124
Sig ΔF	.000	.538

^aDependent variable: invPAR2; Predictors: (Constant), mPSNM, mKSEF, mPEFF, mRECP, mGTRU, mEHLF

^bDependent variable: invPAR2; Predictors: (Constant), mPSNM, mKSEF, mPEFF, mRECP, mGTRU, mEHLF, mRECPmPSNM, mGTRUmPEFF

Model 1 of the moderated regression analysis replicated the results in the linear regression calculations discussed in the previous section that tested Hypotheses 1 and 2. When the predictors were controlled for and the interacting variables added, the Model 2 predicted approximately the same variance (19%) as Model 1, an indication that suggests that the interacting variables did not make a contribution to the model.

The adjusted R², which considers the increase in the number of variables, did not change between the models. The F change from 0.18 to 1.24 was not statistically significant, $F(2, 124) = 1.24$, $p = 0.295$. Both models were statistically significant predictors of participation, $F(6, 126) = 6.25$, $p < .001$ in Model 1 and $F(8, 124) = 4.81$, $p < .001$ in Model 2. Both models had effect sizes ($R = .48$, $R = .49$) somewhat larger than typical.

Table 17

Moderated Multiple Regression Results for Models 1 and Model 2

<i>N</i> = 133	UC ^b		SC			
Model 1^{a,d}	B	SEB	Beta	t	Sig.	95.0% CI
(Constant)	-1.82	.32		-5.61	.000	[1.17, 2.46]
Participation Effort	-.04	.04	-.09	-1.03	.303	[-.04, .12]
Reciprocity	-.03	.04	-.06	-.64	.523	[-.06, .11]
Knowledge self-efficacy	.09	.05	.17	1.92	.057	[-.19, .00]
Enjoyment in helping others	.15	.06	.25	2.60	.011	[-.26, -.03]
Generalized trust	-.04	.05	-.07	-.71	.477	[-.06, .14]
Pro-sharing norms	.14	.05	.25	2.63	.010	[-.24, -.03]
<i>Model 2^c</i>						
(Constant)	-.71	1.05		-.68	.501	[-1.37, 2.78]
Participation Effort	-.23	.22	-.52	-1.03	.308	[-.21, .66]
Reciprocity	-.23	.21	-.46	-1.08	.280	[-.19, .64]
Knowledge self-efficacy	.10	.05	.18	2.01	.047	[-.20, .00]
Enjoyment in helping others	.14	.06	.24	2.51	.013	[-.26, -.03]
Generalized trust	-.19	.18	-.34	-1.02	.310	[-.06, .14]
Pro-sharing norms	-.04	.19	-.08	-.23	.823	[-.18, .56]
Reciprocity -> Pro-sharing norms	.06	.06	.61	.97	.334	[-.17, .06]
General trust -> participation effort	.06	.07	.46	.87	.387	[-.19, .07]

^aDependent Variable: invPAR2; Predictors: (Constant), mPSNM, mKSEF, mPEFF, mRECP, mGTRU, mEHLF

^bUC = Unstandardized Coefficient; SC = Standardized coefficient; CI = Confidence Interval for B;

^cDependent Variable: invPAR2; Predictors: (Constant), mPSNM, mKSEF, mPEFF, mRECP, mGTRU, mEHLF, mRECPmPSNM, mGTRUmPEFF

^dSign is reversed from calculated result due to use of inverse of dependent variable.

As shown in Table 17, enjoyment in helping others was a significant predictor in both models, $p = 0.011$ in Model 1 and $p = 0.012$ in Model 2. Knowledge self-efficacy

was a statistically significant predictor in Model 2, $p = .047$, but not in Model 1, $p = .057$. In contrast, pro-sharing norms was a statistically significant predictor in Model 1, but not in Model 2. Participation effort, reciprocity, and general trust were not statistically significant in either model. Therefore, contrary to expectations, reciprocity appeared to have a negative impact on the relationship between participation and pro-sharing norms and general trust did not improve the relationship between participation effort and participation. However, the change in the statistical significance of knowledge self-efficacy in the second model suggests that the addition of the interaction variables to the model did make a difference. In addition, the interaction variables are included in the research model for the current study. Therefore the hypotheses test results from Model 2 are the focus of the discussion of the findings for this study in the next chapter.

Summary of Findings

This chapter discussed the findings of the statistical analysis completed to test the four hypotheses that formed the focus of this study. This research adapted a survey by Kankanhalli, Tan, and Wei (2005) of business managers in Singapore on the cost and benefit factors impacting their participation in electronic knowledge sharing communities. The current study tested whether the survey would yield similar results when applied to a community of innovative community college faculty in the United States of America—individuals who had registered to attend the 2011 National Science Foundation Advanced Technological Education (NSF ATE) Principal Investigators' Conference.

Registrants on an email list provided by the conference organizer, the Association of American Community Colleges (AACC), were invited to participate in the survey. Of the 712 invitations issues, 698 (98.0%) were successfully delivered, 174 respondents (24.4% of invited) submitted surveys, 140 (19.7%) were complete enough to include in the initial data analysis, and 133 (18.7%) were included in the final moderated multiple regression. After the data were analyzed for quality and completeness, the geographic

dispersion of the survey respondents and the registrants were confirmed at an acceptable level.

The variable constructs were then evaluated with factor analysis and, after some adjustment, found to be acceptable. Next a linear regression analysis explored the relationships of the predictor variables (participation effort, reciprocity, knowledge self-efficacy, and enjoyment in helping others) and the dependent variable (participation). Finally that model was tested again with a moderated multiple linear regression analysis that examined the impact of the moderator variables reciprocity and generalized trust respectively, on the predictor variables on pro-sharing norms and participation effort on participation, after controlling for knowledge self-efficacy, participation effort, enjoyment in helping others, reciprocity, pro-sharing norms, and generalized trust.

As shown in Table 18, the first null hypothesis was supported in the first test, the multiple linear regression analysis, but was rejected as a result of the second test, the moderated multiple linear analysis. The second null hypothesis was rejected by both tests. The third and fourth null hypotheses were supported by both tests. The current and foundational studies thus differed in their findings concerning the impact of the moderator variable interaction on participation. The findings of the current study, the implications of the similarities and differences between the two studies, areas for future research, and issues around data quality and possible errors are discussed in the next chapter.

