

THE SOCIAL NATURE OF AN ONLINE COMMUNITY OF PRACTICE FOR
LEARNING TO TEACH

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LEARNING TO TEACH**

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DEDICATION

With a grateful heart I dedicate this dissertation to my parents, Ching Tsai and Zhu-Ching Liao Tsai, my mother in law, Cai-Di Chen, my husband, Ching-Hua Wu, my brothers, Ming-Chia Tsai and Ming-Ke Tsai, my sister in law, Jing-Yi Qiu, and my cousin, Tse-Han Wu. Without their love and support, I could never have accomplished the many successes that I have achieved in my academic study and professional career.

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THE SOCIAL NATURE OF AN ONLINE COMMUNITY OF PRACTICE FOR LEARNING TO TEACH

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ABSTRACT

Taking advantage of Internet technology, an online community of practice, NETwork, was established to support a group of elementary science pre-service and in-service teachers' learning how to teach. To better understand how teachers can be supported and sustained while participating in an online community of practice, this study investigated the nature of members' participation, members' perceptions of social constructs of online learning experience, and members' learning in a community of practice. Three primary research questions were asked: 1) How do members participate in the primary learning activities through Chat Room discussion, Discussion Board discussion, and information sharing in Resources?; 2) How well does the proposed path model explain the relationships among the social constructs of online learning (i.e. sense of community, social ability, perceived ease of use, and perceived usefulness) and how well do those social constructs explain community outcomes/effects (satisfaction with NETwork experience and effectiveness of NETwork for Teaching)?; and 3) How do members' perceptions (sense of community, social ability, ease of use, usefulness, satisfaction with their NETwork experience, and of the effectiveness of NETwork for supporting teaching) change through participating in the community?

For research question one, members' log files (Context-aware Activity Notification System data - CANS) were analyzed by social network analysis and visualization

techniques to show members' levels and patterns of participation, and qualitative data collected via serial and semester-end interviews and discussion content in the discussion board and chat room were analyzed to triangulate what had been found via CANS data. The results of the analyses show that: 1) Members' levels and patterns of participation varied across time, member types, and tools; 2) Members' identity and levels of participation were reciprocally associated; 3) There were similarities and differences in members' usage of computer-mediated communication (CMC) tools, and members showed growth of their knowledge and skills for teaching via mutual engagement, creating joint enterprise, and establishing shared repertoire supported by CMC tools; and 4) Lack of time influences members' levels of participation.

For the second research question, quantitative data collected in the final survey were analyzed via path analysis to examine the relationships among the social constructs. The final model of primary social constructs was found to explain how members' perceptions of sense of community (SOC), social ability (SA), and perceived ease of use (PEU) and usefulness (PU) of Sakai tools account for 74% and 80% of variance respectively for members' satisfaction with NETwork experience and effectiveness of NETwork for Teaching. Also, the relationships among sub-constructs of SA and other social constructs provided further understanding of how social navigation, social presence with peers, and social presence with instructors related to members' perceptions of PEU and PU, SOC, and S.

For research question three, data collected in both the first and final surveys were analyzed via dependent-sample t test and qualitative data collected in both the serial and semester-end interviews were analyzed to examine changes in members' perceptions of

social constructs. The results show that members' perceptions of social constructs significantly changed after participating in NETwork activities although some social constructs might need more time for changes to be significant. Also, members believe that participating in NETwork is helpful for their current and future teaching.

CHAPTER I

INTRODUCTION

Rationale for the Study

In the late 1990s online learning emerged as an important channel for higher education. Compared to face-to-face learning environments, online learning environments can promote flexible collaborative spaces by providing synchronous and asynchronous opportunities for learning anywhere and anytime. Allen and Seaman (2007) report that online enrollment has been increasing rapidly for the past several years in higher education. Compared to Fall 2004 with 2.3 millions students (18.2% growth rate) and Fall 2005 with 3.2 millions students (36.5% growth rate) who were enrolled in at least one online course, 3.5 millions students (9.7% growth rate) were found enrolled in at least one online course in Fall 2006. Also, the growth of online enrollment has been substantially faster than the overall enrollment in the higher education. In the 2006 Fall semester, the 3.5 million students was about 20% of all U.S. higher education students. Compared to the 1.5% growth rate of overall higher education students in Fall 2006, the 9.7% growth rate of the online learner population in Fall 2006 was much higher. In 2006, 74.1% of public institutions of higher education identified online education as critical to their long-term strategy in sustaining learning (Allen & Seaman, 2007). Taking advantage of the ease of access and affordability of the Internet, universities and researchers have been establishing and testing online learning experiences not only for traditional course-based learning but also for communities of practice (CoP).

The development of Internet technology and concepts of CoP offer potential for diminishing the gaps and disconnection between the stages of teachers' professional

development. Previous studies have recognized the importance of a professional continuum of learning that spans pre-service teacher education, induction of beginning teachers, and continued professional development (e.g., Feiman-Nemser, 2001). Some cases of applying online systems to support the continuum of teachers' professional development have been found effective but not easy to sustain. (Job-Sluder & Barab, 2004; Gray & Tatar, 2004; Roup, Gal, Drayton, & Pfister, 1993; Steele, 2002; Desimone, Porter, Garet, Suk Yoon, & Birmnan, 2002). To better understand how teachers can be supported and sustained while participating in an online community of practice, this study investigated teachers' levels and patterns of participation and social interaction in the online learning community of practice, NETwork (Nurturing Elementary Teachers' work).

Community of Practice (CoP)

Shaffer and Amundsen (1993) define the term: community as “a dynamic whole that emerges when a group of people participate in common practices; depend upon one another; make decisions together; identify themselves as part of something larger than the sum of their individual relationships; and commit themselves for the long term to their own, one another’s, and the group’s well-being” (Shaffer & Amundsen, 1993, p. 10). A form of CoP that has a major focus on improving practice and supporting the learning of members is also called a learning community. In order to distinguish learning communities from other groups, Woodruff (1999) suggested four elements, including function, identity, discursive participation, and shared values, as primary elements that unify a community. A form of CoPs that use the Internet as the primary mechanism for communication, participation, and sharing is called an online community. Preece (2000)

described online communities as consisting of people, shared purpose, policies, and computer systems which diminish members' concerns of location and time. People participate in the practices of a social community to achieve a shared purpose (Wenger, 1998). Also, members' identities are constructed in the interrelations of participating and interacting with others (Woodruff, 1999). Time factor, people's participation, identity, and interconnected relationships are considered interdependent factors in the development of community whether in traditional or online communities.

Wenger (1998) defined CoP as groups of people who join together with a common purpose and share a common practice. Members of CoP integrate practice, meaning, identity, and community as components of learning and knowing in their interaction within CoP. Lave and Wenger (1991) said "activities, tasks, functions, and understandings do not exist in isolation; they are part of broader systems of relations in which they have meaning. These systems of relations arise out of and are reproduced and developed within social communities, which are in part systems of relations among persons" (p. 53). Communities, in which practitioners share interests and resources, engage in joint activities, and work toward the same goals, promote engagement, shape learning, and improve practice. Individual's growth depends not only on members' individual inputs but also the shared values and knowledge reproduced in the interaction. Additionally, Wenger indicated that "Knowledge, belonging, and doing are not separable: What we know, who we are and what we do seamlessly come together in one experience of participation" (Wenger, 1996, p.22). Learning and membership in a community are intertwined as members' identities change gradually from peripheral participation to more core roles as they gain more knowledge of practice. The changes in members

identities, indicating how they perceive who they are and how other members think about them, is a result of their participation and engagement in online learning and interaction (Wenger, 1996). Members' learning, identity changes, and relationships with others, are influenced by their feelings and levels of participation and vice versa.

CoP in Science Teacher Education

Since the 1990s, teachers' professional development has attempted to move beyond simply supporting teachers' knowledge and skill acquisition by changing the training format from one-shot professional development to long-term professional learning development (Vescio, Ross, & Adams, 2006). One effective approach to meeting the needs of long-term professional learning development is the establishment of professional learning communities (PLC) based upon a CoP framework (Wenger, 1998). A CoP framework has been identified as an effective model to support the reform of teacher practice and teaching reflection by a number of teacher education researchers (Hollins, McIntyre, DeBose, Hollins, & Towner, 2004; Andrews & Lewis, 2002; Strahan, 2003). CoP supports teachers as they integrate practice, meaning, identity, and community as components of learning and knowing in their interaction. Previous studies have found that PLC provides teachers opportunities to collaborate and supports continuous teacher learning (Berry, Johnson, & Montgomery, 2005; Phillips, 2003; Englert and Tarrant, 1995; Hollins et al., 2004). However, the professional learning communities studied were face-to-face not implemented online, instead they required teachers to travel to particular locations and coordinate tight schedules for meetings. Taking time to meet is problematic because teachers indicate that they do not have much time to talk or share with fellow teachers in their own buildings. Teachers' daily teaching schedules have occupied most

of their time (Scribner, 2003). Thus, teachers' time commitment has been a challenge for participating in PLC. Given the geographical distribution of teachers upon graduation from a university, this poses a challenge for establishing a long-term PLC across teacher education to school practice.

Taking advantage of computer-mediated communication (CMC) tools and the Internet, researchers have constructed teachers' PLC in online learning environments. Some of the most prominent online PLC's for teachers are LabNet (Roup, et al., 1993), Inquiry Learning Forum (Barab, Makinster, & Scheckler, 2004), and Tapped In (Schlager & Fusco, 2004). Barab and colleagues found first time participants to mainly be observers, but over time become contributors to the community through discussing, sharing, and creating videos of their teaching (Barab, Hay, Barnett, & Squire, 2001a). Studies identify that it is challenging and difficult to sustain members' feelings of a sense of ownership, connections, trust, commitment to the community, and a sharing culture to foster interaction and participation (Barab, Makinster, & Scheckler, 2004; Schlager & Fusco, 2004). A key determinant of how teachers' long-term education can be effectively supported in an online community of practice depends on how well the social interaction can be engaged and sustained by the CMC tools, such as chat room and discussion boards.

A new teachers online professional learning community, NETwork (Nurturing Elementary Teachers' work), was established in 2006 using the Sakai course management system to implement the CoP framework. The purpose of NETwork is to diminish the current distance between teacher education and school practice by providing pre-service and in-service teachers a shared, long-term environment for collaborative

learning. NETwork members are expected to discuss teaching issues and share their theoretical and practical perspectives so as to expand pre- and in-service teachers' practical experiences as well as their knowledge and skills of learning theories and new teaching polices. Additionally, the opportunity to discuss teaching issues is a growth opportunity for the practicing teachers. NETwork allows in-service teachers to discuss their practical issues and to meet knowledge and skill needs they have encountered on the job. Furthermore, the shared experience can lead to an improved community and sense of membership in a professional development community. Both pre- and in-service teachers improve practice by contributing what they experience in class or practice to the online discussion and learning from what has been shared by others. In-service teachers not only receive feedback about their practice but serve as experienced mentors to guide pre-service teachers as they begin learning to teach. Participating in NETwork may change how members think about themselves as teachers (identity) and about how able they are to teach. These changes may occur over time and as they move from peripheral to core participation. Little is known about how to best sustain participation, the variety of ways that teachers may participate, and how sustained participation changes teachers, but the establishment of NETwork provides a test-bed for exploring participation in CoP.

Social Interaction of CoP

Because online PLC's operate through CMC tools and systems, how to facilitate and foster online social interaction within the CoP becomes a critical factor for the success of teachers' professional development in the online learning community (Gess-Newsome, Blocher, Clark, Menasco, & Willis, 2003). Researchers found that when people communicate or interact through online learning environments, the nature of the

tools and the social constructs established around the contexts influence members' participation and interaction (Picciano, 2002; Rovai, 2002a). Hara and Kling (2000) discovered that communication and technical difficulties experienced by students in online learning environments can frustrate them and impede interaction. This is critical because levels and types of interaction influence members' sense of community and participation (Lally & Barrett, 1999). It is difficult for members to interact and contribute in a community if the online learning environment cannot support what they expect to do. Additionally, studies have shown that without sufficient social interaction, students experience a sense of isolation even though they do appreciate the flexibility and convenience of the virtual learning space (Abrahamson, 1998; Rahm & Reed, 1998). Students' feelings of isolation were found to be a primary reason for higher dropout rates in distance education (Carr, 2000). Similarly a lack of social interaction was a factor that depressed students' satisfaction in online learning (Arbaugh, 2000). Also, students' perceptions of their interaction and sense of presence were found to have positive relationships with their perceived performance in an online environment (Picciano, 2002). Similarly, researchers discovered that teachers' interaction and participation in CoPs were associated with the effectiveness of their learning, collaboration, and how they can apply what they learn (Job-Sluder & Barab, 2004; Gray & Tatar, 2004; Schlager & Fusco, 2004).

Sense of Community (SOC)

Sense of community and social ability have been identified as two critical factors influencing members' level of online participation and social interaction (Rovai, 2003; Carroll, 2001; Putnam, 2000; Lin, Lin, Liu, Huan, Shen, & Laffey, 2006; Riedl, 2001;

Picciano, 2002). McMillan and Chavis (1986) defined sense of community as “a feeling that members have of belonging, a feeling that members matter to one another and to the group, and shared faith that members’ needs will be met through their commitment to be together” (p.9). Sense of community is one of the factors that can make an online community a learning community (Blanchard, 2000; Haythornthwaite, Kazmer, Robins, & Shoemaker, 2000). Prior research has found that learners benefit from being a member of a community by feeling a sense of belonging and having others to ask for support (Wellman & Gulia, 1999). Communities have greater flow of information among members, availability of supports, commitment to group goals, and higher members’ collaboration and satisfaction when people experience a stronger sense of community (Wellman, 1999; Dede, 1996; Bruffee, 1993; Tinto, 1993; Scott, 2004). Similar to the results from studies of online courses, sense of community has been shown to be a factor in sustaining social interaction in virtual teacher communities (Steele, 2002; Job-Sluder & Barab, 2004).

Social Ability (SA)

Social ability has been shown to be a critical factor for effective online learning (Laffey, Lin, & Lin, 2006; Rovai, 2001; Gunawardena & Zittle, 1997). Social ability is defined as “a person’s capacity to associate with fellows and to use the members, resources and tools of the social context to achieve something of value” (Social Computing Research Group (SCRG), 2006, p.2). Social presence and social navigation are underlying factors of social ability in online learning environments (Laffey, et al., 2006; Yang, Tsai, Cho, Kim, & Laffey, 2006; Lin, et al., 2006). In online learning studies, social presence “as an attribute of computer-mediated activity is derived from media

studies about how effectively media (TV, et.) convey the sense that mediated participants were really present" (Laffey et al., 2006, p.166). Social navigation is defined as "a construct representing being aware of what others are doing as a primary guide for one's own actions" (Laffey, et al., 2006, p.166). The relationships between social presence and navigation as two critical aspects of social ability are interdependent and contribute to effective online learning. Prior research has found positive relationships between students' perceived social presence and assignment scores (Picciano, 2002). Additionally, what members do or how they act in an online environment are found to be based upon what others have done, where others are, and what they have looked at (Gutwin & Greenberg, 1998, Dourish & Bellotti, 1992).

Relationships among Social Constructs of CoP

Since sense of community and social ability have been recognized as influential factors determining levels of participation and interaction in online learning environments, studies of online courses have examined how particular social constructs influence students' learning satisfaction, course grade, and participation. However, the social constructs are interdependent and intertwined, which make their contribution difficult to understand without considering the relationships among them. The studies examining the relationships among social constructs as a whole in online learning environments are rare. In a recent study which established a unified model to explain the relationship among social constructs in online courses, Lin et al. (2006) found that social ability was a significant predictor for students' online learning satisfaction. The study also found that students' perceptions of using tools in an online context influence not only their learning satisfaction but also how they used the tools to better achieve learning goals. In another

study, researchers examined both social ability and sense of community simultaneously and found that sense of community could be a mediator for the relationship between social ability and learning satisfaction (Tsai, Kim, Liu, Goggins, Kumalasari, & Laffey, 2008) and found that social ability was not a direct predictor for online learning satisfaction. When Lin et al. (2006) examined the relationship between social ability and learning satisfaction, social connectedness was included as a factor of social ability. Thus, it is not clear how the relationships among social ability and learning satisfaction are influenced by the social connectedness which has a similar meaning as sense of community. These two studies examined the relationships between social ability and other social constructs, but they did not examine the sub-relationships among social navigation, social presence, and other social constructs (Lin, et al., 2006; Tsai, et al., 2008). While there is reason to believe that social constructs influence online learning, more research examining all the factors simultaneously is needed to understand the relationships among the social constructs and online learning outcomes.

Previous studies have developed reliable instruments to measure sense of community and social ability in online course contexts (Rovai, 2002b; Yang, et al., 2006; Laffey, et al., 2007) but have not been tested in an online teacher CoP. There is a need to explore how sense of community and social ability contribute or influence teachers' social interaction and effectiveness of participating in the online teacher CoP. Thus, this study examined the relationships among social constructs, including sense of community, social ability, members' overall satisfaction with NETwork experience, and effectiveness of NETwork for their teaching at once by constructing a structural equation model to visualize the relationships.

Technology Acceptance

Social constructs of online learning are highly associated with the affordance of technology in the online learning environment. Although researchers indicate that a sense of community within an online learning environment can be sustained as strong as in face-to-face learning environments (Barber, 1995; Blanchard, 2000; Haythornthwaite et al., 2000), building and sustaining a sense of community in a virtual learning environment, where social awareness information is deficient, is a substantial challenge (Rovai, 2002). Differing from face-to-face collaboration where information is conveyed by facial expressions, body language, gestures, postures, eye contact, and other socially-relevant actions, Gallini and Helman (1995) found that distributed learners need other cues for effective communication and social awareness of context and others' actions. Establishing and maintaining social awareness in distributed groups has been reported to be difficult without appropriate tools (Gutwin & Greenberg, 2002; Gutwin, 1997). Steele (2002) discovered that a context-poor environment of virtual communication is part of the limitation in constructing an online teacher CoP. In-service teachers were eager to enhance their understanding of teaching expertise and knowledge; they expressed, however, that technical resources need to be improved in order to facilitate interaction at teachers' convenience (Hibbert & Rich, 2006). Thus, it is essential and urgent to understand more about how to provide effective communication and social awareness tools to promote better interaction in online learning communities (Hibbert & Rich, 2006).

Previous studies have examined how synchronous and asynchronous CMC tools, such as chatting tools (Alavi, 1994), shared workspace tools (Gutwin & Greenberg, 1998),

discussion board (Alavi, 1994), and notification tools (Carroll, Neale, Isenhour, Rosson, & McCrickard, 2003), deliver social awareness information in online community.

Researchers found social awareness can be supported by CMC tools if they are applied effectively (Tu & Corry, 2003; Lavooy & Newlin, 2003; Tu & McIsaac, 2002; Kearsley, 2000). The CMC tools influence how members socialize with others and appropriate tools when interacting and participating online. With the intention of understanding how usage of CMC tools impacts members' social interaction, researchers have examined people's perception of how they use and how they feel about the information and functions conveyed by the CMC tools (Davis, 1989). The Technology Acceptance Model (TAM) is a frequently used framework for exploring people's technology usage behaviors (Davis, 1989). Since people's intention of using technologies influences their attitude about using the tools and their perception of how useful the tools are, two primary constructs, perceived usefulness and perceived ease of use, have been identified as determinants of people's technology acceptance (Mathieson, 1991; Davis, 1989).

By adapting TAM to examine students' online learning experience, Lin (2005) showed how students' intention of using technologies impacted students' appropriation behavior. Also, previous study, which explored the relationships among perceived ease of use, perceived usefulness, social ability, and sense of community in online courses, found that perceived ease of use directly influences social ability and perceived usefulness positively impacts sense of community (Tsai, et al., 2008). However, it is not clear if these relationships found in online courses exist or are present in the same way in a teacher CoP. In order to better understand how technology use influences people's social interaction in a CoP, this study will not only investigate the relationships among sense of

community, social ability, and overall satisfaction and effectiveness but also relationships among members' perception of technology usage, social ability, and sense of community. Thus, a proposed path model (Figure 1.1) was examined within the teacher online learning community, NETwork. Also, the relationships among the sub-constructs of social ability (i.e. social navigation, social presence with peers, and social presence with instructor) were explored to have deeper understanding of how these sub-constructs influence relationships among the primary constructs in the proposed model.

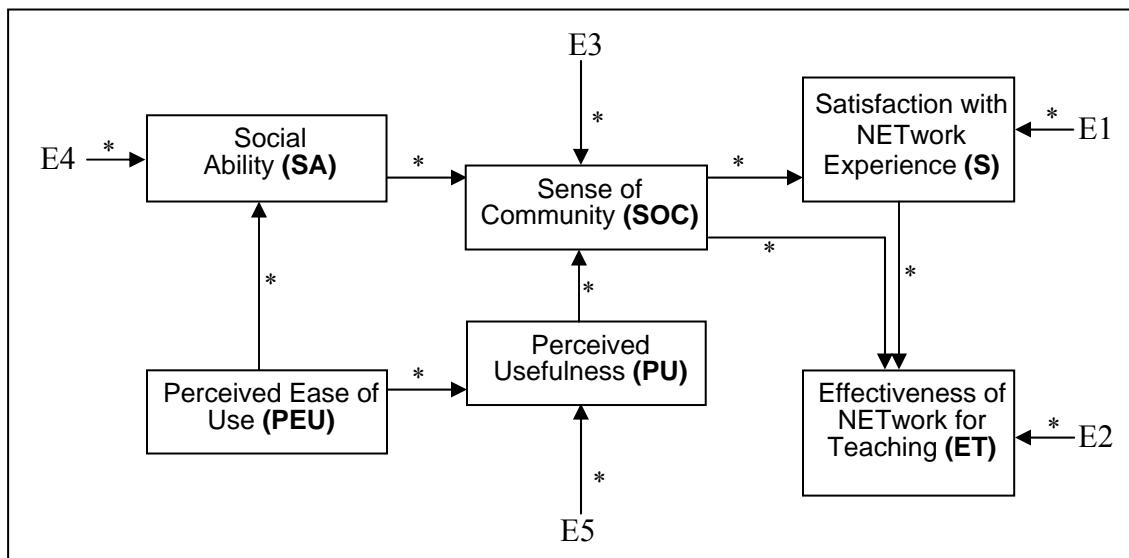


Figure 1.1. Proposed Path Model (→ represents direct relationship, E represents residual error)

Summary

Studies of online courses mostly focus on quantifying and measuring the social constructs of online interaction and exploring discussion board activity. In contrast, researchers investigating social interaction and participation in teacher online CoP have more often applied qualitative research methods, such as case studies and interviews due in part to the small sample sizes found in PLC (Cherny, 1999; Job-Sluder & Barab, 2004; Johnson, 2003). Both quantitative and qualitative approaches can provide insights about

members' perceptions of online interaction and learning outcomes. Few studies however have looked at changes of members' identity and trajectories of participation in the community. According to CoP theory (Wenger, 1998), learning occurs not only when cognition changes but also as a social trajectory within an individual learner and community as a whole (Job-Sluder & Barab, 2004). Thus, it is also important to understand members' actions and the patterns of their participation and interaction across time and online activities through analyzing their activity in the system.

Purpose of the Study

According to CoP theory (Wenger, 1998), learning is a process of participating in social interaction and knowledge is constructed through reflection, sharing, and negotiating with others in the community. The purposes of this study are to understand the nature of participation, social constructs, and learning in a Community of Practice and to test a model of how well the social constructs of the online community explain the effectiveness of professional development in a community. First, this study investigated how members acted differently in different types of learning activity, such as sharing resources, Chat Room discussion, and Discussion Board discussion. The patterns of members' participation levels across activities were examined for better understanding of members' participation across time. Additionally, the relationships among the social constructs of online interaction (i.e. social ability, sense of community, technology acceptance, satisfaction with NETwork experience, and effectiveness of NETwork for teaching) were explored to understand how social constructs relate to each other and explain community outcomes and effects. Last, changes of members' participation patterns and changes of members' perception of social constructs were investigated in

order to understand how members' perceptions and behaviors change when participating in NETwork.

Research Question

To accomplish the purposes of this study, three research questions were addressed.

1. How do members participate in the primary learning activities through Chat Room discussion, Discussion Board discussion, and information sharing in Resources?
 - 1a. What are the characterizations of member activity that represent different levels of participating in the community, and to what extent did members participate?
 - 1b. What are the characterizations of member activity that represent different patterns of participating in the community? Are there differences in the patterns of participation for experienced members and new members and for pre-service and in-service teachers?
2. How well does the proposed path model explain the relationships among the social constructs of online learning (i.e. sense of community, social ability, perceived ease of use, and perceived usefulness) and explain community outcomes/effects (satisfaction with NETwork experience and effectiveness of NETwork for Teaching)?
3. How do members' perceptions (sense of community, social ability, ease of use, usefulness, satisfaction with their NETwork experience, and of the effectiveness of NETwork for supporting teaching) change through participating in the community?

Assumptions

This study was conducted with the following assumptions.

1. Participants had sufficient access to the NETwork.
2. Participants responded to the interview questions and questionnaires with their actual

experience and feeling about interacting with others in the NETwork.

3. Participants' responses were independent of other participants and can be used to represent their perceptions of social constructs.

4. Participants' log files recorded in CANS system included all their actions in the NETwork community site.

Professional Significance of the Study

This study has significant potential for theoretical and practical implications for online learning and teacher education as well as a methodological impact on social computing studies. First of all, this study explored multiple social constructs influencing online interaction at once in a path model, which contributes new knowledge for understanding the interconnected relationships among social constructs. Differing from previous studies that mostly explored unitary relationships between a particular social construct and learning achievement or satisfaction, this study examined a range of relationships in a holistic way. The results of this study provide practical implications for online instructors to better understand how to sustain social interaction in online learning. In addition to quantitative measurements and qualitative interview or thread analysis of discussion board activity, this study analyzed activity logs to explore members' and entire community's levels and patterns of participation. The study demonstrates a new way to visualize the levels and patterns of members' participation and interaction within different online activities. The results of the analysis should help researchers better understand members' actual levels of participation instead of only utilizing members' perception to explain social interaction. Last, this study was implemented in a teacher online CoP, NETwork. The results of this study should help researchers better understand

how members act and interact in an online learning community without course-based requirements. The results contribute to advancing theory about CoP and social learning and can be utilized to improve the activities and tools of CoP to provide members a comfortable and supportive online learning environment.

Limitation

Differing from most online learning studies that were implemented in a course-based context, this study was implemented in an online teacher professional learning community, NETwork. In many ways, NETwork is a unique configuration of members and processes which make it necessary to be cautious with generalizations to course-based online learning contexts or differently formed CoP.

Chapter Summary

This chapter presented issues that impede teachers' continuum professional development and solutions provided via CMC tools. The rationale of using NETwork to support teachers' professional development and importance of investigating members' social interaction in an online learning community were addressed. More detail about the theoretical perspectives used to frame this study, methods utilized for data collection and analysis, results, and findings are addressed in the following chapters.

Definition of Terms

Community of Practice

Based upon the concept of learning by doing, groups of people join together with a common purpose and share a common practice. The integrating practice, meaning, identity, and community are components of learning and knowing. When a CoP has a major focus on improving practice and supporting the learning of members, the CoP can

be called as a learning community.

Effectiveness of NETwork for Teaching

Effectiveness of NETwork for Teaching is members' perceptions of how effective what they learned and what they did in the NETwork help their current teaching or future teaching in terms of teaching knowledge, skills, and confidence.

Learning Outcomes

Learning occurs not only when cognition changes but also as a social trajectory when a learner contributes differently within a community and when a learner's identity for their membership in the community changes. Learning can be assessed by observing how a members' identity changes from peripheral participation to more core roles in the CoP. Thus, the learning outcomes in a community of practice include not only members' changes of knowledge and skills but also the changes of behaviors, perspectives, feelings, or ideas during the process of participating in the community. The learning outcomes belong not only to an individual member but also the community as a whole.

Levels of Participation

NETwork members' levels of participation are assessed from the activity logs of Chat Room discussion, Discussion Board discussion, and actions in Resources where members can share files and resources. In Chat Room, number of chat message posted and number of login Chat room are recorded, as well as number of created new file and number of read files are calculated in Resources. In Discussion Board discussion, number of message posted, number of message replied, and number of message read are recorded as members' participation.

Perceived Ease of Use

Perceived ease of use is members' perception of the degree to which they believe that using CMC tools provided in Sakai would be free of effort (Davis, 1989).

Perceived Usefulness

Perceived usefulness is members' perception of how much they believe the CMC tools provided in Sakai will help them perform their practice better (Davis, 1989).

Professional Learning Community

A professional learning community is a learning community whose goal is to develop one's professional skills and knowledge within a particular professional field. In this study, NETwork is not only viewed as a community of practice but also a teacher professional learning community which aims to help science teachers learn how to teach K-8 students courses better through integrating pedagogical theories and practice and extending teachers' professional development from their teacher education to their daily teaching.

Satisfaction with NETwork experience

Satisfaction with NETwork experience is members' perceptions of how satisfied they are with their overall experience of participating or interacting with others in the NETwork. It includes their perceptions of learning satisfaction in NETwork and NETwork site evaluation.

Sense of Community

Sense of community is a feeling that NETWork members have of belonging, a feeling that NETwork members matter to one another and to the group, and shared faith that NETwork members' needs will be met through their commitment to be together

(McMillan & Chavis 1986).

Social Ability

Social ability is a NETwork member's capacity to associate with other NETwork members and to use the members, resources and tools of the social context in Sakai to achieve something of value (SCRG, 2006).

Social Navigation

Social navigation is a construct explaining how people decide what to do by learning and observing from others' actions in a social context. Social navigation occurs when a NETwork member uses awareness of what others are doing as a primary guide for his or her's own actions (Laffey et al., 2006).

Social Presence

Social presence is the ability of NETwork members to see themselves and others socially and emotionally in a community. In NETwork, an online learning community, this concept includes senses of "being there" and "being there with other members" (Laffey et al., 2006).

Trajectory

According to Strauss (1993), trajectory can be used in two ways: "(1) the course of any experienced phenomenon as it evolves over time, and (2) the actions and interactions contributing to its evolution." In a community of practice, members' changes influenced by others' actions or phenomenon in the community may impact or shape the interactions in process. Simply, the changes in patterns or orbits represent members' trajectory in the online learning community.

CHAPTER II

REVIEW OF THE LITERATURE

Introduction to the Chapter

The purposes of this study are to understand the nature of participation and learning in a Community of Practice (CoP) and to test a model of how social constructs of the online learning community influence the effectiveness of professional development in a community. This study investigated how members participate in a CoP, the social constructs of the CoP, and the professional development outcomes of participation.

The literature review comprises three parts. *Part I, Community of Practice*, discusses the definitions and research of community, online learning community, and CoP. *Part II, Nature of Social Constructs of Online Participation in CoP*, discusses research on participation and social interaction in online learning, on social constructs influencing participation and interaction, and on methods for measuring members' participation and interaction in online learning contexts. *Part III, Online Professional Learning Community (PLC) in Teacher Education*, presents how PLC support teachers' learning continuum across teacher education and school practice and how teachers' professional development in online CoP is measured.

Part I: Community of Practice

A community is different from a group because it contains function, identity, discursive participation, and shared values (Woodruff, 1999) which may not be found in a group. To be more specific, the social bonds, including feeling of belonging, trust, and shared faith, are what make a community different from a group (McMillan & Chavis, 1986). This section presents the theoretical framing for community, online learning

community, and CoP in order to better understand the functions and nature of CoP.

Community & Online Learning Community.

Shaffer and Amundsen (1993) defined community as “a dynamic whole that emerges when a group of people participate in common practices; depend upon one another; make decisions together; identify themselves as part of something larger than the sum of their individual relationships; and commit themselves for the long term to their own, one another’s, and the group’s well-being” (Shaffer & Amundsen, 1993, p. 10).

Bellah, Madsen, Sullivan, Swidler, and Tipton (1996) indicated that community is a group of people who are socially interdependent, participate in discussions and decision making processes and share practices. Before the Internet became prevalent, community was primarily constructed with a geographical requirement of members needing to have physical proximity. Since the 1990s with rapidly advancing distance communication technologies, Blanchard (2000) argued that a community no longer has to be a location where members meet face to face. Considering communities in virtual space, Rheingold (1993) said that virtual communities are “social aggregations that emerge from the Net when enough people carry on...public discussion long enough, with sufficient human feeling, to form webs of personal relations in cyberspace” (p.5). Rheingold (2000) emphasized that community members have shared interests, ongoing discussion, shared histories, norms, and caring. Similar to Rheingold, Preece (2000) defines an online community as a group of people who come together to participate in online interaction with similar interests and that this group of people are governed by policies and norms generated in the community. Members of a community have a shared history established when people participate in practices, shared values, culture, social interdependence, and a

reproduction cycle which make members appreciate belonging to the community (Barab & Duffy, 2000). As a result of new technology and the Internet, online community released community from the geographical and time constraints of social communication.

Hunter (2002) identified a learning community as a group of people who not only interact but also “learn from each others’ work, and provide knowledge and information resources to the group related to certain agreed-upon topics of shared interest” (p.96). This definition emphasizes that community members need to both contribute to the community and absorb others’ and the group’s knowledge. Similar to Hunter, many researchers have considered learning as an important process or outcome of virtual communities, such as in online courses provided by universities and communities of practice. According to Graves (1992), the term learning community began being used in the early 1990s. At this time there was a growing interest in more holistic views of learning. Many educators started considering the context of learners and social situations as a whole for supporting students’ learning. Some leading educators identified three essential environmental conditions for intellectual growth, they said “schools and classrooms are interdependent, cooperative communities” (Costa, 1992, p.44). Also, educators conceptualize learning community based both upon approaches to “curricular organization” and “social relationships among participants” (Kling & Courtright, 2003, p.226). In curricular organization approaches educators emphasize resource sharing and structural arrangement of learning content, such as how to best design the discussion forums for supporting learning and promoting information sharing. For the second approach, educators focus on people’s feeling of belonging, interaction, and commonality of goals in learning communities. Graves (1992) and Riel and Fulton (2001) indicated

that cultivating members' trust, social interaction, and ties need to be supported in order to engage and foster members' participation in online learning communities. Integrating ideas from both approaches, a learning community depends on learners' ability and willingness to collaborate and communicate with others. A learning community should provide a shared collaborative space and communication tools to support learners' ability to interact while fostering social constructs that promote a willingness to learn. After reviewing many definitions and uses of community in education and business literature, Ludwig-Hardman (2003) classified communities into four categories, which represent online learning communities with different foci:

- (1) Knowledge-building community: Knowledge-building community focuses on intellectual development by sharing knowledge and investing resources for better understanding knowledge (Hewitt, Brett, Scardamalia, Frecker, & Webb, 1995)
- (2) Curricular communities: The major focus of curricular communities is to sustain undergraduate students' collaborative learning and successful academic achievement.
- (3) Communities of purpose: Communities of purpose derive from communities of practice. It happens when "community hosts purposefully built communities around transactional sites to provide added value for members (Marathe, 1999)" (Ludwig-Hardman, 2003, p.17).
- (4) Communities of practice: Communities of practice are groups of people who join together with a common purpose and share a common practice in the community (Wenger, 1998).

Similar to Ludwig-Hardman (2003), Jonassen, Peck, and Wilson (1999) identified four types of technology-supported learning communities, including discourse communities, knowledge-building communities, learning communities, and communities of practice. According to Ludwig-Hardman's (2003) and Jonassen et al. (1999) each type of community is unique, but they all have common characteristics. They all emphasize "social and cognitive contributions of a group of learners to each other, with students collaborating and supporting each other toward commonly accepted learning goals" (Jonassen et al., 1999, p.119). Since the community, NETwork, that is the subject of this study was established for teachers' practice of learning how to teach, it is classified as a community of practice where teachers share the same interests and common practices of teaching science.

Community of Practice (CoP)

Framework of CoP

Lave and Wenger (1991) indicated that activities, which are inherently social and shaped by the context, influence one's sense of identity, how and what is learned, and the meaning of practice in the context. How members work and interact socially in CoP shapes learning and practice. Wenger (1998) characterized the formation of a CoP as groups of people who join together with a common purpose and share a common practice. In the community, members integrate practice, meaning, identity, and community as components of learning and knowing in their interaction. Lave and Wenger (1991) said "Activities, tasks, functions, and understandings do not exist in isolation; they are part of broader systems of relations in which they have meaning. These systems of relations arise out of and are reproduced and developed within social communities, which are in part

systems of relations among persons” (p.53). Learning is social, and one’s growth depends on not only individual’s changes of feelings and cognition but also the shared values, relationships, networks, and knowledge reproduced in the interaction. Further, Wenger indicated that “Knowledge, belonging, and doing are not separable: What we know, who we are and what we do seamlessly come together in one experience of participation” (Wenger, 1996, p.22). Thus, learning and membership within CoP are intertwined. Members benefit from community membership by having a sense of belonging and having others to ask for support (Wellman & Gulia, 1999).

Wenger (1998) identified three dimensions of practices which are sources of coherence in a community: mutual engagement of participants, joint enterprise, and shared repertoire.

(1) Mutual engagement: Wenger (1998) said that “Practice does not exist in the abstract. It exists because people are engaged in actions whose meanings they negotiate with one another” (p.73). Practice does not exist in books or tools but in “a community of people and the relations of mutual engagement by which they can do whatever they do” (p.73). Thus, CoP is not just a team or network, but it is a community whose membership changes depending on members’ engagement. Also, members’ mutual engagement results in relationships among members. Both mutual engagement and relationships change over time.

(2) Joint enterprise: Joint enterprise which is created among members’ relations of “mutual accountability” is “the result of a collective process of negotiation” and members’ “negotiated response to their situation” (Wenger, 1998, p.77).

Through negotiation, members’ reflect what they know and what they learn into

the practice and gain and learn from others' feedback.

(3) Shared repertoire: Shared repertoire reflects the history of members' mutual engagement and includes the discourse members use when negotiating with others, making sense of what they learn, expressing their sense of belonging, and identity (Wenger, 1998). Wenger (1998) said: "Because repertoire of a community is a resource for the negotiation of meaning, it is shared in a dynamic and interactive sense" (p.84).

Following from the explanation above, members' experiences of learning in CoP are constructed through their engagement and participation. Although members join CoP based upon their own interests, they must have positive engagement, such as social bonds and relationships with others, to sustain their membership. In the process of engaging or participating in practices, joint enterprise (i.e. mutual accountability and negotiating discourse) can be produced and maintained in a shared space as shared repertoire. The shared repertoire becomes members' resources for further negotiating in practice.

In order to better understand how interaction takes place and the complex relationships in CoP, Figure 2.1 was developed to visually represent the functions and features of CoP theory. This figure is based upon Laffey's (2005) expression of a graphic model of CoP. In Figure 2.1, practice is the center of the community. Members participate in practices by interacting with other members and engaging in activities. Legitimate peripheral participation is the process of how a member moves from peripheral to being a core part of a community (i.e. from first as an observer (lurker) to a core role of participation), as well as how their perception of themselves and their identity as perceived by others changes over time. The trajectory that shows the members

moving from peripheral to central participation represents the growth within and of the COP. Additionally, adoption represents how members adjust themselves to fit the norms, policies, and context of the community, and how they appropriate what has been shared and belongs to others as their own (Wertsch, 1998). Members' sense of belonging changes over time through socialization. Their identities are constructed through participation and vice versa. The development of a CoP is highly related to the changes in members' identities, interaction, and participation. Finally, the learning outcome, the growth of individual member, includes not only the cognitive changes of what they learn but also their development of relationships with others, of levels of participation, and of identities.

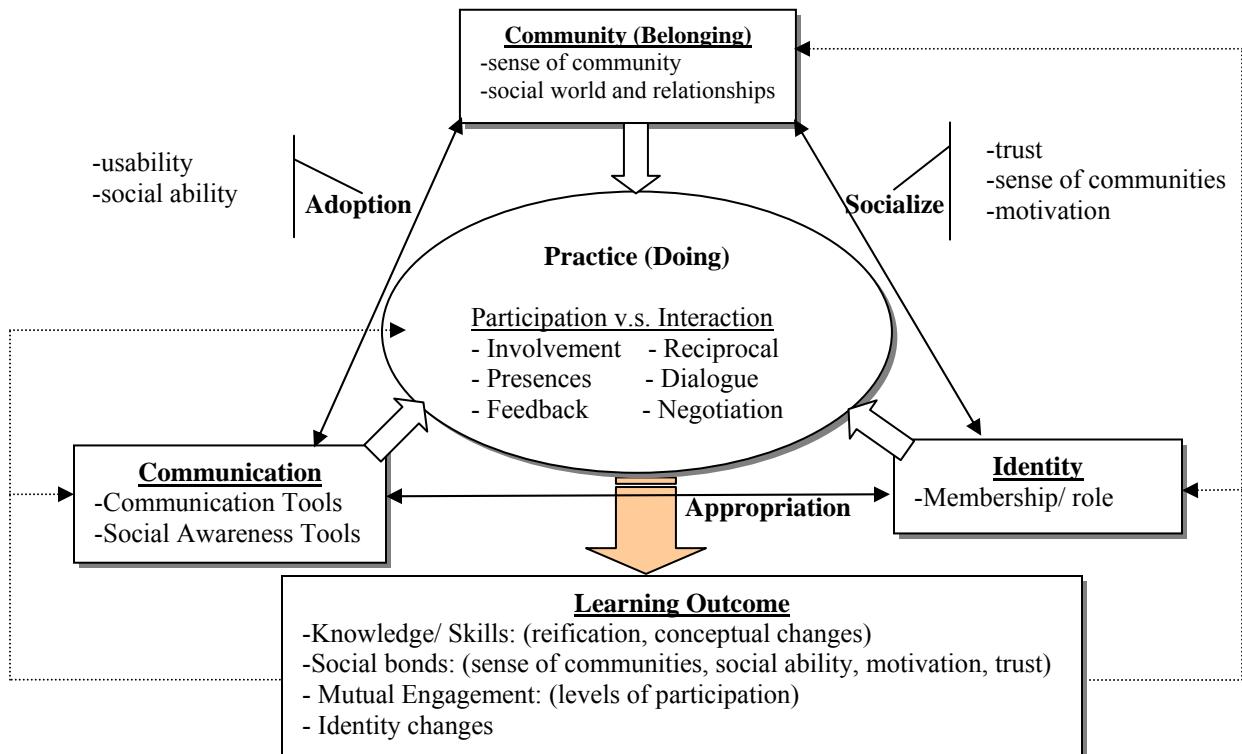


Figure 2.1. Framework of CoP Theory

CMC Tools Support CoP

In CoP implemented in an online learning environment, the mechanism that supports the establishment of members' communication, social relationships, and interaction becomes critical. Wellman and Gulia (1999) have recognized that communities can exist as social networks where members do not need to be physically in the same location. The spirit of community and communion among members are found to be more important than having a sense of physical place (Ward, 1999). Additionally, Jonassen, Davidson, Collins, Campbell, and Haag (1995) believed that "technology can be used to create communities of learners and practitioners and can facilitate the interactions and activities necessary for solving real-world problems" (p. 8). Having computer-mediated communication (CMC) tools to support asynchronous and synchronous interaction of CoP, time and space are not necessarily limitations anymore. In CoP, the content of communication is what brings people together. Without physical interaction, member's physical characteristics become invisible and the textual content of communication is carried by the CMC tools. Given current tools for the Internet textual information delivered by CMC tools is the primary way members shape their understanding and feelings of learning content and others' identities. Thus, members know each other primarily from what they said but not the characteristics of their physical looks or interactions.

Hillman, Willis, and Gunawardena (1994) argued that users' learning are blocked if they can not interact through the medium easily. The technologies and tools need to be easy for members to use in order to facilitate interaction. In order to promote effective collaboration during online learning, researchers have examined how synchronous and

asynchronous computer-mediated communication (CMC) tools can deliver social awareness information and facilitate social interaction in online learning environment.