Table 18

Results of Hypotheses Tests for Null (H_0) and Alternate (H_A) Hypotheses

	Hypothesis	Test 1	Test 2
H₀₁	Participation in online knowledge sharing is not related to knowledge self-efficacy	Supported	Rejected
H_{A1}	<i>Participation in online knowledge sharing is positively related to knowledge self-efficacy.</i>	<i>Rejected</i>	<i>Supported</i>
H₀₂	Participation in online knowledge sharing is not related to enjoyment in helping others	Rejected	Rejected
H_{A2}	<i>Participation in online knowledge sharing is positively related to enjoyment in helping others.</i>	<i>Supported</i>	<i>Supported</i>
H₀₃	Participation in online knowledge sharing is not related to participation effort as moderated by generalized trust	Supported	Supported
H_{A3}	<i>Participation in online knowledge sharing is negatively related to participation effort as moderated by generalized trust</i>	<i>Rejected</i>	<i>Rejected</i>
H₀₄	Participation in online knowledge sharing is not related to pro-sharing norms as moderated by reciprocity	Supported	Supported
H_{A4}	<i>Participation in online knowledge sharing is positively related to pro-sharing norms as moderated by reciprocity.</i>	<i>Rejected</i>	<i>Rejected</i>

CONCLUSION

The previous chapter reviewed the findings of the data analysis conducted to address the research question and test the hypotheses. Specifically the relationship between self-reported participation in online knowledge sharing and the predictor variables of pro-sharing norms, knowledge self-efficacy, and enjoyment in helping others were examined through multiple linear regression analysis. In addition, the moderating influence of reciprocity on the predictor variable of pro-sharing norms, and of generalized trust on the predictor variable of participation effort were also examined with moderated multiple linear regression (see Figure 1). This final chapter provides an overview of the study's purpose, methodology, and findings. Issues of credibility, implications for practice, and potential areas for future research are also discussed.

Statement of the Problem

This study examined the relationship between selected cost and benefit factors and the level of faculty participation in online knowledge sharing in communities of practice supporting innovations in instruction. The research addressed the question: "How do cost and benefit factors relate to participation in online knowledge sharing in communities of practice meant to support efforts to improve instruction?" Kankanhalli, Tan, and Wei's (2005) model of knowledge sharing as an individual cost and benefit analysis decision influenced by organizational context provided the theoretical framework for the current study. However, unlike the foundational study, the current study included both participating and non-participating members of knowledge-sharing communities with online knowledge sharing. Specifically, the current study asked if the results of the foundational study's survey of Singapore business leaders held true for registrants to the 2011 National Science Foundation's (NSF) annual conference for principal investigators of grants funded by NSF's advanced technological education program.

The study examined four null hypotheses and their alternates that were supported by a literature review focused on online knowledge sharing in communities of practice,

cost and benefit factors, and participation in such communities (Bock, Zmud, Kim, & Lee, 2005; Kankanhalli, Tan, & Wei, 2005; Lim & Chan, 2003; Lin, 2007; Sahin, 2008).

The hypotheses were:

Null Hypothesis 1 (H_{01}): Participation in online knowledge sharing is not related to knowledge self-efficacy. *Alternate Hypothesis 1 (H_{A1}): Participation in online knowledge sharing is positively related to knowledge self-efficacy.*

Null Hypothesis 2 (H_{02}): Participation in online knowledge sharing is not related to enjoyment in helping others. *Alternate Hypothesis 2 (H_{A2}): Participation in online knowledge sharing is positively related to enjoyment in helping others.*

Null Hypothesis 3 (H_{03}): Participation in online knowledge sharing is not related to participation effort as moderated by generalized trust. *Alternate Hypothesis 3 (H_{A3}): Participation in online knowledge sharing is negatively related to participation effort as moderated by generalized trust.*

Null Hypothesis 4 (H_{04}): Participation in online knowledge sharing is not related to pro-sharing norms as moderated by reciprocity. *Alternate Hypothesis 4 (H_{A4}): Participation in online knowledge sharing is positively related to pro-sharing norms as moderated by reciprocity.*

Review of the Methodology

As discussed in the previous section, this dissertation study addressed the question of how cost and benefit factors relate to faculty participation in an online knowledge sharing in communities of practice meant to support educators' efforts to improve instruction. The postpositivist philosophical approach (Popper, 1959, 1962) provided a framework for the research that aligned with the goals of the study and the interests of the intended audience, the community of researchers and educators managing National Science Foundation grant-funded projects or centers that foster innovation in teaching and learning in community colleges, specifically participants in the Advanced Technological Education Program (ATE). Data were collected in Fall 2012 through a self-administered online survey on SurveyMonkey. The survey was an edited version of

one developed and validated by Kankanhalli, Tan, and Wei (2005). See Table 2 for a comparison of the foundational and current studies.

In a community of practice, as shown in Figure 3, participants in online knowledge sharing have shared their knowledge with the community by posting to an online discussion or blog. In contrast, non-participating members have not shared their own knowledge with the community. Either group may or may not have used the knowledge added to the site by other members of the community managers that is available to members. Consequently two questions assessing the degree of participation based on the number of times knowledge was shared in the prior month and six months respectively were added to the survey. In addition, two demographic questions designed to permit a comparison of the respondents with the registrants in the conference were also added. These questions were based on the registration form registrants had completed for the conference. Respondents were asked to select their workplace state or territory and to indicate if this was their first ATE PI conference. The constructs, variables, and questions can be found in Appendix D, and the survey in Appendix C.

To improve the response rate, the emails were written to appeal to different reasons for participating in the survey (Groves, Singer, & Corning, 2000). See Appendix B to read the invitation emails.

The survey invitation was sent to 712 registrants listed on a list of emails provided by the AACC, the conference managers. SurveyMonkey first filtered the email addresses to eliminate recipients who had previously opted out of receiving online surveys. Next, three email invitations were delivered over the course of 20 days to 698 of the registrants to the 2011 ATE PI conference. A second and then a third email invitation were sent to individuals who had not responded to the previous invitation. Of the 712 invitees, 24.4% (174) started and 21.5% (153) finished the survey. Elimination of cases through the course of the data analysis resulted in a final N of 133 (18.7%) for the hypotheses testing.

Throughout the data collection and subsequent analysis the Oregon State Human Subjects policy and IRB regulations were followed to protect the rights of the participants

in this research. Options in SurveyMonkey that increased the privacy of the respondents were also utilized. The next section reviews the findings from the survey data.

Summary of the Results

Among the survey respondents, participation in online knowledge sharing was related to the internal motivation knowledge self-efficacy (adjusted Beta = .18, $p = .047$) and enjoyment in helping others (adjusted Beta = .24, $p = .011$) when the influence of the moderator variables reciprocity and generalized trust respectively on the predictor variables pro-sharing norms and participation effort on participation were included in the model. However, the moderator influences were not themselves statistically significant ($P = .334$, $p = .387$). The results are shown in Table 17. Thus the first (knowledge self-efficacy) and second (enjoyment in helping others) null hypotheses were not supported. The third (reciprocity on pro-sharing norms) and fourth (generalized trust on participation effort) null hypotheses were supported. However, much of the variance (81%) remained unexplained by the model.

When the regression was run to test the relationship of participation in online knowledge sharing with the benefit factors of reciprocity, knowledge self-efficacy, enjoyment in helping others, generalized trust, and pro-sharing norms and the cost factors of participation effort without the moderator variables, enjoyment in helping others ($p = .011$) and pro-sharing norms ($p = .010$) were statistically significant. The moderator variables therefore had some influence on the participation model.

Pre-Analysis Data Screening

Before the hypotheses were tested, pre-analysis data screening examined the quality of the data and the characteristics of the respondents. The statistics analysis was limited to complete cases when possible. Fourteen cases were deleted for reported lack of an online space in their community of practice and 20 for having no answers beyond the consent question. Missing data points were considered user entry errors. The findings included the following:

- A frequency analysis found respondents were from 38 states with 13 states having only 1 participant and 1 state (CA) having 16 (See Table 7).
- A cross tab analysis found that 53.7% of repeat attendees and 36.6% of the new attendees reported participating in online knowledge sharing in the previous six months (Pearson Chi-Squared = 2.458, df = 1, p = .117, 2-sided).
- Four additional cases were eliminated, three because they were missing more than 50% of the answers, and one to improve skewness of a pro-sharing norm variable (PSNM2). The data then met the statistical assumptions for inferential statistics.
- The respondents to the survey appeared to be approximately 10.5% more likely to be first-time attendees than the registrants.
- The registrants and respondents were somewhat similarly geographically dispersed ($r = .630$, $p < .001$).

In summary, the respondents to the survey and the participants in online knowledge sharing were more likely to be returning attendees than new. The respondents came from 38 states and were somewhat geographically dispersed.

Validity and Reliability Analysis

The data also analyzed for reliability and compliance with the assumptions of the planned statistical analysis, multiple regression (the variables were somewhat related, sampling was relatively independent, and the pairs of variables shared an approximately linear relationship). The 2-stage conceptual validity was accepted by the current study as tested by the foundational study team. The data were judged to be at least minimally compliant. In the course of that analysis, the following findings were made:

- The six criteria factors were confirmed as most robust after several trial iterations of Principal Component Factor Analysis selecting Varimax Rotation with Kaiser Normalization.

- The constructs were redefined after KSEF3r and EHLP4 were eliminated from the analysis because they did not appear to contribute to the scale's reliability (see Table 10).
- The redesigned constructs were found to be reliable by principal component factor analysis (see Table 11).

The final constructs were:

- Participation Effort (PEFF): PEFF1, PEFF2, PEFF3, PEFF4, PEFF5
- Reciprocity (RECP): RECP1, RECP2, RECP4
- Knowledge Self-Efficacy (KSEF): KSEF1, KSEF2, KSEF4r
- Enjoyment in Helping Others (EHLP): EHLP1, EHLP2, EHLP3
- General Trust (GTRU): GTRU2, GTRU3, GTRU4
- Pro-Sharing Norms (PSNM): PSNM1, PSNM2, PSNM3, PSNM5, PSNM6

The construct variables were then calculated as the summed means of the variable items within each construct. The data were in compliance with the conditions and statistical assumptions recommended for factor analysis. During the course of that analysis, the variable PAR2 was transformed to invPAR2. The use of the inverse required that the sign of the results be reversed in analyzing the findings. Next the hypotheses were tested through moderated multiple regression.

Testing the Hypotheses

Knowledge self-efficacy ($\text{Beta} = .10$, $p = .047$) and enjoyment in helping others ($\text{Beta} = .14$, $p = .013$) were positively and statistically significantly related to participation over the six months prior to the survey when the interacting variables were added. The interacting variables themselves were not found to have a statistically significant influence on participation ($p = .334$, $p = .387$). Approximately 19% of the variance in participation could be predicted from the combination of the six variables both with and without the presence of the interacting variables in the equation. However their presence did change the statistical significance of knowledge self-efficacy from $p = 0.57$ to $p = 0.47$ and of pro-sharing norms from $p = .010$ to $p = .823$. These changes

suggest that the interacting variables served a role in the model. Furthermore, the change in the pro-sharing norms may be due to multicollinearity or an error in the calculation of the interacting variables. This issue is discussed further in the limitations section of this chapter.

Comparison with the Foundational Study

As shown in Tables 19 and 20, the results of the current study did not align with the results of the foundational study. Knowledge self-efficacy and enjoyment in helping others were found to have statistically significant relationships with participation in knowledge sharing in both studies. However participation effort as moderated by generalized trust and pro-sharing norms as moderated by reciprocity were not found to have a statistically significant relationship with participation in knowledge sharing in the current study and were found to have a statistically significant relationship with participation in knowledge sharing in the foundational study. Potential sources of the different results may be in design differences between the studies as listed in Table 4.

Discussion of the Results

Changing teaching requires teaching how to change. Effort is needed to acquire the knowledge of the new pedagogy, put it into practice, and intentionally adjust one's practice of teaching (Savin-Baden & Major, 2006). Faculties pursuing such a change often do so without the support of their institutions or colleagues. Research has shown that faculty reports multiple benefits to participating in a community of faculty in pursuit

Table 19

Comparison of Results for Model 1 of the Alternate Hypotheses with Moderated Multiple Linear Regression Analysis for Current and Foundational Studies

SC ^b	Current Study ^a		Foundational Study	
	Beta ^c	Sig	Beta	Sig
(Constant)	-1.82	.000		
Participation Effort ^c	-.04	.303	- .07	
Reciprocity	-.03	.523	.11	
Knowledge self-efficacy	.09	.057	.25	< .001
Enjoyment in helping others	.15	.011	.43	< .001
Generalized trust	-.04	.477	-.13	
Pro-sharing norms	.14	.010	.04	
R ²	.23		.44	
Adjusted R ²	.19		.38	
F	6.25	< .001	10.95	< .001

Note: Adapted with permission from “Contributing knowledge to electronic knowledge repositories: An empirical investigation,” by A. Kankanhalli, B. Tan, and K. Wei, 2005, *MIS Quarterly*, 29(1), p. 129. Copyright 2005 by Regents of the University of Minnesota.

^aDependent Variable: invPAR2; Predictors: (Constant), mPSNM, mKSEF, mPEFF, mRECP, mGTRU, mEHLF

^bSC = Standardized coefficient

^cBeta sign is reversed from calculated result due to use of inverse of dependent variable.

Table 20

Comparison of Model 2 Testing of the Alternate Hypotheses with Moderated Multiple Linear Regression Analysis for Current and Foundational Studies

SC ^b	Current Study ^a		Foundational Study	
	Beta ^c	Sig	Beta	Sig
(Constant)	-.71	.501		
Participation Effort	-.23	.308	.07	
Reciprocity	-.23	.280	.11	
Knowledge self-efficacy	.10	.047	.25	< .001
Enjoyment in helping others	.14	.013	.43	< .001
Generalized trust	-.19	.310	-.13	
Pro-sharing norms	-.04	.823	.04	
Reciprocity -> Pro-sharing norms	.06	.334	-.18	< .05
General trust -> participation effort	.06	.387	-.18	< .05
R ²	.24		.44	
Adjusted R ²	.19		.38	
F	4.81	< .001	10.95	< .001
R ² change	.01		.08	
F change	.62	.538	3.23	< .01

Note. Adapted with permission from “Contributing knowledge to electronic knowledge repositories: An empirical investigation,” by A. Kankanhalli, B. Tan, and K. Wei, 2005, *MIS Quarterly*, 29(1), p. 129. Copyright 2005 by Regents of the University of Minnesota.

^aDependent Variable: invPAR2; Predictors: (Constant), mPSNM, mKSEF, mPEFF, mRECP, mGTRU, mEHLF

^bSC = Standardized coefficient

^cBeta sign is reversed from calculated result due to use of inverse of dependent variable.

of the same change (Tammets, Pata, & Laanpere, 2013; Yarnall & Fusco, 2013) Faculty-to-faculty support can have a strong influence on sustained, quality implementation of new pedagogical knowledge (Tammets, Pata, & Laanpere, 2013). This is understandable, given the social nature of learning. Yet a clear understanding of how to most effectively support and grow such a community has proved elusive to researchers and practitioners (Derry, Seymour, Steinkuehler, Lee, & Siegel, 2004; Kimble, Hildreth,

& Bourdon, 2008; Palloff & Pratt, 2007; Savin-Baden & Major, 2006). The complex nature of change, learning, knowledge building, and human motivation makes finding a solution a challenging undertaking.