For example,

- (1) Online chatting messengers (e.g. MSN®, YM®, and ICQ) support the exchange of text messages and indicate collaborators' status, actions, and opportunities during communication (Alavi, 1994);
- (2) Video or audio clips help participants develop a sense of others' social presence and enable the members to exchange their thoughts (Alavi, Wheeler, & Valacich, 1995; Dourish & Bly, 1992).
- (3) Social awareness supports a shared sense of community for maintaining work relationships and informal communication (Dourish & Bly, 1992).
- (4) Email and electronic bulletin boards assist asynchronous collaborative communication (Alavi, 1994).
- (5) Various notification strategies seek to enhance users' awareness of people and workspaces without increasing cognitive load (Carroll, et al., 2003).

Studies have found that social interaction can be supported by CMC tools if CMC tools are applied effectively (Tu & Corry, 2003; Lavooy & Newlin, 2003; Tu & McIsaac, 2002; Kearsley, 2000). The qualities of the CMC tools influence how members socialize and how they appropriate and adopt the CMC tools when interacting and participating in CoP. Members' learning is dependent upon the CMC tools being well designed to support communication and social interaction in ways that fit the context.

Research of CoP in Teacher Professional Development

In the book "The Social Life of Information," Brown and Duguid (2000) analyzed

examples of learning in professional practice and how the communication technologies support or compel professional learning. They found that members learn to be practitioners by working and talking about practice. They conclude that: “practice is an effective teacher and the community of practice is an ideal learning environment”. In CoP studies that applied CMC tools to form and sustain teachers’ professional learning (Gray & Tatar, 2004; Job-Sluder & Barab, 2004), a great challenge is how to foster sustained participation, a sense of community, connections, trust, commitment to the community, and a sharing culture among members.

Tapped In (<http://www.tappedin.org>; Gray & Tatar, 2004), an instance of CoP for teacher professional development, is organized around the metaphor of a conference site with a multi-user virtual environment for supporting teachers’ professional development (Gray & Tatar, 2004). CMC tools are used to support members’ synchronous and asynchronous communication of the activities including course and workshop sessions, group meetings, and public discussion pertaining to K-12 teaching. Members login to Tapped In seeking ideas and colleagues outside of their local practice and exploring the affordance of the online learning communities. Fusco (2002) examined members’ login times as a way of assessing their levels of participation. She found in a 3.5 year period (1997 to mid-2001), 62% of members logged into Tapped In less than five times and 25% of the members logged in from 6 to 20 times. Only 1% of members logged in more than 200 times. However, Schlager and Fusco (2003) conclude that “Tapped In has been quite successful in achieving its original goal of bringing together and forging new relationships among education practitioners, providers, and researchers from around the world on a daily basis” (p.204).

The Inquiry Learning Forum (ILF, <http://ilf.crlt.indiana.edu>; Job-Sluder & Barab, 2004) is a CoP for teacher professional development, which was created in 1999 by researchers at the Indiana University School of Education (IUSE). Barab, MaKinster, and Schekler (2004) utilizes Lave and Wenger's (1991) CoP framework to create a "visit to the classroom" metaphor whose interface is structured with various types of rooms, such as a Lounge for public discussion on general topics, a Library for members to share lesson plans and resources, and an Inquiry Lab is used to support members' professional development in inquiry-based pedagogy. ILF uses video-based lessons of actual classroom practice, which are contributed by members of the community, to provide members with opportunities for observing and discussing how teachers teach using inquiry-based strategies. ILF supports learning practices and inquiry-based learning among pre-service math and science teachers in IUSE and in-service math and science teachers across Indiana. After implementing ILF for several years, researchers found that the posting rate in e-ILF was low and the content of the messages was superficial (Baek & Barab, 2005). For example, Kling and Courtright (2003) found that only 23% of in-service teachers had visited the site five or more times within one year (9% of teachers had visited 10 or more time) and 17% of in-service teachers had posted 5 or more messages. Similarly, only 28% of pre-service teachers had posted 5 or more messages within one year. Also, the ILF research team found that online exchanges among teachers did not show the level of engagement and critical reflection they expected (Kling & Courtright, 2003). For example, in a discussion related to a particular teacher's videotaped classroom, the posted messages consisted of questions or opinions that were irrelevant to the content of the video and the resources in use.

Changes in members' level or patterns of participation have been found in Tapped In and ILF studies. Gray and Tatar (2004) found patterns of participation in which some Tapped In members logged in very actively for a period of time and then became inactive for weeks or months before coming back again. Additionally, Kling and Courtright (2003) reported that in ILF in-service teachers' participation increased slowly compared to pre-service teachers. To be more specific, in-service teachers who posted five or more messages increased from 17% (35/202) to 18% (58/320) within nine months, while pre-service teachers who posted five or more messages increased from 28% (51/83) to 34% (147/432). The difference and changes in pre- and in-service teachers' levels of participation in ILF was identified through comparing their postings. Although Kling and Courtright (2003) and Gray and Tatar (2004) applied different indicators, number of postings and login times, to examine members' levels of participation, both of them used time as a critical factor for examining changes in members' levels of participation.

Summary

The literature reviewed in part I presents: community, online learning community, and community of practice as constructs that have previously been studied. These constructs and prior research have been reviewed because the proposed study investigates an online learning community using a CoP framework to understand participation and outcomes. Previous studies have found that social constructs, such as feelings of belonging, social relationships, trust, and members' usage of CMC tools influence how members participate in activities or interact with others. How well these social constructs are sustained determines the success of CoPs. The literature review of this part articulates the current understanding of researchers about the nature, framework, and

implementation of CoP.

Part II: Nature of Social Constructs of Online Participation in CoP

Vygotsky (1978) stated that learning is a process of social interaction, including negotiation, collaborative sense making, constructing joint knowledge, and mentoring knowledge construction by people working together. Wenger (1996) in developing a social theory of learning defines participation as “the social experience of living in the world in terms of membership in social communities and active involvement in social enterprises (p.55)” and argued that “Knowledge, belonging, and doing are not separable: What we know, who we are and what we do seamlessly come together in one experience of participation” (p.22). Through the process of negotiating meaning, learners construct their own understanding based on their experiences and prior knowledge. When negotiating and making sense, learners interact with experienced learners and gain their expertise by participating in negotiation and collaboration for better understanding the new knowledge or skills (Jonassen, 1994; Vygotsky, 1978). Online students’ active participation has been found to be critical in sustaining a learning community and building a sense of community (Wang, Sierra, & Folger, 2003). Brown (2001) and Moller, Harvey, Downs, and Godshalk (2000) found that members’ active participation in collaborative activities can foster their sense of community. Since learning is constituted through social interaction, a sense of community and social ability influence learners’ participation and outcomes (Rovai, 2003; Carroll, 2001; Putnam, 2000; Laffey et al., 2006).

According to Moore (1989) and Hewitt (2005), four types of interaction, including learner-content interaction, learner-teacher interaction, learner-learner interaction, and

learner-interface interaction are in play in online learning communities. These four types of interaction may happen in online systems that include shared spaces for discussion, chatting, upload or download files, and email with other members. For example, the primary interaction of NETwork occurs in Discussion Board, Chat Room, and Resources. The four types of interaction in Network are interacting with learning content of teaching science, university professors who facilitate the interaction, other NETwork members, and the Sakai system. Previous studies found that interaction has a positive effect on students' learning (Picciano, 2002, Richardson and Swan, 2003), positive learner attitudes (Thompson, 1990), and overall learning satisfaction with the instruction (Fulford & Zhang, 1993). Researchers also show that student to faculty and student to student interactions are critical for the implementation of effective online courses (Kearsley, 1995; Kumari, 2001; Moore, 1993; Picciano, 1998; Picciano, 2001; Wise, Chang, Duffy, & del Valle, 2004). As a result, there has been an increasing recognition of the importance of implementing educational practices that foster online learning as a social and interactive activity (Levine Laufgraben, & Shapiro, 2004).

Textual communication and interaction in online discussion boards are the primary form of interaction in online learning environments. In 2000, 62% of distance learning faculty used asynchronous communication tools to support class interactions and discussion (NEA, 2000). Compared to synchronous discussions, asynchronous text-based discussions contain advantages, including members' having more opportunities to interact with each other and having more time to think, reflect, and search for useful information before discussion (Pena-Shaff & Nicholls, 2004). Differing from the un-organized and impermanent e-mail and chat messages, online discussion forums have

been recognized as an effective tool for scaffolding anytime and anyplace discussion, modeling critical thinking, and sustaining reflective thinking (Romiszowski & Mason, 2004; Nonis, Bronack, & Heaton, 2000; Bonk & Kim, 1998). The threaded and written format in the discussion board encourages more reasoned and thoughtful thinking than talking in face-to-face classes (Jonassen, 2000; Bodzin & Park, 2000). The permanent record of the discussion helps students to track and link the ideas and flow of the discussion (Bodzin & Park, 2000). Research conducted in teacher education has found evidence of positive results from interactions in online discussion forums. Khine and Lourdsuamy (2003) found that trainee teachers had positive responses to online discussions. Ninety percent of students ($n = 250$) indicated online discussion forums increased opportunities for discussing problems and gaining peer responses. Based on a mixed method study, Killian and Willhite (2003) concluded that online discussion forums encouraged elementary science pre-service teachers to have consistent participation through the semester. Students who were not used to speaking up in face-to-face class were encouraged to participate in online discussion forums. Eilon and Kliachko (2004) also discovered science pre-service teachers' comprehensive learning of the subjects and peer interaction appeared in the online discussion forums. Reading discussion texts gave students opportunities to ask questions and refine the quality of their postings in ways that fostered their' learning.

Although online discussion forums have been found to be supportive for members' interaction and participation in activities, some researchers have identified concerns with online discussion (Hewitt, 2005; Cheung & Hew, 2005; Angeli, Valanides, & Bonk, 2003). Some discussion threads stop more quickly than expected because of too many

participants and superficial content. Based upon an examination of a 50,000 person community, Watson (1997) concluded that online discussion forums and the community are maintained by the “continued interaction of participating members” (p.104) and the “continuous presence of other people there” which need to be supported by CMC tools (p.105). Therefore, CMC tools used to scaffold students’ interaction and the instructors’ facilitation need to be effective in sustaining students’ interactive discussion.

Factors Influencing Participation & Interaction

Vrasidas and McIsaac (1999) suggested that structure, class size, feedback, and students’ prior experiences with computer-mediated communication all influence interaction in an online course. Especially, content and immediacy of feedback from others impact members’ interaction and levels of participation. Wagner (1994) said that “feedback automatically elicits the correct response without the student being actively aware that learning is taking place. In contrast, cognitivists maintain that feedback serves as information to the learner: the learner actively interprets the information and uses it to generate responses” (p12). Feedback establishes reciprocal relationships and social interaction among members of CoP. Additionally, the use of different types of synchronous and asynchronous communication tools (chat, discussion board, blog, etc.) that enable members to socially interact with others have been shown to influence students’ participation and interaction of online learning (Collins & Zane, 1996). Falvo and Solloway (2004) also found that the types of online learning format, technology used for supporting learning, instructional design, and various social activities and relationships contribute to a greater sense of community and are found to impact participants’ interaction. Participants were found to be satisfied with the format of online

learning because of the convenience of learning at their own pace and location. Previous studies indicated that people's sense of community, social ability, and technology acceptance are three primary constructs impacting their social interaction and participation of CoP.

Sense of Community

McMillan and Chavis (1986) defined sense of community as "a feeling that members have of belonging, a feeling that members matter to one another and to the group, and shared faith that members' needs will be met through their commitment to be together" (p.9). Sense of community has been identified as a critical factor to members' levels of participation, social interaction, and learning satisfaction online (Tinto, 1993; Rovai, 2002a). Wellman and Gulia (1999) stated that learners benefit from being a member of a community from a sense of belonging and having others to ask for support. Previous studies found there was more information exchange among members, availability of support, commitment to group goals, and members' collaboration when people experience a strong sense of community (Wellman, 1999; Dede, 1996; Bruffee, 1993). Consistent with previous studies that indicated the importance of sense of community for making an online community a learning community (Blanchard, 2000; Haythornthwaite, et al., 2000), Rovai (2002a) reported that when learners interact with others and share a common purpose, the quality of learning increases. In an online learning study with 314 students enrolled in 26 graduate education and leadership courses, Rovai (2002c) employed the Classroom Community Scale (CCS) to examine students' sense of community. The CCS developed by Rovai (2002b) is a 20-item instrument for examining students' self-reported feeling of sense of community in an online learning

environment. In his study, Rovai (2002c) found a significant relationship between classroom community and perceived cognitive learning. Students having a stronger sense of community and a greater perceived cognitive learning outcome felt less isolated and more satisfied with their programs. Applying Rovai's CCS to examine 464 students' sense of community in a large Australian university, Dawson (2006) found consistent results with Rovai (2002c). Students with higher frequency of communication tended to have stronger sense of community.

Additionally, students with a higher sense of community have higher satisfaction with their learning experience. Tinto (1993) discovered that students with stronger feelings of community are more likely to persist in the community than those who feel isolated. Also, higher levels of satisfaction was directly correlated with retention rates of online learners as students tended to stay more in online classes if they felt involved in learning activities and had personal relationships with others. Further, an empirical comparative study found that sense of community is a key factor in determining students' staying in class. In a study of 120-adult-learners, Rovai (2003) compared students' sense of classroom community in a traditional face-to-face class with a television-based higher education distance education course. Synchronous one-way television and two way audio technologies were applied in the distance education course that had same instructor as in the face-to-face class. Rovai found students in the distance education course had a significantly lower sense of classroom community than students in the face-to-face class. This result affirms Wiesenber and Hutton's (1995) insights that educators who perceive the value of learning community need to understand how sense of community can be sustained and fostered in distance education environments. Similar to studies within

online courses, sense of community has been found to be a factor for sustaining social interaction in virtual teacher communities (Steele, 2002; Rovai, 2003).

Although sense of community is difficult to sustain in distance education, Barber (1995) and Blanchard (2000) indicate that sense of community can be sustained in online learning environments just as strongly as in face-to-face classrooms. Rovai (2001) examined learners' sense of classroom community with a total of 413 adult learners in 14 undergraduate and graduate classes. Interactions containing constructive comments, trust, and collaboration were found to support the growth of community, while interactions with criticisms or showing tension were found to weaken students' sense of community. Further, Rovai (2002) indicated that to build and sustain a sense of community in a virtual learning environment providing social awareness information for learners is critical. Additionally, McInnerney and Roberts (2004) suggest that building three protocols into the existing online learning environment, including 1) using synchronous communication, 2) establishing a "forming" or "warm-up" stage for collaborative members' relationships, and 3) providing guidelines for successful online community, may promote sense of community and productive social interaction. To summarize, sense of community is a critical determinant of successful online interaction. Sense of community can be sustained, but it depends on many factors, such as people, context, activities, and the CMC tools provided in the system.

Social Ability

Preece (2000) first use the term "sociability" to illustrate the state of how a community is influenced by people, tools, policies, and activities of the community. After Preece (2000), Laffey et al. (2006) integrates the concept of embodiment (Dourish, 2001)

that people act “through” technologies and clarifies sociability as an attribute of an individual in the context. To be more specific, Laffey et al. (2006) prefers to represent the state of the community with the term “sociality” and bring a new concept “social ability” to explain members’ experience and perception of social interaction. Social ability is an attribute of the individual in the context and depends on the relationships among the person, tools, and activities within a virtual environment. Researchers believe members’ social ability and their experiences of social ability are influenced by the sociality of online community (Laffey et al., 2006).

According to Laffey et al. (2006), social navigation and social presence are sub-constructs of social ability. Laffey et al. (2006) employed a 20-item Social Ability Instrument (SAI) to explore students’ social ability in online learning. SAI was developed by adapting 10 items from Picciano’s (2002) social presence questionnaire and developing 10 items representing social navigation based upon Computer Supported Cooperative Work (CSCW) literature (i.e. Hook, Benyon, & Munro, 2003; Munro, Hook & Benyou, 1999). Three constructs of social ability, including social navigation, social presence and connectedness, were found through the factor analysis of 104 respondents (Laffey et al., 2006). The Cronbach’s coefficient alpha of these factors are .92, .84, and .95.

Further a 30-item instrument was developed by modifying and extending the SAI to help explore students’ online learning experience in a quantitative study (Yang, et al., 2006). Advancing from Laffey et al.’s (2006) study, Yang et al. (2006) examined students perceived instructor’s and peers’ social presence separately and found significant differences between these two constructs. Another expansion of the definition of social

ability was made to create a version of SAI with 42 items. This modification added constructs of privacy and written communication skills found in the literature (i.e. Tu, 2002; Lapadat, 2002; Tu & McIssac, 2002). After a factor analysis, 30 out of 42 items were retained and included perceived peers social presence, perceived written communication skills, perceived instructor social presence, comfort with sharing personal information, and social navigation as 5 factors for explaining social ability in online learning environment. The Cronbach's coefficient alpha values of these 5 factors (.93, .90, .91, .83, .88) show high reliability. Social navigation and social presence are key factors that were found in both studies (Laffey et al., 2006; Yang et al., 2006). Social navigation is defined as “a particular phenomenon, in which a user’s navigation through an information space was primarily guided and structured by others’ activities within that space” (Dourish, 1999, p.18), while social presence is explicated as an attribute of computer-mediated activities regarding how effectively the media mediate the sense that other participants are really present (Short, Williams, & Christie, 1976; Laffey, et. al, 2006).

In a study of the social nature of online courses, Lin et al. (2006) examined the relationships among social constructs, including social ability, motivation, and learning satisfaction, of online learning using a structural equation model. The model was tested with a sample of 101 students who enrolled in a distance education program. Social ability was found to be a significant predictor for students’ online learning satisfaction as well as motivation. Further Tsai et al. (2008) employed the 30-items instrument (Yang et al., 2006) and CCS (Rovai, 2002) to examine relationships among social ability, sense of community, and learning satisfaction. Differing from Lin et al. (2006), they found that

sense of community was a mediator for the relationship between social ability and learning satisfaction, which showed social ability is not a direct predictor for online learning satisfaction but an indirect determinant. However, when Lin et. al, (2006) examined the relationships between social ability and learning satisfaction, social connectedness was included as a factor of social ability. Because the meaning of social connectedness is similar to sense of community, it is possible that the direct relationship between social ability and learning satisfaction was partially determined by social connectedness. Thus, the direct relationship disappeared when sense of community was added as a construct in the model (Tsai, et al., 2008). Further research is needed to explicate the relationships among social ability and the other social constructs of online learning which include examining all the factors simultaneously.

Technology Acceptance

Both sense of community and social ability are highly affected by the affordance of technology in online learning environments. Tsai et al. (2008) discovered that members' perceptions of technology use impacted their social ability and sense of community. Dillon and Morris (1996) define technology acceptance as "the demonstrable willingness within a user group to employ IT for the tasks it is designed to support" (p.4). In order to understand how CMC tools influence members' participation and interaction, a Technology Acceptance Model (TAM) was developed by Davis (1989) for examining members' perceptions of use of the information technology tools. TAM consists of two belief factors, perceived ease of use and perceived usefulness. Perceived ease of use is defined as "the degree to which an individual believes that using a particular system would be free from physical and mental effort" (Davis, 1989, p.320) and perceived

usefulness is “the degree to which an individual believes that using a particular system would enhance his or her job performance” (Davis, 1989, p.320). According to Davis (1989), members accept and use a technology primarily because of the functions it performs and how easy they can apply the technology to perform the tasks as well as they like. By examining 789 users’ usage of computing, Davis found that when the members perceived the tools to be easy and useful to use, they had more positive attitudes and intentions to use the tools.

TAM is a widely used model for explaining and predicting members’ usage and acceptance of new technology (Adams, Nelson, & Todd, 1992; Dillon & Morris, 1996; Hubona & Whisenand, 1995; Arbaugh, 2000; Lin, 2005). In an IBM PC-based graphics system study, Davis (1989) examined 40 MBA students’ one-hour experience with two different systems and found perceived usefulness and ease of use to have significant correlation with students’ usage of the systems. Students’ usage of the systems was more highly correlated with perceived usefulness than with perceived ease of use. Similar to Davis’s (1989) results, Adams et al. (1992) also found users’ usage of voice-mail and e-mail was more strongly correlated with perceived usefulness than ease of use. In contrast, studies in web-based technologies found that perceived ease of use was a better predictor for determining users’ usage of technologies (Venkatesh & Davis, 1996; Brown, 2002). The interface of the web-based technologies (perceived ease of use) tends to have more influence on users’ usage. By adapting TAM to examine 187 students’ online learning experience, Lin (2005) constructed a unified model of technology appropriation (UMTA) and found students’ intention to apply technologies impacted their appropriation behaviors. In her UMTA model, both perceived ease of use and perceived usefulness

have direct influence on users' attitude, and perceived ease of use directly impacts students' perceived usefulness of tools. Additionally, a recent study explored students' online learning experience by examining the relationships among perceived ease of use, perceived usefulness, social ability, and sense of community (Tsai, et al., 2008). Similar to Lin's finding, Tsai et al. (2008) found that perceived ease of use directly impacts perceived usefulness, which means students had to perceive the tools as easy to use before they perceived their usefulness. Also, perceived ease of use directly influenced social ability and perceived usefulness influenced sense of community (Tsai, et. al, 2007). The available literature shows TAM to be influential in predicting attitudes and technology use across a variety of contexts, but no literature has been found relevant to its application in CoP.

Measurement of Participation and Interaction of CoP

According to the framework for CoP (Wenger, 1998), learning outcomes of a CoP include not only the knowledge or skills gained in the CoP but also changes of social constructs, such as sense of community, social ability, identity, levels of participation, and social relationships with others. These changes happen when members interact with others through textual communication. Textual information created or generated during members' interaction is the primary source for examining members' changes of social interaction. However, Paccagnella (1997) found limitations in studying a community only through reading the textual messages and logs. Only analyzing the textual messages ignores members' actual experiences of their participation and interaction when working in front of their computers. Also, the logs do not record the nature of turn taking that happens in chat or emails and the time of typing a reply message, which helps form the

experience of collaborating in the community. Similar to Paccagnella, Mason (1999) found that in only reading the posted messages the researchers miss out on the actions that happen around the messages. In addition to only analyzing the content of messages Mason (1999) indicated that using an online survey or email interview are important methods for studying a text-based virtual community. These findings suggest that studies, such as the current study of the NETwork community should not only analyze textual messages and activity logs but also implement survey and interview approaches in order to understand members' experiences.

Wurman (1989) identified five different methods for transforming data into information for exploring particular phenomena. The data can be transformed by:

- (1) Category: categorization is organized by types, such as textual messages of NETwork, statistics data from surveys, transcripts from interviews, and activity logs.
- (2) Time: “time is an easily understandable framework from which changes can be observed and comparisons made (p.60)” and time can be addressed as days, weeks, months, or years. The activity logs recorded in CANS will provide time information of members’ actions, which help to examine members’ changes of participating in NETwork.
- (3) Location: where the data or information come from, such as textual discussion in Discussion board and Chat Room in NETwork.
- (4) Alphabet: alphabetical organization depends on different languages used in diverse cultures.
- (5) Continuum: data is organized by magnitude, such as from small to large.

The recommendations of Wurman (1989) suggest that the data of studies such as this one classified data by types (i.e. survey data, interview transcripts, textual messages, and activity logs), location (i.e. activity logs or transcripts of discussion in Resources, Discussion Board, or Chat room), and time. Since the fundamentals of a community require time to develop in electronic social environments (Tu & McIsaac, 2002), a short-term observation or record of members' actions is not likely to thoroughly describe the formation of an online learning community nor represent the dynamics of a community adequately. Tu and Corry (2003) indicated that longitudinal studies are required that allow the community and participants to develop mature social learning processes. Based upon varying data types, several methods of analysis, including content analysis for textual messages and transcripts (Henri, 1992; Gunawardena, Lowe, & Anderson, 1997; Sing & Khine, 2006), frequency calculation, social network analysis, and visualization techniques for activity logs (Koku & Wellman, 2003; Gray & Tatar, 2004; Kling & Courtright, 2003), and structural equation modeling for statistic data of social constructs (Lin et al., 2006; Tsai et al., 2006), have been recommended by researchers.

Content Analysis for Textual Information

Content Analysis has been recognized as a technique often used to analyze messages of online discussions (De Wever, Schellens, Valcke, & Van Keer, 2006). Content analysis has been adopted by previous studies to uncover the qualitative nature of text-based discussion (Henri, 1992; Gunawardena, Lowe, & Anderson, 1997). Henri (1992) developed a five-dimensions model to examine the learning processes that happen online. The five dimensions are participative, social, interactive, cognitive, and

metacognitive (Table 2-1). Lally (2001) pointed out that the major strength of this model is that “it focuses on the social activity and the interactivity of individuals in a group at the same time as giving a picture of the cognitive and metacognitive processes of those individual” (p. 401). He also indicated that the major limitation is that “it gives us no impression of the social co-construction of knowledge by the group of individuals as a group, in a discussion or a seminar” (p.401). Although the model was not tested by Henri empirically, the model was used in a study by Hara, Bonk, & Angeli (2000). The researchers found that students’ postings were cognitively deep and students’ participation was about one posting per week. However, they found difficulty in getting inter-rater reliability for the metacognitive dimension.

Table 2.1

Content Analysis: Henri’s Model

Dimension	Categories
Participative	Overall participation: total number of messages and accesses to the discussion (levels of participation)
	Active participation in the learning process: numbers of statements related to learning
Social	All statement or part of the statement not related to subject matter
Interactive	Explicit interaction: Direct response, Direct commentary
	Implicit interaction: Indirect response, Indirect commentary Independent statement
Cognitive	Elementary clarification; In-depth clarification; Inference; Judgment; Strategies
Metacognitive	Metacognitive knowledge: Personal; Task; Strategies
	Metacognitive skills: Evaluation; Planning; Regulation; Self awareness

Additionally, Gunawardena, et al. (1997) developed a five-phases interaction analysis model (IAM) for analyzing meaning negotiation and co-construction of knowledge (see Table 2.2). They believe that co-construction of knowledge has five progressive phases, including sharing/comparing of information, discovery and exploration of dissonance or inconsistency among participants, negotiation of meaning/co-construction of knowledge, testing and modification of proposed synthesis or

co-construction, and agreement statement(s)/application of newly constructed meaning.

Table 2.2

Interaction Analysis Model (IAM) by Gunawardena, et al. (1997, p.414)

Phases	Operation
Phase I. Sharing/comparing of information	<ul style="list-style-type: none"> - A statement of observation or opinion - A statement of agreement from one or more other participants - Corroborating examples provided by one or more participants - Asking and answering questions to clarify details of statements - Definition, description, or identification of a problem
Phase II. The discovery and exploration of dissonance or inconsistency among ideas, concepts or statements	<ul style="list-style-type: none"> - Identifying and stating areas of disagreement - Asking and answering questions to clarify the source and extent of disagreement - Restating the participant's position, and possibly advancing arguments or considerations in its support b references to the participant's experience, literature, formal data collected, or proposal of relevant metaphor or analogy to illustrate point of view
Phase III. Negotiation of meaning/co-construction of knowledge	<ul style="list-style-type: none"> - Negotiating or clarification of the meaning of terms - Negotiation of the relative weight to be assigned to types of argument - Identification of areas of agreement or overlap among conflicting concepts - Proposal and negotiation of new statements embodying compromise, co-construction - Proposal of integrating or accommodating metaphors or analogies
Phase IV. Testing and modification of proposed synthesis or co-construction	<ul style="list-style-type: none"> - Testing the proposed synthesis against "received fact" as shared by the participants - Testing against existing cognitive schema - Testing against personal experience - Testing against formal data collected - Testing against contradictory testimony in the literature
Phase V. Agreement statement(s)/application of newly-constructed meaning	<ul style="list-style-type: none"> - Summarizing agreement - Applications of new knowledge - Metacognitive statements by the participants illustrating their understanding that their knowledge or ways of thinking (cognitive schema) have changed as a result of the conference interaction

The IAM model is based upon “ the process of negotiating meaning and coming to an understanding by discussing and contributing knowledge, thus resulting in the shared construction of knowledge (Kanuka & Anderson, 1998)” (De Wever et al., 2006, p.15).

Lally (2001) indicated that this model focuses on “interaction as the vehicle for the co-construction of knowledge” and “the overall patterns of knowledge construction emerging from a conference“ (p.402). He also claimed that this model is “most appropriate in social constructivist and collaborative (student-centered) learning context,”

“a relatively straightforward schema,” and “adaptable to a range of teaching and learning context” (p.402). Schellens and Valcke (2005) used this model to analyze 1428 messages developed by 230 undergraduate students during 12 weeks. They found a 0.69 percent agreement of inter-rater reliability. Also, this model was found to give a holistic view of discussion flow and knowledge construction by Marra, Moore, and Klimczak (2004).

In order to provide accurate analysis and pursue reliable research results in content analysis internal validity, external validity, unit of analysis, inter-rater reliability need to be considered (De Wever et al., 2006). Below are the explanations of these concepts.

- (1) Internal validity: It is the match between the conceptual definition and the operationalization.
- (2) External validity: It is the possibility to generalize the finding to different settings.
- (3) Unit of analysis: Different models of content analysis may apply different coding units. For example, unit of meaning, coding content based upon identifying a consistent “theme” or “idea,” was applied in Henri’s model, while the coding unit of Gunawardena, Lowe, and Anderson’s Model is a whole “message.” Alternatively some researchers view each sentence as a single unit of analysis (Fahy, Crawford, & Ally, 2001).
- (4) Inter-rater reliability: Rourke, Anderson, Garrison, & Archer (1999) defined inter-rater reliability as “the extent to which different coders, each coding the same content, come to the same coding decisions” (p.6). Researchers suggest calculating both Cohen’s kappa and Krippendorff’s alpha indices to demonstrate inter-rater reliability (De Wever et al., 2006). The cut-off point of 0.75-0.80 is

used. A value with over 0.70 can be considered as reliable as well as a value below 0.40 shows poor reliability. Also, a value over 0.75 or 0.80 shows the coders have excellent agreement of coding decisions (Krippendorff, 1980; Neuendorf, 2002).

Descriptive Data & Social Network Analysis for Activity Logs

Schlager and Fusco (2003) indicated that analyzing online activities among members helps articulate the patterns of interaction, relationships among groups or members, and members' identities, which show the social structures of how knowledge is generated and distributed in the community (Wellman & Gulia, 1999; Bozeman, Dietz, & Gaughan, 1998). Previous studies have used frequency calculation, social network analysis, and visualization techniques to visualize the social structures in online communities. First, the time and frequency of members' postings in the discussion space of online learning is helpful information for understanding members' levels of participation across time (Gray & Tatar, 2004; Kling & Courtright, 2003; Nonnecke & Precce, 2000; Selwyn, 2000). To understand how members interact in Tapped In, Gray and Tatar (2004) examined how members behave by analyzing their login times across time. In this way, they represented members' participation. They found members' patterns varied significantly across members. For example, about 80 % of individuals login in less than 20% of their membership months and about 10% of members login between 50 to 100% of membership months. Similar to Gray and Tatar, Kling and Courtright (2003) reported how ILF members behaved in e-forums (e-ILF) by analyzing their login times and the time and numbers of their postings. They found 147 out of 432 (34%) pre-service teachers posted at least 5 or more times within about 18 months, which

was a greater percent than the 18% (58 out of 320) of in-service teachers who posted at least 5 or more messages. The researchers concluded that pre-service teachers' levels of participation were significantly higher than in-service teachers in e-ILF because the participation is part of requirements for pre-service teachers. In addition, in a study of health-related discussion groups 70% of subscribers posted 3 or fewer postings within 12 weeks and over 90% of subscribers mostly lurked in software-related discussion groups (Nonnecke & Preece; 2000). In a 2-year study, Selwyn (2000) discovered that one-third of posted messages were from 26 out of 900 members. By examining the time and frequency of members' postings, these analyses show not only members' levels of participation but also numerical trajectories of members' participation, membership, and interaction across time.

Additionally, the patterns of members' social interaction can be represented not only by members' levels of participation but also the relationships among members and between individuals and the community as a whole. Thus, the size, strength, density, and structure of social networks can be used as indicators of the status and growth of the community. By analyzing the activity logs recording members' actions in the learning environment, Social Network Analysis (SNA) which can visualize (NetDraw@) and calculate (Ucinet@) these indicators is recommended as a powerful method (Koku & Wellman, 2003). SNA incorporates statistics and visualization maps to represent information about patterns of interaction and relationships among social actors in a network (Wasserman & Faust, 1997). Two approaches, egocentric approach and sociocentric approach, are used when implementing SNA. The egocentric approach focuses on relations surrounding individuals, and the sociocentric approach represents the

structural patterns of interaction and participation in the whole community. To understand network structures, the measures of SNA including network density, centrality degree, network centralization, reciprocity, and cliques (SNA indexes) have been employed in studies of online learning (Harrer, Zeini, & Pinkwart, 2005; Nurmela, Palonen, Lehtinen, & Hakkarainen, 2003). Below are the explanations of the SNA indexes.

(1) Network density: The network density measures the proportion of ties in a network relative to the total number of information created (i.e. postings or uploaded files) and represents the proximity of social actors in the network. To be more specific, a network may be a sparse or dense network, and a fully dense network has as a network density value of 1. When the network density is close to 1, the nodes (social actors) are highly connected to each other. In contrast, a density value that is near to 0 represents a sparsely-knit network. Also, the ties among members can be identified from the arrow links among the nodes in visualization maps. The proportion of nodes represents the number of information items created by particular social actors. Schlager and Fusco (2003) showed members who have close ties to members at the center of a network may be in a better position to gain new knowledge, while members who have direct ties to members at the periphery may be in a better position to disseminate information.

(2) Centrality degree: The centrality degree is calculated based upon the number of ties to other actors in the network. The parameters of centrality degree contain the centrality of actors (node) and the overall centralization of the group. Also,

the centrality degree can be computed in forms of in-degree (the information that goes in to an actor, i.e. the actor read others' postings; the actor \leftarrow other members) and out-degree (the information that goes out from an actor, i.e. others read the posting created by the actor; the actor \rightarrow other members). The direction of the arc shows where the information flows to. An actor who has high in-degree shows active reading of others' messages. An actor who has high out-degree is one who is often said to be prominent or to have high prestige because many others expect to read his/her messages. The actor with high out-degree who disseminates their views to others is often an influential actor. According to Wasserman and Faust (1997), an actor can be classified based on the values of the in-degree and out-degree. This classification is that an actor is: 1) isolate if in-degree and out-degree both equal to 0; 2) transmitter if in-degree equal to 0 but out-degree bigger than 0; 3) receiver if in-degree bigger than 0 but out-degree equal to 0; 4) carrier or ordinary if in-degree and out degree both bigger than 0.

(3) Network Centralization: The network centralization represents the difference between the numbers of links for each node divided by maximum possible sum of differences. Thus, a centralized network will have much of its links dispersed around one or few nodes, and a decentralized network will have little variation between the numbers of links of each node.

(4) Reciprocity: Reciprocity can be viewed as a critical indicator of the stability and institutionalization of one's position in the network. It shows the relationship between a pair of social actors, including one-way or two-way relationships.

(5) Cliques: Cliques identify sub-structures or sub-groups existing in the network and indicate the degree to which actors are connected directly to each other by a cohesive bond. It also shows what subgroups undertake an action in the network. It is possible that an actor belongs to multiple subgroups. The cliques can help to articulate the substructure of the network for better understanding how the network behaves.

In a qualitative study which applied SNA to explore the relationships among members in the TechNet community, Koku and Wellman (2003) interviewed 24 TechNet members from 1997 to 1998. The interviews collected information, such as frequency of communication, types of social relationship with others, times of reading other's work, who they discuss research questions with and seek advice from, and collaboration relationships with others. The qualitative transcripts of interviews were transformed into calculable information and analyzed with Ucinet@ software. The values of SNA indices showed the structure and relationships among members of TechNet. Overall 22% of members reported having about 5 friends in TechNET, 43% with 10 colleagues, 39% with nine acquaintances, and 17% with just being aware of 4 members. Also, a moderately strong correlation between members' interpersonal (friends) and work relationships (colleagues) was found, while a high network density (value = .76) indicated success in fostering and sustaining interaction and awareness of others' work. Shen, Nuankhieo, Huang, Amelung, and Laffey (2007) applied SNA to analyze 38 students' activity logs in two online courses during February to May 2006. They employed NetDraw 2.0 to create interaction diagrams and visualize students' social interaction patterns for three types of activities, including posting documents in a shared

space, reading others' messages in discussion forums, and replying to others messages.

The SNA indices were calculated by Ucinet 6.0. According to the results of SNA indices, SNA diagrams, and an ANOVA analysis (sense of community), the course showing more interactive patterns (i.e. ties, links, connections) was found to have a higher sense of community. The SNA indexes provided detailed information about how the levels of participation and interaction were different between two courses.

According to CoP theory, trajectories of members moving from a peripheral to central participation represent growth for members and for the community. Since interaction of online learning are unanticipated and not entirely arrange-able, Strauss (1993) stated that “the interact-ants themselves often develop conceptualizations of phases too; these then may affect their next actions and interactions” (p.54). The trajectory phasing shows how members move based upon their interaction over time, which also demonstrates members’ learning processes. Additionally, Wurman (1989) indicated that “time is an easily understandable framework from which changes can be observed and comparisons made” (p.60). Considering changes over time, Barab, Hay, Barnett, and Squire (2001a) applied a methodology, Constructing Networks of Action-Relevant Episodes (CN-ARE), to capture and trace the emergence of shared understanding and evolution of a practice. In CN-ARE, they illuminated the historical development (evolving trajectory) by organizing data into a web of action over time. In their study of a one-week camp, they found students’ reciprocal nature of learning and doing from the trajectory of historical development. Adding to the SNA diagrams, which provide an overview of the interaction relationship patterns among members in a group, a network, and interacting space, the visualization of members’ trajectory of participation

and interaction bring researchers insights about members' historical development of participation, interaction, and growth. More advanced than CN-ARE in which researchers need to organize data manually, Tableau@ is software for visualizing members' evolving trajectories via analyzing activity logs. Little research has been found that takes advantage of using visualization patterns or trajectories of members' social interaction across time, but visualization has potential to provide new insights as we explore evolving social interaction in online learning environments. Thus, studies of CoP can use tools such as frequency calculation, SNA, and Tableau@ for visualizing members' interaction patterns and changes over time for their levels of participation and interaction.

Structural Equation Modeling/Path Analysis for Social Constructs

Analyzing the quantitative data collected from 20-items of sense of community (CSS, Rovai, 2002b), 30-items of social ability (Yang, et al., 2006), 9-items of satisfaction with NETwork experience, and 10 items of effectiveness of NETwork for teaching, Structural Equation Modeling (SEM) is an appropriated statistical method for examining and visualizing the relationships among the latent variables and observed variables (Lin, et al., 2005; Lin, et al., 2005; Tsai et al., 2008). Based upon the results of Lin, et al.'s (2005) and Tsai et al.'s (2008) studies (reported in the social ability section of Part II) and the relationships identified by the literature, a proposed online learning experience model (Figure 2.2) has been constructed to model the relationships among social constructs in a community of practice.

In the proposed path model, the relationships among social ability, sense of community, perceived ease of use, and perceived usefulness, satisfaction with NETwork experience, and effectiveness of NETwork for teaching are represented. In Figure 2.2, the

direct relationship represents how one variable impacts the other variable directly as well as the in-direct relationship means that a particular variable influences the other variables via the other variable. The correlated relationships mean that two factors are correlated but any direction of impact is uncertain.

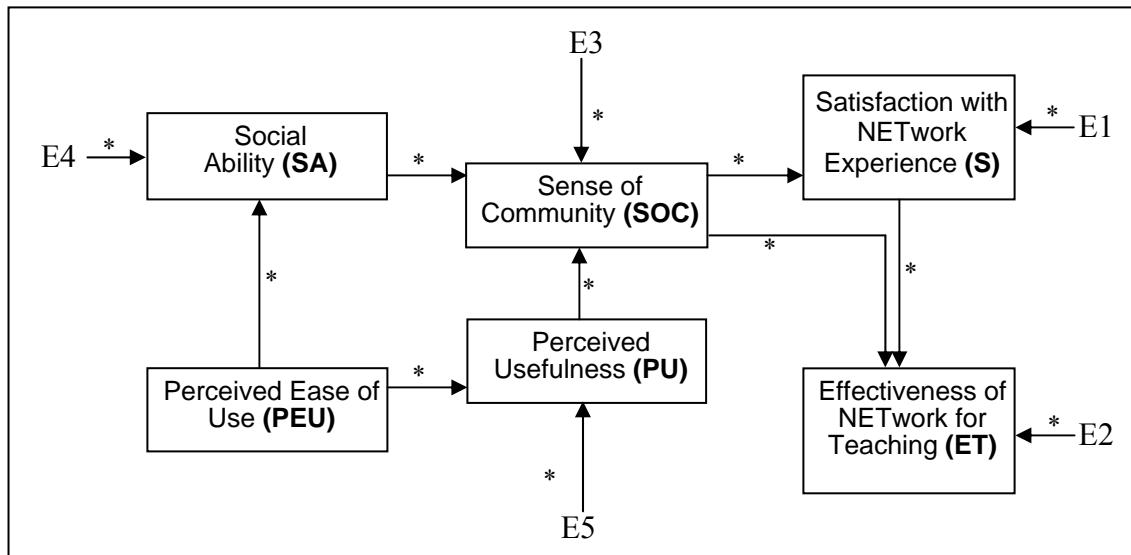


Figure 2.2. Proposed Path Model (→ represents direct relationship, E represents residual error)

This model is adapted from the model that Tsai et al. (2007) examined. The difference from the previous model is that the current model includes members' satisfaction with NETwork experience and effectiveness of NETwork for teaching which can broadly represent members' learning outcomes. Also, the variable, satisfaction with NETwork experience, of this model was modified from overall learning satisfaction of online learning in Tsai et al. (2007). This variable is viewed as members' overall satisfaction with NETwork that comes from their learning satisfaction and satisfaction with using the online learning environment.

Summary

The literature review in Part II described the primary social constructs that

influence members' participation and interaction in CoP. The relationships among these social constructs are described from the empirical results of previous studies.

Additionally, methods for assessing members' patterns and levels of participation are introduced. Content Analysis has been employed for analyzing online discussion content and interview transcripts and has been found to be useful in identifying members' social interaction and critical thinking. Frequency calculation, social network analysis, and visualization techniques are promising for visualizing patterns and articulating evolving trajectories of members' social relationships and participation. Finally, structural equation modeling/path analysis is introduced for better understanding the relationships among social constructs of CoP. This literature review has identified the social constructs and relationships among them and described appropriate measurements of members' social interaction in CoP.

Part III: Online Professional Learning Community (PLC) in Teacher Education

Teacher Professional Development v.s. Professional Continuum

Teacher Professional Development (TPD)

The National Science Education Standards (NSES) envisions K-12 science education as enabling students to 1) experience the richness and excitement of knowledge about and understanding the natural world; 2) use appropriate scientific processes and principles in making personal decisions; 3) engage intelligently in public discourse and debate about matters of scientific and technological concern; and 4) increase their economic productivity through the use of the knowledge, understanding, and skills of the scientifically literate person in their careers (NRC, 1996, p.13). In order to cultivate effective science teachers who can best assist students to reach the ideals of science

learning, the NSES grounded science teaching standards in a vision of science education, stressing that a qualified science teacher should be capable of 1) planning an inquiry-based science program for their students; 2) guiding and facilitating learning; 3) engaging in ongoing assessment of teaching and students' learning; 4) designing and managing learning environments; 5) developing communities of science learners that reflect the intellectual rigor of scientific inquiry and the attitudes and social values conducive to science learning; and 6) actively participating in the ongoing planning and development of the school science program (NRC, 1996). According to the science teaching standards above, science teachers utilize teaching and assessment strategies that support the development of student understanding and build a community of science learners, orchestrating discourse among students about scientific ideas, and creating a flexible environment supportive of inquiry.

In order to reach the NSES teaching standards when preparing effective teachers, knowledge that needs to be addressed in teacher development can be easily classified by the categories presented by Shulman (1987). Shulman (1987) suggested knowledge that an effective teacher needs includes not only subject matter and curriculum (content knowledge) but also general pedagogical knowledge (Knowledge about how to teach) and pedagogical content knowledge (PCK, knowledge about how to transform learning content to be understandable to students). PCK is a combination of applying content knowledge and general pedagogical knowledge. The teaching standards grounded in NSES only can be achieved when teachers have enough content knowledge, general pedagogical knowledge and pedagogical content knowledge. Based upon Shulman's insights for teacher education and working with teachers over 3 years, Appleton (2005)

proposed a model for elementary beginning teachers' science PCK development. He emphasized "activities that work" as a center of the model. Teachers often discuss activities that work in the context of their own experiences; in this way they communicate their own science PCK with others. "Activities that work" plays a central role in the model to express explicitly how contexts, teachers' content knowledge, confidence, general pedagogy, knowledge of students, and existing PCK in science or other subjects contribute to the activities, and how the process of designing, planning, and implementing activities increment teachers' existing science PCK. Figure 2.3 presents the process of development of elementary teachers' science PCK. Appleton (2005) found that beginning teachers' science PCK increased when they tried to write or describe their activities that worked and that their reflection on their previous work and observations of others teaching helped construct a repertoire of science PCK. However, science educators recognize that the needs of teachers, just as their knowledge and skills, change throughout their careers. Thus, it is very critical to provide support across a professional continuum to facilitate teachers' PCK development throughout their careers.

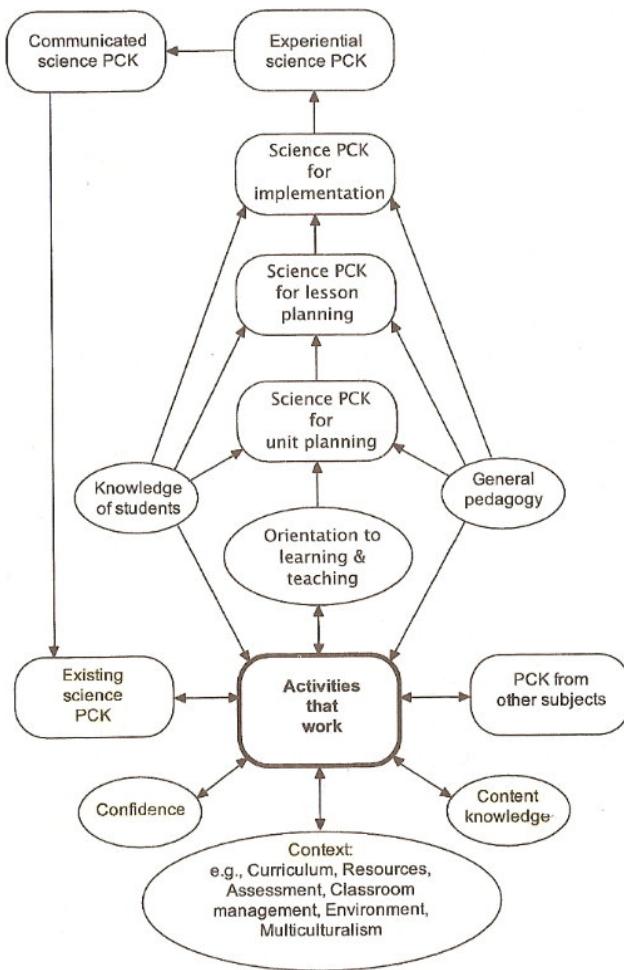


Figure 2.3. A Model of Science PCK Development for Elementary Teachers
 (Appleton, 2005, p.38)

Professional Continuum

Although the required knowledge and skills of effective science teachers have been addressed by NSES and previous research, current research indicates that what typically transpires in the science classroom is not the synthesis of content and pedagogy reflected in the inquiry-based paradigm on which the NSES are based. Rather, science teaching is more often characterized as presentation of a collection of facts and discussion of textbook readings, or a barrage of disconnected activities (Anderson & Smith, 1987; Gee,

Boberg, & Gabel, 1996; Moscovici, 1998; Prather, 1993). Recent research indicates that K-12 science teachers lack sufficient knowledge and competence to teach science effectively (Akerson, 2006; Ball, Heather, & Bass, 2005; Bleicher, 2004; Lindgren and Bleicher 2003; King, Shumow, & Lietz, 2001; Schibeci & Hickey, 2000). This problem is coming to be recognized as a systemic issue in teacher development. Despite having NSES describe a continuous, career-long process of learning in which science teachers have regular, sustained opportunities to engage in inquiry, knowledge acquisition and integration, reflection, and collaboration (NRC, 1996), the current status of science teacher education does not effectively connect teachers' university preparation and continued education throughout their careers (Kahle & Kronebusch, 2003). The problems that lead to teachers' shortage of knowledge and skills are identified as the deficiency of collaboration and connectedness between schools of education and K-12 education, isolation during teachers' induction year, and the discontinuity of teachers' professional development across their career-long lives (Goodlad, 1990; Kahle & Kronebusch, 2003).

Teacher education programs have emphasized reform-based practices, which link teacher education to practicum, induction year, and teaching life; however, the science teacher education continuum has been criticized as "a fractured system, lacking both continuity and accountability" (Kahle & Kronebusch, 2003, p. 585). Universities typically regard pre-service preparation as their task, and responsibility of new teacher induction rests on schools (Feiman-Nemser, 2001). The emphasis of reform-based practices has not resulted in wide-sweeping improvements to K-12 instruction (Smith, Banilower, McMahon, & Weiss, 2002). During induction, for example, novice teachers are often overwhelmed with the number of duties and responsibilities that are part of their

teaching job (Kagan, 1992; Fessler & Christensen, 1992) and the feelings of isolation that characterize teaching alone for the first time (Holt-Reynolds, 1995). As such, novice teachers may rely on whatever practices enable them to survive, whether or not these are best practices. Rather than implementing reform-based practices learned in their teacher education program, they may “adopt ways of thinking and acting that place them in harmony with the existing occupational culture” (Schempp, Sparkes, & Templin, 1993, p. 448). Feiman-Nemser argued teacher education programs represent only a “weak intervention compared to the influence of teachers’ own schooling and their on-the-job experience” (Feiman-Nemser, 2001, p. 1014).

Bell and Gilbert’s (1996) science teacher development model emphasizes three components, including 1) personal development: the teachers must be aware of a need for professional development and acknowledge the desire to acquire new ideas or strategies; 2) social development: the teachers have opportunities to discuss ideas with other teachers and to collectively renegotiate what it means to teach science and be a science teacher; and 3) professional development: the teachers are supported in implementing new ideas and strategies in their classroom practice, drawing on the changes they make personally and socially. Bell and Gilbert’s model moves teachers’ professional development from institution-oriented to learner (teacher)-oriented. This model focuses on teachers’ personal development needs and emphasizes that these needs will vary according to teachers’ stage in the professional continuum. Ball and Cohen (1999) argue that without sustaining opportunities for learning through every stage in teachers’ professional development and careers, they are unlikely to teach in ways that meet NSES expectations for students’ science learning. To better sustain teachers’ learning through

stages of professional development, Feiman-Nemser (2001) identified the central tasks (see Table 2.3) across stages of teachers' professional development as they progress throughout their careers. She also emphasized that teachers need to be facilitated in these tasks through each stage.

Table 2.3
Central Tasks of Learning to Teach (Feiman-Nemser, 2001)

Pre-service Teacher Education	Induction of Beginning Teachers	Continuing Professional Development
Examine beliefs critically in relation to vision of good teaching	Learn the context- students, curriculum, and school community	Extend and deepen subject matter knowledge for teaching
Develop subject matter knowledge for teaching	Design a responsive instructional program	Extend and refine repertoire in curriculum, instruction, and assessment
Develop an understanding of learners, learning, and issues of diversity	Create a classroom learning community	Strengthen skills and dispositions to study and improve teaching
Develop a beginning repertoire	Enact a beginning repertoire	Expand responsibilities and develop leadership skills
Develop the tools and dispositions to study teaching	Develop a professional identity	

From the perspective of the social theory learning, teachers may face barriers to their social development though they may be committed to personal development. Mostly, teachers work alone in their classrooms and feel isolated from colleagues by norms of autonomy and noninterference (Little, 1990; Lortie, 1975; Feiman-Nemser, 2001). Thus, teachers often lack connections with colleagues who work in different areas but have similar interests, and rarely have opportunities to discuss their problems with someone who is familiar with the same subjects or situations. This is particularly problematic for novice teachers which may lead to the difficulties of their induction years. However, as Feiman-Nemser emphasizes, if new teachers "learn to ask for clarification, share uncertainties, and request help (p.1030)" they can develop knowledge and skills for

improving their teaching. Therefore, there is a need to assist teachers to establish their teaching social network where they can find support by sharing ideas and discussing teachings.

Additionally, research recognizes that change in practice and teacher learning happens over an extended period of time, not through “one-shot” workshops (Loucks-Horsley et al., 1998). The one-shot professional development has been identified as difficult to support teachers’ individual needs that occur through daily teaching (Richardson & Placier, 2001). Teachers’ opportunities for reflection and learning may increase in professional development activities such as workshops and conferences; however, the gains from these activities are often not maintained afterwards. Effective professional development draws from “the collective wisdom that thoughtful teachers can generate by working together” (Feiman-Nemser, 2001, p. 1042). Further, a review of research on professional development reinforces that teacher interaction in a context of trust, collegiality and community is important for the acquisition and activation of professional knowledge (Wilson & Berne, 1999). Effective professional development is embedded into the ongoing practice of teaching and related to teachers’ concerns and problems (Feiman-Nemser, 2001). It recognizes that teachers function as a community of practice.

Professional Learning Community (PLC) in Teacher Education

Since the 1990s, teachers’ professional development has moved beyond supporting teachers’ knowledge acquisition for new knowledge and skills by trying to change the training format from one-shot professional development, such as workshops or conferences, to a long-term professional learning format. Previous researchers argued that

successful professional development is built upon continuous collaboration when teachers experiment and reflect on what and how they teach in schools (Blumenfeld, Soloway, Marx, Kracjik, Guzdial, & Palincsar, 1991). Darling-Hammond and McLaughlin (1995) identified that professional development needs to provoke teachers' rethinking of teaching practice which promotes teachers taking a dual role of both teacher and learner. Integrating insights from Bell and Gilbert's (1996) and Darling-Hammond and McLaughlin (1995), professional learning with CoP attempts to bridge the gaps among university preparation, teacher induction, and practical school teaching and has been recognized as an effective format for teachers professional development (Englert and Tarrant, 1995; Hollins, McIntyre, DeBose, Hollins, & Towner, 2004; Andrews & Lewis, 2003; Dunne, Nave, & Lewis, 2000; Strahan, 2003). Professional learning communities assist teachers in implementing what they learned in their teacher education programs and in building upon this knowledge base of teaching through discussing issues or problems of their practices.

Vescio, Ross, and Adams (2006) indicated that the professional learning community is grounded in two assumptions, including 1) knowledge is situated in teachers' daily experience through critical reflection when sharing with others having the same interests, and 2) teachers' professional knowledge and students' learning will be improved because of teachers' being engaged in the activities of PLC. Previous studies have found evidence to support that teachers who participated in PLC tended to apply what they learned in PLC to teaching practice (Englert and Tarrant, 1995; Hollins et al., 2004; Andrews & Lewis, 2003) and to have flexible classroom arrangements and change of instruction (Dunne et al., 2000; Strahan, 2003). Researchers identified two major

advantages of PLC which are providing teachers opportunities to collaborate by sharing, reflecting, and supporting and by promoting continuous teacher learning (Berry, Johnson, Montgomery, 2005; Phillips, 2003; Englert and Tarrant, 1995; Hollins et. al, 2004). However, these professional learning communities have been limited to face-to-face settings requiring teachers to travel to particular locations and coordinate tight schedules for the PLC. Teachers indicate that they do not have much time to talk or share with their fellow teachers because of their busy daily teaching, especially teachers who are teaching in rural areas (Scribner, 2003). Thus, it may not be easy for teachers to participate in PLC. One possible solution is creating PLC online, so that technology can bridge teachers' continuum development throughout their careers without the obstacles caused by time and spatial distance.

Online PLC in Teacher Education

Given the geographical distribution of teachers upon graduation from a university, it is a challenge to operate a long-term professional learning community. Ball and Cohen (1999) argued that without providing opportunities for learning through continuum stages in teachers' careers, teachers are unlikely to teach in ways that meet high standards for students' learning. When the school day does not provide extended opportunities for teacher collaboration outside of student responsibilities, web-based communities are one means for bringing teachers together across physical barriers of distance and time, as well as social barriers of isolation. Taking advantage of synchronous and asynchronous communication in the virtual space, teacher online learning communities promoting a continuous and collaborative learning environment for teachers in their career lives may enable innovative solutions to bridge the gap of teacher education and school practice.

Researchers try to transcend the boundaries caused by geographical distribution and provide extended opportunities for teacher collaboration outside of work by providing teachers online learning communities which serve as “safe” venues for teachers to share problems and seek assistance (Barab, MaKinster, Moore, Cunningham, & the ILF design Team, 2001b; Gray & Tatar, 2004).

This term “online learning community” is frequently applied to distance learning. Online courses are recognized as course-based online learning communities where members have learning tasks to complete based upon the structure and requirements of the course design. Some teacher online learning communities are established through courses in teacher education, such as LabNet (Roup et al., 1993), Concord Consortium (Lu & Rose, 2003), English teacher online learning community (Steele, 2002), and online courses offered by teacher education programs. However, previous research indicates it is difficult to provide coherence with teachers’ needs and practical teaching through a “course” structure in online learning communities (Desimone, et al., 2002) because teacher development needs a professional continuum of learning and course structure learning is similar to one-shot workshops delivered during a time period (Feiman-Nemser, 2001). A teacher online learning community needs to be a continuous space where supports will always be available for teachers no matter where the teachers are. When establishing a long-term online professional learning community for teachers, it is also hard to not integrate pedagogical learning activities. Therefore, researchers have started to establish teachers’ online learning communities by integrating online courses in teacher education with extended long-term online learning communities. For example, Barab, Makinster, and Scheckler (2004) established a teacher online learning community,

the Inquiry-based Learning Forum (ILF), by integrating pre-service teachers' courses of teacher education with in-service teachers' professional development training. The learning activities of ILF change based upon the learning topics, which provides both in- and pre-service teachers opportunities for collaborative learning. Additionally, Tapped In serves as a resource for providing teachers after-school chat or for sharing teaching resources and ideas and is recognized as a comprehensive online learning community (Schlager & Fusco, 2004). Tapped In includes workshops, online learning sessions, and teacher discussions. However, an online leaning community, such as Tapped In, may lack needed pedagogical approaches to sustain involvement and foster engagement with activities since it may be perceived as a resource and information center without pedagogical design (Gess-Newsome, et al., 2003).

This study aimed to investigate how a long-term online learning community, NETwork, provided opportunities and supported pre-service teachers and in-service teachers to meet in a virtual environment and advance their teaching knowledge and skills. Table 2.4 presents how the central tasks of teachers' continuum professional development can be supported by the CoP as well as NETwork activities.

Table 2.4
Central Tasks v.s. Interaction/Functions of CoP

Continuum Stage	Central Tasks	Functions of CoP	NETwork Activities
Pre-service Teacher Education	Examine beliefs critically in relation to vision of good teaching	- Meaning negotiation - Identity change: teacher belief & understanding of teaching and roles of teaching	- Weekly discussions related to questions of teaching - Live chat session in Chat Room & regular conversation in Chat Room (learning from experience of others)
	Develop subject matter knowledge for teaching	- Meaning negotiation - Growth of content knowledge - Growth of pedagogical content knowledge	- Weekly discussions: extend from field experience courses
	Develop an understanding of learners, learning, and issues of diversity	- Meaning negotiation - Growth of pedagogical knowledge	- Weekly discussions related to questions of teaching - Live chat session in Chat Room
	Develop a beginning repertoire	- Shared repertoire/information associated with teaching theory	- Sharing resources & information a. post developed projects, lesson plans, or relevant files in Resources b. post relevant resource links in Resources or Discussion Board
	Develop the tools and dispositions to study teaching	- Mutual reflection in learning to teach	- Weekly discussions in Discussion Board - Live chat session in Chat Room
	Learn the context- students, curriculum, and school community	- Meaning negotiation - Application and Growth of content, pedagogy, and pedagogical content knowledge	- Participating in weekly Chat discussions to share diverse insights - Reflect what was learned in weekly Chat discussions
Induction Years: Beginning Teachers	Design a responsive instructional program	- Meaning negotiation - Application and Growth of content, pedagogy, and pedagogical content knowledge	- Weekly discussions related to problems of practice - Live chat session in Chat Room (sharing teaching experience)
	Create a classroom learning community	- Meaning negotiation - Application and Growth of pedagogy and pedagogical content knowledge	- Weekly discussions: provide insights from working in practice - Live chat session in Chat Room
	Enact a beginning repertoire		- Weekly discussions - Live chat session in Chat Room
			- Sharing resources & information a. post developed projects, lesson plans, or relevant files in Resources b. post relevant resource links in Resources or Discussion Board - Weekly discussions in Discussion Board - Live chat session in Chat Room

Continuum Stage	Central Tasks	Functions of CoP	NETwork Activities
	Develop a professional identity	<ul style="list-style-type: none"> - Meaning negotiation - Identity change: bring insights of practice and concerns for new teaching environments 	<ul style="list-style-type: none"> - Weekly discussions - Live chat session in Chat Room & regular conversation in Chat Room
	<i>Extend and deepen subject matter knowledge for teaching</i>	<ul style="list-style-type: none"> - Meaning negotiation - Application and Growth of content, pedagogy, and pedagogical content knowledge 	<ul style="list-style-type: none"> - Weekly discussions - Live chat session in Chat Room
Continuing Professional Development	Extend and refine repertoire in curriculum, instruction, and assessment	<ul style="list-style-type: none"> - Shared repertoire/information to offer critical perspectives on teaching theory and practice 	<ul style="list-style-type: none"> - Sharing resources & information <ul style="list-style-type: none"> a. post developed projects, lesson plans, or relevant files in Resources b. post relevant resource links in Resources or Discussion Board - Weekly discussions in Discussion Board - Live chat session in Chat Room
	Strengthen skills and dispositions to study and improve teaching	<ul style="list-style-type: none"> - Meaning negotiation - Application and Growth of content, pedagogy, and pedagogical content knowledge - Identity change: be more open to work with others 	<ul style="list-style-type: none"> - Weekly discussions - Live chat session in Chat Room & regular conversation in Chat Room
	Expand responsibilities and develop leadership skills	<ul style="list-style-type: none"> - Meaning negotiation - Identity change: bring experienced insights of practice 	<ul style="list-style-type: none"> - Weekly discussions - Live chat session in Chat Room (provide insights from experience and respond to questions of others)

Measurement of Teachers Professional Development in CoP

According to CoP theory, members' learning and growth is demonstrated not only in participation and social interaction but also in cognitive changes and changes to teaching practices. How to measure members' participation and social interaction in CoP has been described in Part II, which is the primary focus of this study. This section describes the way previous studies have assessed teachers' learning in professional learning community.

A review of ten empirical studies of teachers' professional learning community was conducted by Vescio, Ross, and Adams (2006). These ten studies all supported the idea that teachers' changes in practice result from participating in a learning community. These studies assessed how teachers' learning in professional learning communities improved their teaching in practice by comparing students' achievement, comparing class teaching of teachers with and without participating in the community, comparing teachers' practice before and after participating in the community, and interviewing teachers about their changes in teaching and perceptions of teaching. For example, Phillips (2003) compared students' achievement scores within a three-year period and reported the achievement of students whose teachers participated in the learning community increased dramatically. Similar to Phillips' (2003), Berry, Johnson, and Montgomery (2005) compared students' achievement over a four-year period in a middle school whose teachers were engaged in a learning community. The results showed teachers' learning did lead to students' improvement on grade level testing. Additionally, Dunne, Nave, and Lewis (2000) compared practices of teachers who participated and with those who did not participate in the learning community (Critical Friends Groups,

CFG) via interviewing teachers and observing classroom teaching. They found teachers who participated in CFG had higher agreement of their experience in sharing teaching ideas and samples of students' work, discussing classroom problems regularly, and working together to develop learning activities and materials. Englert and Tarrant (1995) compared transcripts of taped weekly project meetings which showed changes in instruction and teaching strategies for those who participated in the learning community.

Within the studies that utilized interviews to assess teachers' changes, Vescio, Ross, and Adams (2006) found that some studies (i.e. Dunne, et al., 2000; Hollins, et al., 2004; and Strahan, 2003) collected detailed information of teachers' perceptions of the changes, including how their particular changes in teaching strategies or instruction were applied in classes, but some studies (i.e. Andrews and Lewis (2003), Phillips (2003), and Whitford and Fisher (2003)) did not., Andrews and Lewis (2003), Phillips (2003), and Whitford and Fisher (2003) only reported teachers' general perceptions of changes in practice and thinking in their studies. Teachers' self reported data through interview, survey, or discussions from project meeting are frequently used in studies of the effects of PLC.

According to Vescio, Ross, and Adams's (2006) review, the two primary methods to directly assess teachers' professional development from participating in CoPs are to observe their classroom teaching and compare their students' achievement before and after their participation. However, these two methods are difficult to implement when the professional learning community is established online. When teachers are distributed around the country, it is difficult to conduct observations in their classrooms. Also, the studies (Phillips, 2003; Berry, Johnson, & Montgomery, 2005) that assessed students'

achievement to find the effectiveness of the professional communities took from 3 to 4 years to see the effects of teachers' learning. The influence of teachers' participating in the CoP might not be reflected immediately in their teaching or students' performance. It might take several years or longer to show the effects.

In a study of web-based professional learning community (235 teacher participants), Kinzie, Whitaker, Neesen, Kelley, Matera, and Pianta (2006) assessed teachers' learning through examining their students' outcomes and classroom teaching. For students' achievement during the 2 intervention years, 4 students from each teacher's class were selected and assessed (pre and post) on language and literacy, while observations of teaching practice and classroom quality were collected via videotapes. Also, follow-up teaching videotapes were collected in the third year after the intervention had ended. This study shows that it is possible to collect data from teachers' practice and students' achievement; however, it costs more money and time to implement in online CoPs. Differing from face-to-face professional learning community, online professional learning community does have advantages in assessing how well teachers learn. Teachers' interaction and discussion are automatically recorded in the system of the online professional learning community. Previous studies primarily employed content analysis of members' asynchronous and synchronous discussion content and interviews of teachers' self-reported perception and reflection of learning in the CoP.

Additionally, for some online professional learning communities that are particularly integrated with workshops (i.e. web-supported community) or online courses (i.e. online courses provided by teacher education programs), it is possible to collect members' grades or required assignments or projects to assess how well members learn

in the CoP. For example, in a qualitative study that investigated the value and effectiveness of online workshops as a tool for developing teachers' professional learning community, Yang and Liu (2004) used individual assignments, one individual final report, and three group projects as sources to assess students' growth from the learning activities. In addition to these artifacts of participating in the community, content analysis of members' discussion was employed and a survey was administered to explore members' attitudes about participating in the community. Brett (2002) studied online engagement and community among pre-service mathematics teachers enrolled in an experimental two-year certification course. Data were collected from database notes, math content test, interview, questionnaires, and portfolios of 20 students.

Differing from the workshops-based or course-based online professional learning communities, it is difficult for many teacher online CoPs whose members' participation are voluntary to require members to complete assignments or project reports. Additionally, most of these online CoP studies applied in the context of teacher professional development focus on studying teachers' participation and social interaction of CoP and not their direct teaching effectiveness. For those that explore how participation and interaction of CoP influence teachers' professional development, researchers analyze members' online discussion postings and employ surveys or interviews to collect teachers' perception of their learning in the CoP. In an investigation of why K-12 teachers participate in informal online learning and how their participation influences their professional development, Riddle (2003) collected survey and interview data. The interview results analyzed with NVivo@ and Inspiration@ were used for answering questions about how teachers' participation influences their development as

teachers. When studying a teaching methods course in a teacher education program, Erick and Dias (2005) analyzed pre-service teachers' practical knowledge expressed in the weekly electronic postings focusing on emergent issues of teaching practice. Similar to Erick and Dias (2005), Kling and Courtright (2003) applied content analysis to analyzing members' discussion postings and found that members' critical thinking was not shown frequently in the discussion of videotapes of others' classroom teaching. Based upon the experience of previous studies and the constraints of studying an online CoP, interviews, surveys, and content analysis of discussion content to examine teachers' perception of their learning and how their learning influenced their current or future teaching seem appropriate methods.

Summary

The literature review in Part III discusses how CoP has been applied for integrating science teacher education and school teaching and how previous studies in PLC and online PLC assess teachers' professional development through participating in PLC. The review shows that online professional learning community has become a channel to bridge teacher education and school practice and to promote teachers' continuum of professional development. Previous studies show that it is difficult to measure the future effects of participating in online CoP in teaching practices but that perceptions of what is being learned through surveys and interviews as well as analysis of learning through content analysis of online discussions are frequently used methods.

Chapter Summary

The framework of CoP (Wenger, 1998) identifies members' growth as including both cognitive changes and changes in social constructs influencing participation and

interaction. Previous studies have examined how members' technology acceptance influences members' social ability and sense of community which in turn are primary determinants of members' learning satisfaction and levels of participation. However, previous studies have not found consistent results for relationships among social ability, sense of community, and learning satisfaction. In order to better understand these social constructs and their influence on members' learning in CoPs, further study is needed.

Participation and social interaction in online CoP is studied with both content analysis of discussion content and interview transcripts and activity logs analysis for calculating frequency of members' actions, social network analysis, and visualization techniques. In order to examine changes in participation, identities, and social relationships, time can be used to identify evolving trajectory and development. Also, the relationships among social constructs and how they influence members' participation and interaction of CoP can be modeled through SEM.

Online teachers' professional learning community is recognized as a useful channel to construct the continuum of teachers' development. While observing teachers' practical teaching in class and examining their students' achievement that result from teachers' learning is difficult to execute, teachers' self-reported information about how and what they learn can be helpful for understanding how well teachers learn in the online teacher professional learning community. Teachers' self-reported information can be collected through interviews and surveys by asking teachers' perceptions of what they learned and what has changed in their teaching as a result of participating in the online learning community.

This chapter summarizes the theoretical framework of CoP and empirical studies

that investigated the social interaction, effectiveness, and challenges of online learning communities. The literature review shapes the focus and guides the research design and questions. In chapter III, detail about the research design, methods, data collection, and data analysis will be presented.

CHAPTER III

RESEARCH METHODS

Introduction to the Chapter

This chapter introduces and describes the research design and methods of this study.

The chapter includes five sections: 1) research purposes and questions; 2) research context; 3) research methods, consisting of information about the participants, data collection, and data analysis; 4) instruments; and 5) ethical concerns.

Research Purposes and Questions

The purposes of this study were to understand the nature of participation, social constructs, and learning in a Community of Practice and to test a model of how well the social constructs of the online learning community explain the effectiveness of professional development in a community. The participation, social constructs, and members' learning in the community were examined in several ways including social network analysis and visualization techniques of activity logs, content analysis of Chat Room and Discussion Board messages and interview transcripts, as well as structural equation modeling and dependent-samples t-tests for understanding the relationships among social constructs. The model of social constructs and effectiveness will be examined by testing a path model (Figure 3.1) which was constructed from the framework of CoP and a review of prior work.

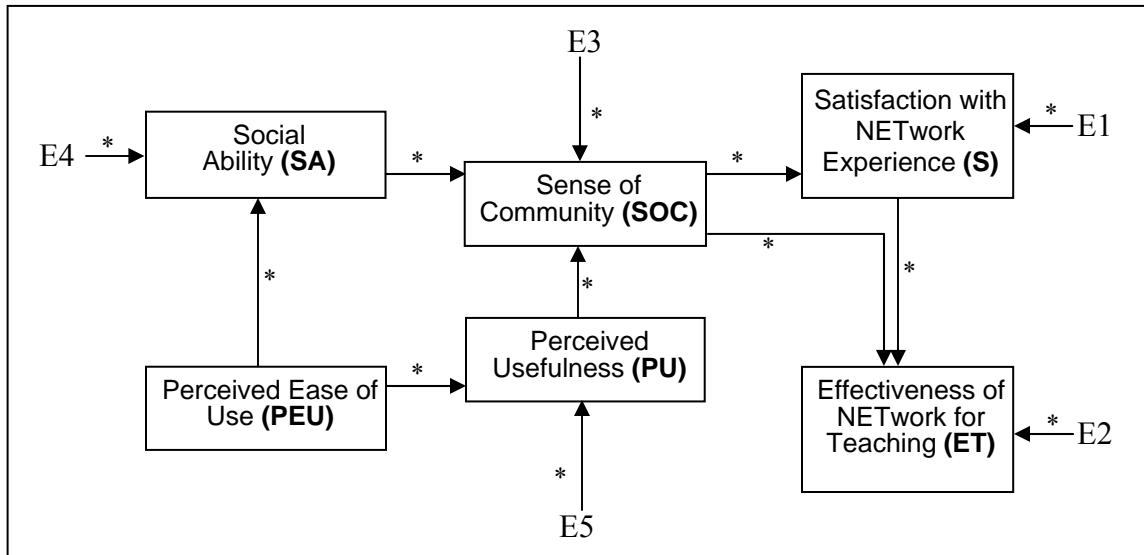


Figure 3.1. Proposed Path Model (→ represents direct relationship, “E” represents residual error)

Three research questions were addressed in this study:

1. How do members participate in the primary learning activities through Chat Room discussion, Discussion Board discussion, and information sharing in Resources?
 - 1a. What are the characterizations of member activity that represent different levels of participating in the community, and to what extent did members participate?
 - 1b. What are the characterizations of member activity that represent different patterns of participating in the community? Are there differences in the patterns of participation for experienced members and new members and for pre-service and in-service teachers?
2. How well does the proposed path model explain the relationships among the social constructs of online learning (i.e. sense of community, social ability, perceived ease of use, and perceived usefulness) and explain community outcomes/effects (satisfaction with NETwork experience and effectiveness of NETwork for Teaching)?
3. How do members’ perceptions (sense of community, social ability, ease of use,

usefulness, satisfaction with their NETwork experience, and of the effectiveness of NETwork for supporting teaching) change through participating in the community?

Research Context

An online teacher community, NETwork (Nurturing Elementary Teachers' work), has been in place using the Sakai course management system to support K-8 science teaching since August 2006. The purpose of NETwork at the University of Missouri is to overcome the current disconnection between pre-service teacher education and in-service teaching practice and to provide pre-service and in-service teachers a collaborative learning environment.

Features of NETwork

The key features of NETwork include:

1. NETwork was established in the Sakai system which provides communication tools, such as: Discussion Board for asynchronous discussion, Chat Room for synchronous discussion, a Resources space for sharing files or links, Announcement tool for distributing information from the instructors, Private Message tool for sending private messages to a particular member, Social Presence Box to indicate who is online and in the chat room, Daily Email Digest to notify members what happened in the previous day, and Personal Profile for sharing personal information and creating an avatar in the community. A set of screen shots of the interface of NETwork environment is presented in Appendix 3-A.
2. For pre-service teachers who took field experience courses in Spring 2007, they participated in NETwork in order to accomplish some learning tasks assigned from their course instructors, while other members participated in NETwork voluntarily.

3. Network extends pre-service teachers' field experiences by connecting them with problems and issues in-service teachers were encountering in practice.
4. Learning tasks, including topic discussions in Discussion Board, chat discussion sessions in Chat Room, and information sharing in Resources, were implemented to encourage and sustain interaction among university faculty, pre-service teachers, and in-service teachers.
5. Members consisted of professors of teacher education, K-8 pre-service teachers who started their field teaching or student teaching, and K-8 in-service teachers who graduated from the teacher education program of University of Missouri or Indiana University. For the in-service teachers that taught all subjects and participated in the NETwork voluntarily, their inspiration for joining this community came from their association with the lead professor (IS1) in the community.
6. Membership of the NETwork increased when new pre-service teachers enrolled in the field experience courses and when professors and in-service teachers invited other in-service teachers to join the community. For example, 30 students enrolled in the field experience courses, such as literacy, mathematics, and science courses, and were added as new members of NETwork in Spring, 2007. To give another example, one of the in-service teachers invited one of his colleagues to join the NETwork, his colleague was added as a new member.

NETwork is not just a CoP within an online course. While it does integrate some activities for pre-service teachers/new members while undertaking their field experience courses, the primary goal of Network is to establish connections that go beyond the pre-service classroom in time and place. In addition to pre-service teachers/new members,

NETwork members included pre-service and in-service teachers who were not taking the field experience courses. Also, most of the NETwork activities were not necessarily related to what pre-service teachers/new members were doing in their field experience courses. NETwork members were expected to share their theoretical and practical perspectives when discussing teaching issues in order to enhance pre-service teachers' practical experiences and pre-service teachers' knowledge and skills of learning theories and new teaching policies. Participation by members also was expected to provide professional development for in-service teachers and promote a social network that grows in its potential to serve both pre-service and in-service teachers. In addition to the basic communication and collaboration tools of Sakai, NETwork includes social awareness tools, such as Users Present List that indicates who is currently online, and daily Email Digests that notifies members of others' activities within NETwork.

Three Primary Learning Activities in NETwork

Members' social interaction occurred primarily in three types of learning activities: Discussion Board (DB) discussion, Chat Room (CR) discussion, and information or resource sharing in Resources (RS). The discussions of NETwork were classified as asynchronous discussion in DB and synchronous discussion in CR. NETwork was initiated by a professor (lead professor of NETwork) who had taught science field experience courses in Teacher Development Program (TDP) for many semesters, and has been joined by other professors who teach literacy and mathematics field experience courses. Professors used NETwork to enhance and extend their course activities and include practicing teachers in the CoP. For example, instead of asking students' to give feedback for a particular student's class presentation in class, the professor asked students

to post their questions in a discussion forum for extended class discussion. While professors primarily led discussions in DB to provide professional suggestions for members' questions and discussion issues, some CR discussions were hosted to bring practical perspectives into the training experience for pre-service teachers.

In addition to asynchronous and synchronous discussion, information sharing in Resources, a space for uploading and downloading files, was the other type of social activity in NETwork. For general resources sharing, all members could upload the information they wanted to share with others in Resources as well as download what others shared. For specific course work sharing, the pre-service teachers uploaded their course work to the shared space where any of the NETwork members would be able to access it. Table 3.1 explains what learning activities members did and how the learning activities were undertaken in NETwork.

Table 3.1
NETwork Learning Activities

Learning Activities		What to do	Primary Participants
DB Discussion	Field Experience Weekly Discussion	Discussing questions/issues about one's field experience (<i>Required</i>)	Pre-service teachers who were taking field experience courses
	Extended Class Discussion	Discussion extending from particular class discussions of field experience courses (<i>Required/ Not Required</i>)	Pre-service teachers who were taking field experience courses
	NETwork Discussion Topic	Discussion about practical teaching issues (<i>Not Required</i>)	All NETwork members
	General Discussion (i.e. The Teachers' Lounge; Who's who in the NETwork)	Social chatting (<i>Not Required</i>)	All NETwork members
CR Discussion	Chat Room Discussion-hosted by Professors	Discussion issues about current teaching practice (<i>Not Required</i>)	All NETwork members
Resources Sharing	General Resources sharing	Sharing resources from all members (<i>Not Required</i>)	All NETwork members
	Course work sharing by pre-service teachers	Pre-service teachers share their course work with other members (<i>Not Required</i>)	Pre-service teachers who were taking field experience courses

Note. All members will be allowed to participate in any activity; however, primary participants for activities are identified.

Table 3.1 shows the three types of discussion common to the NETwork discussion boards: field experience weekly discussion, extended class discussion, and network discussion topics (i.e. “Get to Know You,” “Classroom Management,” “Assessing Student Learning,” and “The First Years of Teaching”). In addition, synchronous discussions hosted by professors were arranged in Chat Room (CR). Typically, learning activities were scheduled every two weeks. However, some activities may be brought to the NETwork if the professors or other members want to share something impromptu and timely with other members.

During the first two weeks of the Spring 2007 semester, members typically spent time getting to know each other and exploring the tools. They could ask questions and introduce themselves on the NETwork weekly discussion board named: “Get to Know You”. A warming up chat room discussion was carried on by members and the lead professor to help members know more about NETwork and feel more comfortable in participating in NETwork. After that, field experience weekly discussions and NETwork weekly discussions were opened for discussion through the whole semester. New NETwork discussion topics were opened every two weeks and chat room discussions were implemented once a month depending on the lead professor’s schedule. In addition to having text-based interaction with other members in learning activities, members were allowed to share resources or information in Resources by uploading links or files. However, there was no specific time schedule for interaction in Resources. Table 3.2 shows when learning activities happened through the semester as well as DB discussion topics in Table 3.3.

Differing from CR discussion for which the lead instructor hosted the discussions,

DB discussion were monitored and guided by professors. The professor who primarily hosted the community was the major professor to monitor and guide the discussion of NETwork discussion topics, while the field experience discussions were monitored by another instructor and the extended class discussions were guided by the class instructors. For example, professors participated in all discussion forums except the discussion forums that were extended from a particular class discussion if that was not what they taught. Furthermore, the weekly discussion for field experience and some extended class discussions were required for pre-service teachers who were taking field experience courses, additionally some extended class discussions and NETwork discussion topics were required. The members, including in- and pre-service teachers were welcome to participate in Network discussion topics and weekly discussion for field experience. However, the extended class discussion forums were not accessible to members who were not taking field experience courses. Also, members were informed about when the discussions started and ended through NETwork announcements as well as other activities in NETwork.

Table 3.2
Learning Activities of NETwork in Spring 2007

Week	Discussion Board Opened	Chat Room Discussion Opened	Resources
W1 - W2: Introduce NETwork to members	<ul style="list-style-type: none"> - Orientation Activity: Trying functions of CMC tools & Building repertoire for NETwork” - General Discussion: Post questions and comments regarding NETwork and Resources shared - NETwork Discussion Topics: Discuss What You Want (W2); Teaching Elementary Literacy 	<ul style="list-style-type: none"> - Chat Room Discussion opened for: Exploring the functions of Sakai tools; - Exploring the repertoire built in Resources 	
W3 - W4: Get to Know You	<ul style="list-style-type: none"> - Get to Know You (NETwork Discussion Topic) - NETwork Discussion Topics: Teaching Elementary Mathematics; Classroom Management; Effective Strategies; Standardized Tests; Tips and Advice - Field Experience/Extended Class Discussions 		- Members shared their course work and resources anytime they wanted.
W5 – W6	<ul style="list-style-type: none"> - NETwork Discussion Topics: Assessing Student Learning; Teaching Elementary Science; The First Years of Teaching; Interdisciplinary Instruction; Student Teaching; What should a teacher do when.... - Field Experience/Extended Class Discussions 	<ul style="list-style-type: none"> - Chat Room Discussion Topic I: What's your biggest challenge as a new teacher (W6: 2/20, Tue, 6-7pm CT) 	- Particular folders where members' shared the files were opened through the whole semester based on needs.
W7 – W8	<ul style="list-style-type: none"> - NETwork Discussion Topics: Parents - Field Experience/Extended Class Discussions 	<ul style="list-style-type: none"> - Chat Room Discussion Topic II: How can you meet all of your objectives in EVERY subject within the school day? (W8: 3/07, Wed, 7-8pm CT) 	
W9 – W10	- Field Experience/Extended Class Discussions	<ul style="list-style-type: none"> - Chat Room Discussion Topic III: Connecting in positive ways with parents (W10: 3/20, Tue, 7-8pm CT) 	
W11 – W12	- Field Experience/Extended Class Discussions		
W13 – W14	- Field Experience/Extended Class Discussions		
W15 – W16	- Field Experience/Extended Class Discussions		
Note	<p>Discussion Board:</p> <ul style="list-style-type: none"> - Extended class discussions set up anytime the instructor needed. - Once the NETwork discussion topics in DB were opened, members were allowed to continue discussions through the whole semester. <p>Chat Room:</p> <ul style="list-style-type: none"> - The discussion topics were assigned based on the lead instructors' scheduled for issues considered important by the lead instructor. 		

Table 3.3
Discussion Topics in DB

Discussion Categories	Discussion Topics
General Discussion	1. Questions about NETwork (no posting during the semester)
NETwork Discussion Topics (Total: 15 Discussion Topics)	1. Get to Know You 2. Discuss What You Want 3. Teaching Elementary Literacy 4. Teaching Elementary Mathematics 5. Teaching Elementary Science 6. Classroom Management 7. Effective Strategies 8. Standardized Tests 9. Tips and Advice 10. Assessing Student Learning 11. The First Years of Teaching 12. Interdisciplinary Instruction 13. Student Teaching 14. What should a teacher do when.... 15. Parents
Field Experience Discussion (Total: 5 Discussion Topics)	1. Being Proactive and Taking Initiative in Your Field Classroom 2. Field Questions & Concern2 3. Professionalism & Professional Development 4. Reflecting on Elementary Science - Case Studies 5. Teaching Styles
Extended Class Discussion (Total: 14 Discussion Topics for Mathematics Field Experience Course)	1. General Weekly Discussions 2. Are you ready 3. Did you know that... 4. Your learning of mathematics 5. Forum 3_Probability 6. Forum4_Calculator Assumptions 7. Forum5_Connecting with your Students 8. Forum6_Your Choice 9. Forum7_Current Issues 10. Measurement Misconceptions 11. Assessment Assignment Reflections 12. Media Piece Teaching to the test 13. Sample MAP Test Items 14. Sample Space Discussions

Note. The Mathematics Field Experience Course was the only field experience course that created extended class discussion in the community. The rest of field experience courses, including literacy and science, did not use the community site for much of the course work because many activities were implemented in face-to-face class.

Methods

To answer the three research questions, multiple quantitative and qualitative methods were employed to collect data for triangulating members' online learning

experience of the NETwork community. A set of self-report questionnaires were administered to collect pre-service and in-service teachers' perceptions of technology acceptance, sense of community, social ability, satisfaction with the NETwork experience, and the effectiveness of NETwork for supporting teaching. Additionally, semester-end interviews examined members' summative opinions about how they participated and learned in NETwork and serial interviews were conducted three times to capture members' changes of opinions regarding their participation and interaction. Finally, members' activity logs recorded in the Context-aware Activity Notification System (CANS, Amelung, 2005) and discussion content recorded in the Sakai system were analyzed to address members' behaviors while interacting with other members.

Participants

NETwork members in Spring 2007 included: 1) 4 professional support members (3 faculty from Teacher Development Program (TDP) and 1 mentor of field experience); 2) 79 pre-service teachers who were taking courses in the undergraduate TDP including student teaching in schools or taking courses as part of a masters degree program; and 3) 17 in-service teachers who were teaching in schools. Most NETwork members were pre-service or in-service teachers who will teach or were currently teaching in K-8 grades. Although the TDP faculty and the mentor were members of NETwork, they were not included as subjects in this study to maintain a focus on pre- and in-service teachers' learning and interaction in NETwork. CANS data and discussion content of these instructional leaders were collected so as to provide a context for understanding the activity of the pre and in-service teachers.

The term "members" described in this study represents the teacher members,

including pre- and in-service teachers. All NETwork members work in a community site within MU's SAKAI course management system. Table 3.4 shows NETwork members' role, membership, and current learning or working status as anticipated for the Spring, 2007 semester.