This study was an exploratory first-step in a research agenda directed at improving support for faculty adopting innovative instructional practices. Specifically this phase of the research addresses how to sustain online knowledge sharing in communities of practice for faculty through increased participation by faculty. Therefore findings of practical significance to managers of online knowledge sharing in communities of practice are of particular interest to the researcher.

With that approach in mind, this study focused the literature review on the following three questions:

- How is the knowledge of a practice built and shared?
- What is a community of practice with online knowledge sharing?
- What are the costs and benefits associated with participating in online knowledge sharing?

As shown in Table 3, prior researchers have adopted various approaches that emphasize different factors influencing participation that may be summarized into the dimensions of organizational norms (context and tools), interpersonal norms (reciprocity and generalized trust), and personal norms (beliefs and attitudes). As shown in Table 21, the current study's findings added to the interpersonal dimension of that research.

This study followed the example of the prior studies and collected data through a survey administered to individual members of a community of practice. However, in contrast to the above studies, the present study used an existing survey delivered electronically to a geographically dispersed community. The target industry to be surveyed and cultural context also differed in the new study. The prior studies focused on

Table 21

Updated Key Dimensions of Factors that Impact Knowledge Sharing in Communities of Practice

Dimension	Supporting Citations
Organizational norms (context and tools)	The expectations of consequences based on the pattern of reward/punishment within the context influences the decision (Bandura, 1977) The context influences cost/benefit decisions (Tversky & Kahneman, 1981) Organizational norms influenced by organizational climate support knowledge sharing (Bock, Zmud, Kim, & Lee, 2005) If context includes collaboration and cooperation then reciprocity is not needed (Constant, Kiesler, & Sproull, 1994; Kankanhalli, Tan, & Wei, 2005) Open leadership climate is the most impactful attitude within leadership ranks, the third of four dimensions impacting knowledge sharing (Lin, Lee, & Wang, 2009) Knowledge networks is the most impactful attitude within Information Technology, the fourth of four dimensions impacting knowledge sharing (Lin, Lee, & Wang, 2009).
Interpersonal norms (reciprocity and trust)	Swift response encourages sharing (Jarvenpaa & Leidner, 1998) Knowledge viewed as for the public good with cultural expectation of generalized reciprocity then knowledge is shared (Wasko & Faraj, 2000) Reciprocity needed if context not good (Kankanhalli, Tan, & Wei, 2005). Anticipated reciprocity impacts attitudes towards sharing (Bock, Zmud, Kim, & Lee, 2005) Reciprocal benefits encourage knowledge sharing (Lin, 2007) Interpersonal trust most important attitude in dimension of corporate culture influencing knowledge sharing (Lin, Lee, & Wang, 2009)
Personal norms (beliefs and attitudes)	Knowledge sharing is seen as fun, challenging, interesting, the right thing to do, and a good way to improve the community (Wasko & Faraj, 2000) Personal attitudes towards sharing impact intentions to share (Bock, Zmud, Kim, & Lee, 2005) Sense of self-worth (Bock, Zmud, Kim, & Lee, 2005) Personal reward seen in the sharing (intellectual challenge) and enjoyment in helping others (McLure-Wasko & Faraj, 2005) Professional reward (reputation enhanced) as outcome in the sharing (McLure-Wasko & Faraj, 2005) Knowledge self-efficacy and enjoyment in helping others supports knowledge sharing (Lin, 2007) Knowledge self-efficacy most important attitude impacting knowledge sharing in the dimension of employee motivation (Lin, Lee, & Wang, 2009). Knowledge self-efficacy and enjoyment in helping others support participation in online knowledge sharing (Current Study).

populations that were fairly homogenous and employed in large public organizations in Korea and Singapore, traditionally collectivist cultures (Bock, Zmud, Kim, & Lee, 2005; Irwin, 2009). In contrast, this study applied the prior research to a new, more diverse population—community college faculty in the United States of America, a more individualistic culture. Nonetheless, the prior and current studies shared a belief that knowledge resides in individuals and that the success of organizations and institutions depends to some extent on the sharing of that knowledge. In addition, the belief by the individual that the benefits gained from sharing knowledge outweigh the anticipated costs was seen as a requirement for that knowledge sharing to occur.

Kankanhalli, Tan, and Wei (2005) tied this sharing and valuing with the concept of social capital. This echoed Rothstein's and Stolle's (2003) argument in their discussion of the role of social capital in Scandinavian life, that voluntary associations benefit from members' social capital. They defined social capital as having two dimensions—the collection of relations that can be used as an asset by the individual, and that individual's set of values and attitudes. "Simply put, the more social networks A is involved in, and the more trust and willingness to cooperate A possesses, the more social capital A has" (Rothstein & Stolle, 2003, p. 3). From that perspective, it could be argued that the findings of the current study introduced a dilemma in characterizing the role of social capital in communities. The current study's survey results indicated that the respondents as members of voluntary associations (communities of practice for faculty) were more likely to contribute assets (knowledge) if they had knowledge self-efficacy and found enjoyment in helping others. Trust and reciprocity, as measured by survey constructs, did not evidently play significant roles in the decision to share. Were they absent because, as Rothstein and Stolle argued, social capital and therefore trust and reciprocity are rare in the United States? Or was it absent because voluntarily sharing one's own knowledge was motivated by something else? Something yet to be identified that if added to the model would explain the 81% of the equation that the model did not explain?

In their study of the influence of social good versus personal cost on attitudes towards information sharing, Constant, Kiesler, and Sproull (1994) found that attitudes

towards sharing were learned through work experience and work-related schooling. When the organizational norm was altruistic (pro-sharing), individuals were more likely to share even with those who have previously refused to share with them. Furthermore, the influence of reciprocity was different for attitudes towards sharing tangible information products (e.g., a computer program created at work) and intangible information products (e.g., personal expertise in using the program). Perhaps because the sharer gained personal satisfaction in the sharing, personal expertise was likely to be shared even in the face of negative behavior by the recipient. Thus in an environment where sharing is strongly encouraged, such as the NSF ATE program, reciprocity would not be expected to be a necessary ingredient for knowledge sharing among acculturated faculty.

Participation in knowledge building might also be influenced by the potential sharer's beliefs around ownership of the knowledge. Tammets, Pata, and Laanpere (2013) argued that knowledge building was a visible process that was both internal and socially shared and resulted in cognitive artefacts. Data became information when meaning was created and it was used to inform, influence, or change another. Information became knowledge when it was transformed by individuals or collectively by adding value through experience, contextualization, comparison, expert insight, connections, or conversations (Davenport & Prusak, 1998). The ownership of the cognitive artefacts of knowledge might be considered to be: a) Held by one entity (e.g., an individual, corporation) who could sell, rent, or otherwise charge others for the use of the knowledge; b) Held by one entity who could share it with others but not transfer it – the owners remains the expert for that knowledge; or c) Created by one entity or many but held for and available to the public good (Wasko & Faraj, 2000). An individual's view of knowledge ownership might therefore influence his or her willingness to share. Beliefs of ownership of knowledge and values held by national culture were not explored in the current study and are a topic for future investigation.