Table 3.4
NETwork Membership

Types of NETwork Members		N	Membership	Status
Pre-service Teachers	TDP	33	Since Aug. 2006	Finish first-semester field experience courses and taking second-semester field experience courses (Redblock) [PO]
		5	Since Aug. 2006	Student Teaching in Schools [PO]
		30	Since Jan. 2007	Taking first-semester field experience courses (Blueblock) [PN]
In-service Teachers		17	Since Aug. 2006	Teaching in schools [IO]
		7	Since Jan. 2007	Teaching in schools [IN]
Total		92		

Note. "P"=Pre-service Teachers; "I"= In-service Teachers; "O"=Old Members; "N"=New Member

The pre-service teachers were all elementary education majors in MU (University of Missouri) Teacher Development Program (TDP) and would graduate with a degree in elementary education. The in-service teachers were mostly teaching in elementary school or science in K-8 grades at various locations around the U.S. All members of the community were eligible to participate in the research. Members who had participated in NETwork since August 2006 were classified as more experienced/old members and members who started in January 2007 were categorized as new members. Table 3.5 shows the number of NETwork members who participated in the study. The original plan was to recruit two experienced in-service teachers and two new in-service teachers for both the serial interviews and the semester-end interview. However, only 1 experienced in-service teachers (old members) agreed to do the serial interviews and 1 experienced in-service teacher participated in the semester-end interview (old members). For new in-service teachers, no one responded to the invitations for the serial interviews,

semester-end interview, or the surveys. All members received the invitations and completed first and/or final surveys in Feb and April 2007. A total of 50 (N=96) members responded to the first survey and 66 participated in the final survey.

Table 3.5
Research Participants

Types of NETwork Members	N	Serial Interviews	Semester-end Interviews	First Survey	Final Survey
Experienced Members (Since Aug. 2006)	Pre-service Teachers (PO)	38	2	2	25
	In-service Teachers (IO)	17	1	2	4
New Members (Since Jan. 2007)	Pre-service Teachers (PN)	30	2	4	23
	In-service Teachers (IN)	7	0	0	0
Total	92	5	8	50	66
Time for Participation		During Spring 2007 semester	End of the Spring 2007 semester	5 th week of the Spring 2007 semester	End of the Spring 2007 semester

Note. “P”=Pre-service Teachers; “I”= In-service Teachers; “O”=Old Members since Aug. 2006; “N”=New Member during Jan. 2007

Data Collection

Based upon the purposes of this study, serial interviews, semester-end interviews, self-report surveys, and archiving of CANS data and the content of Discussion Board (DB) and Chat Room (CR) activity were implemented for data collection. Data collection was undertaken during the Spring 2007 semester. Before starting data collection, an application of this study was sent to and approved by the University of Missouri Institutional Review Board (IRB) for human subjects protection. Table 3.6 shows the timeline of the data collection in Spring 2007.

Table 3.6
Timeline for Data Collection

Data Collection	W1 1/15	W2 1/22	W3 1/29	W4 2/5	W5 2/12	W6 2/19	W7 2/25	W8 3/5	W9 3/12	W10 3/19	Spring Break 3/26	W11 4/2	W12 4/9	W13 4/16	W14 4/23	W15 4/30	W16 5/7
IRB Application																	
Serial Interviews																	
Surveys																	
Semester-end interviews																	
CANS Data																	
Discussion Content of DB & CR																	

Note. a) Gray sections represent the time periods when the events happened; b) "W" represents week

Serial Interviews (45-60 minutes)

Semi-structured serial interviews (see Appendix 3-B) were implemented in the fifth, tenth, and fourteenth weeks (about once per month) of the Spring 2007 semester, and aimed to capture how experienced and new members' and pre- and in-service teachers experienced and participated in NETwork. The first interview started at the fifth week of the semester, so that new members could experience the interaction and environment of NETwork before being asked to answer interview questions. After that, the second and third serial interviews were administered about a month after the previous serial interview. As shown in Table 3.3, these three semi-structured serial interviews were conducted with 3 experienced members (2 pre-service teachers and 1 in-service teachers) and 2 new members (2 pre-service teachers) who were recommended by the professors in NETwork based upon their observed enthusiasm of participating in the study or participation level in class.

Semester-end Interviews (45-60 minutes)

Both experienced and new members were included to gather their experiences and feelings about participating in NETwork. The semester-end interviews were implemented in the last few weeks of the semester. E The eight voluntary participants who completed

the surveys were randomly selected to participate in the semester-end interviews, including 3 experienced members and 5 new members. The semi-structured interview protocol is shown in Appendix 3-C.

Survey Data (20-30 minutes)

Two surveys (see Appendix 3-D and E) representing early perceptions and perceptions from later in the semester were used to assess members' perceptions of sense of community, social ability, and how the social awareness tools support their interaction and learning in NETwork. Members who volunteered to participate in the study completed the early survey, NETwork Online Experience survey (I), at the fifth week of the semester. Toward the end of the semester, they completed a final survey (semester-end survey), NETwork Online Experience survey (II). In order to ensure surveys were available for all members, surveys were accessible online for members via the Internet. Both surveys contained the same content questions but different demographic questions because most demographic questions, such as gender, age, and previous online experience, did not need to be collected twice. The specific instruments used in the survey are discussed later in this chapter.

CANS Data

All NETwork members' actions were automatically recorded in CANS beginning in January 2007. The CANS activity logs included events, event authors' name, event time, and were aggregated to provide number of new postings, read posts, files uploaded, read file documents, and send chat messages. Based upon action types, CANS data were classified as message.post, message.read, resources.upload, resources.review, and chat.post. CANS data were retrieved from the CANS database one week after Spring

2007 ended.

Discussion Content of DB & CR

The discussion content of DB and CR was recorded in the Sakai system starting with the first day of the Spring semester 2007. Discussion Content of DB and CR was retrieved from the Sakai system a week after the Spring 2007 semester ended. The purpose of this study was to understand how members interact socially via discussion in DB and CR. Thus, discussion content in DB and CR were utilized to identify the ways members interact with others via written messages in DB and CR.

Data Analysis

To accomplish the purposes of this study, four types of data, including quantitative data from survey responses, qualitative interview transcripts, CANS data, and discussion content in DB and CR, were collected and analyzed. Table 3.7 provides a summary view of how the data were analyzed for answering each research questions.

Table 3.7
Data Collection

Data Collection	Instruments/Sources	Collected Data	Analysis Strategies	Answered RQ
Serial Interviews	Serial Interviews Protocol (I, II, III) [Appendix 3-B]	Changes of pre- and in-service teachers' experiences and interaction in NETwork	Content Analysis: serial interviews coding scheme [Appendix 3-F]	RQ1b, RQ3
Semester-end interviews	Semester-end interview Protocol [Appendix 3-C]	Opinions regarding how teachers participate and learn in NETwork	Content Analysis: semester-end interviews coding scheme [Appendix 3-G]	RQ1b, RQ3
Surveys Data	NETwork First Survey [Appendix 3-D] NETwork Final survey [Appendix 3-E]	Quantitative date of pre- and in-service teachers' perceptions of social constructs in NETwork	Correlation Analysis & Path Analysis; Dependent-sample t tests	RQ2*, RQ3*
CANS Data	CANS (automatically record systems)	Members' actions in NETwork	Descriptive Statistics, SNA, & Visualization techniques	RQ1a*, RQ1b*,
Discussion Content	DB Discussion Board in Sakai (automatically record systems)	Members' discussion content of Discussion Board	Content Analysis: Coding Scheme for DB [Appendix 3-H] & Coding Scheme for CR [Appendix 3-I]	RQ1b,
	CR Chat Room in Sakai (automatically record systems)	Members' discussion content of Chat Room		

Note. “*” represents the method primarily used to provide answers for the research question.

Research Question 1

How do members participate in the primary learning activities through Chat Room discussion, Discussion Board discussion, and information sharing in Resources?

CANS data (activity logs), discussion content in DB and CR, serial interview transcripts ($n=5 \times 3$), and semester-end interview transcripts ($n=8$) were examined to address this research question. Social Network Analysis (SNA via Netdraw@ and Ucinet@), and visualization techniques (Tableau@) were applied in analyzing CANS data, while content analysis (Nvivo@) was used for analyzing serial interview and semester-end interview transcripts, and the content of DB and CR. Tableau@ was used to calculate descriptive statistics and construct visual representations of trajectories for characterizing levels of activities and members' levels of participation in DB, CR, and RS (research question 1a), while descriptive statistics and diagrams of social networks (Netdraw@) were utilized for characterizing patterns of members' social interaction and how they participate in activities (research question 1b). Also, results of content analysis of serial and semester-end interviews and discussion content provided descriptions to support and triangulate what had been found via CANS data.

Research Question 1a. What are the characterizations of member activity that represent different levels of participating in the community, and to what extent did members participate?

Table 3.8 shows indicators in DB, CR, and RS that were recorded by CANS including event author (who is doing the action), event time (when the action happens), event context (where the action happens), and object author (who created the object that one is reading or replying). For message.post, chat.post, and resources.upload, event

author is the same as object author.

Table 3.8

Indicators for Levels of Participation

NETwork Activity Contexts	Indicators for levels of Participation	Meaning of Indicators
Discussion Board (DB)	- message.post - message.read	- member's action of posting or replying a message - member's action of reading a message
Chat Room (CR)	- chat.post	- member's action of creating a message in CR.
Resources (RS)	- resources.upload - resources.review	- member's action of uploading a document to Resource - member's action of reviewing or downloading a document in Resource
NETwork Site	- login frequency	- frequency of member's login to NETwork site

Once the descriptive statistics of CANS data were generated via Tableau®, the characterizations of participation levels could be determined. For example, the total amount of message.post and message.read could be used to indicate individual member's levels of participation in discussion board.

Research Question 1b. What are the characterizations of member activity that represent different patterns of participating in the community? Are there differences in the patterns of participation for experienced members and new members and for pre-service and in-service teachers?

By calculating descriptive statistics, generating interaction diagrams via social network analysis, and visualization techniques for CANS data, and content analysis of the 15 (5x3) serial interviews and 8 semester-end interview transcripts, characterizations of how members participated in NETwork were made and patterns of participation were identified. Although the focus of this study was not to analyze the knowledge conveyed in the discussion content in DB and CR, it would be valuable to identify how members interacted with others via written postings in DB and CR. Thus, content analysis for both DB and CR messages was included to help triangulate the understanding of members'

patterns of social interaction.

Since this study aimed to understand members' social interaction and participation in NETwork, a combination of the framework of CoP (refer to Figure 2.1; Laffey, 2005) and IAM Models were implemented in the analysis. Thus, a coding scheme for serial interviews (Appendix 3-F), a coding scheme for semester-end interviews (Appendix 3-G), a coding scheme for discussion board content (Appendix 3-H) and chat room discussion content (Appendix 3-I) were developed based upon Wenger's framework of community of practice (Wenger, 1996, refer to Figure 2.1) and the Interaction Analysis Model (IAM) developed by Gunawardena et al. (1997, refer to Table 2.2). The coding schemes for analyzing the serial and semester-end interview transcripts, discussion board content, and chat discussion content were developed and adjusted based on the data types. One of the coding methods (Morse & Richards, 2002), topic coding, was applied to code the interview data whose coding schemes were formed from the framework of CoP and the themes of the interview questions. The serial interview coding scheme was developed from coding the first three serial interview transcripts. After that, the coding scheme for semester-end interviews was adapted from the serial interview coding scheme and tested on one semester-end interview. Additionally, both topic coding and analytic coding methods (Morse & Richards, 2002) were utilized when coding chat and discussion board messages whose schemes were jointly developed from the framework of CoP and AIM and issues that emerged from the nature of the chat or discussion board messages. To be more specific, members' DB or CR messages classified as phase I were categorized into a few primary constructs (i.e. advice from knowledge authority, shared in-school experience, guidance from the instructor, etc) based on the relevance of data associated

with the social concepts of CoP. The discussion content coding scheme was generated from coding the first two NETwork weekly discussion topics, and the coding scheme for the discussion content in CR was modified from the coding scheme for DB content and tested on the content of the two discussion topics (Topic 1 & 2).

Since members often presented several ideas in response to a single interview question, the theme and idea analysis unit was applied to the content analysis of interview transcripts, while discussion board content and chat messages were analyzed based on the message analysis unit. The results coded in IAM can be used to understand members' ways of meaning negotiation and co-construction of knowledge, while the results coded in the research themes or the CoP concepts can be used for explaining members' perceptions of participating and interacting in a teacher online learning community. Table 3.9 presents the steps of content analysis for serial interviews, semester-end interviews, and discussion content in DB and CR.

After the drafts of the coding schemes were developed, the coding schemes were discussed with another researcher who served as an inter-rater for the content analysis. A total of eight steps were implemented to ensure a reasonable inter-rater reliability for the coding results. Basically, steps 1 and 2 were undertaken to develop reliable coding schemes, while steps 3 to 6 were undertaken to ensure that the inter-rater was able to code the descriptive data using the coding schemes and that sufficient levels of the inter-rater reliability were reached. The procedures for step 3 to 6 were conducted to ensure the primary researcher and the inter-rater had same understanding and definitions of the coding schemes. In step 6, both raters coded a set of sample data based on the coding scheme. After comparing the raters' coding results, the initial agreement ranged

from 80% to 94% initial agreement for coding serial interviews, from 88% to 90% initial agreement for DB messages, and 88% to 92% initial agreement for CR messages. The initial disagreements of the coding results were discussed, clarified, and resolved one by one. A finalized 100% agreement for DB, CR, serial interviews, and semester-end interviews coding data was attained before step 6 was concluded. After that, independent coding for 100% of the rest of coding content was completed by the raters. The amount of different coding categories for DB and CR messages were shown in Table 3.10. Fifty-six out of 726 (7.71%) messages in NETwork Discussion Topics were coded differently as well as 21 out of 313 (6.71%) messages in Field Experience Discussion. Also, 24 out of 258 (9.30%) messages in CR were coded differently. The differences in coding messages were discussed and resolved again to reach a 100% final agreement of the coding results. Similar to the comparison of coding results for DB and CR messages, two raters' coding results of serial and semester-end interview data were compared. The raters went through each difference and inconsistency in coding results together and resolved all the disagreement to reach a finalized 100% agreement. By the end of the step 8, there was 100% agreed between coders for the finalized coding results.

Table 3.9
Steps for Content Analysis

Procedure	Purpose	Results
Step 1: Develop the coding schemes	- To prepare a draft of the coding schemes based on the framework of CoP (Wenger, 1996) and AIM (Gunawardena et al., 1997)	- Coding schemes for serial interview, semester-end interview, discussion content in DB, and discussion content in CR were developed. The coding nodes for each coding schemes were defined.
Step 2: Try the coding schemes	- To test if there is anything that needed to be modified when coding the first few transcripts or discussion content. - To modify the coding schemes based on the testing.	- 3 serial interviews (1 set), 1 semester-end interview, 2 topic discussion content in DB, and 2 topic discussion content in CR were analyzed based on the coding schemes. - Some nodes in the coding schemes were merged and adjusted.
Step 3: Discussion the coding schemes with the inter-rater	- To ensure if the coding schemes made sense to another researcher (the inter-rater). - To ensure both raters had same understanding of the definitions for the nodes. - To modify the coding schemes	- Based on the opinions of the inter-rater, the coding schemes had been modified. The inter-rater took the coding schemes back and read through it more careful to prepare for the testing in the next step.
Step 4: Test the inter-rater's understanding of the nodes of the coding schemes via examples abstracted from the real coding content.	- To ensure the inter-rater had same understanding with the primary researcher. - To develop the coding book	- Scores were given to the inter-rater's answer for the testing coding content. The inter-rater had correct answers: * 8/10 for both serial and semester-end interviews * 5/5 for DB discussion content * 3/3 for CR discussion content. - The wrong coding answers in the test were discussed and clarified. - A coding book with some coding examples was developed after the discussion. [Appendix 3-J]
Step 5: Independent coding of samples, including 3 serial interviews (1 set), 1 semester-end interview, 2 topic discussion content in DB, and 2 topic discussion content in CR	- To ensure both researchers understand how to apply the coding scheme for coding the data.	- Both researchers coded the same samples by using the coding book to guide the coding.
Step 6: Compare the results of the independent coding.	- To ensure both researchers have same understanding of what should be coded for the nodes. - To clarify and resolve the differences of the coding results	- After comparison, the percentages of the same coding answers were at least over 80%. * SI: 94% for the first serial interview coding results, 86% for the second serial interview coding results, 85% for the third serial interview coding results. * FI: 80% for the semester-end interview coding results * DB: 90% and 88% for the content of the two sample discussion boards. * CR: 88% for discussion topic 1 and 92% for discussion topic 2. - The difference of the coding results were resolved and clarified again.
Step 7: Finish coding independently	- To conduct coding for all the transcripts and discussion content	- Both raters finished coding 100% of the rest of descriptive data independently.
Step 8: Compare the results of 100% coding content the inter-rater finished	- To calculate the inter-rater reliability for the coding results.	- The percentage of the original same coding results were showed in Table 3.10. - After comparison, the different coding results were discussed and resolved to reach a finalized 98% to 100% agreement.

Table 3.10
Comparison of Coding Results

Discussion Categories	Discussion Topics/ Participants	Number of different coding messages	Sum of messages	Percentage of same coding results (%)
DB: NETwork Discussion Topics (Total: 15)	1. Get to Know You	5	42	88.09
	2. Discuss What You Want	8	182	95.60
	3. Teaching Elementary Literacy	4	54	92.59
	4. Teaching Elementary Mathematics	1	6	83.33
	5. Teaching Elementary Science	5	49	89.79
	6. Classroom Management	7	76	90.79
	7. Effective Strategies	2	36	94.44
	8. Standardized Tests	1	31	96.77
	9. Tips and Advice	5	42	88.09
	10. Assessing Student Learning	1	8	87.5
	11. The First Years of Teaching	5	50	90.00
	12. Interdisciplinary Instruction	0	14	100.00
	13. Student Teaching	5	52	90.38
	14. What should a teacher do when....	6	58	89.66
	15. Parents	1	26	96.15
Total		56	726	92.29 (Average)
DB: Field Experience Discussion Topics (Total: 5)	1. Being Proactive and Taking Initiative in Your Field Classroom	3	36	91.67
	2. Field Questions & Concern2	10	153	93.46
	3. Professionalism & Professional Development	0	20	100.00
	4. Reflecting on Elementary Science - Case Studies	6	64	90.63
	5. Teaching Styles	2	40	95.00
Total		21	313	93.29 (Average)
CR Messages	Time Period 1: (1/18-2/20)	3	41	95.12
	Topic Discussion 1 (2/20)	18	152	88.16
	Time Period 2: (2/20-3/5)	1	17	94.12
	Topic Discussion 2 (3/7)	2	26	92.31
	Time Period 3: (3/11-3/13)	0	7	100.00
	Topic Discussion 3 (3/20)	0	5	100.00
	Time Period 4: (3/20-4/26)	0	10	100.00
Total		24	258	90.70 (Average)

Note. The messages in CR are categorized into 3 topic discussions and four time periods, including Time Period 1, 2, 3, and 4 based on when the chat messages were posted.

The content analysis of members' serial interviews and semester-end interviews yielded descriptions of how members participate in the community. And the content analysis of members' discussion content of DB and CR described how members participated in the discussion. These descriptions were examined for patterns of participation. The results of content analysis provided narrative information for explaining differing patterns of participation among different types of members.

In addition to content analysis of serial interview transcripts, an SNA analysis was

applied to identify structural patterns of members' interaction and assess how the patterns explain outcomes. The descriptive statistics and interaction diagrams were constructed based on CMC tools types, such as social interaction for DB and Resources. SNA tools, including Netdraw@ and Ucinet@, and visualization techniques via Tableau@ were utilized for visualizing and statistically analyzing the CANS data. Ucinet@ provided statistical information of network density, centrality degree, network centralization, reciprocity, and cliques to better represent the structural patterns of the interaction and relationships between a particular member and the community as a whole. Also, Netdraw@ was used to construct social network visualization diagrams that represented relationships and ties among members, whereas Tableau@ was used to create tables to present the frequency of members' interaction with each other. These diagrams and interaction tables show the interaction patterns of a social network in a particular context (i.e. social interaction networks in DB or Resources) as well as interaction patterns for particular social interaction in DB or RS activities (i.e. field experience weekly discussion, extended class discussion, NETwork discussion topic, and general discussion in DB). Because the data-recording format in CANS for Chat Room could not specify who read what chat entries, SNA was not applied to analyze members' interaction patterns in the Chat Room. Instead, the members' participation levels of CR were only analyzed via descriptive statistics by Tableau@. Also, Tableau@ was employed to represent the trajectories of members' participation across time. For example, the trajectories showed changes for the numbers of posting or reading messages across the whole semester in the DB, RS, and CR as well as members' levels of participation, such as login frequency or posting frequency. Based upon the analysis in Tableau@,

characterizations of activity that represented members' participation patterns in particular activities were found and how different types of members participated in the activities were explored by comparing the trajectories.

Analyses of NETdraw@, Ucinet@, and Tableau@ reports were conducted for groups, individuals, contexts, activities and time periods. In order to answer research question 1b, two types of analyses, including viewing the whole community as a group and comparisons based on members' types were conducted. Also, based on different types of discussion topics, the DB analysis was classified into 3 different conditions to better understand members' interaction when the nature of the discussion forum was different. These three conditions included a) including interaction across the entire discussion board (entire DB); b) excluding the participation of the extended class discussion (FE & NETwork only); c) excluding the participation of the extended class discussion and field experience discussion (retaining only the participation of NETwork discussion topics, represents as "NETwork only"). Table 3.11 shows how the data analysis was conducted for exploration and comparison of groups.

**Table 3.11
SNA & Trajectories**

Levels of participation	Analysis Groups	Login	DB 3 Conditions			RS	CR
			Entire DB	FE & NETwork only	NETwork only		
Levels of participation	Tableau@: a set of Trajectories and descriptive statistic results of members' participation levels across time	X	X	X	X	X	X
Patterns of participation	NETdraw@: a Social Network Diagram	X	X	X	X	X	X
Patterns of participation	Ucinet@: a set of Statistic Parameters	X	X	X	X	X	X
Patterns of participation	Tableau@: a set of Trajectories and descriptive statistic results of members' participation patterns across time	X	X	X	X	X	X

Research Question 2

How well does the proposed path model explain the relationships among the social constructs of online learning (i.e. sense of community, social ability, perceived ease of use, perceived usefulness) and explain community outcomes/effects (levels of participation, satisfaction with NETwork experience, and effectiveness of NETwork for Teaching)?

Survey data of the final survey were analyzed for answering this research question. Correlation analysis and path analysis were conducted via SPSS@ and Mplus@. Table 3.12 shows how these analyses were conducted.

Table 3.12
Statistical Analysis Stages for RQ2

Analysis Stages	Steps	Explanations	Variables
Preliminary Stage	1. Clean data	- The raw score of all variables were used to examine for outliers and missing data.	PEU, PU, SA, SoC, S, and ENT
Correlation Analysis	1. Mean scores of all social constructs and sub-constructs will be generated.	- The mean scores of variables were generated in SPSS for further analysis.	PEU, PU, SA, SPp, SPI, SN, SOC, S, LS, CE, and ET
	2. Examine Assumptions for Correlation Analysis	- The mean scores were used for examining the assumptions.	
	3. Run correlation analysis	- The relationships among social constructs were identified by examining if the correlation coefficients show significant correlations between each two factors.	
Path Analysis	1. Develop initial path model based on the proposal model	- A correlation matrix with standard deviations was generated and ready for the analysis. - An initial measurement model was developed and L-M test was applied for dropping paths in order to find a final measurement model that shows good model fit.	PEU, PU, SA, SOC, S, and ET
	2. Construct and examine the final path model	- Set up the final measurement model for the initial structural model. (The relationships identified in correlation analysis can be the references for constructing the directions of relationships). - Using values of Chi-Square, CFI, TFI, and RMSEA to examine a better model fit. - Identify the mediating and moderating relationships among the social constructs.	
	3. Explore further relationships among social ability's sub-constructs and other social constructs	- Explore the relationships among social navigation, social presence with instructor, social presence with peers, and other social constructs based on the results found in the examination of the proposed path model. - Using values of Chi-Square, CFI, TFI, and RMSEA to examine a better model fit. - Identify the mediating and moderating relationships among the social constructs.	PEU, PU, SN, SPi, SPp, SOC, S

Note. Perceived ease of use (PEU), Perceived usefulness (PU), Social Ability (SA), Social Presence with Professors/Instructors (SPi), Social Presence with Peers (SPp), Social Navigation (SN), Sense of Community (SoC), Satisfaction with NETwork experience (S), Learning Satisfaction (LS), Community Evaluation (CE), Effectiveness of NETwork for Teaching (ENT)

In the Preliminary Stage, the statistical assumptions for correlation analysis and path analysis were examined before starting analyses. Correlation analysis provided information about the strength of the relationships among social constructs which prepared the researcher to gain a big picture of the relationships. After that the techniques of path analysis were employed for examining how well the proposed model explained the relationships among social constructs of online interaction in NETwork community and how relationships exist among the social ability's sub-constructs and other social constructs.

Research Question 3

How do members' perceptions (sense of community, social ability, ease of use, usefulness, satisfaction with their NETwork experience, and of the effectiveness of NETwork for supporting teaching) change through participating in the community?

Survey data from the first survey, final survey, and coding results of the serial interview and semester-end interviews were analyzed for answering this research question. Descriptive statistics for the social constructs were provided and used for dependent-sample t test analysis of the relationships between measures in two different time periods. SPSS@ was employed for conducting the statistical analyses. The primary answers to question 3 reside in the significance of comparisons, but the coding results from the interviews may offer insights for explaining the findings. Table 3.13 shows the analysis procedure for the quantitative data.

Table 3.13
Statistical Analysis Stages for RQ3

Analysis Stages	Steps	Explanations	Variables
Preliminary Stage	1. Clean data	- The raw score of all variables were used for examine the outliers and missing data.	PEU, PU, SA, SPi, SPP, SOC, S, CE, LS, and ET
Dependent-samples T Tests	1. Mean scores of every social constructs will be generated in descriptive statistics data.	- The mean scores of variables were generated in SPSS for further analysis.	IV: Time: week 5 v.s. week 15 (data from first survey and final survey)
	2. Examine Assumptions for Dependent-samples T Tests	- The mean scores were used for examining the assumptions.	
	3. Run analysis of Dependent-samples T Tests	- The relationships among social constructs were identified by examining if the correlation coefficients show the significant correlations between each two factors.	DV: PEU, PU, SA, SOC, S, and ET

Note. Dependent Variable (DV), Independent Variable (IV), Perceived ease of use (PEU), Perceived usefulness (PU), Social Ability (SA), Social Presence with Professors/Instructors (SPi), Social Presence with Peers (SPP), Social Navigation (SN), Sense of Community (SoC), Satisfaction with NETwork experience (S), Learning Satisfaction (LS), Community Evaluation (CE), Effectiveness of NETwork for Teaching (ET)

Table 3.13 shows analysis stages for dependent-samples t tests. To understand change over time, time is the independent variable and members' perceptions of sense of community, social ability, ease of technology use, usefulness of technology, learning satisfaction, effectiveness of NETwork for teaching are the dependent measures. Members' perceptions from the first survey (fifth week) are compared with their perceptions from the final survey (fourteenth week).

Instruments

Five types of instruments, including the serial interview protocol, the semester-end interview protocol, surveys, CANS activity logs, and Sakai user created content from the DB and CR systems, were employed for collecting data in this study.

Serial Interview Protocols (Appendix 3-B)

A serial interview protocol was developed for conducting serial interviews. The questions on the semi-structured serial interview were classified into three themes: participants' experience of learning in NETwork, current teaching beliefs and perceptions,

and effectiveness of NETwork for supporting teaching. The first theme explored members' experience and feelings of interacting in NETwork. The second theme investigated how members perceive their current teaching, such as what kind of teacher they are and their satisfaction with current support, knowledge, and skills. The third theme examined how members' interaction and participation in NETwork influence their perception of applying what they learn in current or future schools. Additionally, while the three semi-structured serial interviews used the same themes, the nature of the questions applied an evolving focus. For example, in the second interview, the researcher described what the participants addressed in the first interview for particular questions and asked him/her about "what has changed in the past month?" The purpose of the second and third interviews was to explore what had changed since the previous interview. Finally, inter-rater reliability was assessed when analyzing the serial interview transcripts by comparing coding results between the researcher and the lead professor.

Semester-end Interviews Protocol (Appendix 3-C)

A semi-structured semester-end interview was utilized. This semester-end interview contained the same themes and questions asked in the first serial interview protocol. The purpose of the semester-end interview was to collect members' perceptions of participating in NETwork across the 3 month-time period. The semi-structured interview is shown in Appendix 3-C. For analyzing the interview transcripts, inter-rater reliability was assured by comparing coding results between the researcher and the lead professor.

Survey (Appendix 3-D & 3-E)

The items for assessing the social constructs were adapted from previous studies (Davis, 1989; Rovai, 2002; Laffey, et. al., 2006; Yang, et. al, 2006; Alavi, 1994). Both

the early and later surveys included 5 primary constructs: technology acceptance, sense of community, social ability, learning satisfaction, and effectiveness of NETwork for teaching. In addition to the content items of 5 social constructs, participants were asked demographic questions. In the early survey, 8 demographic questions were asked, including gender, age, academic status, taken online courses, course management systems used before, login hours, amount of messages posted, and self-reported perception of what kind of teacher he/she is. The last three questions were repeated in the later survey. For the content items of social constructs, participants were asked to rate their agreement with the items on a 7 point Likert-type Scale where 1 represented strongly disagree and 7 meant strongly agree.

Technology Acceptance

Perceived ease of use and perceived usefulness were two sub-constructs derived from Davis's technology acceptance model (Davis, 1989). The 10 items of these constructs were adapted from an online learning experience survey (Yang, et. al, 2006; Tsai, et. al., 2007) based upon Davis's technology acceptance instrument (Davis, 1989). The Cronbach α reliability of perceived ease of use and perceived usefulness assessed in the previous study were .96 and .98 (Tsai, et. al., 2007).

Sense of Community.

The 20 items for sense of community were adapted from Rovai's Classroom Community Scale (Rovai, 2002), which measures sense of community in an online learning environment. Rovai's 20 items, which consist of two sub-constructs: connectedness and learning, were developed to address members' feelings of connectedness, cohesion, spirit, trust, and interdependence. The Cronbach α reliability of

connectedness subscale and learning subscale are reported as .92 and .87 (Rovai, 2002).

Social ability

The 18 items of social ability were adapted and modified from a 30-item instrument of online learning experience (Yang, et. al., 2006) which was extended from the 20-item Social Ability Instrument (Laffey, et. al., 2006). These 30 items included 10 items for perceived peers social presence, 8 items for perceived instructor social presence, 6 items for social navigation, 3 items for perceived written communication skills, and 3 items for comfort with sharing personal information. Social presence, including with the instructor and with peers, and social navigation are two primary sub-constructs of social ability found by previous study (Laffey, et. al., 2006). Advances to the original instrumentation (Yang et. al. 2006) found students perceived instructor's social presence and peers' social presence differently. Based upon this result, this study examined social presence with professors (instructor role: professor or mentor, 6 items) and social presence with peers (peer role: pre- and in- service teachers, 6 items) separately. The Cronbach α reliability of social navigation, social presence with instructor, and social presence with peers were .88, .93, and .91 (Yang, et. al., 2006).

Satisfaction with NETwork experience

Nine items to measure members' satisfaction with NETwork experience were modified to meet the context of this study from a previous online learning experience study (Laffey, et. al., 2006; Yang, et. al., 2006) which developed items based upon Alavi's (1994) learning and evaluation scales. Since a previous study (Tsai, et. al., 2008) found that the learning satisfaction (4 items) and course evaluation (5 items) constructs can explain overall learning satisfaction as a whole, the 9 items were adapted and

modified to examine satisfaction with NETwork experience as one construct. The items for course evaluation were modified to examine the community by changing the description from referencing a course to the NETwork community. The Cronbach α reliability of overall satisfaction of online learning were .92 and .87 for learning satisfaction and .89 for course evaluation (Tsai, et. al., 2008).

Effectiveness of NETwork for Teaching

The 10 items about how members perceive the value of participating in NETwork were adapted from the semester-end interview protocols. These items addressed how members feel about their teaching knowledge, skills, and confidence after participating in NETwork. Two expert reviews were conducted for developing these items in August 2006. The expert with expertise in science education reviewed the items to ensure the questions could address members' feeling of their improvement/change of the content and pedagogical knowledge in science teaching. After that, the expert with expertise in social computing reviewed the questions to ensure questions were realistic and meaningful to measure members' changes after participating in an online learning community.

CANS

Context-aware Activity Notification System (CANS) is a system for recording activity in Sakai. Members' actions are recorded automatically once they log into the NETwork community site. The activity logs included event authors' name, event time, where the event happens, and number of new postings, replied posting, read postings, file uploaded, read file documents, and chat messages. Based upon action types, CANS data were classified as message.post, message.read, resources.upload, resources.read, and

chat.post.

Sakai System

Sakai is a collaborative groupware system which provides a set of software tools to help instructors and students learn collaboratively. Differing from Blackboard@ and WebCT@, Sakai has an open source community license which allows researchers to create and develop software tools which can add to the system. For example, CANS is a tool that was developed by Amelung (2005) for better supporting social awareness in Sakai. The NETwork members primarily worked and interacted in three spaces in Sakai, including Discussion Board, Chat Room, and Resources. The content of Discussion Board and Chat Room activity and the shared documents in Resources have been archived since the first day of the Spring semester 2007.

Protection of Human Subjects

An application for this study was sent to and approved by the University of Missouri Institutional Review Board (IRB) for human subjects protection. Consent forms (Appendix 3-K & 3-L) were given to participants requesting their agreement for completing the surveys, interview, and serial interviews data. Members' activity logs and discussion content in NETwork were accessible under a professor's consent (Appendix 3-M). All records and information collected in this study were confidential. To protect the participants, any information regarding participants' identity, such as name, address, and student ID number, will not be presented in any publications and presentation of the findings. Participants were informed that they could withdraw from participation at any time or skip any questions for which they were not comfortable giving an answer. To increase participation in this study, an incentive with twelve \$30 checks were given.

Eight \$30 checks were given to 8 participants who completed the serial interviews and surveys. Additionally four \$30 checks were used in a drawing. A participants' name was entered into the drawing every time they participated in a task of this study, such as completing a survey or semester-end interview. The more they participated, the more times their names were entered in the drawing. At the end of the Spring 2007 semester, four winners who were randomly selected from the drawing were given a \$30 check. The information from participants was protected thoroughly, including consent form, identified information, interview recorded audio files, survey data files, activity log files, and discussion content, by storing on the researcher's personal computer with password protection.

Chapter Summary

The purposes of this study were to understand the nature of participation, social constructs, and learning in a Community of Practice. The multiple methods used to investigate members' participation and social interaction in a teacher online learning community, NETwork, were presented in Chapter III. As discussed in Chapter II, a social interaction path model for an online learning community was proposed to explain the inter-relationship among the social factors of an online learning community. Further, members' levels and patterns of participation and social interaction were examined via social network analysis and visualization techniques. Last, content analysis of interviews and discussion content was utilized to support and triangulate what had been found in SNA or statistical analysis. The context and sample used in this study, research procedures, data collection, and data analysis were included in this chapter. Next, Chapter IV will report the results found from the multiple data analyses.

CHAPTER IV

RESULTS

Introduction to the Chapter

To understand the nature of participation, social constructs, and learning in a Community of Practice and to test a model of how well the social constructs of the online learning community explain the effectiveness of professional development in a community, quantitative and qualitative data and activity log (CANS data) were collected in Spring 2007. This chapter describes results of data analyses for the data collected. The data analyses include: a) social network analysis, descriptive analysis, and visualization of social interaction for CANS data; b) path analysis and one-way repeated measurement for quantitative survey data; c) content analysis for serial interview and semester-end interview transcripts and discussion board and chat room discussion content. The results of the analyses are used to answer the research questions below.

1. How do members participate in the primary learning activities through Chat Room discussion, Discussion Board discussion, and information sharing in Resources?
 - 1a. What are the characterizations of member activity that represent different levels of participating in the community, and to what extent did members participate?
 - 1b. What are the characterizations of member activity that represent different patterns of participating in the community? Are there differences in the patterns of participation for experienced members and new members and for pre-service and in-service teachers?
2. How well does the proposed path model explain the relationships among the social constructs of online learning (i.e. sense of community, social ability, perceived ease of

use, and perceived usefulness) and explain community outcomes/effects (satisfaction with NETwork experience and effectiveness of NETwork for Teaching)?

3. How do members' perceptions (sense of community, social ability, ease of use, usefulness, satisfaction with their NETwork experience, and of the effectiveness of NETwork for supporting teaching) change through participating in the community?

Data Analyses and Results

Research Question 1

The first research question was: "how do members participate in the primary learning activities through Chat Room discussion, Discussion Board discussion, and information sharing in Resources?" Also, two sub questions for the first research questions were:

- 1a. What are the characterizations of member activity that represent different levels of participating in the community, and to what extent did members participate?
- 1b. What are the characterizations of member activity that represent different patterns of participating in the community? Are there differences in the patterns of participation for experienced members and new members and for pre-service and in-service teachers?

The activity log data collected via CANS during the Spring 2007 semester and qualitative data, including serial and semester-end interview transcripts and discussion content posted in the discussion board and chat room in NETwork site, were analyzed to answer this research question. For CANS data and discussion content of Discussion Board and Chat Room, only members who logged-in during the Spring 2007 semester (Jan 2007 to May 2007) and participated on the discussion boards had records saved in

CANS and NETwork community site. The CANS data about activity in Resources includes all activity in the Spring 2007 semester. However, in some instances files from 2006 are included such as when members in Spring 2007 accessed files that were uploaded in 2006. Table 4.1.1 presents the number of members who logged-in to the NETwork during Spring 2007.

Table 4.1.1
Members Logged-in during Spring 2007

Types of NETwork Members		N	Login during Spring 2007
Experienced Members (Since Aug. 2006)	Pre-service Teachers (PO)	38	18
	In-service Teachers (IO)	17	3
New Members (Since Jan. 2007)	Pre-service Teachers (PN)	30	30
	In-service Teachers (IN)	7	2
Total		92	53

To answer the first sub research question (RQ1a.), CANS data were analyzed via Tableau@ to visualize members' levels of participation as represented by members' overall login frequency and frequency of use of the tools (i.e. Discussion Board, Resources, and Chat Room). CANS data were analyzed via Tableau@, Netdraw@, and Ucinet@ to visualize members' patterns of participation in Discussion Board (DB), Resources (RS), and Chat Room (CR) for the second sub research question (RQ1b). Additionally, the results of content analyses for discussion activity in DB and CR, and for serial and semester-end interviews were utilized to answer both RQ1a and RQ1b. To present the results for research question 1, the results were organized based on results for analyzing CANS data and results for content analyses. Also, the results of analyzing CANS data were classified into login frequency, participation in DB, participation in Resources (RS), and participation in CR. The results for members' participation in DB, RS, and CR include two attributes: levels of participation and patterns of participation.

Further, there are three categories of Discussion Board topics, which are NETwork weekly discussion topic, field experience weekly discussion, and extended class discussion. One unusual level of activity during the Spring 2007 semester occurred when the instructor of the mathematics field experience course required members who were taking this course to post at least 3 weekly discussion messages and participate in the extended class discussion intensively. Thus, the members who were taking this mathematics field experience course have extremely high frequency of interaction in the discussion board. To compare different types of members' interaction objectively, the analyses for members' interaction in the Discussion Board were classified into three conditions: a) including entire discussion board interaction (entire DB); b) excluding the participation of extended class discussion (FE & NETwork only); c) including only the participation of NETwork discussion topic (NETwork only). The differences and similarities of members' interaction under these three conditions are presented next.

Of note is that the CANS data for Chat Room activities only recorded posting activity (posting chat messages, not reading messages) because the way chat messages are represented in the Sakai system makes it impossible to distinguish or record who was actually reading a particular message. Also, the reading activities could not be accurately determined by examining the content of chat discussions. While some participants did address others' name in their messages, the instances where names were mentioned in the chat discussion content represented only a small fraction of the total messages. Thus, it was impossible to represent the social interaction among members via social network analysis diagram or statistic results. Therefore, the frequency and trajectories generated by Tableau@ were the primary results for understanding the interaction in the Chat Room.

The structure of the results answer for the research question 1 is presented in Table 4.1.2.

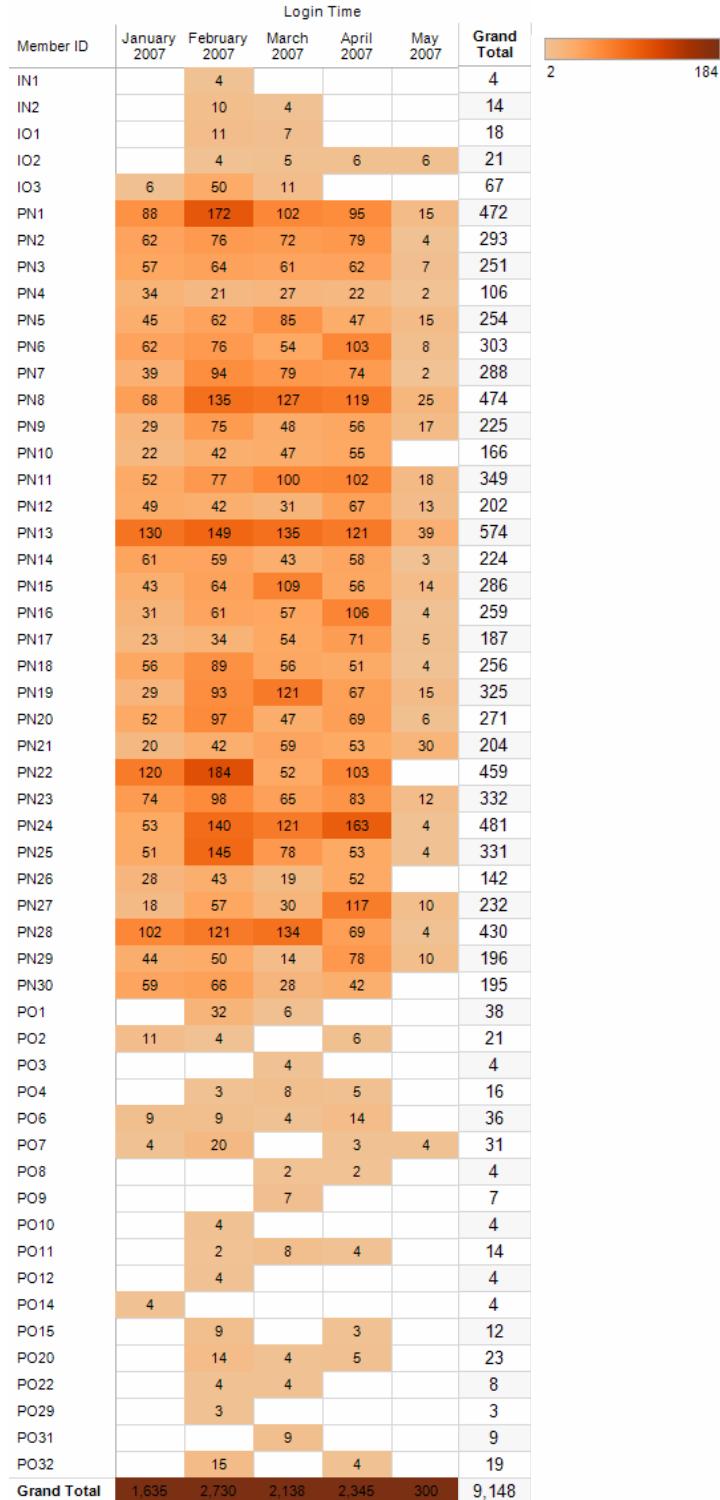
Table 4.1.2
Structure of Results Presented

Categories	Results	RQ1 answered	
		RQ1a	RQ1b
I. Login Frequency	Levels of participation	X	
II. Participation in Discussion Board (DB)	a. Entire DB discussion (Entire DB)	1. Levels of participation X	
		2. Patterns of Participation X	
	b. Field Experience & NETwork weekly discussion only (FE & NETwork only)	1. Levels of participation X	
		2. Patterns of Participation X	
III. Participation in Resources (RS)	c. NETwork weekly discussion only (NETwork only)	1. Levels of participation X	
		2. Patterns of Participation X	
IV. Participation in Chat Room (CR)	a. Levels of participation in RS	X	
	b. Patterns of Participation in RS		X
V. Content Analysis	Level & Patterns of Participation in CR	X	X
	a. Participation in DB	X	X
	b. Participation in CR	X	X
	c. Members' Perceptions of Participation (Serial Interviews)	X	X
	d. Members' Perceptions of Participation (Semester-end Interviews)	X	X

I. Login Frequency: Levels of Participation

Table 4.1.3 presents the login frequency of members classified into in-service teachers who were new members (IN, in-service teachers/new members) or experienced/old members (IO, in-service teachers/old members) in Spring 2007, and pre-service teachers who were new members (PN, pre-service teachers/new members) or experienced/old members (PO, pre-service teachers/old members) in Spring 2007. In Table 4.1.3, darker colors indicate higher degree of login frequency and vice versa. Overall, members' login frequency was fairly consistent across February (total frequency=2,730, M=85 per day), March (total frequency=2,138, M=69 per day), and April 2007 (total frequency=2,345, M=78 per day). The total login frequency of January 2007 (total frequency=1,635, M=102 per day) was slightly less than the following three month during the semester, can be explained by NETwork activities not officially starting until Jan 15th. The last month (May 2007) had a lower login frequency (total frequency=300, M=43 per day) because most members left school after the first week of May 2007. Thus, NETwork members started to login to NETwork with a relatively high frequency in January 2007 and the frequency (daily average) remained fairly consistent throughout the semester but dropped at the end of the semester (from M=102 times/per day in January to 85 times/per day in February, 69 times/per day in March, 78 times/per day in April, and 43 times/per day in May).

Table 4.1.3
Login Frequency (Jan. to May 2007)



Note. a. Color shows count of Login Frequency. Darker color represents higher frequency of login to the NETwork, and vice versa. b. The text values show the count of the login frequency. c. The frequency ranges from 2 to 184.



Figure 4.1. Comparison of Login Frequency

Note. Lighter blue bars represent in-service teachers who joined NETwork since Spring 2007 (IN). Darker blue bars represent in-service teachers who joined NETwork since Fall 2006 (IO). Lighter red bars represent pre-service teachers who joined NETwork since Spring 2007 (PN), as well as darker red bars are pre-service teachers joined since Fall 2006 (PO).

Comparing the login frequency across member types, pre-service teachers/new members (with darker colors) have higher login frequency ($M=292.4$ per member during whole semester) than pre-service teachers/old members ($M=14.1$ per member during whole semester), in-service teacher/new members ($M=9$ per member during whole semester), and in-service teachers/old members ($M=35.3$ per member during whole semester). Figure 4.1 provides a bar chart visualization to compare the total amount of members' login frequency across different member types. Among pre-service teachers, new members had higher login frequency which is at least partially attributable to having one of their field experience courses require a lot of interaction for course participation. Different from pre-service teachers, in-service teachers/new members had lower frequencies than old members had.

The darker colors of Table 4.1.3 show that pre-service teachers/new members have a total login frequency from 106 to 574 which is a lot more than the rest of three member types. To further examine different member types' login frequency, Table 4.1.4 shows the login frequency among in-service teachers. Most of in-service teachers started login in February, but did not continue coming back to the NETwork in April or May. Only 2 in-service teachers/old members kept logging-in through the last month of the semester.

Table 4.1.4
Login Frequency (Jan. to May 2007): In-service Teachers

Member ID	Login Time					Grand Total
	January 2007	February 2007	March 2007	April 2007	May 2007	
IN1		4				4
IN2		10	4			14
IO1		11	7			18
IO2		4	5	6	6	21
IO3	6	50	11			67
Grand Total	6	79	27	6	6	124



Note. a. Color shows count of Login Frequency. Darker color represents higher frequency of login to the NETwork, and vice versa. b. The text values show the count of the login frequency. c. The frequency ranges from 4 to 50.

Additionally, Table 4.1.5 shows pre-service teachers' login frequency. While all pre-service teachers/new members logged-in to NETwork for their course work and voluntary activities in NETwork, 18 out of 38 pre-service teachers/old members voluntarily logged-in during Spring 2007. However, only 2 old members kept logging-in for the entire 4 months of the semester, while 4 members logged-in for 3 months, 5 for 2 months, and 7 for only one of the five months.

Table 4.1.5
Login Frequency (Jan. to May 2007): Pre-service Teachers

Member ID	Login Time					Grand Total
	January 2007	February 2007	March 2007	April 2007	May 2007	
PN1	88	172	102	95	15	472
PN2	62	76	72	79	4	293
PN3	57	64	61	62	7	251
PN4	34	21	27	22	2	106
PN5	45	62	85	47	15	254
PN6	62	76	54	103	8	303
PN7	39	94	79	74	2	288
PN8	68	135	127	119	25	474
PN9	29	75	48	56	17	225
PN10	22	42	47	55		166
PN11	52	77	100	102	18	349
PN12	49	42	31	67	13	202
PN13	130	149	135	121	39	574
PN14	61	59	43	58	3	224
PN15	43	64	109	56	14	286
PN16	31	61	57	106	4	259
PN17	23	34	54	71	5	187
PN18	56	89	56	51	4	256
PN19	29	93	121	67	15	325
PN20	52	97	47	69	6	271
PN21	20	42	59	53	30	204
PN22	120	184	52	103		459
PN23	74	98	65	83	12	332
PN24	53	140	121	163	4	481
PN25	51	145	78	53	4	331
PN26	28	43	19	52		142
PN27	18	57	30	117	10	232
PN28	102	121	134	69	4	430
PN29	44	50	14	78	10	196
PN30	59	66	28	42		195
PO1		32	6			38
PO2	11	4		6		21
PO3			4			4
PO4		3	8	5		16
PO6	9	9	4	14		36
PO7	4	20		3	4	31
PO8		2	2			4
PO9		7				7
PO10		4				4
PO11		2	8	4		14
PO12		4				4
PO14	4					4
PO15		9		3		12
PO20		14	4	5		23
PO22		4	4			8
PO29		3				3
PO31			9			9
PO32		15		4		19
Grand Total	1,629	2,661	2,111	2,339	294	9,024

Note. a. Color shows count of Login Frequency. Darker color represents higher frequency of login to the NETwork, and vice versa. b. The text values show the count of the login frequency. c. The frequency ranges from 2 to 184.

Figure 4.2 provides a big picture view of members' login trajectories based on member types (diagram a) and individual members (diagram b). As shown in figure 4.2, in-service teachers/new members were found to have lowest login frequency and did not keep logging-in through the last month. Referring to the daily trajectory (Figure 4.3), the trajectories indicate that members' login frequency dropped during the spring break (March 24th to April 1st) and increased right after the break. Overall, the level (from high to low) of different types of members' login frequency was pre-service teachers/new members (PN), pre-service teachers/old members (PO), in-service teachers/old members (IO), and in-service teachers/new members (IN). More detailed trajectories for each member types are presented in Appendix 4-A.

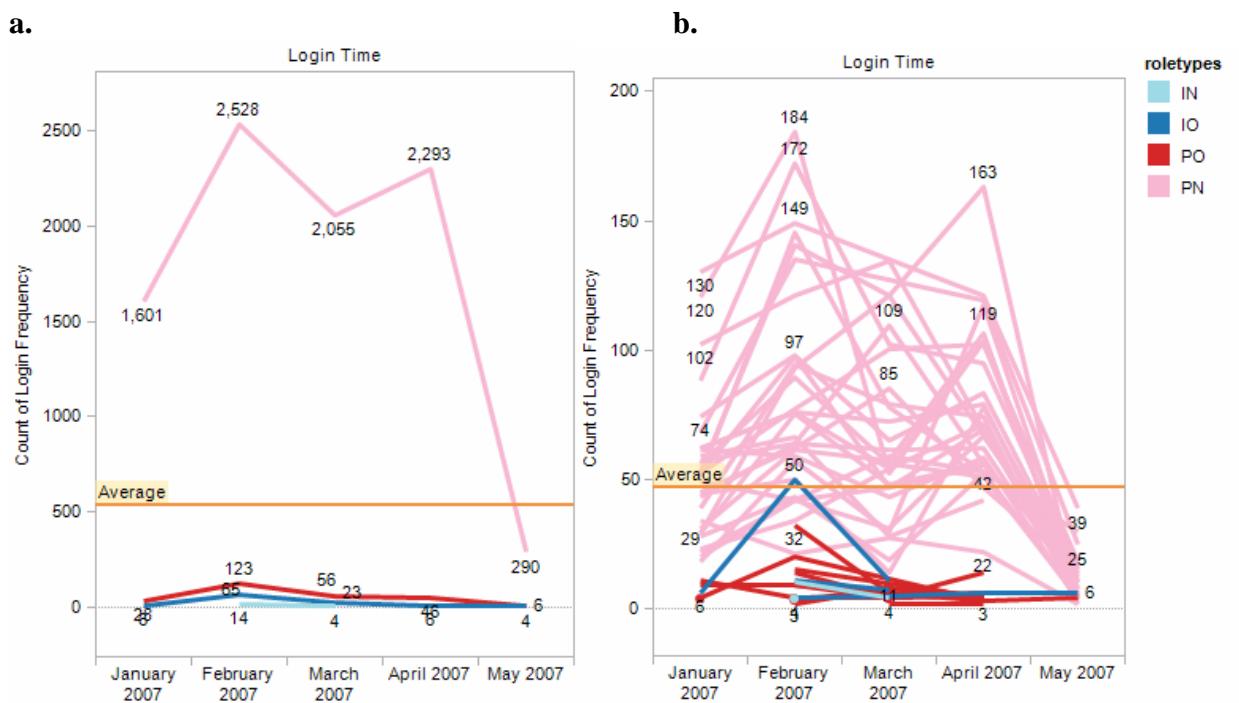


Figure 4.2. Monthly Trajectory of Login Frequency

Note. Lighter blue lines represent in-service teachers who joined NETwork since Spring 2007 (IN). Darker blue lines represent in-service teachers who joined NETwork since Fall 2006 (IO). Lighter red lines represent pre-service teachers who joined NETwork since Spring 2007 (PN), as well as darker red lines are pre-service teachers joined since Fall 2006 (PO).

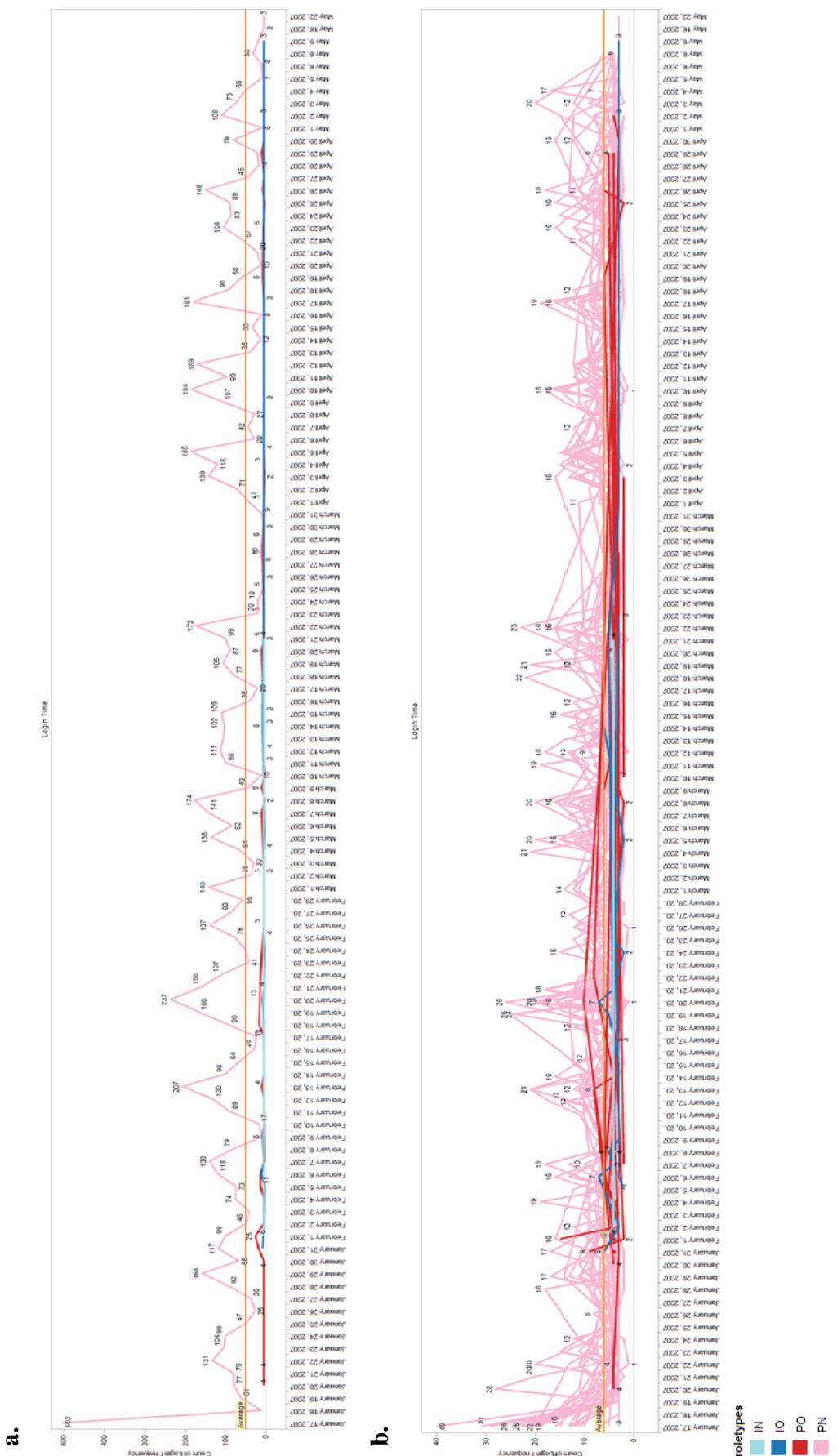


Figure 4.3. Daily Trajectory of Login Frequency

Note. Lighter blue lines represent in-service teachers who joined NETwork since Fall 2006 (IO). Lighter red lines represent pre-service teachers who joined NETwork since Spring 2007 (PN), as well as darker red lines are pre-service teachers joined since Fall 2006 (PO).

II.a.1. Participation in Discussion Board (Entire DB): Levels of Participation

This section describes participation and interaction level in the discussion board.

Table 4.1.6 presents the frequency of member activity classified into in-service teachers/new members (IN), in-service teachers/old members (IO), pre-service teachers/new members (PN), and pre-service teachers/old members (PO). In Table 4.1.6, darker colors indicate higher frequency of posting and reading messages and vice versa. Overall, members had more reading activity and less posting activity. The frequency of members' posting activity ranged from 1 to 106 and for reading activity was from 1 to 2,144. As shown in Table 4.1.7, members' posting frequency increased in the second month of the semester (from total posting frequency=170, $M=11.3$ per day in January to total posting frequency=600, $M=21.4$ per day) and later dropped slightly in March (total posting frequency=536, $M=17.3$ per day) and decreased again in April (total posting frequency=376, $M=12.5$ per day) and May 2007 (total posting frequency=11, $M=1.6$ per day). Similar to members' posting activity, members' reading activity increased in February (from total reading frequency=811, $M=54.1$ per day in January to total reading frequency =11,098, $M=396.4$) and dropped in March (total reading frequency=9,683, $M=312.4$) and April (total reading frequency=6,447, $M=214.9$) and decreased again in May 2007 (total reading frequency=335, $M=47.9$).

Table 4.1.6
Participation Frequency in DB (Entire DB)

Member ID	Posting Messages	Reading Messages
IN1		5
IN2		22
IO1	1	28
IO2	7	87
IO3	22	413
PN1	35	889
PN2	84	768
PN3	29	175
PN4	26	550
PN5	57	862
PN6	52	966
PN7	78	1,867
PN8	46	804
PN9	45	494
PN10	57	762
PN11	62	859
PN12	44	581
PN13	93	1,440
PN14	72	1,058
PN15	31	2,144
PN16	53	847
PN17	61	1,053
PN18	57	519
PN19	55	1,524
PN20	55	823
PN21	15	196
PN22	64	954
PN23	46	625
PN24	89	1,201
PN25	57	1,206
PN26	17	189
PN27	50	920
PN28	106	1,249
PN29	47	1,209
PN30	49	552
PO1	1	20
PO2	7	56
PO3	1	32
PO4	1	37
PO6	2	38
PO7	12	288
PO8	1	17
PO9	2	23
PO10	1	15
PO11	1	61
PO12		6
PO13		1
PO14		1
PO15		3
PO31	2	6
Grand Total	1,693	28,445

Note. a. Color shows count of Frequency. Darker color represents higher frequency of interaction, and vice versa. b The text values show the count of the frequency of interaction. c. The frequency ranges from 1 to 2144.

Table 4.1.7
Monthly Participation Frequency in DB (Entire DB)

Member ID	Posting Messages					Grand Total	Reading Messages					Grand Total
	January 2007	February 2007	March 2007	April 2007	May 2007		January 2007	February 2007	March 2007	April 2007	May 2007	
IN1							5					5
IN2							22					22
IO1		1				1		28				28
IO2		7				7		3	53	13	18	87
IO3	3	18	1			22	10	376	27			413
PN1	5	20		10		35	28	550	99	212		889
PN2	4	33	21	26		84	25	228	219	296		768
PN3	7	8	8	6		29	16	29	89	41		175
PN4	6	3	10		7	26	37	167	220		126	550
PN5	8	16	22	11		57	27	431	246	150	8	862
PN6	6	19	17	10		52	27	490	341	108		966
PN7	4	31	26	17		78	18	759	683	403	4	1,867
PN8	6	29	9	2		46	55	547	183	19		804
PN9	5	17	18	5		45	20	240	191	43		494
PN10	4	19	27	7		57	24	228	413	97		762
PN11	4	8	36	14		62	16	89	546	206	2	859
PN12	3	7	7	26	1	44	9	109	95	332	36	581
PN13	14	31	40	8		93	59	622	513	246		1,440
PN14	12	21	22	17		72	45	396	445	172		1,058
PN15	1	10	16	4		31	2	225	1,562	355		2,144
PN16	1	14	15	23		53		232	294	321		847
PN17	6	5	10	40		61	42	123	189	688	11	1,053
PN18	7	23	17	10		57	18	202	202	97		519
PN19		24	25	6		55		664	765	105		1,524
PN20	5	27	14	9		55	21	445	228	127	2	823
PN21	4	8		2	1	15	10	84	15	60	27	196
PN22	5	23	21	15		64	28	466	266	194		954
PN23	3	18	19	6		46	15	242	258	110		625
PN24	11	30	34	14		89	40	559	416	186		1,201
PN25	8	32	17			57	97	889	220			1,206
PN26	3	9		5		17	1	67		121		189
PN27	3	15	10	22		50	10	390	186	307	27	920
PN28	9	36	50	11		106	46	545	503	155		1,249
PN29	5	13		29		47	43	155		1,011		1,209
PN30	5	19	9	16		49	19	272	111	150		552
PO1		1				1		17	3			20
PO2	2	1		4		7	1	6		35	14	56
PO3				1		1					13	13
PO4			1			1			9	28		37
PO6	1	1				2	1	11		26		38
PO7		10			2	12		189		1	46	236
PO8			1			1			7	10		17
PO9			2			2			23			23
PO10		1				1		15				15
PO11			1			1			39	22		61
PO12								6				6
PO13										1		1
PO14							1					1
PO15								3				3
PO31			2			2			6			6
Grand Total	170	600	536	376	11	1,693	811	11,098	9,683	6,447	335	28,374

Note. a. Color shows count of Frequency. Darker color represents higher frequency of interaction, and vice versa. b. The text values show the count of the frequency of interaction. c. The frequency ranges from 1 to 50 for posting messages & 1 to 1562 for reading messages.

Comparing posting frequency across member types, pre-service teachers/new members (with darker colors) showed higher posting frequency ($M=54.4$ per member during whole semester) than pre-service teachers/old members ($M=2.8$ per member during whole semester), in-service teacher/new members ($M=0$ per member during whole semester), and in-service teachers/old members ($M=10$ per member during whole semester). Similarly, pre-service teachers/new members have higher reading frequency ($M=909.5$ per member during whole semester) than pre-service teachers/old members ($M=40.3$ per member during whole semester), in-service teacher/new members ($M=13.5$ per member during whole semester), and in-service teachers/old members ($M=176$ per member/per semester). Figure 4.4 and 4.5 provide bar chart visualizations to compare the amount of members' posting and reading frequency across different member types. Pre-service teachers/new members had higher posting and reading frequency than the other member types.

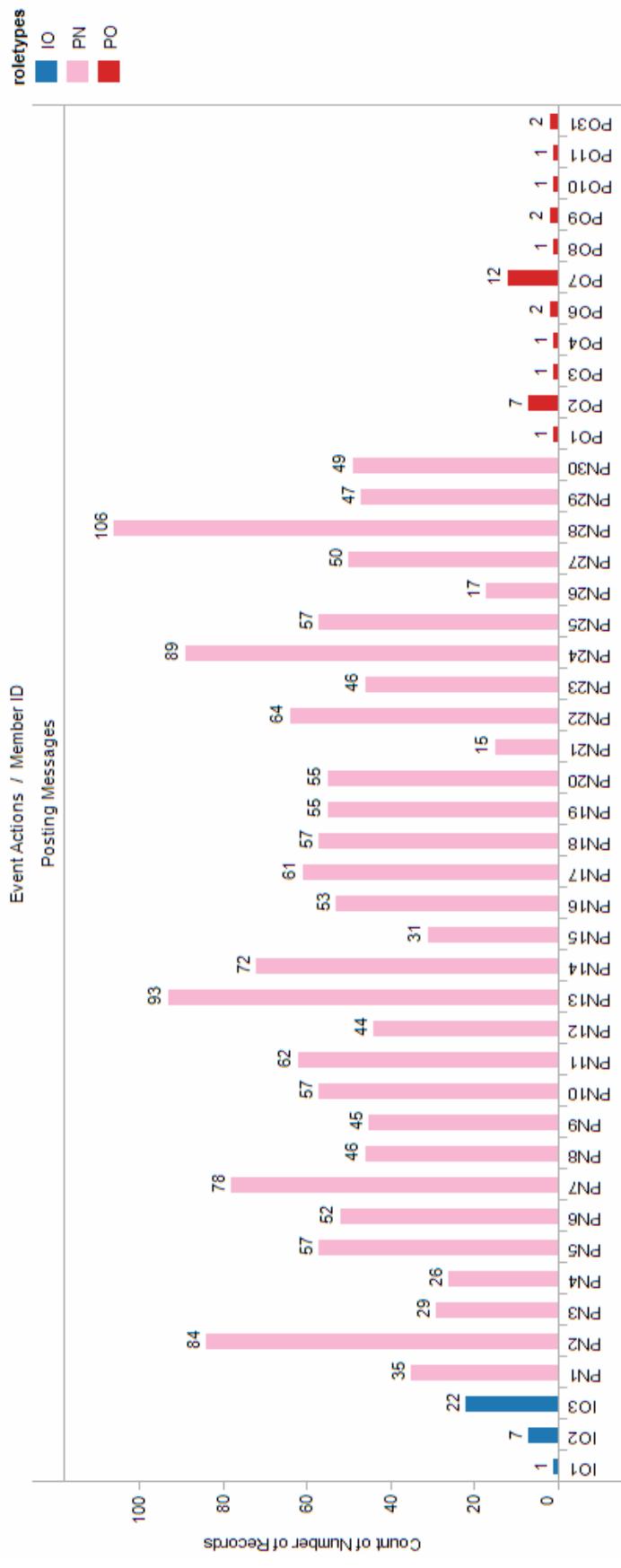


Figure 4.4. Comparison of Posting Frequency in DB (Entire DB)

Note. Lighter blue bars represent in-service teachers who joined NETwork since Spring 2007 (IN). Darker blue bars represent pre-service teachers who joined NETwork since Fall 2006 (IO). Lighter red bars represent pre-service teachers who joined NETwork since Spring 2007 (PN), as well as darker red bars are pre-service teachers joined since Fall 2006 (PO).



Figure 4.5. Comparison of Reading Frequency in DB (Entire DB)

Note. Lighter blue bars represent in-service teachers who joined NETwork since Spring 2007 (IN). Darker blue bars represent pre-service teachers who joined NETwork since Fall 2006 (PO). Lighter red bars represent in-service teachers who joined NETwork since Spring 2007 (IN). Darker red bars represent pre-service teachers joined since Fall 2006 (PO).

Figures 4.6 and 4.7 present an overview of members' posting and reading trajectories based on member types (diagram a) and individual members (diagram b). As shown in Figure 4.6, in-service teachers/new members did not post any messages and in-service teachers/old members had higher posting activity than pre-service teachers/old members, while pre-service teachers/new members had higher posting frequency than other member types. However, in-service teachers/old members were found to only post messages from January to March 2007, while pre-service teachers posted messages throughout the semester. The trajectories also indicate that members have more posting activities in February but dropped gradually in the following months

By examining the daily trajectories shown in Appendix 4-B, it was found that in-service teachers' posting activities stopped right before the spring break (March 24th to April 1st) while pre-service teachers' posting and reading activities still carried on after the spring break. As shown in Appendix 4-C, in-service teachers/old members still read messages after spring break, but the activity level was lower than before spring break. Also, in-service teachers/new members' only read messages in early February. Overall, the level (from high to low) of posting frequency by member types was pre-service teachers/new members (PN), in-service teachers/old members (IO), pre-service teachers/old members (PO), and in-service teachers/new members (IN), as well as the ranking of reading frequency was PN, PO, IO, and IN. More detailed reports of posting and reading frequency for each member type are presented in Appendix 4-B and 4-C.

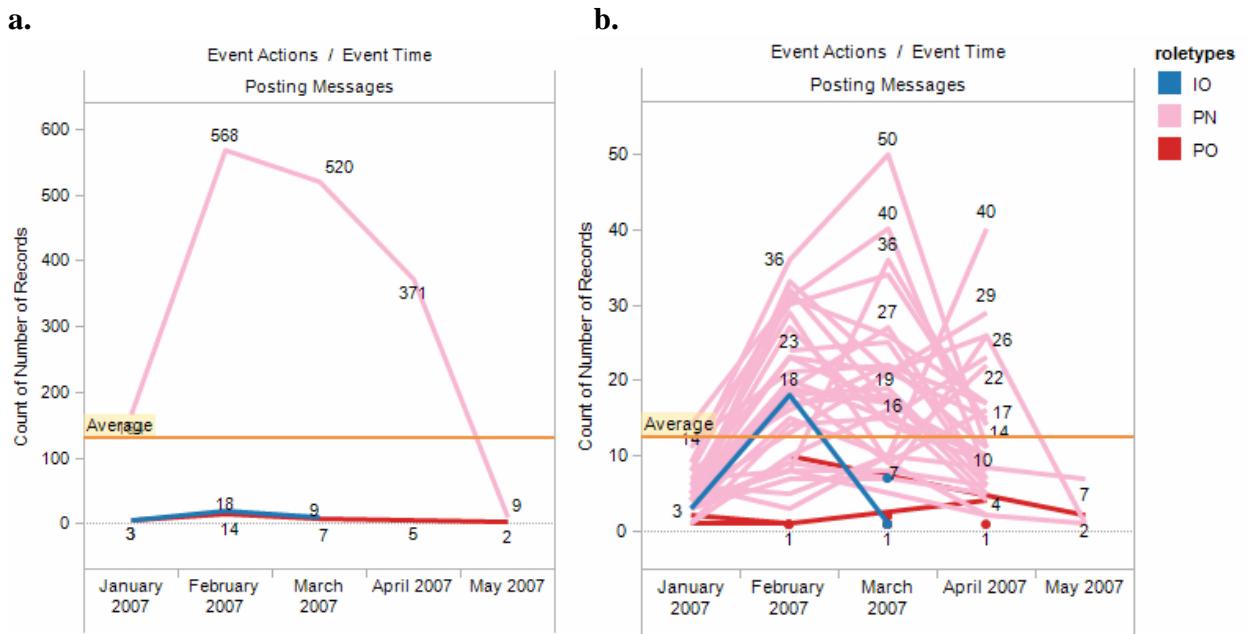


Figure 4.6. Monthly Trajectory of Posting Frequency in DB (Entire DB)

Note. Lighter blue lines represent in-service teachers who joined NETwork since Spring 2007 (IN). Darker blue lines represent in-service teachers who joined NETwork since Fall 2006 (IO). Lighter red lines represent pre-service teachers who joined NETwork since Spring 2007 (PN), as well as darker red lines are pre-service teachers joined since Fall 2006 (PO)

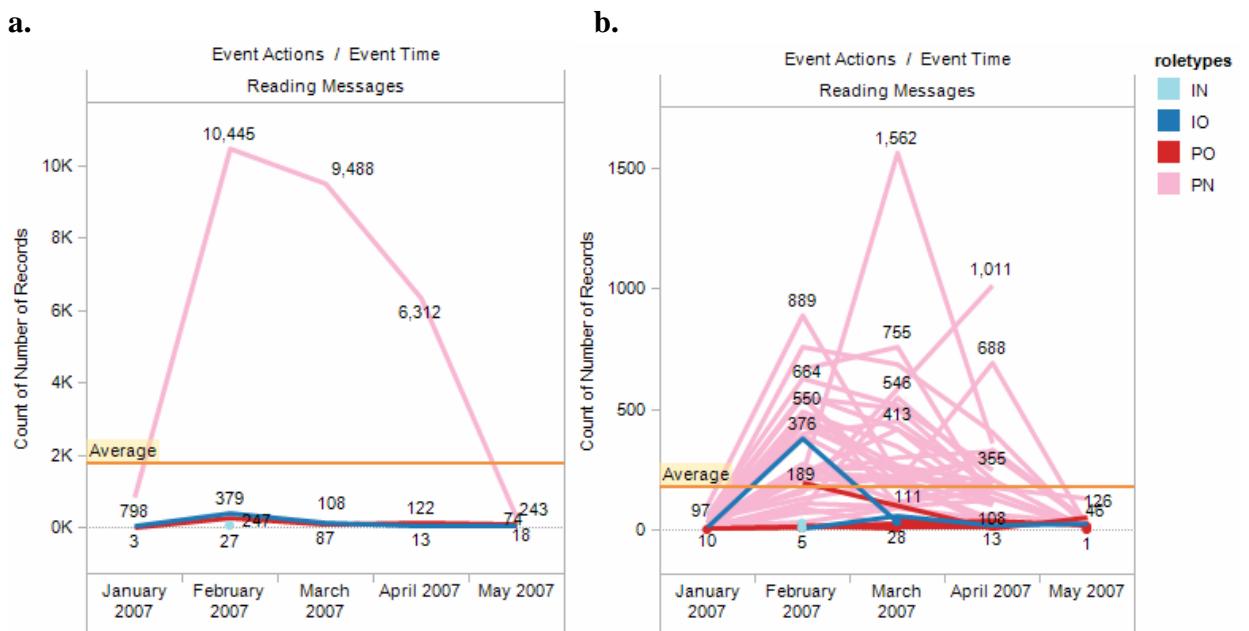


Figure 4.7. Monthly Trajectory of Reading Frequency in DB (Entire DB)

Note. Lighter blue lines represent in-service teachers who joined NETwork since Spring 2007 (IN). Darker blue lines represent in-service teachers who joined NETwork since Fall 2006 (IO). Lighter red lines represent pre-service teachers who joined NETwork since Spring 2007 (PN), as well as darker red lines are pre-service teachers joined since Fall 2006 (PO)

II.a.2. Participation in Discussion Board (Entire DB): Patterns of Participation

Social network analysis was undertaken using the interaction frequency information generated from Tableau®, building social NETwork diagrams with NetDraw®, and calculating statistical results with Ucinet®. Social NETwork analysis is being reported in this section to explain members' patterns of participation across all the DB discussions. Refer to Appendix 4-D and 4-E, for detailed accounts of message reading behavior linking reader to poster. The in-service teachers and the pre-service teachers both tended to read messages posted by the lead professor (IS1). Only five out of fifteen pre-service teachers/old member did not read the messages from the lead professor (IS1). Also, two in-service teachers/old members who had higher levels of interaction with others generally read the messages from all member types. However, the pre-service teachers/new members were found to have more interaction within the group. Most of them also read messages posted by pre-service teachers/old members, but had most interaction with 3 particular members (PO2, PO6, and PO7).

Compared to pre-service teachers/new members, pre-service teachers/old members had less reading activity. The 3 particular PO members who were read most by pre-service teachers/new members were found to have more reading activities than the rest of pre-service teachers/old members. Also, some pre-service teachers/old members (PO1, PO3, and PO10) were found to read other members' postings, but other members' rarely read the posts of these three members. Additionally, some pre-service teachers/old members (PO12, PO13, PO14, and PO15) and the in-service teachers/new members (IN1 and IN2) did not post any messages but did read others messages, which indicates lurking behaviors in the community. Last, PO31 only read the messages posted by other

pre-service teachers/old members, which might indicate a lack of interest in interacting with unfamiliar others.

Figure 4.8 shows how different types of members interacted with other member types. Each node of the diagram represents one member and each color represents one type of member (refer to the note of the figure). The size of nodes represents number of members' posting activity and the linking lines (ties) represent members' reading activity. Also, the lines between a pair of nodes indicate interaction between two members, with the gray lines indicating a one-way interaction and the black lines showing reciprocal interaction. The direction of arrows shows who received information from whom. For example, an outgoing arrow from IS1 to IO1 means IO1 read IS1's message. As shown in Figure 4.8, pre-service teachers/new members had many posting and reading activities. Most of pre-service teachers/new members have bigger nodes while most of pre-service teachers/old members have smaller nodes. Also, one of the in-service teachers/old members (IO3) posted many messages and read many messages from pre-service teachers/new members. Similar to IO3, PO7 and PO2 also read many messages posted by pre-service teachers/new members. These three members had the most interaction with members in PN group. The rest of old members (IO & PO) had lower reading and fewer posting activities. Additionally, there were a lot of one-way gray lines from PO, IO, and IN to PN, which indicate that pre-service teachers/new members read a lot of these groups' messages although they only posted few messages. Compared to the overall interaction in NETwork, the interaction among pre-service teachers/new members were more reciprocal, while pre-service teachers/old members (PO) and in-service teachers/old members (IO) were shown to be less reciprocal within their groups.

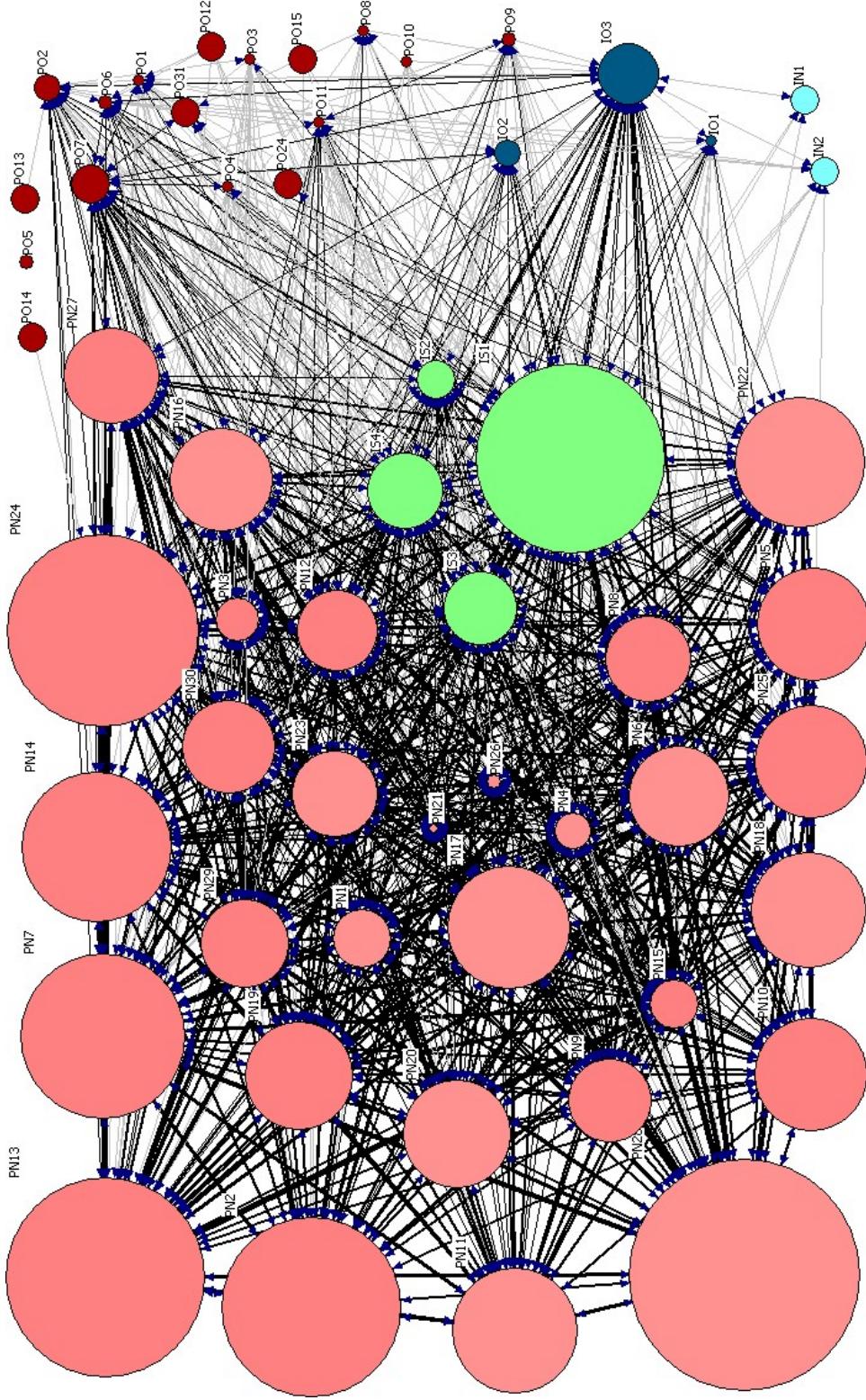


Figure 4.8. Interaction Patterns Diagram for Discussion Board (Entire DB)

Note. a. Each node of the diagram represented one member and each color represented one type of members. b. Lighter blue nodes represent in-service teachers/new members (IN). Darker blue nodes represent in-service teachers/old members (IO). Lighter red nodes represent pre-service teachers/new members (PN), as well as darker red nodes for pre-service teachers/old members (PO). Green color nodes represent instructors (IS)c. The lines between a pair of nodes indicated interaction between two members, and the gray lines indicated the one-way interaction as well as black lines were reciprocal interaction.

The statistical results from Ucinet@ show the density of the social network was 10.24 ($SD=18.00$) which indicates a fully dense network (network density >1) meaning that members connected to other members frequently. Table 4.1.8 presents the centrality scores and density derived from social network analysis. As shown in Table 4.1.8, members' out-degree (the degree to which other members read one's posts) varied between 0 and 1983 ($M=534.52$, $SD=532.58$), and in-degree (the degree to which the member read other members messages) was between 1 and 1947 ($M=534.52$, $SD=511.78$). The members with both high out-degree and high in-degree in the entire discussion board were PN28, PN13, PN24, PN14, PN7, PN25, PN6, and PN9. Eleven members, including PO31, PO8, PO3, IN3, PO13, PO12, PO4, PO14, PO15, PO10, and IN1, had an out-degree of less than 10, indicating that they contributed little to the discussion because few of their messages were read by others. Also, six members (PO31, PO13, PO12, PO14, PO15, and IN1) had in-degrees of less than 10 showing little reading activity and a peripheral or passive participation in the discussion. These six members' out-degree were also less than 10, meaning they were not only passive but also ignored by other members (no members read their messages).

Forty-two members were classified as information carriers because their in-degree and out-degree were larger than 0, and eight members whose out-degree was equal to 0 but in-degree was larger than 0 were identified as information receivers. Most of the receivers were pre-service teachers/old members and in-service teachers/new members. Pre-service teachers/new members who were the group that had higher out-degree and in-degree showed relatively higher levels of exchanging information. Although the in-degree and out-degree were not as high as that for pre-service teachers/new members,

some of the pre-service teachers/old members (PO7, PO2, PO6, PO9, PO11, and PO1) and few in-service teachers/old members (IO3, IO2, and IO1) also had roughly equivalent in-degree and out-degree, meaning that they read others' messages as well as others read their messages. The network centralization shows that the out-degree centralization is a little higher than the in-degree centralization ($17.44\% > 17.00\%$). This shows that on a relative basis when looking at who was read (who was influential) some members stood out, but that when looking at who was reading the reading behavior was more equally distributed across the members.

Last, a sub-group diagram presented in Appendix 4-F shows how members interact with each other and formed interaction groups naturally. In the interaction tree, many cliques were formed using members' density of interaction as a basis for identifying a clique. The cut-off lines (i.e. a, b, c, and d lines in Appendix 4-F) are indicators of sub-groups. For example, PN18, PN10, PN19, PN30, PN29, PN7, PN20, PN2, IO3, PN25, PN5, PN15, PN13, PN22, PN24, and PO7 formed a small group based on the cut-off line a, and so on.

Table 4.1.8
Social network analysis indices (Entire DB discussion)

Members	Out-degree		In-degree	
	Rank	(M=534.52, SD=532.58)	Rank	(M=534.52, SD=511.78)
PN28	1	1983	5	1192
PN13	2	1847	4	1365
PN24	3	1546	7	1132
PN14	4	1417	10	1002
PN7	5	1183	2	1751
PN2	6	1162	20	734
PN25	7	1131	6	1143
PN6	8	1117	11	913
PN22	9	1061	12	899
PN18	10	1044	26	493
PN5	11	1016	16	818
PN11	12	1000	15	829
PN8	13	891	19	760
PN10	14	843	21	722
PN9	15	840	27	464
PN20	16	834	18	768
PN1	17	749	14	849
PN23	18	746	22	600
PN30	19	738	24	517
PN19	20	728	3	1440
PN16	21	688	17	814
PN12	22	573	23	535
PN27	23	550	13	887
PN3	24	432	32	162
PN17	25	414	9	1015
PN29	26	403	8	1109
PN15	27	401	1	1947
PN4	28	339	25	500
IO3	29	301	28	356
PN21	30	247	30	187
PN26	31	163	31	184
PO7	32	138	29	244
PO2	33	47	35	51
IO2	34	45	33	75
PO6	35	33	36	32
PO9	36	18	40	22
PO11	37	16	34	58
PO1	38	11	41	18
IO1	39	10	39	23
PO31	40	9	45	6
PO8	41	8	42	14
PO3	42	4	38	28
IN2	43	0	43	13
PO13	43	0	49	1
PO12	43	0	46	5
PO4	43	0	37	30
PO14	43	0	49	1
PO15	43	0	48	3
PO10	43	0	44	11
IN1	43	0	47	4
Network Centralization (Out-degree)		17.44%		
Network Centralization (In-degree)		17.00%		
Network Density		10.24 (SD=18.00)		

Note. N=50

II.b.1. Participation in Discussion Board (FE & NETwork only): Levels of Participation

This section describes participation and interaction levels for the discussion activities in the Field Experience Weekly Discussion and NETwork Weekly Discussion forums. These data are comparable to the entire discuss board activity minus the extended class discussion data. Table 4.1.9 presents the frequency of member activity classified into IN, IO, PN, and PO. In Table 4.1.9, darker colors indicate higher frequency of posting and reading messages, and vice versa. Overall, members had more reading activity and less posting activity, which is similar to the results when not excluding the extended class discussion activities. The total frequency of members' posting activity ranged from 1 to 59 as well as reading activity was from 1 to 2,021. Compared to the levels of participation across all DB activity, the frequency decreased substantially (from 1-106 to 1-59 for posting messages and from 1-2,144 to 1-2,021 for reading activities). Including the extended class discussion substantially increased the difference in levels of participation for those required to participate over those not required to participate.