Limitations of the Study

The power of the findings of this study is limited by errors in design and implementation of the research. This study centers on a survey administered at one moment in time online and relies on self-reporting of suggested participation in online knowledge sharing, the costs associated with the effort, and the benefits perceived. The response rate was considered adequate for an online survey. However, when considering changes in policy and professional practice, decisions ideally should be made based on a majority of the population. Furthermore, the researcher should determine the effects of non-response bias and make appropriate statistical adjustments. In the current study, the online survey might have attracted responses from a lower percentage of the population who were not participants in online knowledge sharing than participants since the survey was an experience in online knowledge sharing. Further, the survey was administered during one of the busiest months of the year for the respondents, which may have negatively impacted the response rate.

The study was designed to replicate an existing study as much as possible. Consequently, when the data gathered in this study were not good fits to the chosen statistical tests, the data were adjusted to fit the statistical test rather than the tests selected based on the data. While eliminating outliers to improve data's alignments with the statistical assumptions of the specific analysis is encouraged (Osborne, 2010). Outliers are often where innovation happens or is blocked. Therefore, educational research that is seeking information on innovations might lose the information about the key participants if outliers are eliminated. Further, outliers might be an indication of problems with the regression model that, if addressed, might improve the accuracy of the findings (Cohen, Cohen, West, & Aiken, 2003).

The accuracy of the comparison between the respondents and the registrants on the issue of first time or repeat attendees is questionable because the AACC's number was derived from a list that unlike the study's list, included NSF and AACC staff. The NSF and AACC staffs are likely to be repeat attendees, thus elevating the number of repeat attendees in that list.

Although the data were considered independent in that they were collected from individuals responding to emails within a limited span of time, the individuals are all affiliated with the National Science Foundation's ATE program. Consequently there may be some clustering that needs to be taken into consideration when the findings are interpreted or applied.

Finally, this study is the work of one individual and therefore subject to the errors common to solo endeavors that demand a high attention to accuracy and details. Nonetheless, the study results may be of interest to other researchers and practitioners and future research, as discussed in the next section, might remedy some of the limitations.

Implications for Practice and Research

As discussed above, given the limitations of this research study, the conclusions, while interesting, are not sufficiently definitive to justify a change in practice. They do, however, open some interesting doors to future inquiry, including the following:

- Knowledge self-efficacy – how is it built? Identified?
- Enjoyment in helping others – Is it or can it be made contagious?
- Are there cultural differences or organizational differences in knowledge sharing practices that impact an individual's decision to share knowledge? Or do the differences in results between the two studies reflect the research designs rather than the nature of the populations studied?
- What cost and benefit factors would explain more of the equation? What was left out of the model?
- What value is in the knowledge that is shared to those who share their knowledge? To those who do not?
- What within the context or larger institutional system that encases the faculty's practice of teaching is influencing the decision to share knowledge?

This is a complex, multidimensional problem that may require a multidimensional systems approach. Solutions to effective scale-up of innovation through professional

development opportunities for faculty have been known for some time (e.g., Glennan, Bodilly, Galegher, & Kerr, 2004; Zimmerman, 2006), yet many professional development projects persist in following the traditional model of one day or one week of knowledge-transference workshops with little or no follow-up support. Why does this model persist?

As the research shows, that faculty seeking to change their practice of teaching need to collectively reflect on their assumptions of what teaching looks like, negotiate a new definition of expertise in their practice, be aware of the effectiveness of the changes as implemented, adjust all as needed, and acknowledge the challenge implicit in this work. So too must managers of communities of practice intended to support faculty innovators reflect upon their own professional practice, negotiate new meanings around that practice, implement change with awareness, and accept that change in complex systems requires systemic solutions and time. One step towards understanding might be to ask the community members what costs and benefits they see in sharing their knowledge and do a survey based on that list, rather than using an existing, literature-based list. Another is to orchestrate a discussion on community—what is it? What role, if any, does it play in faculty's efforts to improve their practice and to sustain that change?

A perhaps even larger issue is how is a community of practice with online space defined in 2013? If a community is a collection of individuals with a shared goal and values who build knowledge collectively, what is the role of new technologies (e.g. Twitter) in building community and collective knowledge?

Personal and Professional Reflection

As mentioned above, over the course of time since this project began, the world of online communication and collaboration has changed. A few of those changes particularly relevant to this study include:

- More webs as pegs—places where we hang our hats while we gain what knowledge, support, enjoyment we need from that place on the web before taking our hats and moving on to the next place of interest (Bell, 2006)
- Email saturation—more professionals saying “I don’t read my email”
- Higher works loads—many faculty, particularly community college instructors, are teaching heavier loads of larger classes with fewer resources.
- More time spent “alone together” (Turkle, 2011) with our technologies rather than our people, particularly amongst the younger generation.
- Short bursts of communication (e.g., Twitter) available everywhere.

Paradoxically, I have observed an increasing belief among my professional development colleagues that even minimal face-to-face contact improves connections among faculty. It would be interesting to find out exactly what seeing another’s eyes, hearing a voice, and shaking hands adds to the professional development experience that technology does not replicate (yet). In the absence of an opportunity or funding for in-person meetings, voice and/or video add a sense of connection that posting to online discussion threads or blogs does not. Consequently, as an educator and researcher dedicated to improving teaching and learning, I have change my community-building goal from creating an online community for faculty innovators to building a hybrid community with opportunities for multiple levels of connection and communication. However, the ideal community seems to still be in the ether awaiting the improvements in technology that will someday, somehow allow us to efficiently communicate and effectively support each other’s efforts to fix what is broken in education.

Summary of Conclusion

This concluding chapter provided an overview of the study’s purpose, methodology, and findings. Issues of credibility, implications for practice, potential areas for future research, and personal reflections by the researcher are also discussed.

Developing a sustainable online knowledge sharing space within a community of practice is a goal of instructional innovation projects because participating in online

knowledge sharing within communities of practice reportedly benefits faculty who are working to change the practice of teaching. However, building a membership committed to sustained participation in knowledge sharing with the community has proven difficult to accomplish. With that challenge in mind, this study adopted a post positivist approach and addressed the question “How do cost and benefit factors relate to participation in online knowledge sharing in communities of practice meant to support efforts to improve instruction?”

The literature review focused on the following three questions:

- How is the knowledge of a practice built and shared?
- What is a community of practice with online knowledge sharing?
- What are the costs and benefits associated with participating in online knowledge sharing?