As shown in Table 4.1.10, members' posting frequency increased in the second month of the semester (from total posting frequency=63, M=4.2 per day in January to total posting frequency=365, M=13.0 per day), but later dropped in March (total posting frequency=310, M=10.0 per day) and more in April (total posting frequency=141, M=4.7 per day) and May 2007 (total posting frequency=10, M=1.4 per day). Similar to the tendencies seen in posting activities, members' reading frequency increased in February (from total reading frequency=90, M=6 per day in January to total reading frequency =4,282, M=152.9) and March (total reading frequency=5,575, M=179.8 per day), but dropped in April (total reading frequency=2,843, M=94.8) and more in May (total

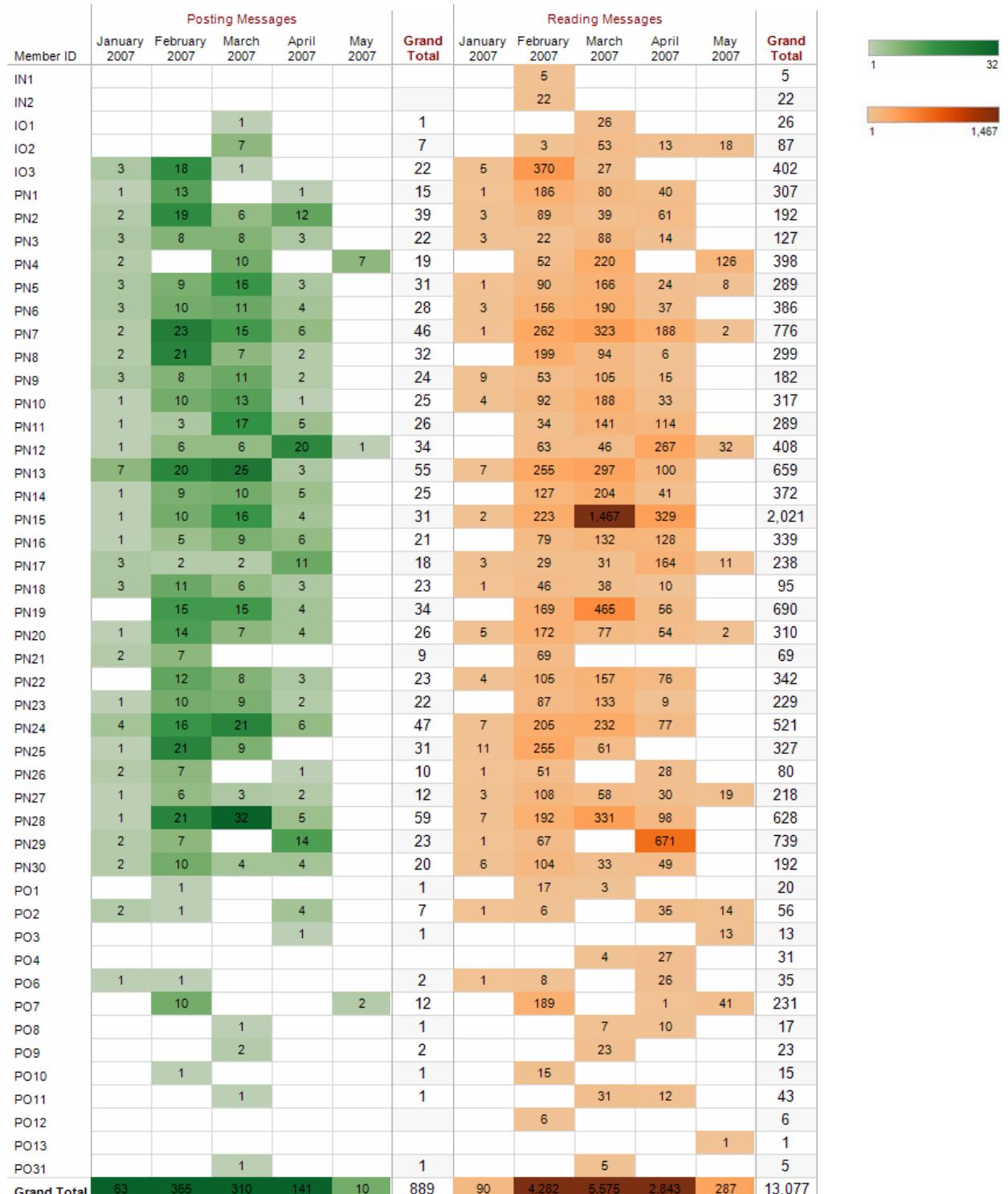
reading frequency=287, M=41). When only examining FE and NETwork Discussion Topics, the trajectory of members' posting activity remained the same, but reading activity increased in March which dropped when considering the entire discussion board activity.

Table 4.1.9
Participation Frequency in DB (FE & NETwork only)

Member ID	Posting Messages	Reading Messages
IN1		5
IN2		22
IO1	1	26
IO2	7	87
IO3	22	402
PN1	15	307
PN2	39	192
PN3	22	127
PN4	19	398
PN5	31	289
PN6	28	386
PN7	46	776
PN8	32	299
PN9	24	182
PN10	25	317
PN11	26	289
PN12	34	408
PN13	55	659
PN14	25	372
PN15	31	2,021
PN16	21	339
PN17	18	238
PN18	23	95
PN19	34	690
PN20	26	310
PN21	9	69
PN22	23	342
PN23	22	229
PN24	47	521
PN25	31	327
PN26	10	80
PN27	12	218
PN28	59	628
PN29	23	739
PN30	20	192
PO1	1	20
PO2	7	56
PO3	1	32
PO4		31
PO6	2	35
PO7	12	272
PO8	1	17
PO9	2	23
PO10	1	15
PO11	1	43
PO12		6
PO13		1
PO31	1	5
Grand Total	889	13,137

Note. a. Color shows count of Frequency. Darker color represents higher frequency of interaction, and vice versa. b The text values show the count of the frequency of interaction. c. The frequency ranges from 1 to 2021

Table 4.1.10
Monthly Participation Frequency in DB (FE & NETwork only)



Note. a. Color shows count of Frequency. Darker color represents higher frequency of interaction, and vice versa. b. The text values show the count of the frequency of interaction. c. The frequency ranges from 1 to 32 for posting messages and 1 to 1467 for reading messages.

Comparing posting frequency across member types, pre-service teachers/new members showed higher posting frequency ($M=27.7$ per member/per semester) than pre-service teachers/old members ($M=2.2$ per member/per semester), in-service teacher/new members ($M=0$ per member/per semester), and in-service teachers/old members ($M=10$ per member/per semester). Similarly, pre-service teachers/new members have higher reading frequency ($M=401.3$ per member/per semester) than pre-service teachers/old members ($M=42.8$ per member/per semester), in-service teacher/new members ($M=13.5$ per member/per semester), and in-service teachers/old members ($M=171.7$ per member/per semester). The ranking of members' posting and reading frequency remained the same with the ranking of considering the entire discussion board activity.

Figure 4.9 and 4.10 provide bar chart visualizations to compare the total amount of members' posting and reading frequency across different member types. Pre-service teachers/new members had higher posting and reading frequency than the other member types. Examining Figure 4.9 and 4.10 shows some pre-service teachers/old members only posted one or two messages but did have higher levels of reading posts, and some in-service teachers/new members did not post anything but did read some messages. Additionally, when only examining both FE and NETwork Discussion Topics, pre-service teachers/new members' posting and reading activity dropped about 50%, while other members (PO, IN, IO) remained the same or with only slight changes.

Table 4.1.11
Comparison of Members' Average Activities during the Whole Semester

Included Discussion Activities		PN	PO	IN	IO
Posting Activities	Entire DB discussion	54.4 (1)	2.8 (3)	0 (4)	10 (2)
	FE & NETwork Only	27.7 (1)	2.2 (3)	0 (4)	10 (2)
Reading Activities	Entire DB discussion	909.5 (1)	40.3 (3)	13.5 (4)	176 (2)
	FE & NETwork Only	401.3(1)	42.8 (3)	13.5 (4)	171.7 (2)

Note. Values with in the brackets present the ranking order; 1 to 4 indicates high to low.

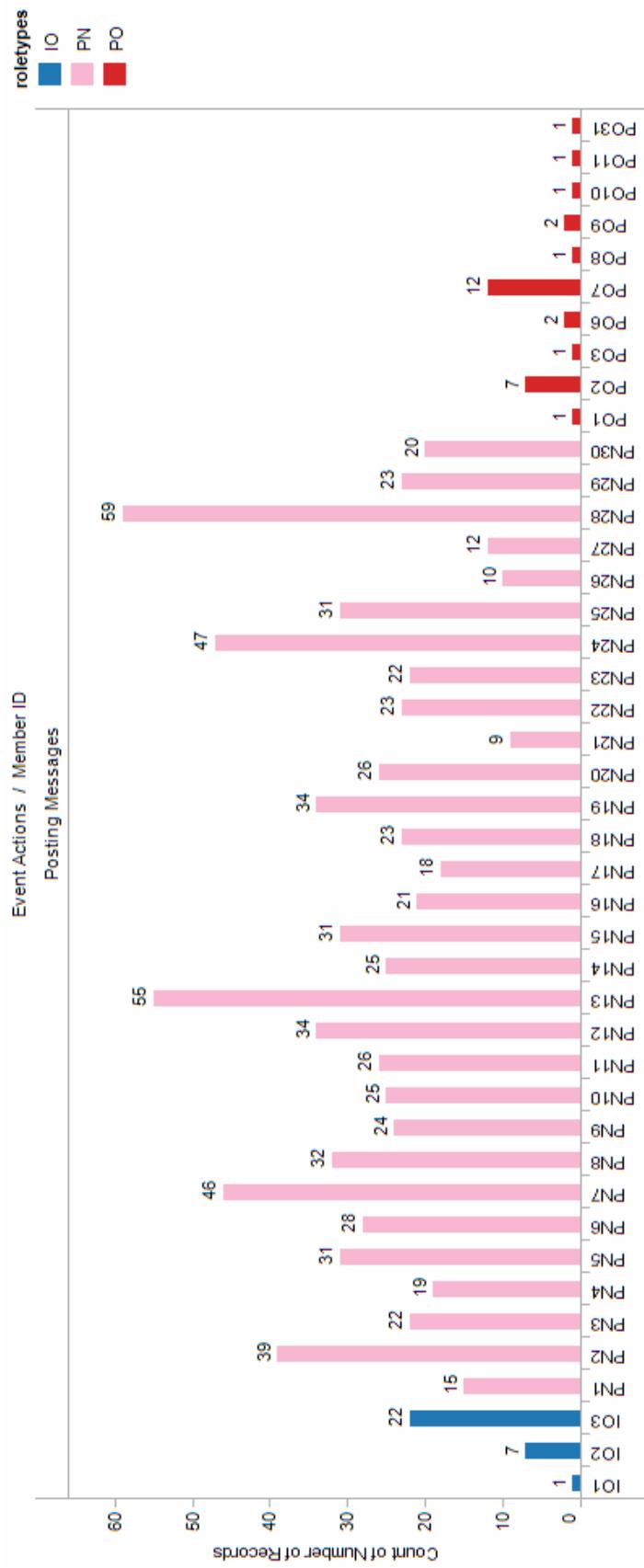


Figure 4.9. Comparison of Posting Frequency in DB (FE & NETwork only)
Note. Lighter blue bars represent in-service teachers who joined NETwork since Spring 2007 (IN). Darker blue bars represent pre-service teachers who joined NETwork since Fall 2006 (IO). Lighter red bars represent in-service teachers who joined NETwork since Spring 2007 (PN), as well as darker red bars are pre-service teachers joined since Fall 2006 (PO).

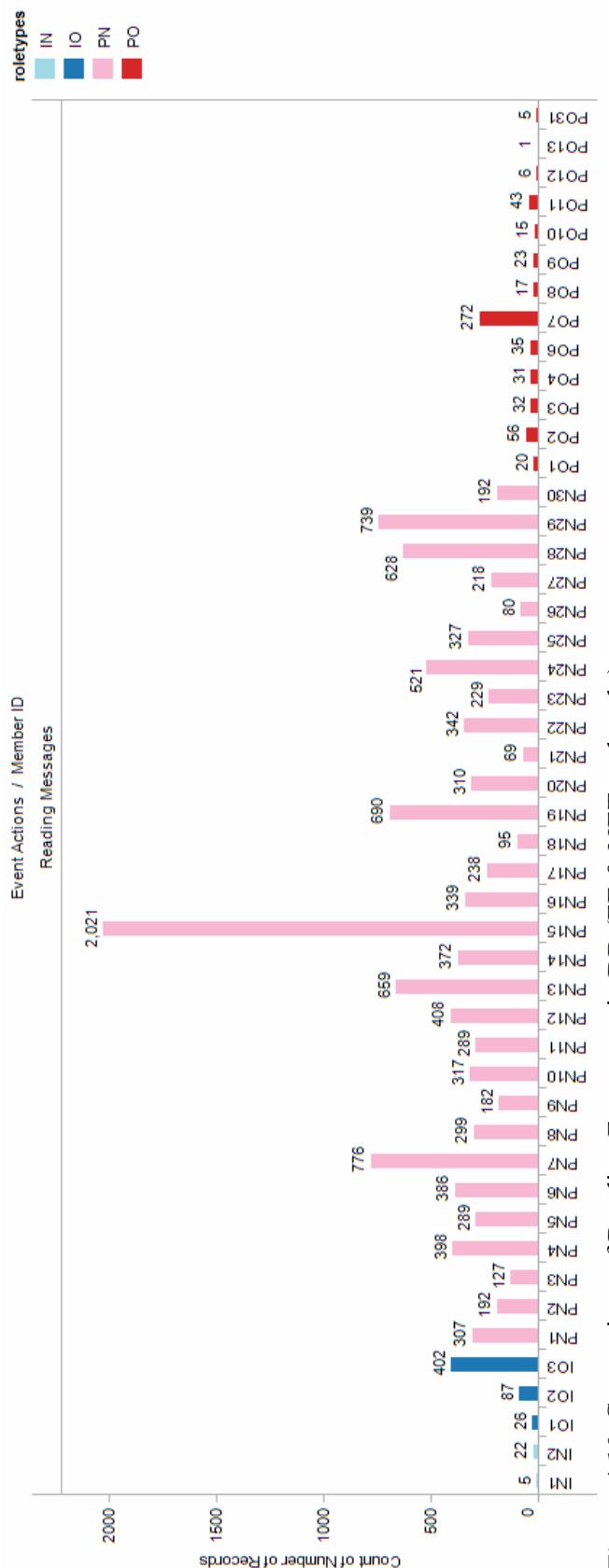


Figure 4.10. Comparison of Reading Frequency in DB (FE & NETwork only)
 Note. Lighter blue bars represent in-service teachers who joined NETwork since Spring 2007 (IN). Darker red bars represent pre-service teachers who joined NETwork since Fall 2006 (IO). Lighter red bars represent pre-service teachers who joined NETwork since Spring 2007 (PN), as well as darker red bars are pre-service teachers joined since Fall 2006 (PO).

Figure 4.11 and 4.12 present an overview of members' posting and reading trajectories based on member types (diagram a) and individuals (diagram b). As shown in Figure 4.11, in-service teachers/new members had no posting activity and in-service teachers/old members on average had higher posting activity than pre-service teachers/old members, while pre-service teachers/new members had higher posting frequency than all other member types. However, in-service teachers/old members only posted messages from January to March 2007, while all pre-service teachers posted throughout the semester. The trajectories also indicate that members have the most posting activity in February but the frequency of posting activity decreased gradually in the following months.

By examining the daily trajectories shown in Appendix 4-G, it was found that in-service teachers' posting activity stopped right before spring break (March 24th to April 1st) while pre-service teachers' posting and reading activity carried on after the spring break. As shown in Appendix 4-H, in-service teachers/old members still read messages after spring break, but the level of activity was lower than before spring break. Also, in-service teachers/new members' only read messages in early February. Overall, the level (from high to low) of different types of members' posting frequency was pre-service teachers/new members (PN), in-service teachers/old members (IO), pre-service teachers/old members (PO), and in-service teachers/new members (IN), and the ranking of reading frequency was PN, IO, PO, and IN. The level of posting and reading frequency across different types of members was the same as when considering the entire DB discussion. More detailed trajectories of posting and reading frequency for each member type are presented in Appendix 4-G and 4-H.

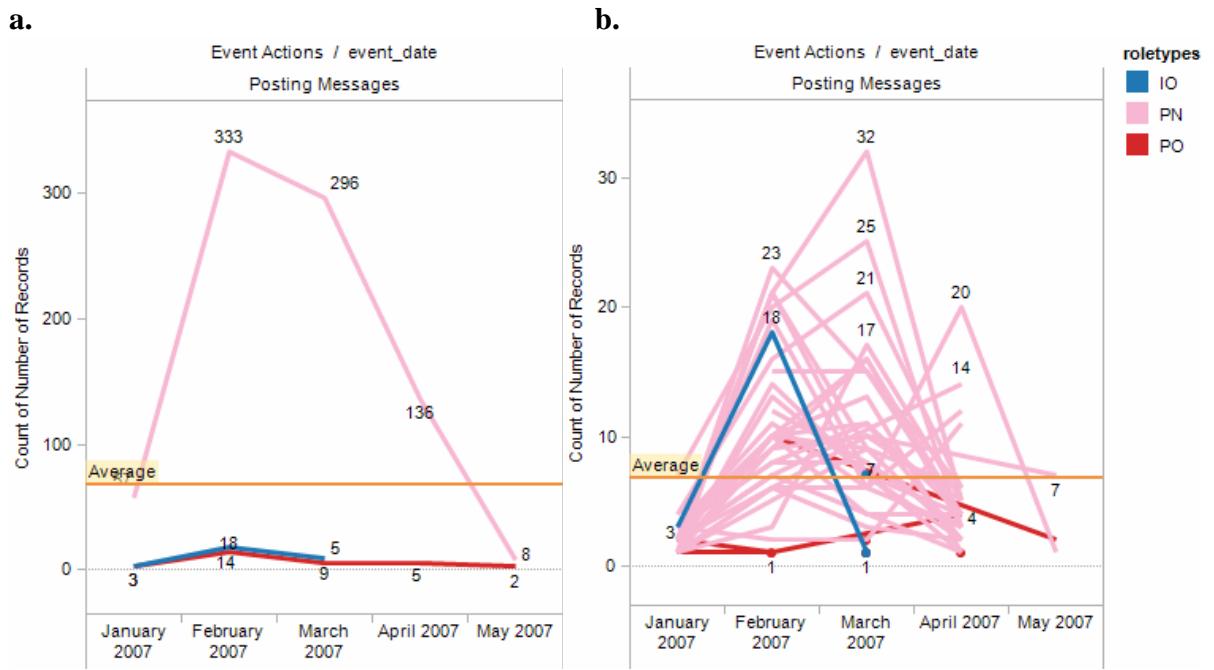


Figure 4.11. Monthly Trajectory of Posting Frequency in DB (FE & NETwork only)
Note. Lighter blue lines represent in-service teachers who joined NETwork since Spring 2007 (IN). Darker blue lines represent in-service teachers who joined NETwork since Fall 2006 (IO). Lighter red lines represent pre-service teachers who joined NETwork since Spring 2007 (PN), as well as darker red lines are pre-service teachers joined since Fall 2006 (PO)

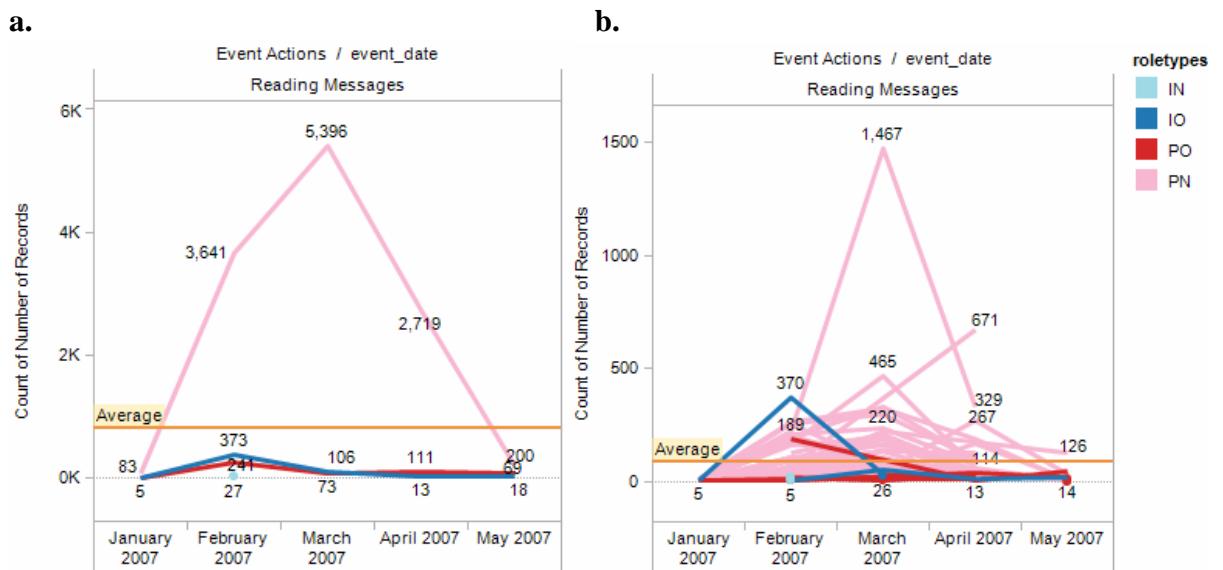


Figure 4.12. Monthly Trajectory of Reading Frequency in DB (FE & NETwork only)
Note. Lighter blue lines represent in-service teachers who joined NETwork since Spring 2007 (IN). Darker blue lines represent in-service teachers who joined NETwork since Fall 2006 (IO). Lighter red lines represent pre-service teachers who joined NETwork since Spring 2007 (PN), as well as darker red lines are pre-service teachers joined since Fall 2006 (PO)

II.b.2. Participation in Discussion Board (FE & NETwork only): Patterns of Participation

The number of messages members read from particular other members is presented in Appendix 4-I and 4-J. After excluding the discussion activity from the extended class discussion for the Mathematic field experience course, the overall level of interaction among pre-service teachers/new members was reduced. For example, the interaction frequency between PN15 and PN13 dropped from 173 to 164, PN19 and PN20 decreased from 44 to 10, and so on. Of note is that the interaction frequency from pre-service teachers/old member and in-service teachers to other members did not change much. Excluding the extended class discussion shows how members interacted when most of the activities were not required. Compared to the interaction including the extended class discussion, the overall interaction patterns did not change much except for the level of interaction among pre-service teachers/new members.

Overall, in-service teachers tended to read messages initiated by the lead professor (IS1). Also, the two in-service teachers/old members who had the highest interaction levels with others read the messages from all member type. However, the pre-service teachers/new members had the most intensive interaction within their group. Most of them also read messages posted by pre-service teachers/old members, but had the most interaction with 3 particular members (PO2, PO6, and PO7). Compared to pre-service teachers/new members, pre-service teachers/old members read fewer posts. The 3 PO members who were read most by pre-service teachers/new members also had more reading activities than the other pre-service teachers/old members. Some pre-service teachers/old members (PO1, PO3 and PO10) did read other members' postings, but were rarely read by other members. The extreme case was PO10 who had none of his/her

messages read. Also, PO4 read others' messages but never posted to the discussion board, which is characterized as lurking behavior in a community. Last, two pre-service teachers/old members (PO13 and PO31) had no interaction with other member types. They only read the messages posted by other pre-service teachers/old members.

The social network diagram presented in Figure 4.13 and the statistical results in Table 4.1.12 illustrate the relationships among members. The size of nodes represents number of members' posting activity and the linking lines (ties) represent members' reading activity. Figure 4.13 uses color to show interaction among member types. As shown in the figure, pre-service teachers/new members have the most posting and reading activity. However, the size of PNs' nodes diminished after excluding the extended class discussion. Similarly, the nodes for the other three instructors (IS2, IS3, and IS4) became smaller. For IS2 who was the instructor for the mathematic field experience course, his node became much smaller than the node (see figure 4.8) presented in the social network diagram for the entire DB discussion. In summary, Figure 4.13 represents the voluntary interaction within DB and can be compared to Figure 4.8.

As shown in Figure 4.13 on average pre-service teachers/new members have bigger nodes than pre-service teachers/old members. Members IO3 and PO7 have nodes as big as most of the pre-service teachers/new members, which shows their high level of interaction with other members. Also, pre-service teachers/new members have high numbers of one-way reading activity for many of the pre-service teachers/old members, which indicate that PNs read many messages posted by PO's, but PO's read fewer messages from PNs. However, some experienced members (i.e. PO7, PO6, IO1, IO2, and IO3) had reciprocal interaction with PNs. In-service teachers/new members (IN1 and IN2)

tended to play a lurking role by reading others' messages only. Relative to the overall interaction in the NETwork, the interaction among pre-service teachers/new members were more reciprocal, while pre-service teachers/old members (PO) and in-service teachers/old members (IO) had fewer reciprocal interactions within their groups.

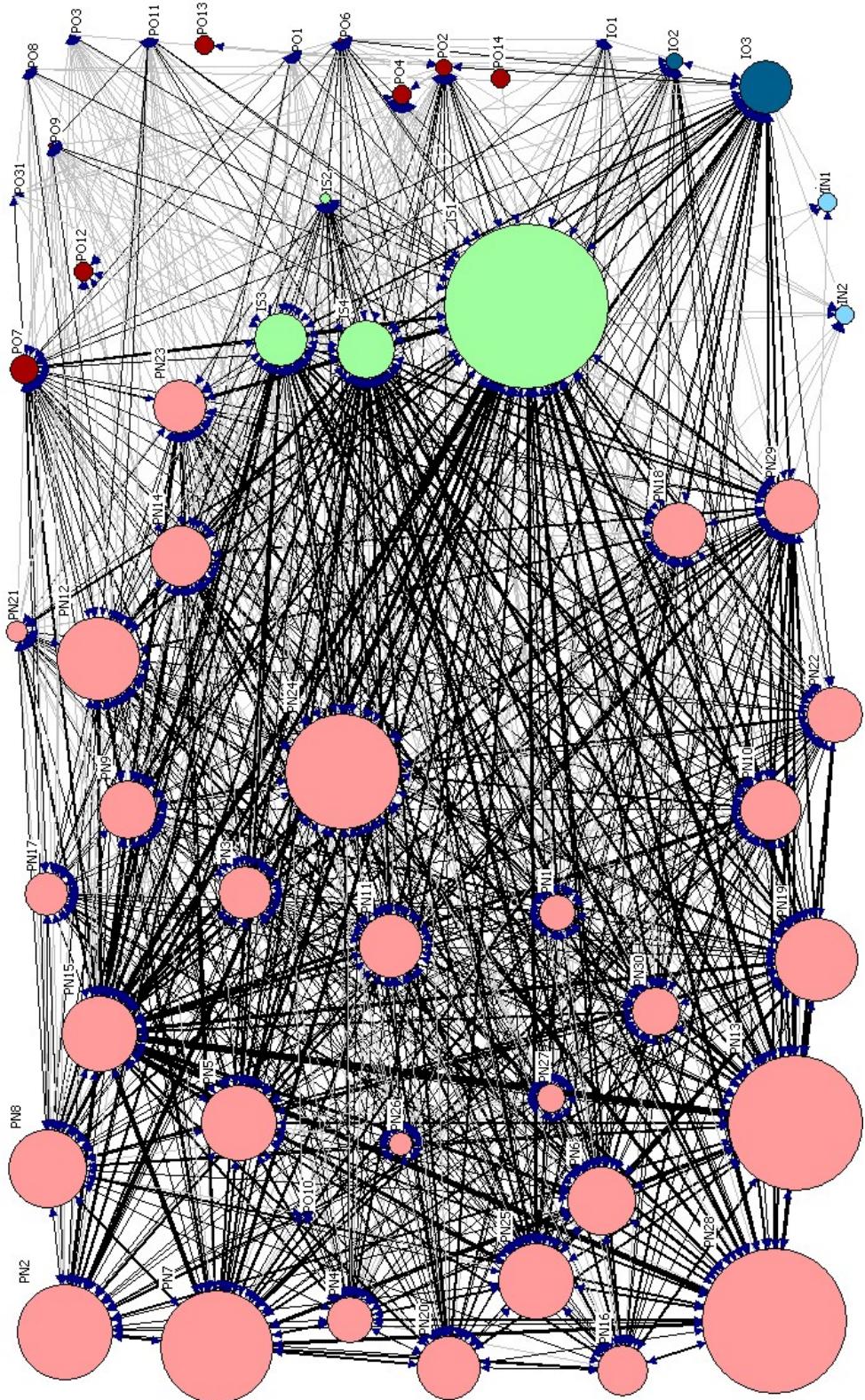


Figure 4.13. Interaction Patterns Diagram for Discussion Board (FE & NETwork only)

Note. a. Each node of the diagram represented one member and each color represented one type of members. b. Lighter blue nodes represent in-service teachers/new members (IN). Darker blue nodes represent in-service teachers/old members (IO). Lighter red nodes represent pre-service teachers/new members (PN), as well as darker red nodes for pre-service teachers/old members (PO). Green color nodes represent instructors (IS).c. The lines between a pair of nodes indicated interaction between two members, and the gray lines indicated the one-way interaction as well as black lines were reciprocal interaction.

As shown in Table 4.1.12, the density of the social network was 4.87 (SD=10.13) which indicates a fully dense network (network density >1), meaning that members connected to other members frequently. Table 4.1.12 presents the centrality scores and density derived from social network analysis. As shown in Table 4.1.12, members' out-degree (the degree to which other members read one's posts) varied between 0 and 1011 ($M=246.04$, $SD=242.53$), and in-degree (the degree to which the member read other members messages) was between 1 and 1828 ($M=246.04$, $SD=299.28$). The members with both high out-degree and high in-degree in the FE and NETwork only discussion topics were PN13, PN28, PN24, and PN7. Nine members, including PO8, PO31, PO3, IN1, PO10, IN2, PO13, PO4, and PO12, had an out-degree less than 10, indicating that they contributed little to the discussion because few of their messages were read by others. Also, four members (PO13, IN1, PO3, and PO12) had in-degree less than 10 showing little reading activity and a peripheral or passive participation in the discussion. These four members' out-degree were also less than 10 (three of them had 0 out-degree), meaning they were not only passive but also ignored by other members (no members read their messages).

Forty-two members were classified as information carriers because their in-degree and out-degree were larger than 0, and six members whose out-degree was equal to 0 but in-degree was larger than 0 were identified as information receivers. These six receivers included four pre-service teachers/old members and two in-service teachers/new members. Pre-service teachers/new members who had higher out-degree and in-degree showed relatively higher levels of exchanging information. Although the in-degree and out-degree were not as high as that for pre-service teachers/new members had, some of

the pre-service teachers/old members (PO7, PO2, PO6, PO9, PO11, and PO1) and few in-service teachers/old members (IO3, IO2, and IO1) also had roughly equivalent in-degree and out-degree, meaning that they read others' messages as well as others read their messages. Especially, IO3 and PO7 had higher out-degree and in-degree than the scores some pre-service teachers/new members had. Additionally, few pre-service teachers/new members (PN15, PN19, and PN29) had relatively higher in-degree although their out-degree scores were not ranked as high as their in-degree. The network centralization shows that the out-degree centralization is much lower than the in-degree centralization ($10.14\% < 20.96\%$). This shows that on a relative basis when looking at who was reading some members stood out, but that when looking at who was read (who was influential) the been read activity was more equally distributed across the members.

Compared to the out-degree centralization and in-degree centralization for the interaction of the entire discussion topics, the FE and NETwork only discussion showed less centralization of members whose messages were read (out-degree: $10.14\% < 17.44\%$), but the group of members who read others' messages were more centralized (in-degree: $20.96\% > 17.00\%$). Also, the NETwork density for the FE & NETwork only discussion is lower than the density for the entire DB discussion, meaning that the density of members' information exchange was less when only considering the discussion interaction in FE & NETwork only discussion topics.

Last, a sub-group diagram presented in Appendix 4-K shows how members interacted with each other and formed interaction groups. As shown by the density of interaction in the interaction tree, many cliques seem to have formed. The cut-off lines (i.e. a, b, c, and d lines in Appendix 4-K) are indicators of sub-groups. For example,

PN18, PN10, PN19, PN30, PN29, PN7, PN20, PN2, IO3, PN25, PN5, PN15, PN13, PN22, PN24, and PO7 appear to associate as a small group based on the cut-off line a, and so on. Compared to the interaction tree reported for the entire DB discussion, the sub-groups formed in the interaction were the same.

Table 4.1.12
Social NETwork analysis indices (FE & NETwork only)

Members	Out-degree		In-degree	
	Rank	(M=246.04, SD=242.53)	Rank	(M=246.04, SD=299.28)
PN13	1	1011	5	602
PN28	2	966	6	585
PN24	3	656	7	469
PN7	4	618	2	689
PN25	5	520	16	284
PN5	6	503	21	261
PN8	7	478	20	265
PN2	8	475	27	169
PN6	9	423	10	348
PN14	10	415	12	337
PN19	11	412	4	624
PN23	12	383	24	214
PN15	13	376	1	1828
PN18	14	370	30	82
PN10	15	329	15	290
PN9	16	324	28	160
PN11	17	317	19	270
PN22	18	312	14	306
IO3	19	301	11	345
PN12	20	292	8	370
PN16	21	282	13	316
PN20	22	281	18	271
PN3	23	275	29	116
PN30	24	248	26	171
PN1	25	216	17	278
PN29	26	165	3	653
PO7	27	138	22	229
PN21	28	126	33	62
PN17	29	120	23	218
PN4	30	107	9	351
PN26	31	91	31	76
PN27	32	81	25	203
PO2	33	47	34	51
IO2	34	45	32	75
PO6	35	33	33	30
PO9	36	18	35	22
PO11	37	16	35	40
PO1	38	11	37	18
IO1	39	10	36	21
PO8	40	8	38	14
PO31	41	7	41	5
PO3	42	4	34	28
IN1	43	0	43	4
PO10	43	0	40	11
IN2	43	0	39	13
PO13	43	0	44	1
PO4	43	0	33	30
PO12	43	0	42	5
Network Centralization (Out-degree)		10.14%		
Network Centralization (In-degree)		20.96%		
Network Density		4.87 (SD=10.13)		

Note. N=48

Table 4.1.13
Comparison of social NETwork analysis indices (Entire DB v.s. FE & NETwork only)

Included Discussion Activities	Network Density (SD)	Out-degree	In-degree
Entire DB discussion	10.24 (SD=18.00)	17.44%	17.00%
FE & NETwork Only	4.87 (SD=10.13)	10.14%	20.96%

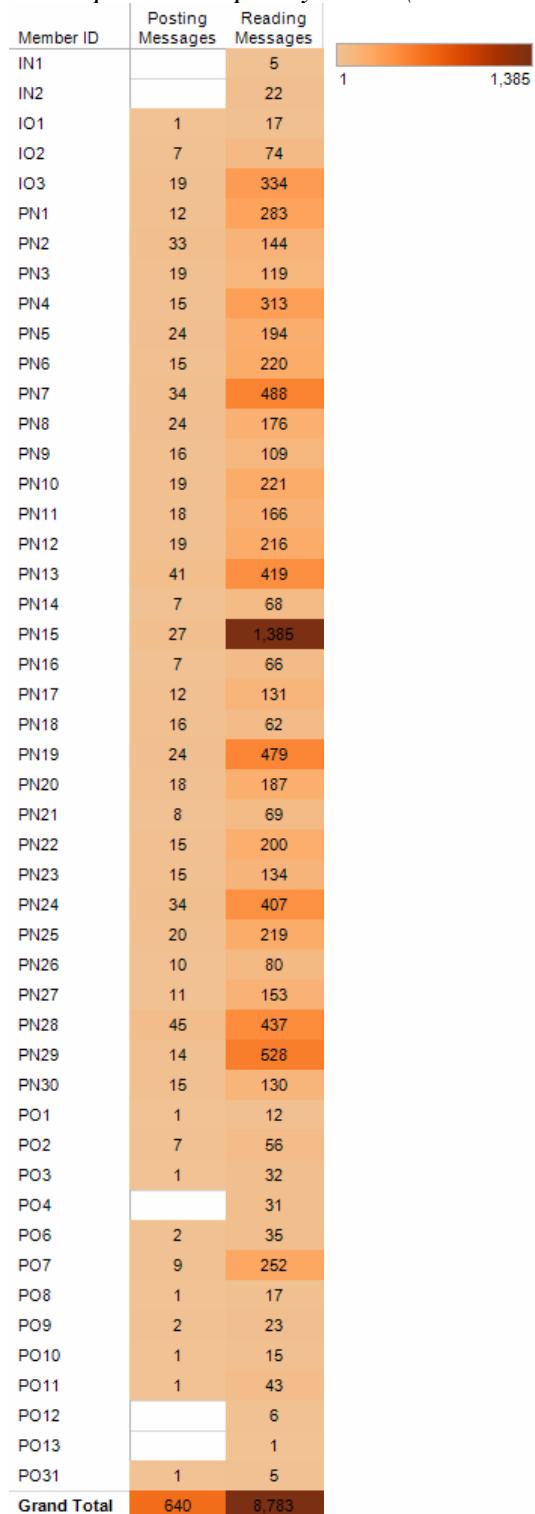
II.c.1. Participation in Discussion Board (NETwork only): Levels of Participation

This section describes participation and interaction level for the discussion activities in the NETwork Weekly Discussion forums that were voluntary for all members. Table 4.1.14 presents the frequency of member activity classified into IN, IO, PN, and PO. In Table 4.1.14, darker colors indicate higher frequency of posting and reading messages, and vice versa. Similar to the results from when entire DB discussion or only FE & NETwork discussion were included, members had more reading activity and less posting activity. The total frequency of members' posting activity ranged from 1 to 45 and reading activity was from 1 to 1,467. Compared to the levels of participation across all DB activity and activity in FE & NETwork discussion forums, the frequency decreased slightly after excluding the field experience weekly discussion and mathematic course extended class discussion (Table 4.1.15). The analysis of this step highlights the levels of members' participation when the activities were voluntary.

Table 4.1.15
Comparison of Changes of Frequency Range

Included Discussion Activities	Posting Activity	Reading Activity
Entire DB discussion	1 to 106	1 to 2,144
FE & NETwork Only	1 to 59	1 to 2,021
NETwork only	1 to 45	1 to 1,467

Table 4.1.14
Participation Frequency in DB (NETwork only)



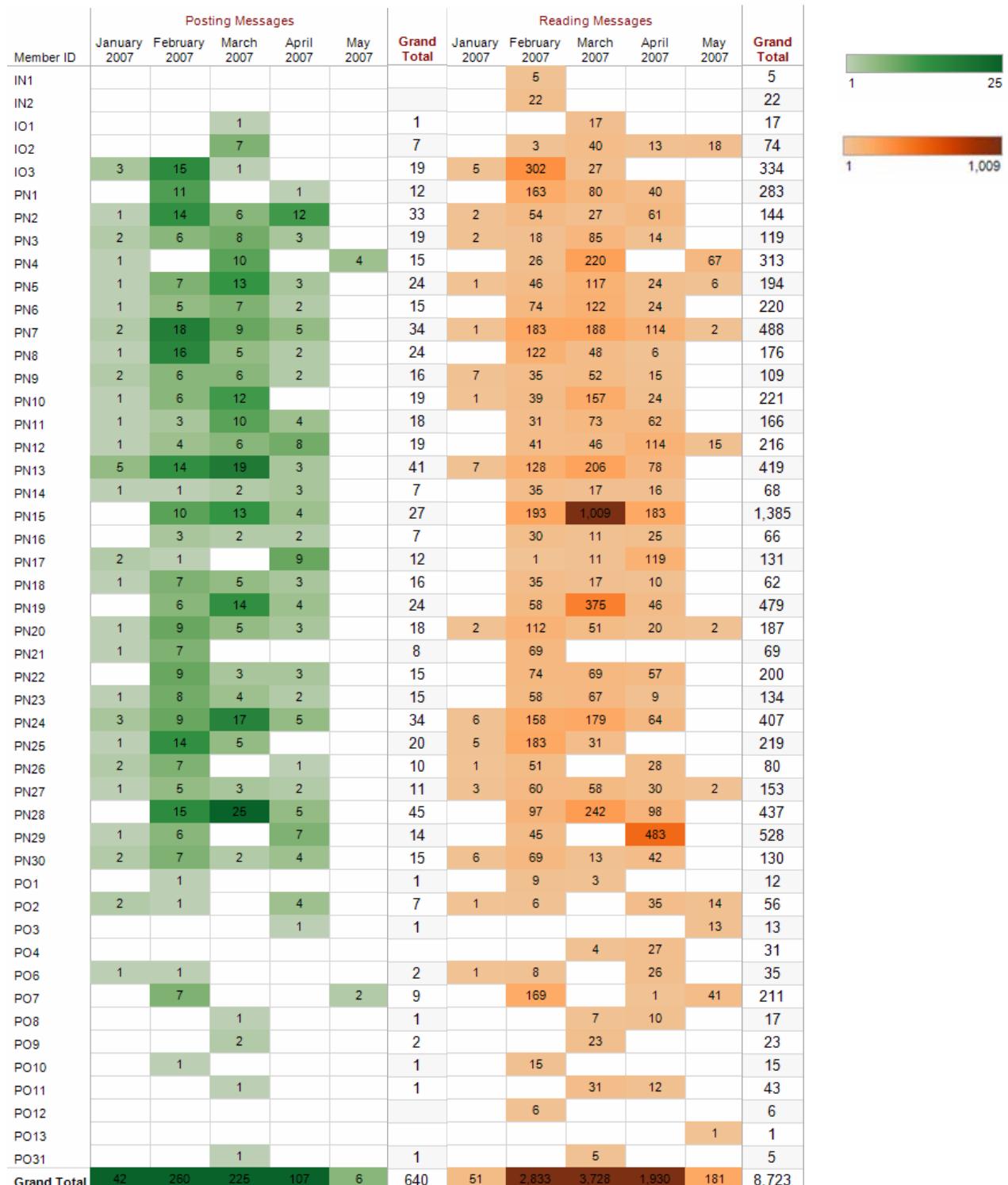
Note. a. Color shows count of Frequency. Darker color represents higher frequency of interaction, and vice versa. b. The text values show the count of the frequency of interaction. c. The frequency ranges from 1 to 1385.

As shown in Table 4.1.16, members' posting frequency increased in the second month of the semester (from total posting frequency=42, M=2.8 per day in January to total posting frequency=260, M=9.3 per day), but later dropped in March (total posting frequency=225, M=7.3 per day) and more in April (total posting frequency=107, M=3.6 per day) and May 2007 (total posting frequency=6, M=0.9 per day). Similar to the tendencies shown for posting activity, members' reading frequency increased in February (from total reading frequency=51, M=3.4 per day in January to total reading frequency =2,833, M=101.2) and March (total reading frequency=3,728, M=120.3 per day), but dropped in April (total reading frequency=1,930, M=64.3) and more in May (total reading frequency=181, M=25.9). The trajectory of members' posting activity was the same across all three conditions of representations of discussion activities, with the exception of reading activity increasing in March for the FE & NETwork discussion or only NETwork discussion. Table 4.1.17 presents the monthly average frequency of members' activity.

Table 4.1.17
Comparison of Frequency of Posting and Reading across Months

Included Discussion Activities		Jan 07	Feb 07	March 07	April 07	May 07
Posting Activity	Entire DB discussion	11.3	21.4	17.3	12.5	1.6
	FE & NETwork Only	4.2	13.0	10.0	4.7	1.4
	NETwork Only	2.8	9.3	7.3	3.6	0.9
Reading Activity	Entire DB discussion	54.1	396.4	312.4	214.9	47.9
	FE & NETwork Only	6	152.9	179.8	94.8	41
	NETwork Only	3.4	101.2	120.3	64.3	25.9

Table 4.1.16
Monthly Participation Frequency in DB (NETwork only)



Note. a. Color shows count of Frequency. Darker color represents higher frequency of interaction, and vice versa. b. The text values show the count of the frequency of interaction. c. The frequency ranges from 1 to 25 for posting messages & 1 to 1009 for reading messages.