Findings of prior researchers on factors influencing participation are summarized in Table 3. Based on that review, a model of knowledge sharing as an individual cost and benefit analysis decision influenced by institutional context was applied to online knowledge sharing within communities of practice supporting faculty innovation (Kankanhalli, Tan, & Wei, 2005). Four hypotheses were addressed within this study:

Null Hypothesis 1 (H_{01}): Participation in online knowledge sharing is not related to knowledge self-efficacy. *Alternate Hypothesis 1 (H_{A1}): Participation in online knowledge sharing is positively related to knowledge self-efficacy.*

Null Hypothesis 2 (H_{02}): Participation in online knowledge sharing is not related to enjoyment in helping others. *Alternate Hypothesis 2 (H_{A2}): Participation in online knowledge sharing is positively related to enjoyment in helping others.*

Null Hypothesis 3 (H_{03}): Participation in online knowledge sharing is not related to participation effort as moderated by generalized trust. *Alternate Hypothesis 3 (H_{A3}): Participation in online knowledge sharing is negatively related to participation effort as moderated by generalized trust*

Null Hypothesis 4 (H_{04}): Participation in online knowledge sharing is not related to pro-sharing norms as moderated by reciprocity. *Alternate Hypothesis 4*

(H_{A4}): Participation in online knowledge sharing is positively related to pro-sharing norms as moderated by reciprocity.

Data was collected through an online survey. An invitation to participate in the survey was sent to 174 registrants to the National Science Foundation's Advanced Technological Education Program's 2011 Principal Investigator's Conference. The survey was started by 24.4% (174) of the registrants and completed by 21.5% (153). Factor analysis confirmed the constructs for the independent predictor variables. Variables, definitions, and questions can be found in Appendix D.

Moderated Simultaneous Regression analysis tested the hypotheses. Contributors who identified knowledge self-efficacy (adjusted Beta = .18, $p = .047$) and enjoyment in helping others (adjusted Beta = .24, $p = .011$) with participation were also more likely to have participated in online knowledge sharing in the prior six months. However, unlike the foundational study, reciprocity and generalized trust did not moderate the influence of pro-sharing norms and participation effort on the respondent's participation. The model tested explained approximately 19% of the regression. Additional research is needed to identify the additional factors influencing participation in online knowledge sharing for the target population.

Possible influences on the findings, alternate factors to consider, and future topics for research include beliefs about sharing different types of knowledge, the diminished influence of reciprocity in pro-sharing cultures, value of social capital in individual or collective cultures, contextual norms, and beliefs about ownership of tangible and intangible knowledge. The knowledge and other resources available to the researcher, flaws in research design, and the accuracy of the data collected impact the strength of the study's findings. Nonetheless, the findings do suggest new areas of research to pursue and possible changes in the practice of community managers. Specifically, if, as is suggested by the results of this study, faculty with knowledge self-efficacy and enjoyment in helping others are more likely to report participating in knowledge sharing, then activities that increase those factors in members might positively influence participation. Exactly what those activities are is a subject for future research.

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APPENDICES

Appendix A: Screenshots of Online Community

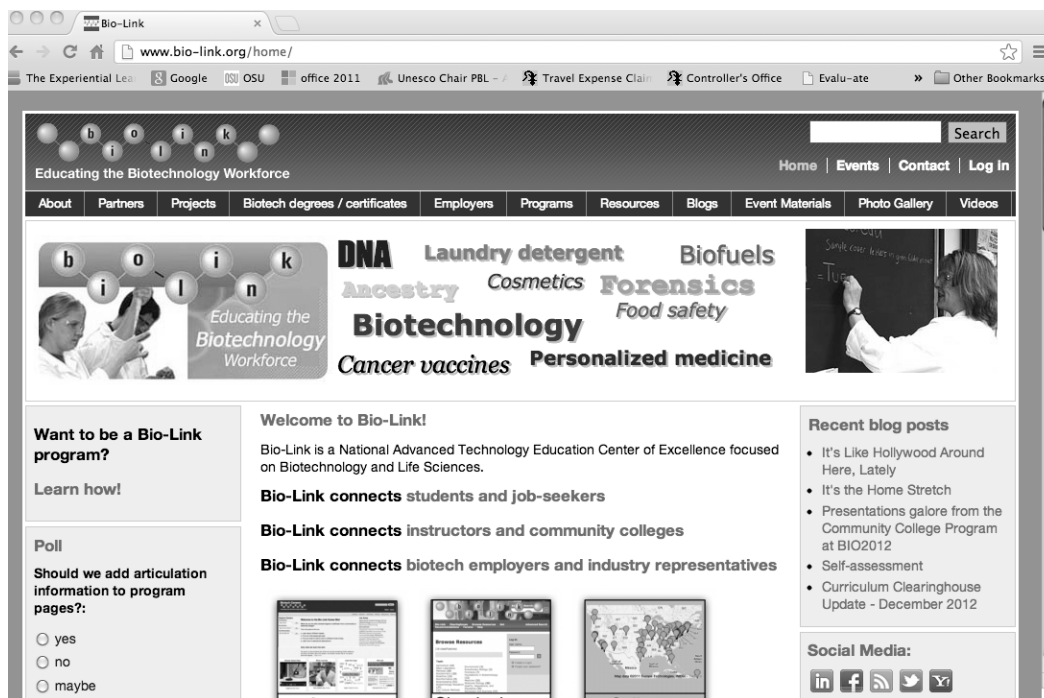


Figure A1. Bio-Link Community's Home Page.

Screenshot taken at <http://www.bio-link.org/home/> of Web page copyright 2012 by Bio-Link™. Used with permission. The site offers members the opportunity to follow links to connect with others with similar interest, participate in a poll, read and comment on blogs, learn how to be a Bio-Link program, upload images, post news items, and use social media to interact with other members. The Bio-Link community is sponsored by the Bio-Link National Advanced Technology Education Center of Excellence at City College of San Francisco. The center is funded by the National Science Foundation's Advanced Technological Education program to support biotechnology and life sciences programs nationally.

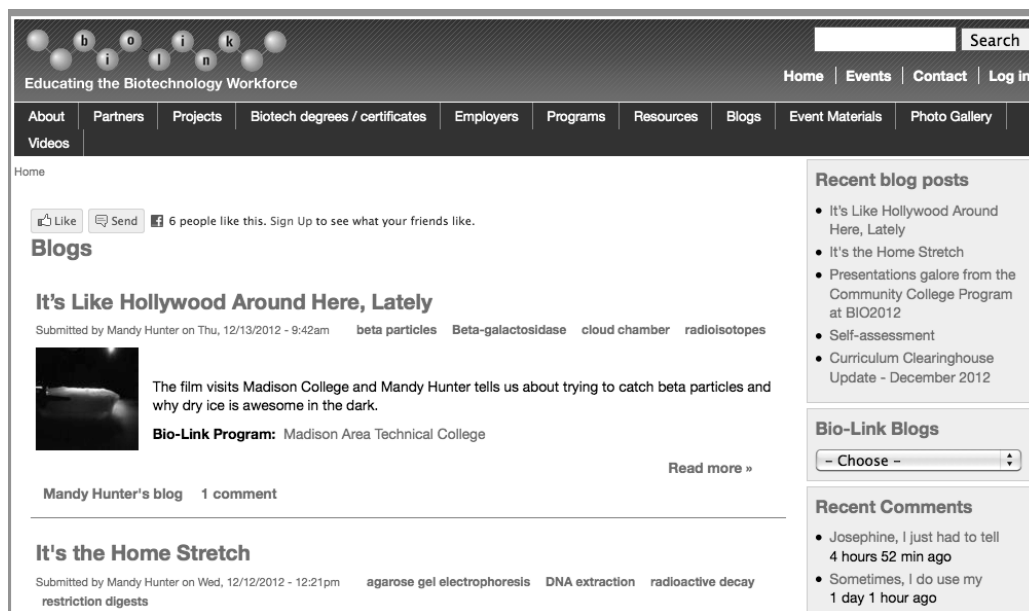


Figure A2. Online Participation (blog posts and comments) on Bio-Link Site.

Screenshot of knowledge sharing at <http://www.bio-link.org/home/blog> Copyright 2012 by Bio-Link™. Used with permission. The Blogs link in the previous figure leads to a section of the online knowledge sharing community that lists members' blogs and provides opportunities for comments by participants.

Appendix B: Invitations

Invitation email 1 [emailed to 712 recipients]

Subject: Take a short survey & help a colleague & grad student—Please!

Date: September 30, 2012

Dear Colleague,

You have been identified as a registrant to the 2011 ATE PI Conference. As part of the research component of my dissertation, I am conducting a study, Costs, Benefits, and Participation in Online Knowledge Sharing in Communities of Practice for Faculty, to explore the relationship of costs and benefits to participation or non-participation in online knowledge sharing in communities of practice for faculty.

If you have any questions about this research project, please contact Jane Ostrander by email at jostrander@tmcc.edu or Dr. Darlene Russ-Eft by email at darlene.russeft@oregonstate.edu

Please follow the link below to participate in my research survey. The survey will close on October 20th.

Thank you,

//Jane

Jane Ostrander

Destination PBL Project

Truckee Meadows Community College

jostrander@tmcc.edu

Here is a link to the survey:

<https://www.surveymonkey.com/s.aspx>

This link is uniquely tied to this survey and your email address. Please do not forward this message.

Please note: If you do not wish to receive further emails from us, please click the link below, and you will be automatically removed from our mailing list.

<https://www.surveymonkey.com/optout.aspx>

<https://www.surveymonkey.com/optout.aspx>

Invitation email 2 [mailed to 609 Recipients]

Subject: Share your ideas & help a colleague—Please!

Date: October 9, 2012

Greetings,

Please take a few minutes to participate in a survey of registrants at the 2011 ATE PI Conference. The survey explores the relationship of costs and benefits to participation or non-participation in online knowledge sharing in communities of practice for faculty and is part of the research component of my dissertation, Costs, Benefits, and Participation in Online Knowledge Sharing in Communities of Practice for Faculty. Your answers are an important component of the research.

The survey will involve approximately 15 minutes of your time. Follow the link below to

find out more. If you have any questions about this research project, please contact Jane Ostrander by email at jostrander@tmcc.edu or Dr. Darlene Russ-Eft by email at darlene.russeft@oregonstate.edu. The survey will close on October 20th.

Here is a link to the survey:

<https://www.surveymonkey.com/s.aspx>

This link is uniquely tied to this survey and your email address. Please do not forward this message.

Thank you,

//Jane Ostrander, Destination PBL Project
Truckee Meadows Community College
jostrander@tmcc.edu

Please note: If you do not wish to receive further emails from us, please click the link below, and you will be automatically removed from our mailing list.

<https://www.surveymonkey.com/optout.aspx>

Invitation email 3 [mailed to 563 recipients]

Subject: Last Chance –Short Survey!

Date: October 16, 2012

Greetings,

Don't miss your chance to participate in this research survey that to explore the relationship of costs and benefits to participation or non-participation in online

knowledge sharing in communities of practice for faculty. The short survey is part of the research component of my dissertation, Costs, Benefits, and Participation in Online Knowledge Sharing in Communities of Practice for Faculty.. Your answers are an important component of the research.

The survey will involve approximately 15 minutes of your time. Follow the link below to find out more. If you have any questions about this research project, please contact Jane Ostrander by email at jostrander@tmcc.edu or Dr. Darlene Russ-Eft by email at darlene.russeft@oregonstate.edu. The survey will close on October 20th.

Thank you,

// Jane Ostrander

Destination Problem-Based Learning Project

Truckee Meadows Community College

jostrander@tmcc.edu

Here is a link to the survey:

<https://www.surveymonkey.com/s.aspx>

This link is uniquely tied to this survey and your email address. Please do not forward this message.

Please note: If you do not wish to receive further emails from us, please click the link below, and you will be automatically removed from our mailing list.

<https://www.surveymonkey.com/optout.aspx>

Appendix C: Survey & Consent in SurveyMonkey

Cost Benefit Analysis, Participation, and Online Knowledge Sharing

Welcome

Dear Colleague,

You have been identified as a registrant to the 2011 ATE PI Conference. I am a doctoral candidate under the direction of Dr. Darlene Russ-Eft in the College of Education, at the Oregon State University. As part of the research component of my dissertation, I am conducting this survey to explore the relationship of cost and benefits factors to participation or non-participation in online knowledge sharing in communities of practice for faculty.

The survey will involve approximately 15 minutes of your time. Your participation in this study is voluntary and anonymous. If you choose not to participate there will be no penalty. You may consider some of the survey questions to be personal. You may exit the survey at any time. If the results of this project are published individual responses will not be discussed and your participation in this study will not be made public. The security and confidentiality of information collected from you online cannot be guaranteed. Information collected online can be intercepted, corrupted, lost, destroyed, arrive late or incomplete, or contain viruses.

If you have any questions about this research project, please contact Jane Ostrander by email at ostrandj@onid.orst.edu or Dr. Darlene Russ-Eft by email at darlene.russeft@oregonstate.edu

If you have questions about your rights or welfare as a participant in this study, please contact the Oregon State University Institutional Review Board (IRB) Office at (541) 737-8008 or by email at IRB@oregonstate.edu

Please complete the survey by October 20, 2012.

Thank you,
Jane Ostrander
ostrandj@onid.orst.edu

PI, Destination Problem-Based Learning Project
Truckee Meadows Community College
jostrander@tmcc.edu

1. I have read and understand the above.

☐ I agree to participate in the survey and am 18 years of age or older.

☐ I decline to participate in the survey

**Cost Benefit Analysis, Participation, and Online Knowledge Sharing
**

2. Was the October 2011 ATE PI conference the first one you attended?

☐ Yes

☐ No

3. What U.S. state or territory was your primary place of work in October 2011?

State:

4. In the last month, how many times did you post a question, an answer, or a resource in the online discussion area of a community of practice for faculty?

☐ 0

☐ 1-5

☐ 6-11

☐ More than 11

☐ My community does not have an online discussion area

**Cost Benefit Analysis, Participation, and Online Knowledge Sharing
**

5. In the previous 6 months, how many times did you post a question, an answer, or a resource in the online discussion area of a community of practice for faculty?

- ☐ 0
- ☐ 1-5
- ☐ 6-11
- ☐ More than 11
- ☐ My community does not have an online discussion area

Cost Benefit Analysis, Participation, and Online Knowledge Sharing

In answering the following questions, please think about the community of practice you spent the most time participating in over the last six months that has an online collaboration space (e.g. threaded discussion, blog that allows comments, place for posting resources). Please indicate your level of agreement with each statement.