As shown in Table 4.1.18, the ranking of posting and reading frequency across member type remained the same after excluding activities in extended class discussion and field experience weekly discussion forums. The pre-service teachers/new members show higher posting frequency ($M=19.6$ per member/per semester) than pre-service teachers/old members ($M=2.0$ per member/per semester), in-service teacher/new members ($M=0$ per member/per semester), and in-service teachers/old members ($M=9.0$ per member/per semester). Also, pre-service teachers/new members have more reading activity ($M=260.1$ per member/per semester) than pre-service teachers/old members ($M=40.6$ per member/per semester), in-service teacher/new members ($M=13.5$ per member/per semester), and in-service teachers/old members ($M=141.7$ per member/per semester). The in-service teachers/new members' frequency of reading activity remained the same in all three conditions, which indicates that in-service teachers only participated in reading messages posted in the NETwork weekly discussion.

Table 4.1.18
Comparison of Members' Average Activities during the Whole Semester

Included Discussion Activities		PN	PO	IN	IO
Posting Activity	Entire DB discussion	54.4 (1)	2.8 (3)	0 (4)	10 (2)
	FE & NETwork Only	27.7 (1)	2.2 (3)	0 (4)	10 (2)
	NETwork only	19.6 (1)	2.0 (3)	0 (4)	9.0 (2)
Reading Activity	Entire DB discussion	909.5 (1)	40.3 (3)	13.5 (4)	176.0 (2)
	FE & NETwork Only	401.3 (1)	42.8 (3)	13.5 (4)	171.7 (2)
	NETwork only	260.1 (1)	40.6 (3)	13.5 (4)	141.7 (2)

Note. Values with in the brackets present the ranking order; 1 to 4 indicates high to low.

Figure 4.14 and 4.15 provide bar chart visualizations to compare the total amount of members' posting and reading frequency across different member types. Pre-service teachers/new members had higher posting and reading frequency than the other member types. Examining Figure 4.9 and 4.10 shows some pre-service teachers/old members only

posted one or two messages but had higher reading activity, and some in-service teachers/new members did not post anything but read some messages. After excluding both the extended class discussion and field experience weekly discussion, pre-service teachers/new members' posting and reading activity dropped approximately 30% to 35% (compared to only excluding the extended class discussion), while PO and IN remained the same or with only slight changes. Also, in-service teachers/old members' reading activity diminished approximately 20% after excluding both the extended class discussion and field experience weekly discussion. This result indicates that in-service teachers/old members sometimes also read the messages in the field experienced weekly discussion.

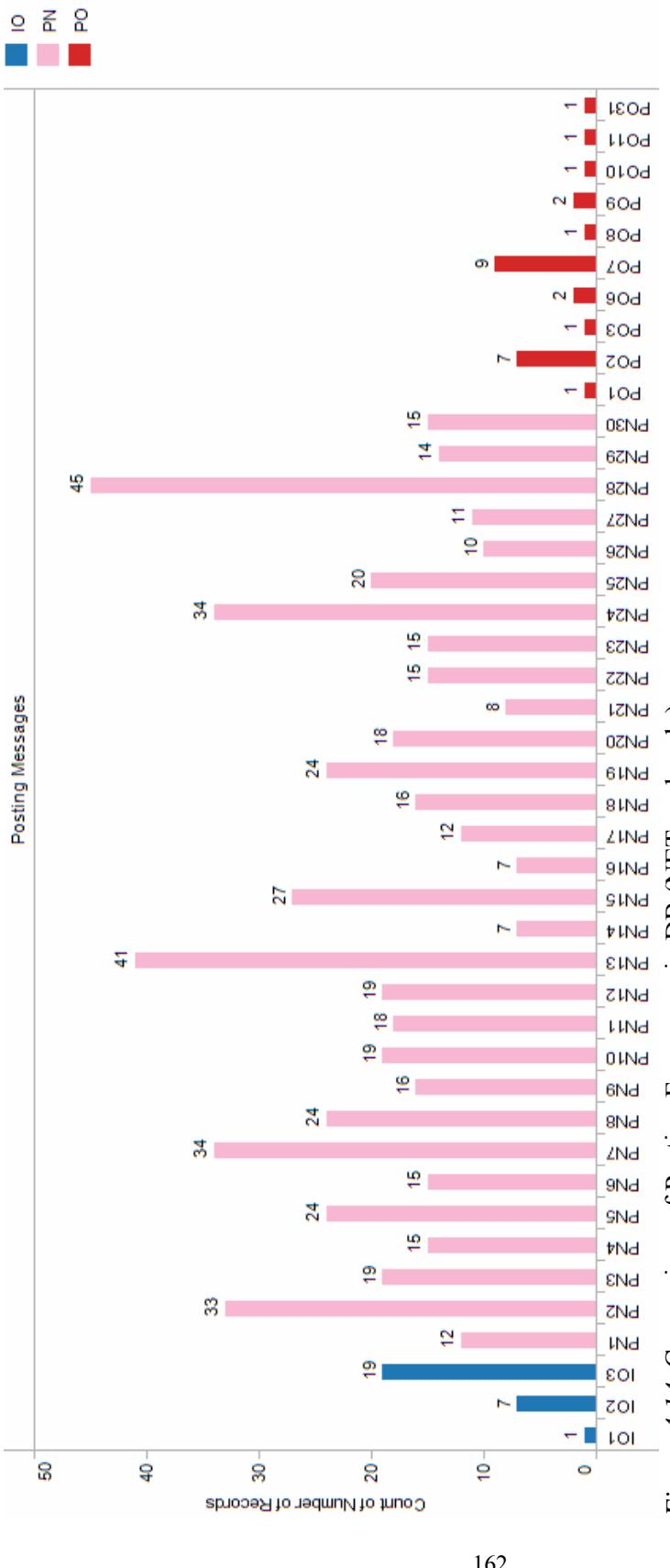


Figure 4.14. Comparison of Posting Frequency in DB (NETwork only)

Note. Lighter blue bars represent in-service teachers who joined NETwork since Spring 2007 (IN). Darker blue bars represent in-service teachers who joined NETwork since Fall 2006 (IO). Lighter red bars represent pre-service teachers who joined NETwork since Spring 2007 (PN), as well as darker red bars are pre-service teachers joined since Fall 2006 (PO).

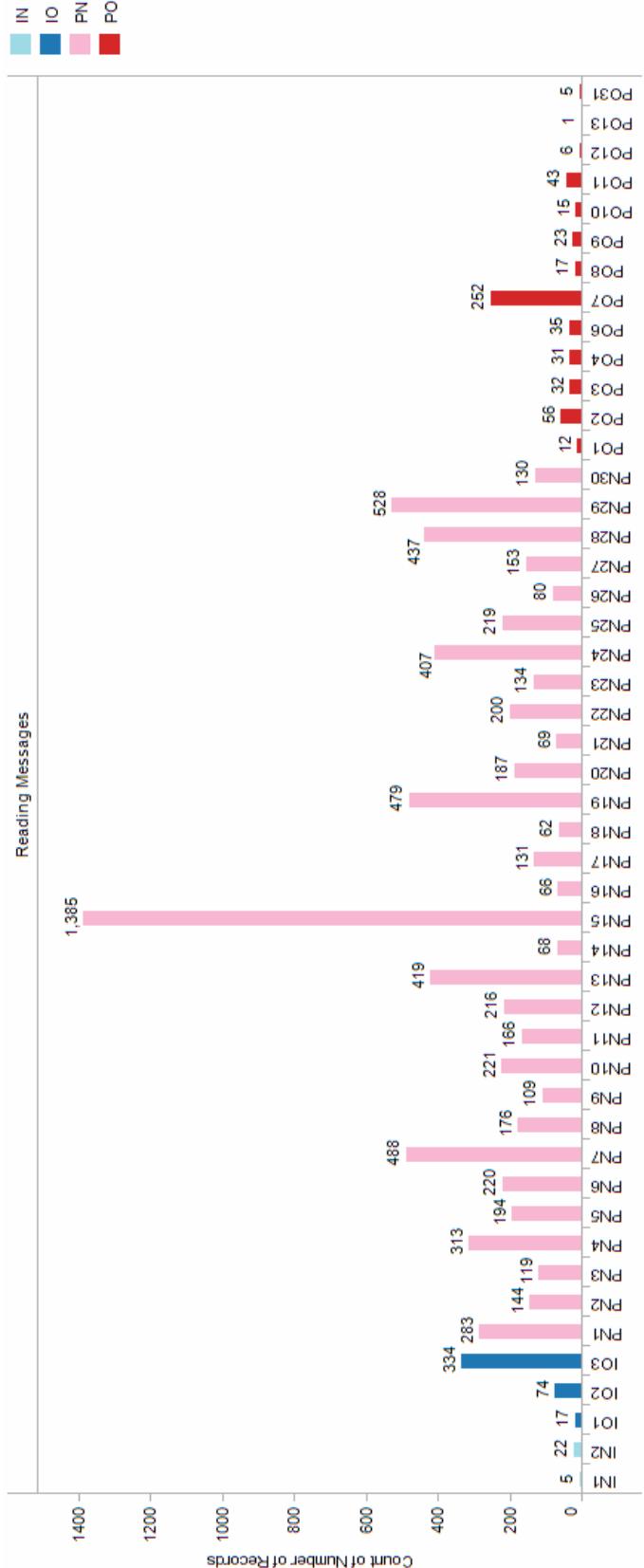


Figure 4.15. Comparison of Reading Frequency in DB (NETwork only)

Note. Lighter blue bars represent in-service teachers who joined NETwork since Spring 2007 (IN). Darker blue bars represent in-service teachers who joined NETwork since Fall 2006 (IO). Lighter red bars represent pre-service teachers who joined NETwork since Spring 2007 (PN), as well as darker red bars are pre-service teachers joined since Fall 2006 (PO).

Figure 4.16 and 4.17 present an overview of members' posting and reading trajectories based on member types (diagram a) and individuals (diagram b). Similar to the analysis of the entire DB discussion and FE & NETwork only discussion, in-service teachers/new members showed no posting activity and in-service teachers/old members on average had higher posting activity than pre-service teachers/old members. Also, pre-service teachers/new members had higher posting activity than other member types. However, in-service teachers/old members only posted messages from January to March 2007, while all pre-service teachers posted messages throughout the semester. The trajectories also indicate that members have the most posting activity in February and that the frequency of posting activity decreased gradually in the following months.

Examining the daily trajectories shown in Appendix 4-L and 4-K, that in-service teachers' posting activity stopped right before spring break (March 24th to April 1st) while pre-service teachers' posting and reading activity still carried on after the spring break. Appendix 4-M shows that in-service teachers/old members still read messages after spring break, but their level of activity was lower than before spring break. Also, in-service teachers/new members only read messages in early February. Overall, the ranking level (from high to low) of different types of members' posting activity was pre-service teachers/new members (PN), in-service teachers/old members (IO), pre-service teachers/old members (PO), and in-service teachers/new members (IN), and the ranking of reading activity was PN, IO, PO, and IN. The level of posting and reading frequency across different types of members was the same as that shown for the entire DB discussion and when excluding only the extended class discussion. More detailed trajectories of posting and reading activity for each member type are presented in

Appendix 4-L and 4-K.

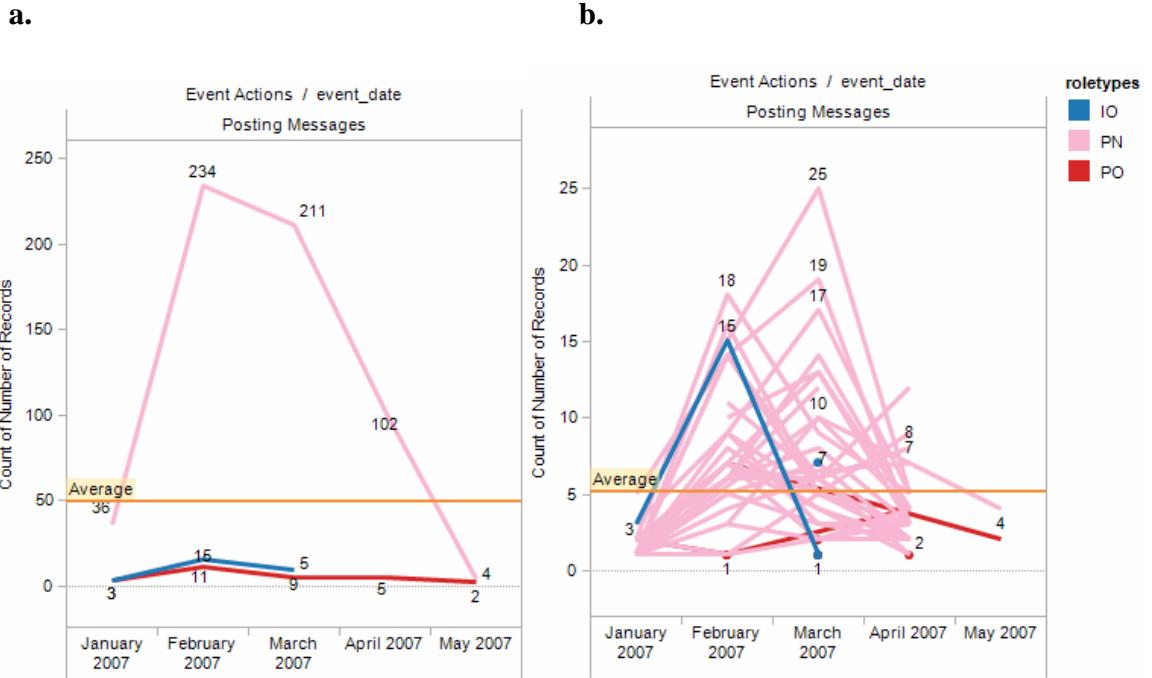


Figure 4.16. Monthly Trajectory of Posting Frequency in DB (NETwork only)

Note. Lighter blue lines represent in-service teachers who joined NETwork since Spring 2007 (IN). Darker blue lines represent in-service teachers who joined NETwork since Fall 2006 (IO). Lighter red lines represent pre-service teachers who joined NETwork since Spring 2007 (PN), as well as darker red lines are pre-service teachers joined since Fall 2006 (PO)

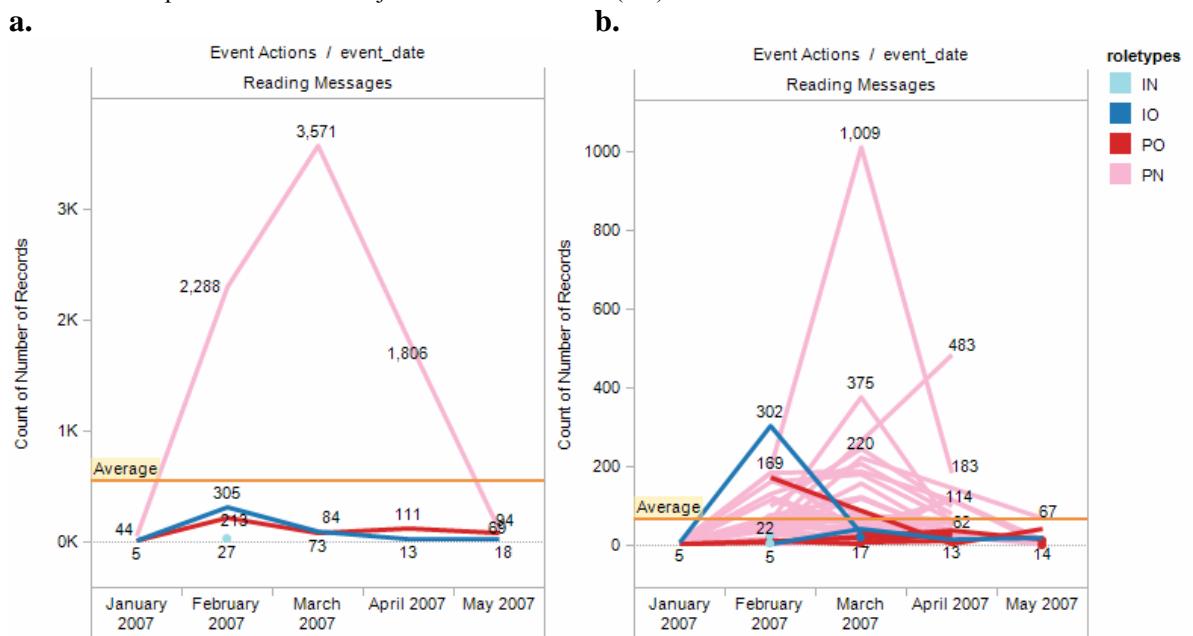


Figure 4.17. Monthly Trajectory of Reading Frequency in DB (NETwork only)

Note. Lighter blue lines represent in-service teachers who joined NETwork since Spring 2007 (IN). Darker blue lines represent in-service teachers who joined NETwork since Fall 2006 (IO). Lighter red lines represent pre-service teachers who joined NETwork since Spring 2007 (PN), as well as darker red lines are pre-service teachers joined since Fall 2006 (PO)

II.c.2. Participation in Discussion Board (NETwork only): Patterns of Participation

The number of messages members read from particular other members is presented in Appendix 4-N and 4-O. After excluding the discussion activity from the extended class discussion for Mathematic field experience course and the field experience weekly discussion, the overall level of interaction among pre-service teachers/new members decreased. For instance, compared to the condition of FE & NETwork discussion only, the interaction frequency between PN15 and PN 13 dropped from 164 to 121, PN19 and PN20 decreased from 10 to 1, and so on. Of note is that the interaction frequency from pre-service teachers/old member and in-service teachers to other members did not change much. Excluding the extended class discussion shows how members interacted when most of the activities were not required. Compared to including the entire DB discussion or excluding only the extended class discussion, the overall interaction patterns for the voluntary interactions did not change much except for the level of interaction among pre-service teachers/new members.

Similar to what was found in previous conditions, in-service teachers tended to read messages initiated from the lead professor (IS1) and two in-service teachers/old members who had the highest interaction levels with others read the messages from all member types. Further, the pre-service teachers/new members had the most intensive interaction within their group. Most of them read messages posted by pre-service teachers/old members, but had the most interaction with 3 particular old members (PO2, PO6, and PO7). Compared to pre-service teachers/new members, pre-service teachers/old members had fewer reading activity. The 3 PO members who were read most by pre-service teachers/new members also had more reading activity than the other pre-service

teachers/old members. Some pre-service teachers/old members (PO1, PO3 and PO10) did read other members' postings, but were rarely read by other members. An extreme case is PN10's messages which were never read. Also, PO4 and PO12 read messages but never posted to the discussion which is characterized as lurking behavior in a community. Last, two pre-service teachers/old members (PO13 and PO31) had no interaction with other member types. They only read the messages posted by other pre-service teachers/old members.

The social network diagram presented in Figure 4.18 and the statistical results in Table 4.1.19 illustrate the relationships among members. The size of nodes represents the amount of members' posting activity and the linking lines (ties) represent members' reading activity. As shown in Figure 4.18, pre-service teachers/new members had the most posting activity and reading activity. However, the size of some PNs' and instructors' nodes diminished after excluding the extended class discussion and field experience weekly discussion. Thus, Figure 4.18 represents the interaction of voluntary discussion activity among members. As shown in Figure 4.18, on average pre-service teachers/new members have bigger nodes than pre-service teachers/old members. The node for Member IO3 is as big as most of the pre-service teachers/new members, which shows a common high level of interaction with other members. Additionally, pre-service teachers/new members seemed to have high numbers of one-way reading activity in relation to the pre-service teachers/old members, which indicates that PNs read many messages posted by POs, but POs read fewer messages from PNs. However, some experienced members (i.e. PO7, PO6, IO1, IO2, and IO3) had more reciprocal interaction with PNs. In-service teachers/new members (IN1 and IN2) read others' messages but

never posted messages. Relative to the overall interaction in the NETwork, the interaction among pre-service teachers/new members were more reciprocal, while pre-service teachers/old members (PO) and in-service teachers/old members (IO) had fewer reciprocal interaction within their groups.

As shown in Table 4.1.19, the density of the social network was 3.62 (SD=7.26) which indicates a fully dense network (network density >1). Table 4.1.19 also presents the centrality scores and density derived from social network analysis. As shown in Table 4.1.19, members' out-degree (the degree to which other members read one's posts) varied between 0 and 725 ($M=172.38$, $SD=159.04$), and in-degree (the degree to which members read other members messages) was between 1 and 1234 ($M=172.38$, $SD=203.94$). The members with high out-degree and high in-degree in the NETwork only discussion topics were PN13, PN28, PN7, and PN24. Six members, including PO8, PO31, PO3, PO4, IN1, and IN2, had an out-degree less than 10, indicating that they contributed little to the discussion because few of their messages were read by others. Also, three members (PO11, PN 31, and IN1) had in-degree of less than 10 showing little reading activity and a peripheral or passive participation in the discussion. Two of these three (PO31 and IN1) members' out-degree were also equal to 0 (less than 10), meaning they were not only passive but also ignored by other members (no members read their messages).

Forty-two members were classified as information carriers because their in-degree and out-degree were larger than 0, and three members whose out-degree was equal to 0 but in-degree was larger than 0 were identified as information receivers. These three receivers included one pre-service teacher/old member (PO4) and two in-service

teachers/new members (IN1 and IN2). Overall, pre-service teachers/new members, who were the group that had higher out-degree and in-degree, showed relatively higher levels of exchanging information. Although the in-degree and out-degree were not as high as that for pre-service teachers/new members, some pre-service teachers/old members (PO7, PO2, PO6, PO9, PO11, and PO1) and a few in-service teachers/old members (IO3, IO2, and IO1) also had fairly even in-degree and out-degree, meaning that they read others' messages as well as others read their messages. Especially, IO3 and PO7 had higher out-degree and in-degree than that for some pre-service teachers/new members.

Additionally, few pre-service teachers/new members (PN15, PN19, and PN29) had relatively higher in-degree although their out-degree were not ranked as high as their in-degree. Similar to the interaction of FE and NETwork only discussion, the centralization out-degree is much lower than the centralization in-degree (10.14%<20.96%). This shows that on a relative basis, when looking at who was reading messages, some members stood out, but that when looking at who was read (who was influential) the being read activity was more equally distributed across the members.

Compared to the centralization out-degree and centralization in-degree for the interaction of the entire discussion topics in Table 4.1.20, the NETwork only discussion shows lower centralization out-degree (10.62%<17.44%) but higher centralization in-degree (20.39%>17.00%). Compared to the indices shown in the social NETwork analysis for the FE & NETwork only discussion, the NETwork only discussion shows higher centralization out-degree (10.62%>10.14%) but lower centralization in-degree (20.39%<20.96). Also, the NETwork density for the FE & NETwork only discussion is lower than the density for the entire DB discussion or FE & NETwork only discussion,

meaning that the density of members' information exchange was less when only considering the NETwork only discussion topics.

Table 4.1.19
Social network analysis indices (NETwork only)

Members	Out-degree		In-degree	
	Rank	(M=172.38, SD=159.04)	Rank	(M=172.38, SD=203.94)
PN13	1	725	6	378
PN28	2	577	5	402
PN7	3	436	4	425
PN24	4	434	7	360
PN2	5	355	21	129
PN5	6	318	16	175
PN15	7	317	1	1234
PN8	8	296	19	152
PN25	9	287	14	185
PN19	10	267	3	429
PN23	11	262	22	124
IO3	12	254	8	280
PN18	13	245	30	56
PN11	14	234	18	154
PN9	15	232	26	96
PN3	16	229	25	110
PN22	17	207	15	179
PN10	18	201	12	203
PN12	19	190	13	193
PN1	20	163	10	256
PN6	21	160	13	193
PN30	22	157	24	113
PN20	23	155	17	167
PN29	24	147	2	455
PN21	25	123	28	62
PN16	26	109	28	62
PN4	27	102	9	270
PO7	28	94	11	211
PN26	29	91	27	76
PN27	30	72	20	142
PN14	31	70	29	59
PN17	32	52	23	115
PO2	33	46	31	51
IO2	34	45	28	62
PO6	35	32	34	30
PO9	36	18	35	22
PO11	37	16	39	0
IO1	38	10	37	13
PO1	38	10	32	41
PO8	39	8	36	14
PO31	40	7	39	0
PO3	41	4	33	32
PO4	42	0	34	30
IN2	42	0	37	13
IN1	42	0	38	4
Network Centralization (Out-degree)		10.62%		
Network Centralization (In-degree)		20.39%		
Network Density		3.62 (SD=10.13)		

Note. N=45

Table 4.1.20
Comparison of Social Network Analysis Indices

Included Discussion Activities	Network Density (SD)	Out-degree	In-degree
Entire DB discussion	10.24 (SD=18.00)	17.44%	17.00%
FE & NETwork Only	4.87 (SD=10.13)	10.14%	20.96%
NETwork only	3.62 (SD=7.26)	10.62%	20.39%

Last, a sub-group diagram presented in Appendix 4-P explicates how members interacted with each other and formed interaction groups. As shown by the density of interaction in the interaction tree, many cliques seem to have formed. The cut-off lines (i.e. a, b, c, and d lines in Appendix 4-P) show the possible existence of sub-groups. For example, PN12, PN22, PN6, PN30, PN5, IO3, PN25, PN18, PN30, PN29, PN15, PN7, PN24, PN13, PN19, and PO7 appear to associate as a small group based on the cut-off line a, and so on. Compared to the interaction trees reported for the entire DB discussion and for the FE and NETwork only discussion, the sub-groups formed in the interaction were changed due to the different interaction density. For example, PO9 formed a sub-group with PO11, but PO9 was originally formed with in the sub-group with no one.

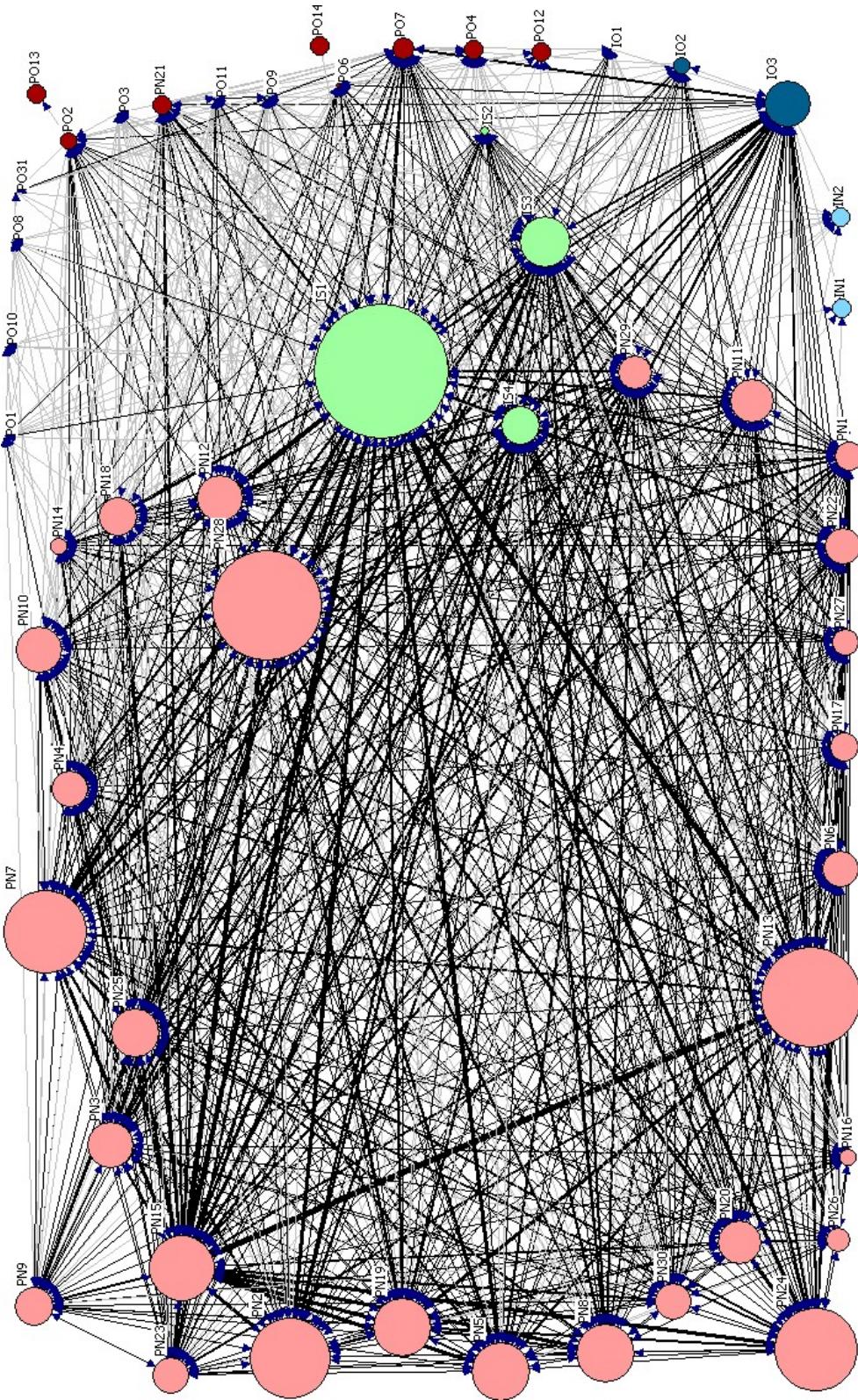


Figure 4.18. Interaction Patterns Diagram for Discussion Board (NETwork only)

Note. a. Each node of the diagram represented one member and each color represented one type of members. b. Lighter blue nodes represent in-service teachers/new members (IN). Darker red nodes represent in-service teachers/old members (IO). Lighter red nodes represent pre-service teachers/new members (PN), as well as darker red nodes for pre-service teachers/old members (PO). Green color nodes represent instructors (IS).c. The lines between a pair of nodes indicated interaction between two members, and the gray lines indicated the one-way interaction as well as black lines were reciprocal interaction.

III.a. Participation in Resources: Levels of Participation

This section describes participation and interaction levels of uploading and reviewing activity in the Resources. The resources uploaded in Fall 2006 semester were included in the analysis because they were involved in members' activities for Spring 2007 semester. Table 4.1.21 presents frequency of member activity classified into in-service teachers/new members (IN), in-service teachers/old members (IO), pre-service teachers/new members (PN,) and pre-service teachers/old members (PO). Overall, members had more reviewing activity and less uploading activity. The total frequency of members' reviewing activity ranged from 1 to 97 and no one uploaded more than one resource. In addition to the resources uploaded by the instructors, most resources were uploaded by the pre-service teacher/old members in Fall 2006. But some of pre-service teachers/new members also uploaded a resource to Resources during Spring 2007 semester.

As shown in Table 4.1.22, members' reviewing activity increased in the second month of the semester (from total reviewing frequency=197, $M=13.1$ per day in January to total reviewing frequency=409, $M=14.6$ per day in February) and later dropped in March (total reviewing frequency=249, $M=8.0$ per day). However, the reviewing activity increased again in April (total reviewing frequency=664, $M=22.1$ per day) and decreased again in May 2007 (total reviewing frequency=33, $M=4.7$ per day). The large reviewing activity of April probably results from specific course requirements. April 2007 was the time period that pre-service teachers/new members were working on the projects for the field experience courses; they, therefore, reviewed the lesson plans or other resources uploaded in Resources. Different from members' reviewing activity, members' uploading

frequency was low in Spring 2007 semester. Many resources were uploaded by pre-service teachers/old members in Nov 2006. When the pre-service teachers/old members were finishing their field experience courses in Fall 2006 semester, they uploaded their lesson plan to share with others in the community. This same behavior was not repeated by the PN's in Spring 2007 semester.

Comparing the posting frequency across member types, pre-service teachers/new members show higher reviewing frequency ($M=49.9$ per member/per semester) than pre-service teachers/old members ($M=15.3$ per member/per semester), in-service teacher/new members ($M=5$ per member/per semester), and in-service teachers/old members ($M=4$ per member/per semester). However, 33 out of 35 pre-service teachers/old members uploaded 1 resource in Fall 2006 semester, while only 6 out of 30 pre-service teachers/new members uploaded 1 resource in Spring 2007 semester. No resources were uploaded by any in-service teachers.

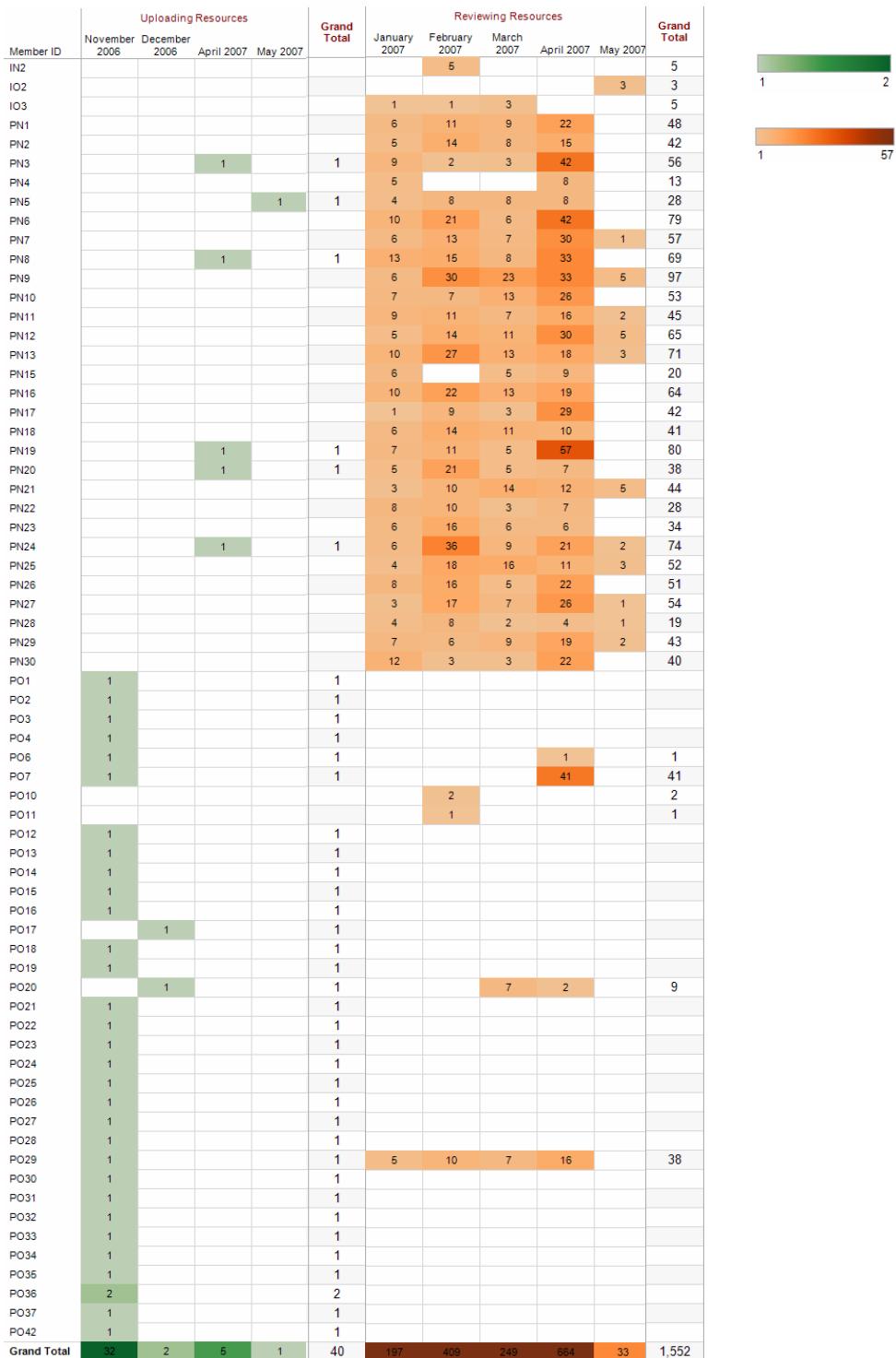
Figures 4.19 and 4.20 provide bar chart visualizations to compare the amount of members' reviewing and uploading frequency across different member types. Compared to pre-service teachers/old members, pre-service teachers/new members had more reviewing activity but less uploading activity. As shown in Figure 4.19, only two pre-service teachers/old members reviewed resources to roughly the same extent as new members. Although in-service teachers did review some resources, their reviewing activity was rare and they did not have any uploading activity. As shown in Figure 4.20, the instructors were the primary people who uploaded resources while of the teacher members only uploaded one resource.

Table 4.1.21
Participation Frequency in Resources

Member ID	Reviewing Resources	Uploading Resources
IN2	5	1
IO2	3	
IO3	5	
PN1	48	
PN2	42	
PN3	56	1
PN4	13	
PN5	28	1
PN6	79	
PN7	57	
PN8	69	1
PN9	97	
PN10	53	
PN11	45	
PN12	65	
PN13	71	
PN15	20	
PN16	64	
PN17	42	
PN18	41	
PN19	80	1
PN20	38	1
PN21	44	
PN22	28	
PN23	34	
PN24	74	1
PN25	62	
PN26	51	
PN27	54	
PN28	19	
PN29	43	
PN30	40	
PO1		1
PO2		1
PO3		1
PO4		1
PO6	1	1
PO7	41	1
PO10	2	
PO11	1	
PO12		1
PO13		1
PO14		1
PO15		1
PO16		1
PO17		1
PO18		1
PO19		1
PO20	9	1
PO21		1
PO22		1
PO23		1
PO24		1
PO25		1
PO26		1
PO27		1
PO28		1
PO29	38	1
PO30		1
PO31		1
PO32		1
PO33		1
PO34		1
PO35		1
PO36		2
PO37		1
PO42		1
Grand Total	1,552	40

Note. a. Color shows count of Frequency. Darker color represents higher frequency of interaction, and vice versa. b The text values show the count of the frequency of interaction. c. The frequency ranges from 1 to 97.

Table 4.1.22
Monthly Participation Frequency in Resources



Note. a. Color shows count of Frequency. Darker color represents higher frequency of interaction, and vice versa. b. The text values show the count of the frequency of interaction. c. The frequency ranges from 1 to 2 for uploading resources & 1 to 57 for reviewing resources.

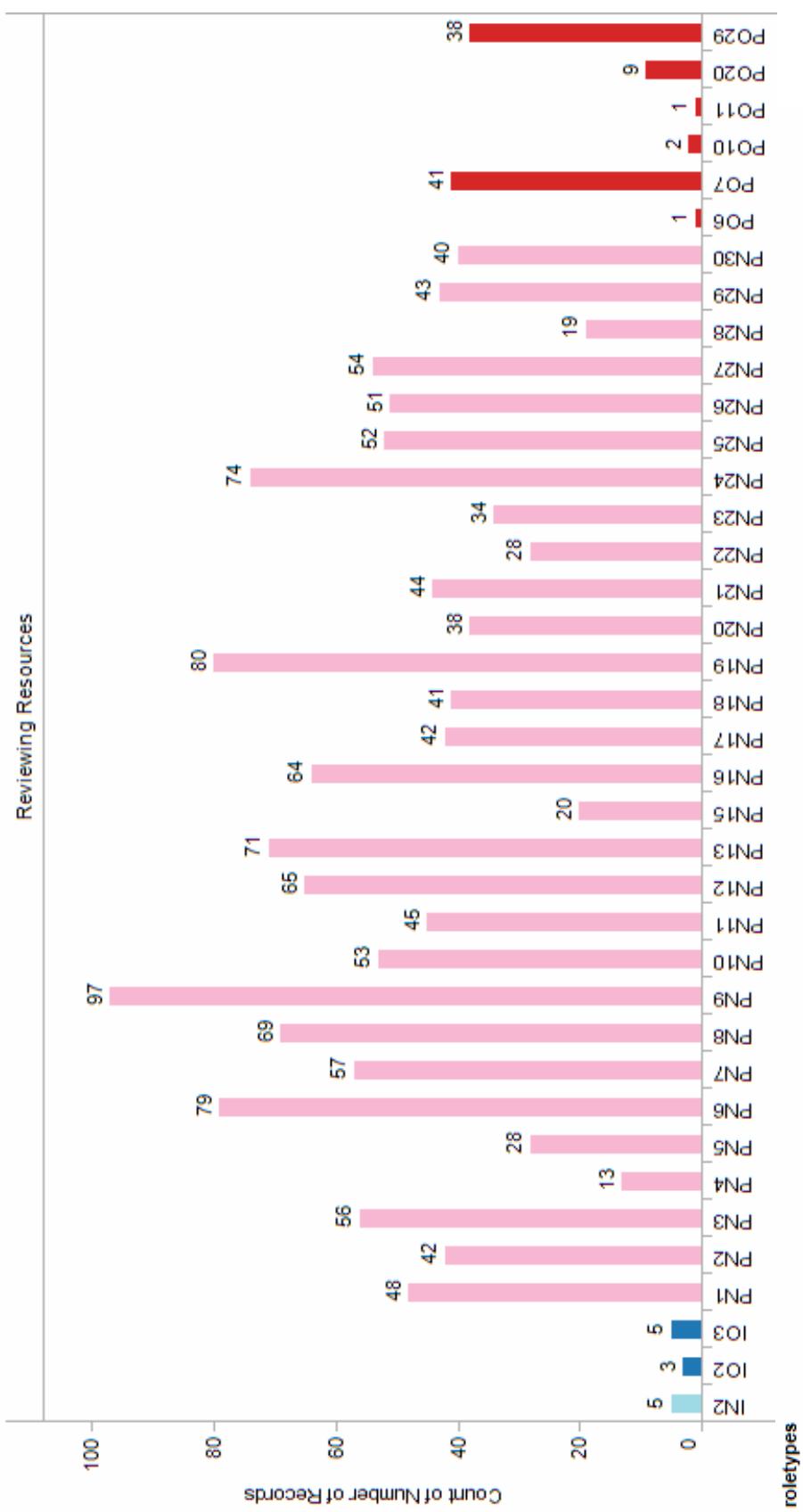


Figure 4.19. Comparison of Reviewing Frequency in Resources

Note: Lighter blue bars represent in-service teachers who joined NETwork since Spring 2007 (IN). Darker blue bars represent in-service teachers who joined NETwork since Fall 2006 (IO). Lighter red bars represent pre-service teachers who joined NETwork since Spring 2007 (PN), as well as darker red bars are pre-service teachers joined since Fall 2006 (PO).