6. I do not have the time to share my knowledge.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
☐	☐	☐	☐	☐

7. It is laborious to share my knowledge

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
☐	☐	☐	☐	☐

8. The effort is high for me to post my knowledge online.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
☐	☐	☐	☐	☐

9. I am worried that if I share my knowledge, I will have to spend additional time answering follow up questions.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
☐	☐	☐	☐	☐

10. I am afraid that my submission will evoke additional clarifications or requests for assistance.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
☐	☐	☐	☐	☐

11. Sharing my knowledge with others give me pleasure.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
☐	☐	☐	☐	☐

12. Most other members can provide more valuable knowledge than I can.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
☐	☐	☐	☐	☐

13. I have confidence in my ability to provide knowledge that others consider valuable.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
☐	☐	☐	☐	☐

Cost Benefit Analysis, Participation, and Online Knowledge Sharing

14. There is a norm of cooperation.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
☐	☐	☐	☐	☐

15. There is a norm of tolerance of mistakes

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
☐	☐	☐	☐	☐

16. I believe that people use others' knowledge appropriately.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	☐	☐	☐	☐	☐

17. There is a norm of collaboration.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
☐	☐	☐	☐	☐

18. When I share my knowledge I believe that I will get an answer for giving an answer.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
☐	☐	☐	☐	☐

19. There is a willingness to value and respond to diversity.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
☐	☐	☐	☐	☐

20. I believe that people in my community share the best knowledge that they have.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
☐	☐	☐	☐	☐

21. I enjoy sharing my knowledge with others.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
☐	☐	☐	☐	☐

22. I have the expertise needed to provide valuable knowledge.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
☐	☐	☐	☐	☐

23. It feels good to help someone else by sharing my knowledge.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
☐	☐	☐	☐	☐

Cost Benefit Analysis, Participation, and Online Knowledge Sharing

24. When I share my knowledge I believe that my queries for knowledge will be answered in future.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
☐	☐	☐	☐	☐

25. There is a norm of openness to conflicting views.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
☐	☐	☐	☐	☐

26. I enjoy helping others by sharing my knowledge.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
☐	☐	☐	☐	☐

27. It doesn't really make any difference whether I add to the knowledge others are likely to share.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
☐	☐	☐	☐	☐

28. There is a norm of teamwork.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
☐	☐	☐	☐	☐

29. I believe that people do not use unauthorized knowledge.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
☐	☐	☐	☐	☐

30. When I share my knowledge I expect somebody to respond when I'm in need.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
☐	☐	☐	☐	☐

**Cost Benefit Analysis, Participation, and Online Knowledge Sharing
****Congratulations!**

You have completed the survey. Thank you.

Regards,
Jane Ostrander
ostrandj@onid.orst.edu
jostrander@tmcc.edu

Appendix D: Constructs, Variables, Questions, and Scoring

Consent (CNST)

CNST (1) I have read and understand the above.

Demographic questions

ATEF (2) Was the October 2011 ATE PI conference the first one you attended?

Scoring: No=1, Yes=2; rescored to No=0, Yes=1

STAT (3) What U.S state or territory was your primary place of work in October 2011?

Scoring: 2 letter state name from dropdown list provided by SurveyMonkey

Dependent Variables, Questions, & Scores

Participation (PART) was EKR Usage (EKRU) in foundational study

PAR1 (4) In the last month, how many times did you post a question, an answer, or a resource in the online discussion area of a community of practice (CoP) for faculty?

Scored: 1 = none; 2 = 1-4, 3 = 5-10, 4 = 11+, 5 = no online in CoP

Cases with PAR1 scores of 5 were eliminated from the analysis.

PAR1y Participated in online CoP in the last month (True/False). Calculated from PAR1 by assigning a score of 0 (no participation) to PAR1 scores of 1 and a score of 1 (some participation) to PAR2 scores of 2, 3, or 4 with the formula $IF(PAR1=1,0,1)$. Cases with PAR1 scores of 5 were eliminated from the analysis.

PAR2 (5) In the previous 6 months, how many times did you post a question, an answer, or a resource in the online discussion area of a community of practice for faculty?

PAR2y Participation in online CoP in the last 6 months. Calculated from PAR2 by assigning a score of 0 (no participation) to PAR2 scores of 1 and a score of 1 (some participation) to PAR2 scores of 2, 3, or 4 with the formula $IF(PAR2=1,0,1)$.

Independent (predictor) Variables & Questions

Scoring: Strongly Disagree = 1, Disagree = 2, Neutral = 3, Agree = 4, Strongly Agree = 5

Participation Effort (PEFF) was Codification effort in foundational study (CEFF)

- PEFF1 (6) I do not have the time to share my knowledge.
- PEFF2 (7) It is laborious to share my knowledge
- PEFF3 (8) The effort is high for me to post my knowledge online.
- PEFF4 (9) I am worried that if I share my knowledge, I will have to spend additional time answering follow up questions.
- PEFF5 (10) I am afraid that my submission will evoke additional clarifications or requests for assistance.

Reciprocity (RECP)

- RECP1 (18) When I share my knowledge I believe that I will get an answer for giving an answer.
- RECP2 (24) When I share my knowledge I believe that my queries for knowledge will be answered in future.
- RECP4 (30) When I share my knowledge I expect somebody to respond when I'm in need.

Knowledge Self-Efficacy (KSEF)

- KSEF1 (13) I have confidence in my ability to provide knowledge that others consider valuable.
- KSEF2 (22) I have the expertise needed to provide valuable knowledge.
- KSEF3 (27) It doesn't really make any difference whether I add to the knowledge others are likely to share.
- KSEF3r KSEF3 Reversed (1 = Strongly Agree...5 = Strongly Disagree)
- KSEF4 (12) Most other members can provide more valuable knowledge than I can.
- KSEF4r KSEF4 Reversed (1 = Strongly Agree...5 = Strongly Disagree)

Enjoyment in Helping Others (EHLP)

- EHLP1 (21) I enjoy sharing my knowledge with others.
- EHLP2 (26) I enjoy helping others by sharing my knowledge.
- EHLP3 (23) It feels good to help someone else by sharing my knowledge.
- EHLP4 (11) Sharing my knowledge with others gives me pleasure.

Moderating Variables

General Trust (GTRU)

- GTRU2 (29) I believe that people do not use unauthorized knowledge.
- GTRU3 (16) I believe that people use others' knowledge appropriately.
- GTRU4 (20) I believe that people in my community share the best knowledge that they have.

Pro-Sharing Norms (PSNM)

- PSNM1 (14) There is a norm of cooperation.
- PSNM2 (17) There is a norm of collaboration.
- PSNM3 (28) There is a norm of teamwork.
- PSNM4 (19) There is a willingness to value and respond to diversity.
- PSNM5 (25) There is a norm of openness to conflicting views.
- PSNM6 (15) There is a norm of tolerance of mistakes

Questions from Foundational Study that were inadvertently left off survey

- RECP3 When I contribute knowledge to my community, I expect to get back knowledge when I need it
- GTRU1 I believe that people in my organization give credit for other's knowledge where it is due