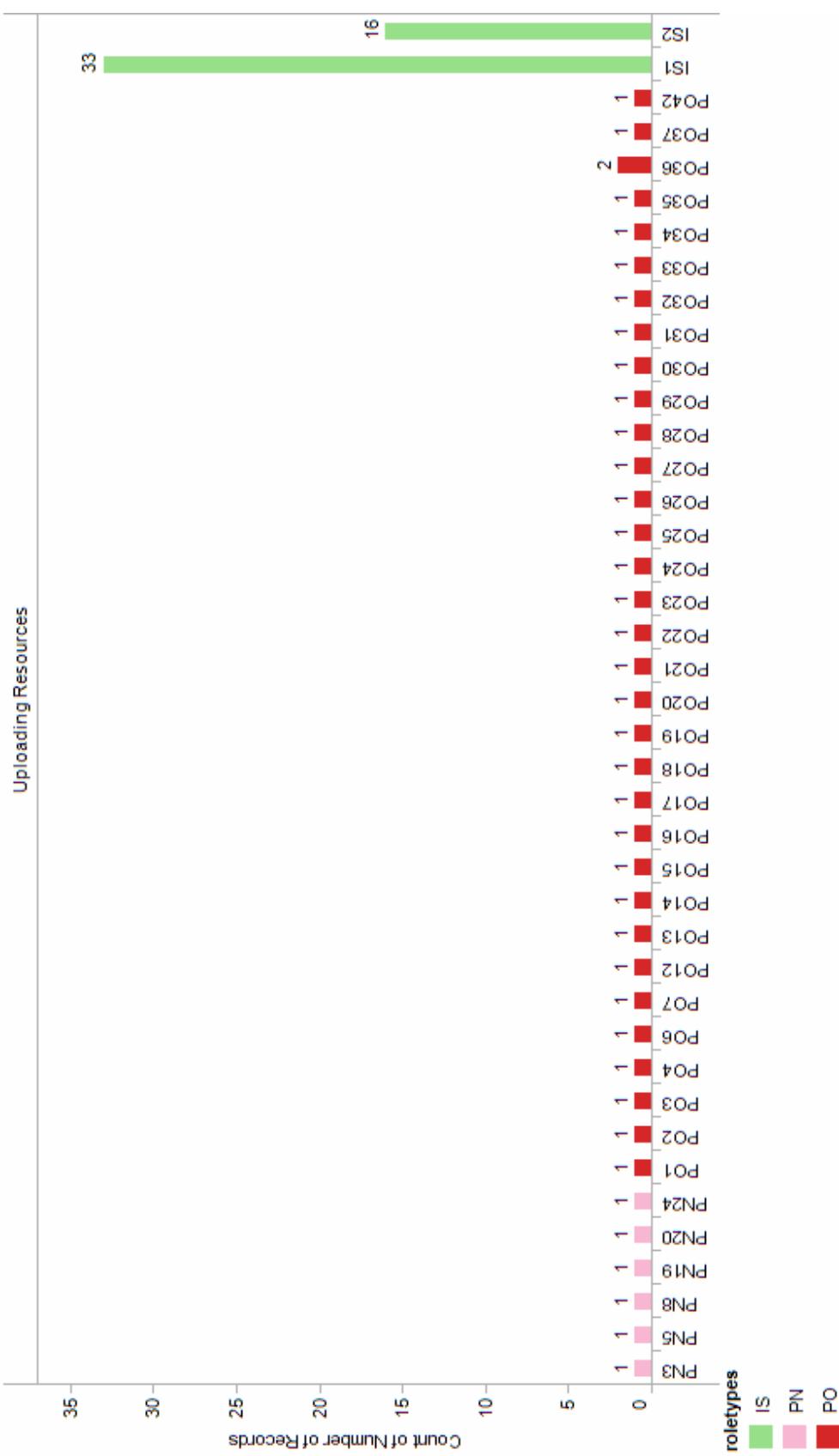


Figure 4.20. Comparison of Uploading Frequency in Resources

Note. Lighter red bars represent pre-service teachers who joined NETwork since Spring 2007 (PN), as well as darker red bars are pre-service teachers joined since Fall 2006 (PO). Green bars represent instructors (IS).

Figure 4.21 and 4.22 present an overview of members' reviewing and uploading trajectories based on member types (diagram a) and individual members (diagram b). As shown in Figure 4.21, pre-service teachers/new members had more reviewing activity than the other member types. Both pre-service teachers/new members and old members reviewed the resources more in April when they were working on their final projects for field experience courses. In-service teachers also reviewed some resources, but not as frequently as pre-service teachers. As shown in the trajectories reported in Appendix 4-Q, the amounts of pre-service teachers/new members' reviewing activity was 604 in April (diagram a). In addition to pre-service teachers/new members, one of pre-service teachers/old members also reviewed the resources frequently (41 times) toward the end of Spring 2007 semester.

As shown in Figure 4.22, in-service teachers had no uploading activity. In addition to the instructors, pre-service teachers/old members had higher uploading activity which indicates POs shared more resources with other members in the community. Additionally, the trajectories in Figure 4.22 show when the resources were uploaded. The instructors uploaded resources through out the semester, while pre-service teachers/old members and new members uploaded resources in particular months, such as November 2006, April 2007, and May 2007. Appendix 4-R provides more detailed daily trajectories of members' uploading activity.

Overall, the ranking level (from high to low) of reviewing frequency by member types was pre-service teachers/new members (PN, $M=49.9$), pre-service teachers/old members (PO, $M=15.3$), in-service teachers/new members (IN, $M=5$), and in-service teachers/old members (IO, $M=4$). In contrast to ranking level of reviewing activity, the

ranking of uploading activity was PO and PN.

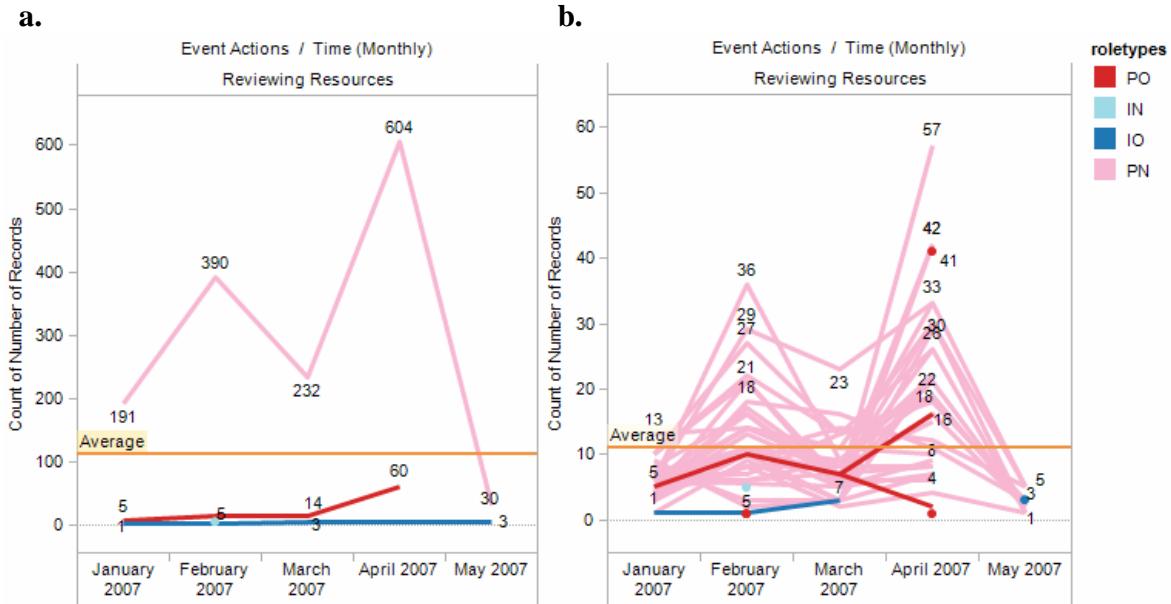


Figure 4.21. Monthly Trajectory of Reviewing Frequency in Resources

Note. Lighter blue lines represent in-service teachers who joined NETwork since Spring 2007 (IN). Darker blue lines represent in-service teachers who joined NETwork since Fall 2006 (IO). Lighter red lines represent pre-service teachers who joined NETwork since Spring 2007 (PN), as well as darker red lines are pre-service teachers joined since Fall 2006 (PO)

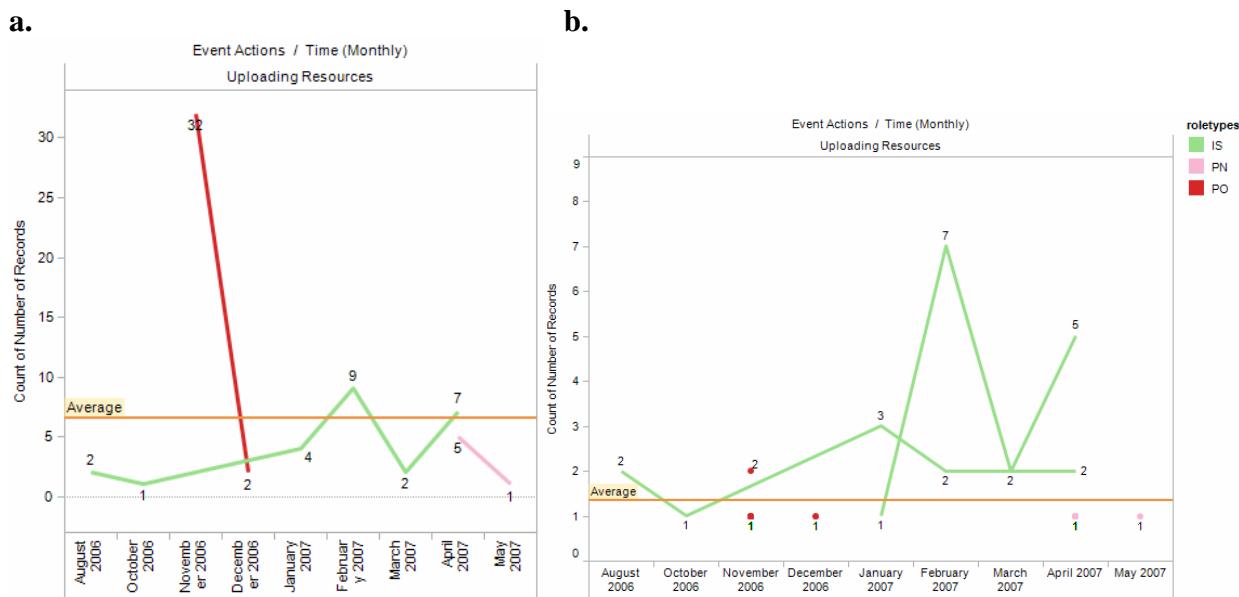


Figure 4.22. Monthly Trajectory of Uploading Frequency in Resources

Note. Lighter red lines represent pre-service teachers who joined NETwork since Spring 2007 (PN), as well as darker red lines are pre-service teachers joined since Fall 2006 (PO). Green lines represent instructors (IS).

III.b. Participation in Resources: Patterns of Participation

Social network analysis was undertaken using the interaction frequency information generated from Tableau®, building social network diagrams with NetDraw®, and calculating statistical results with Ucinet®. Social network analysis is being reported in this section to explain members' patterns of participation in Resources. Refer to Appendix 4-S and 4-T for the detailed accounts of resources reviewing behavior linking reviewer and poster. The in-service teachers/old members tended to review both the resources uploaded by the lead professor (IS1) and other pre-service teachers/old members, but in-service teachers/new members only reviewed resources uploaded by the pre-service teachers/old members (i.e. PO3, PO28, PO29, PO32, PO35, PO42). Different from other PO members, PO29 reviewed resources uploaded by the instructors while other POs reviewed only some resources uploaded by other PO members. Additionally, pre-service teachers/new members reviewed the IS2's resources more than the lead professor's, which indicates that IS2 was likely uploading resources relating to the course work of PNs and the lead professor mostly uploaded resources without specific course purposes. Compared to members' activity in Discussion Board, members had less interaction with each others in Resources and the patterns of pre-service teacher's interaction were varied.

Figure 4.23 shows how member types interact with each other. Each node of the diagram represents one member and each color represents one type of member (refer to the note of the figure). Also, the size of nodes represents the amount of resources uploaded by a member and the linking lines (ties) represent members' reviewing activity. The node sizes among the members who uploaded the resources are fairly even because

most of them uploaded only 1 resource. The instructors have bigger nodes because they were the primary people to upload resources. Members who reviewed resources but did not upload any were represented with a small circle. Leaving out reciprocal relationships between the instructors and members, the only reciprocal relationships exist between PO7 and PN3 and between PO7 and PN19 (black lines). The rest of relationships were one-way relationships (gray lines). By examining the directions of information flow, many one-way direction arrow lines were from pre-service teachers/old members to pre-service teachers/new members and in-service teachers. Especially, PN3, PN8, PN12, and PN19 were the pre-service teachers/new members who had high levels of reviewing activity. Except for PN19, who reviewed many IS2's resources, the information reviewed by PN3, PN8, and PN12 were from pre/service teachers/old members. Additionally, pre-service teachers/new members reviewed more resources uploaded by the instructors, but the instructors did not review PN resources. Also, a difference between the two instructors' (IS1 and IS2) interaction patterns is half of the lines linked to the lead professor (IS1) represent her reviewing pre-service teachers/old members' resources and another half represent her resources being reviewed by pre-service teachers/old members, and IS2's resources were all reviewed by pre-service teachers/new members.

As shown in the Table 4.1.23, the density of the social network was .10 (SD=.47) shows a sparsely-knit network (network density close to 0) that implies a low proximity among members. Table 4.1.23 presents the centrality scores and density derived from social network analysis. As shown in Table 4.1.23, members' out-degree (the degree to which other members reviewed one's resources) varied between 0 and 28 ($M=5.97$, $SD=6.91$), and in-degree (the degree to which the member reviewed other members

resources) was between 0 and 43 ($M=5.97$, $SD=10.25$). Overall, because the POs were invited to upload their lesson plans in the end of the Fall 2007 semester they have higher out-degree scores than all the pre-service teachers/new members and in-service teachers. Those lesson plans from the PO's were used in the Sprng by the pre-service teachers/new members while they were working on the same projects for their field experience course. In addition to the resources uploaded by the professors, most of the resources were from pre-service teachers/old members. Thus, in addition to professors POs were the primary contributors to the shared resources.

Additionally, because POs were not taking the same field experience courses, they did not need to review these lesson plan examples because the subjects for their field experience courses in Spring 2007 semester were different. Thus, POs had higher out-degree but lower in-degree because they were the resource providers and did not review these resources during Spring 2007 semester. For most of PNs and in-service teachers, they did not upload resources to share with others; thus, their out-degree scores were equal to 0. Only five PNs (PN8, PN20, PN24, PN19, and PN3) uploaded resources to share with others in Spring 2007 semester. Additionally, PNs, as well as PO7, IO3, and IN2, were the primary members who reviewed resources in Spring 2007 semester. Also, the most active members in reviewing the resources were PN19, PN3, and PO7 as shown by their high in-degree score, indicating that they reviewed many resources submitted by others. Further, the out-degree of the centralization is lower than the in-degree of the centralization ($4.83\% < 8.12\%$), which shows that the group that received information (who reviewed resources) is more centralized than the group of members who had resources reviewed.

Table 4.1.23
Social Network Analysis Indices (Resources)

Members	Out-degree		In-degree	
	Rank	(M=5.97, SD=6.91)	Rank	(M=5.97, SD=10.25)
PO33	1	28	20	0
PO21	2	26	20	0
PO34	2	26	20	0
PO23	3	19	20	0
PO6	4	16	19	1
PO22	5	15	20	0
PO25	5	15	20	0
PO4	6	14	20	0
PO1	6	14	20	0
PO36	7	11	20	0
PO27	8	10	20	0
PO3	8	10	20	0
PO37	9	9	20	0
PO16	9	9	20	0
PO35	9	9	20	0
PO20	9	9	12	9
PO26	10	8	20	0
PO30	10	8	20	0
PO24	10	8	20	0
PO42	10	8	20	0
PO14	11	7	20	0
PO28	11	7	20	0
PO29	11	7	20	0
PO32	12	6	20	0
PO17	12	6	20	0
PO2	12	6	20	0
PO31	13	5	20	0
PO7	13	5	3	37
PO15	13	5	20	0
PO12	13	5	20	0
PO18	14	4	20	0
PO19	14	4	20	0
PO13	15	3	20	0
PN8	15	3	7	19
PN20	16	2	18	2
PN24	16	2	18	2
PN19	16	2	1	43
PN3	17	1	2	42
PN1	18	0	10	14
IO3	18	0	17	3
PN17	18	0	18	2
PN18	18	0	15	5
PN15	18	0	11	11
PN12	18	0	4	25
PN25	18	0	14	6
PN26	18	0	15	5
PN10	18	0	5	21
PN29	18	0	14	6
PN13	18	0	14	6
PN30	18	0	9	16
PN16	18	0	18	2
PN6	18	0	8	18
PN7	18	0	10	14
PN27	18	0	16	4
PN9	18	0	6	20
PN21	18	0	15	5
PN22	18	0	19	1
PN4	18	0	13	8
IN2	18	0	15	5
Network Centralization (Out-degree)		4.83%		
Network Centralization (In-degree)		8.12%		
Network Density		.10 (SD=.47)		

Note. N=59

Table 4.1.24
Comparison of Social Network Analysis Indices (DB v.s. RS)

SNA analyses		Network Density (SD)	Out-degree	In-degree
Discussion Board	Entire DB discussion	10.24 (SD=18.00)	17.44%	17.00%
	FE & NETwork Only	4.87 (SD=10.13)	10.14%	20.96%
	NETwork only	3.62 (SD=7.26)	10.62%	20.39%
Resources		.10 (SD=.47)	4.83%	8.12%

The SNA indices for Resources are not as centralized as was the case for the discussion boards (out-degree: 4.83%<10.14%, 10.62%, & 17.44%) (in-degree: 8.12%<17.00%, 20.39%, & 20.96%). Also, the network density for Resources is lower than the density for conditions in Discussion Board. Table 4.1.24 shows the comparison of the indices.

A sub-group diagram presented in Appendix 4-U explicates how members interacted with each other and formed interaction groups naturally. As shown in the interaction tree, many cliques were formed using members' members' density of interaction as a basis for identifying a clique. The interaction among members clustered the two in-service teachers (IN2 and IO3) and most pre-service teachers/new members into a sub group (from PN1 to PN6 on the figure), which indicates that these members had more interaction within the sub-group. In contrast, some pre-service teachers/new members (PN3, PN8, PN12, PN19, PN20, and PN30) formed into the sub-groups including pre-service teachers/old members. For example, PN3 and PO7 were formed as a small sub-group because both of them reviewed the most resources uploaded by other members. Compared to the interaction trees reporting the interaction in Discussion Board, the sub-groups formed were different. As shown in the interaction tree in Resources (Appendix 4-U), members were formed into sub-group based primarily on member types because pre-service teachers/old members had more uploading activity and pre-service teachers/new members had more reviewing activity.

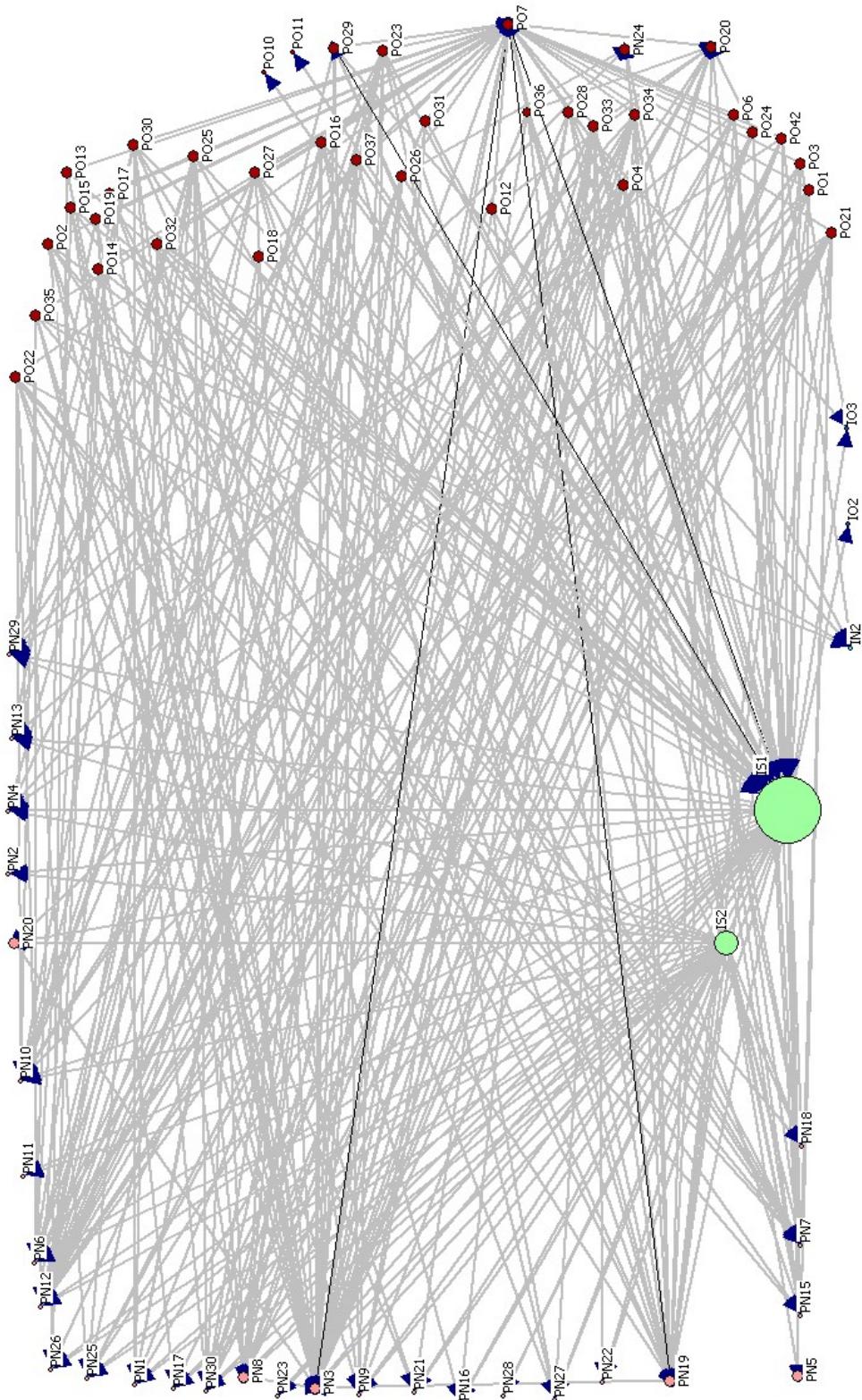


Figure 4.23. Interaction Patterns Diagram for Resources

Note. a. Each node of the diagram represented one member and each color represented one type of members. b. Lighter blue nodes represent in-service teachers/new members (IN). Darker red nodes represent in-service teachers/old members (IO). Lighter red nodes represent pre-service teachers/new members (PN), as well as darker red nodes for pre-service teachers/old members (PO). Green nodes represent instructors (IS). c. The lines between a pair of nodes indicated interaction between two members, and the gray lines indicated the one-way interaction as well as black lines were reciprocal interaction

IV. Participation in Chat Room: Levels & Patterns of Participation

Table 4.1.25 presents members' chatting frequency in Chat Room. Basically, there were three official Chat Room topic discussions planned for the Spring 2007 semester. Only two of the topic discussions took place successfully (February 20th and March 7th); and, no members participated in the third chat room topic discussion (March 20th). In addition to chat room topic discussions, members also asked questions or socialized with each other in Chat Room. The analysis for activity in Chat Room includes all the professors' and members' activities.

As shown in Table 4.1.25, darker colors indicate higher degree of chat frequency and vice versa. Overall, most of the members who participated in the Chat Room discussion were pre-service teachers/new members (PNs). Only one in-service teachers/old members and two pre-service teachers/old members participated in the chat room activities with PNs and ISs. Members' chat frequency was higher in January (total frequency=75, M=3.8 times/per day) and February (total frequency=111, M=4.0 per day); however, the chat activity reduced in March (total frequency=45, M=1.5 times/per day), April 2007 (total frequency=6, M=0.2 times/per day), and May (total frequency=0, M=0 times/per day).

Comparing the chatting frequency across member types, pre-service teachers/old members have higher average of chatting frequency (M=26, 57 chat activities /2 participants) than pre-service teachers/new members (M=7.2, 166 chat activities /23 participants), in-service teachers/old members (M=1, 1 chat activities/1 participant), and in-service teacher/new members (M=0).

Table 4.1.25
Monthly Participation Frequency in Chat Room

Member ID	Chatting Time				Grand Total
	January 2007	February 2007	March 2007	April 2007	
IO3	1				1
PN1	3	1	14		18
PN2	6				6
PN3	5		1		6
PN7	1				1
PN8	1	1		2	4
PN10		1	4		5
PN11			1		1
PN12	2				2
PN13	1		14		15
PN16	2				2
PN17	3	2	3	2	10
PN18	1	18			19
PN20	3	11	7		21
PN21		4			4
PN22	1	15			16
PN23	4	2			6
PN24		2	1		3
PN25	5				5
PN26	1	2		2	5
PN27	1				1
PN28	3				3
PN29	6	1			7
PN30	6				6
PO6	1				1
PO20		51			51
Grand Total	57	111	45	6	219

Note. a. Color shows count of Frequency. Darker color represents higher frequency of interaction, and vice versa. b. The text values show the count of the frequency of interaction. c. The frequency ranges from 1 to 51.

Figure 4.24 and 4.25 provide bar chart visualizations to compare members' chatting frequency across different member types and time periods. The total messages posted by the pre-service teachers/new members were more than messages posted from the pre-service teachers/old members and in-service teachers. In January 2007, 19 out of 31 pre-service teachers/new members, 1 pre-service teacher/old members, and 1 in-service teachers/old member participated in the Chat Room activities even though there was no official chat discussion topic. In addition it can be seen that the primary professor (IS1) and PN20 engaged in substantial chat among in February. Members' chatting activity was more active on the days chat room topic discussions were scheduled. Additionally, members' monthly and daily chatting trajectories reported in Appendix 4-V illustrate members' patterns of interacting with others in the Chat Room. In-service teachers were found to have less participation in Chat Room throughout the semester, and only one of the pre-service teachers/old members participated in the first official topic discussion. In the second topic discussion, only the lead professor (IS1) and some pre-service teachers/new members participated in the discussion. Appendix 4-W provides a visualization diagram including the trajectories of professors' activity. Compared to members' participation in Discussion Board and Resources, members had a lower level of participation in Chat Room.

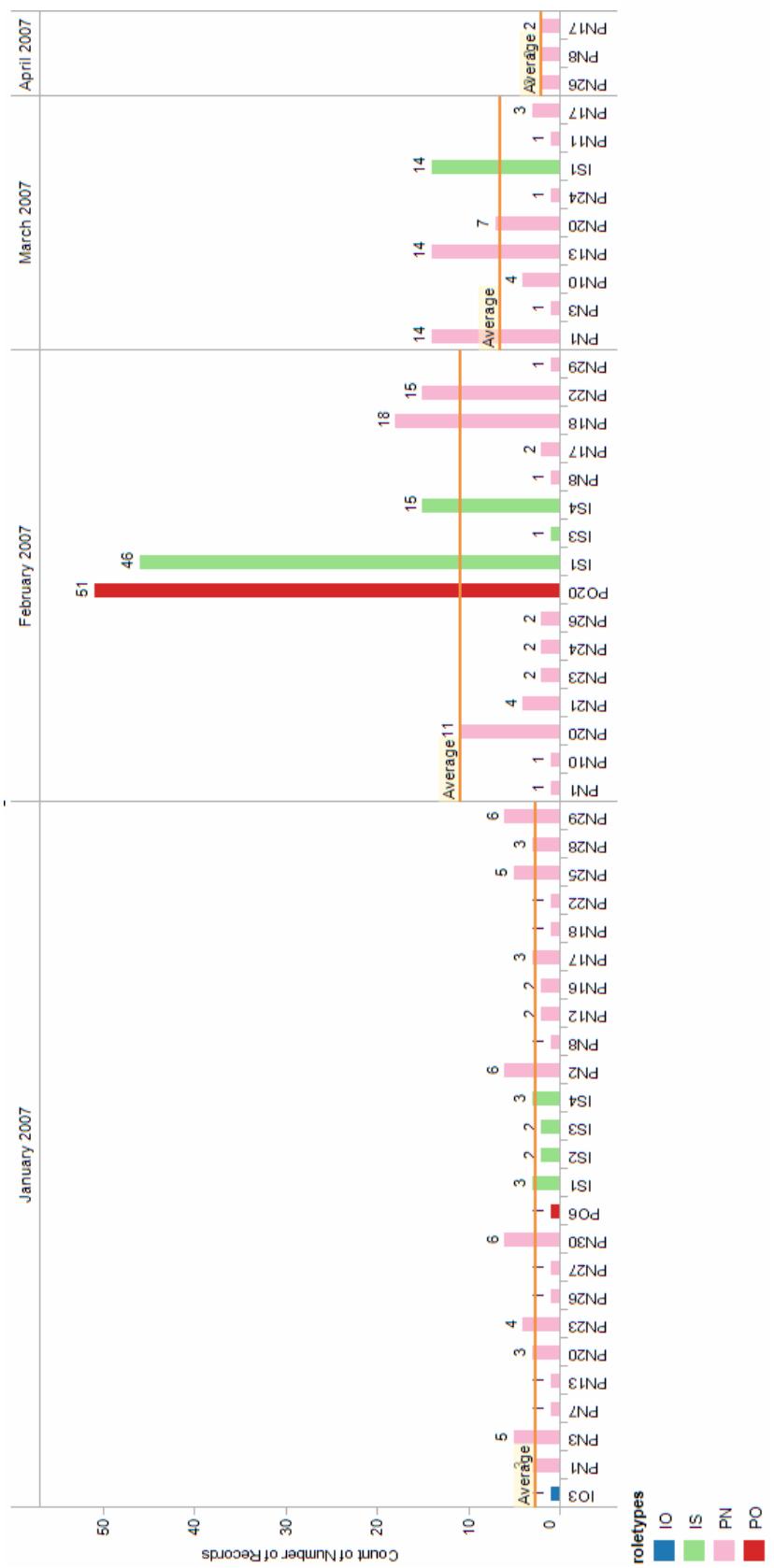
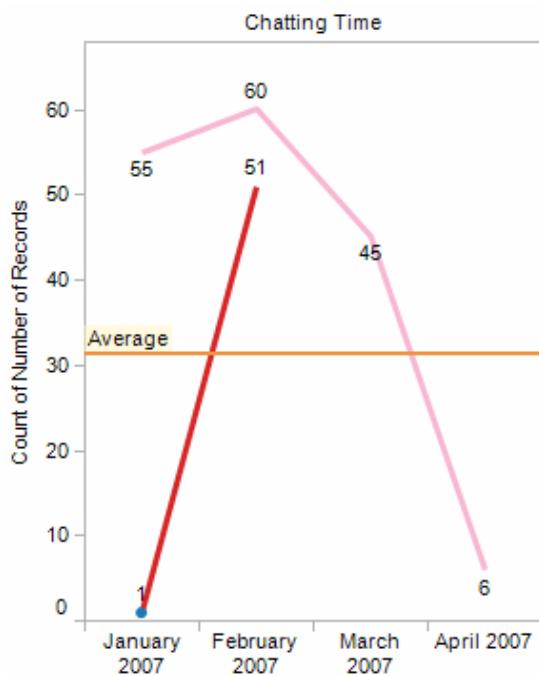


Figure 4.24. Comparison of Uploading Frequency in Chat Room

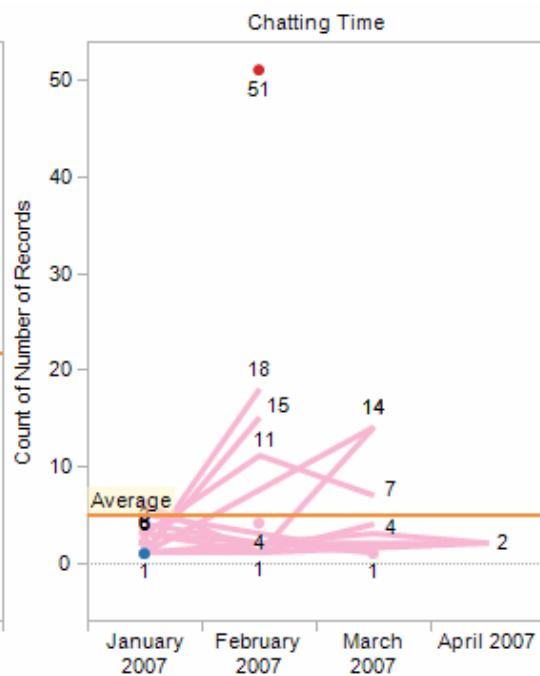
Note. Lighter blue bars represent in-service teachers who joined NETwork since Spring 2007 (IN). Lighter red bars represent pre-service teachers who joined NETwork since Spring 2007 (PN), as well as darker red bars are pre-service teachers joined since Fall 2006 (PO). Green bars represent instructors (IS).

Without Instructor

a.

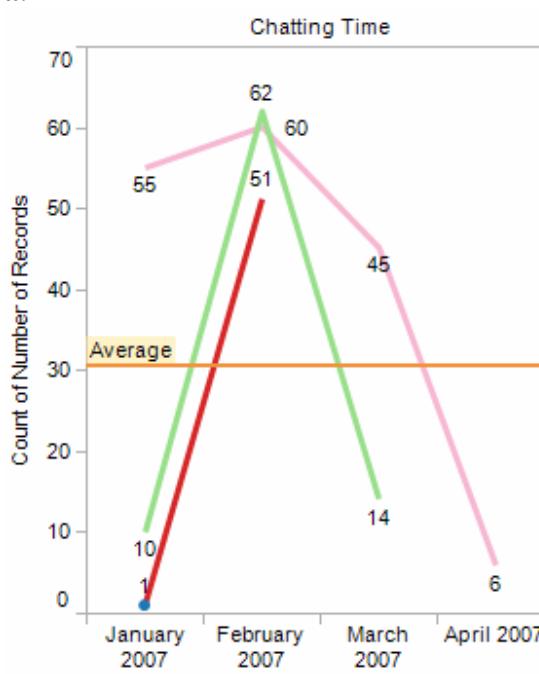


b.



With Instructor

a.



b.

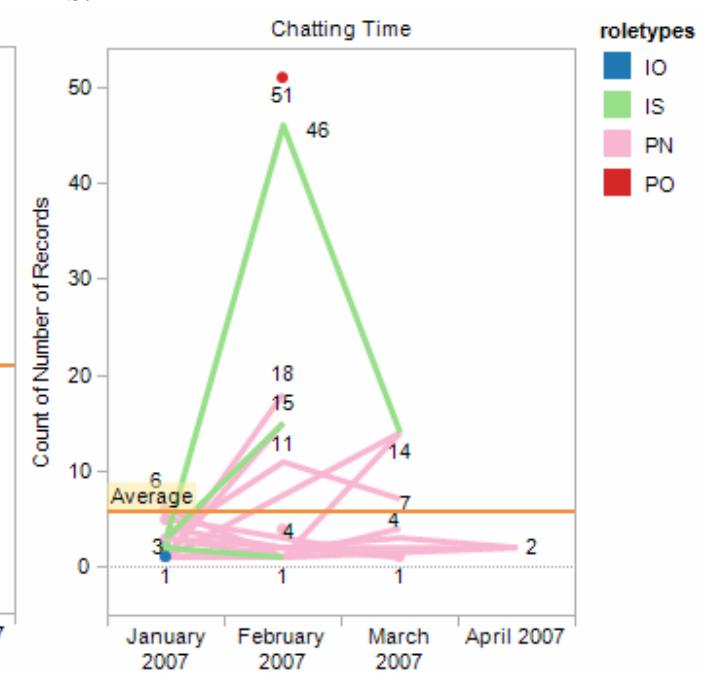


Figure 4.25. Monthly trajectory of Chatting in Chat Room (With/Without Instructor)

Note. Lighter blue lines represent in-service teachers who joined NETwork since Spring 2007 (IN). Lighter red lines represent pre-service teachers who joined NETwork since Spring 2007 (PN), as well as darker red lines are pre-service teachers joined since Fall 2006 (PO). Green line represents instructors (IS).

V.a. Content Analysis: Participation in DB

The purpose of the content analysis for members' DB messages was to examine if the ways members discussed teaching issues could be used to identify patterns of participation in the community of practice. Because the extended class discussions were primarily used for the mathematics field experience course (course-based), these discussion forums were not analyzed. Since there were no messages posted in the General Discussion forum, the content analysis only includes the discussion forums that were classified as NETwork Discussion Topics and Field Experience Discussion Topics. Members' discussion messages in both NETwork Discussion Topics and Field Experience Discussion Topics were coded based on a coding scheme (Appendix 3-H). Table 4.1.26 presents the coding results for members' messages in DB. Five themes were found through the coding process, including: 1) members mostly participated in DB by providing information and sharing experience but rarely responded with opposing opinions or deeper negotiation; 2) both professors and members with in-school experiences shared their experience and provided emotional support when responding to others' messages; 3) members' social interaction in DB was shaped by the relevance of the discussion topic to immediate and practical concerns; 4) members' messages were oriented by the foci of the discussion topics; and 5) members provided more emotional supports when discussing their concerns about future teaching and field experience.

Table 4.1.26
Coding Results for DB Messages

Discussion Categories	Discussion Topics	Sum of Messages	Identity	Socialization	Socialization/E motional Support	Socialization/ Sharing Stress	Community and Belonging	P1	P1: Advice from knowledge authority	P1: Shared in-school experience	P1: Shared NETwork experience	P2
NETwork Discussion Topics (Total: 15)												
1. Get to Know You	42	40	29									29
2. Discuss What You Want	182	5	33	7	1	139	11	30				1
3. Teaching Elementary Literacy	54	2	2	1		36	6	13				1
4. Teaching Elementary Mathematics	6		1			2	2	2				1
5. Teaching Elementary Science	49	3	8			32	5	13				4
6. Classroom Management	76		9			44	11	18	1			1
7. Effective Strategies	36		1			19	2	14				2
8. Standardized Tests	31	1				21	5	4				2
9. Tips and Advice	42		3	1		25	5	10				2
10. Assessing Student Learning	8					4	1	2				1
11. The First Years of Teaching	50		1	4		36	10	5				1
12. Interdisciplinary Instruction	14			2		12		1				1
13. Student Teaching	52	2	7	8		40	2					
14. What should a teacher do when....	58		5	3		34	13	10				
15. Parents	26		2			20	3	3				
Total	718	40	42	72	26	1	464	76	125	2	30	12
Field Experience Discussion Topics (Total: 5)												
1. Being Proactive and Taking Initiative in Your Field Classroom	36	1	2	1		18	1	17				
2. Field Questions & Concerns	153	5	22	6		108	13	27				5
3. Professionalism & Professional Development	20		1			17	2	1				
4. Reflecting on Elementary Science - Case Studies	64	1	13			55	9					1
5. Teaching Styles	40		17	1		24		10				
Total	312	0	7	55	8	0	222	25	55	0	0	6
Grand Total	1030	40	49	127	34	1	686	101	180	2	18	30
Percentage (%)	100	3.88	4.76	12.33	3.30	.10	66.6	9.81	17.48	.19	1.75	2.91

First of all, most of messages in DB were coded as phase one: “sharing and comparing of information” of IAM (Gunawardena et al., 1997) and very few messages belonged to phase two: “discovery and exploration of dissonance or inconsistency” of IAM. Also, there were no messages identified as phase three, four, or five information, which means that members mostly participated in DB discussion by providing information, sharing experiences, and giving suggestions, but rarely responded to others with opposing opinions or moved the discussion to a deeper negotiation process as represented by IAM codes. As shown in Table 4.1.26, 969 out of 1030 (94.08%) were coded as phase one messages, while only 18 out of 1030 (1.75%) were found to be phase two messages. An example topic that includes phase two messages addressing opposing opinions is titled: “Give me 5!!” from NETwork Discussion Topic 6: “Classroom Management.” This topic involved sharing positive and opposing perspectives for using the “Give me 5” strategy in teaching and sharing emotional support.

PN17: “All being at School C, I know you have heard at least 500 times the order to "Give me 5!". What are your thoughts? Do you see it working? Do students understand its purpose? Do you agree with it? What would you do differently? I am very curious to hear others opinions, b/c this is the first time I have death with something like this.....and OH!! do I have my own opinions and thoughts.”

PN8: “I personally like the Give Me Five method for the younger elementary students, but not really for the upper elementary students. In my fifth grade classroom whenever the teacher says give me five, the class seems to get bored and a little irritated with it. However, when the "buddies" who are in first grade come in our class and the teachers use the give me five method, the young students love it and respect it. Maybe the teachers could think of a new method for just upper elementary students that's a sign of seniority or something that is different from the younger grades. That way the students might think its cool to do it instead of boring and childish!!”

PN7: “I do like how the "Give me five" is a way to get everyone's attention when it is necessary. However, I am not sure that every student knows the true meaning. I am sure they learned from the beginning of their schooling at School A what the give me five stands for. But, I have a feeling that it may just be routine to them now, instead of a way to reinforce the five principles it stands for. The idea behind it is great, but I think that the students need to be reminded about what the true meaning and value of the "Give me five" really stands for. When someone announces give me five, everyone automatically (or it may take a few minutes) raises their hand. Do they really know what it is supposed to mean?” (**Phase two message**)

PN28: "Give me 5 is a great resource that seems to be working for School A, but it is something I personally would not use. I feel its 'real world' implication cannot be found. My teacher constantly reviews what Give me 5 means, and I feel these children are ordered around like a Concentration Camp. I, even as a pre-service teacher, feel awkward when hands are raised and children are to just stare at the "Fiver" (I do not even know what to call them).

I would simply do what teachers did when I was growing up and that was get quite, walk around, be proactive, instead of reactive, which I see the Give me 5 as." (**Phase two message**)

PN21: "Wow, so many great responses people! Well, I even thought all lot of people have mentioned that the "give me 5" strategy doesn't work as well in upper grade levels, I happen to think it does work, if practiced effectively! Last semester I was a preservice taught at School B (known for having severe problems in their past about bad behavior), and was in a 4th grade classroom. I saw it used in the classroom numerous times and worked like a charm. Actually when the term "give me 5" was introduced in as a PBS district wide guideline, It helped a school like School B the most ! And it's the older grade that usually give off the most trouble for fighting and misbehaving, and principles visits. So I do think it's extremely effective and a great tool especially for older children in 4 and 5 grades!"
(Emotional support)

Second, the messages were coded into attributes from Wenger's framework for a community of practice. Of 1030 messages, 177 (17.18%) were identified as advice from a knowledgeable authority and 305 out of 1030 (29.61%) messages were classified as messages of shared in-school experience. When discussing teaching issues, instructors, in-service teachers and pre-service student teachers responded to others about their in-school experience and teaching practices. In addition to messages directly related to discussion topics, members also provided emotional support to others or shared their stress with each other during discussions. Out of 1030, 240 (23.69%) messages and out of 1030, 60 (5.83%) messages were coded as emotional support and sharing stress, while 350 out of 1030 (33.98%) messages were identified as messages with socialization information. Below is an example with title: "Classroom Library" identified from NETwork Discussion Topic11: "The First Years of Teaching" which shows how members shared in-school experience and shared their emotional support and stress within their postings.

PN9: “One thing I'm getting a little nervous about is my classroom library. I've got a couple books from my younger years, but not enough to supply a classroom. So I spent \$65 on books with the scholastic book order and realized that building my classroom library is going to cost me a lot of money! Also, when building up our libraries, how do we know which level of books to buy because we don't know what grades we're going to teach yet. I don't know why but I'm really anxious about this library...”

PN21: “Holy moly, Do I agree! I actually didn't even have the money this week to spend on the Scholastic books, but completely understand your nervousness! Every classroom I have been in has had hundreds of books it seems like! I asked one of my teachers last semester about that when I preservice taught at School B and she said she went to the Good Will. There she found so many books that they were going to throw away and she saved them for her classroom. I also think Garage sales, I found are a great source, because close to where I live there's a humongous neighborhood that has a massive collaborative garage sale day, so all the houses have a garage sale, and there I always find all sorts of books for all reading levels! I mean, as you may know, were not going to be roll'n' in the cash money anytime soon in our lives! SO you might as well be creative and fins alternative ways to get the materials we need for your future kiddies!” (**Sharing in-school experience & stress**)

PN13: “I have been buying books since freshman year of college. A few books here and there really add up. I try to hit local book sales- at libraries and schools- where I can find books for less than a dollar. Used books- as long as they aren't falling apart- are just as good as new books. I am also open to buying multiple copies of the same book in attempts to have copies for an entire reading group....Don't stress and don't spend a million dollars, buy books when you absolutely can not leave the store without them. I will be honest, the only time I have bought books full price is when I go out looking for a specific book- the rest of my books have been bought at used book sales.

I hope this helps!” (**Emotional support**)

PN8: “I know I am stressed about my classroom library also!! However, PN11 and I discussed how beneficial it would be to find an older teacher who doesn't need to use their scholastic book points. A new teacher could save ALOT of money buying investing in a friendship like this :)" (**Sharing stress**)

Third, members' social interaction in DB was shaped by the relevance of the discussion topic to immediate and practical concerns. As an example, NETwork Discussion Topic 6, 11, 12, 13, and 14 and Field Experience Discussion Topic 2 and 4 have more messages (over 50) relative to other discussion forums. The levels of participation may have been higher than others because these discussion topics provided opportunities for members to ask/discuss issues that directly related to the coming teaching stages (i.e. student teaching and the first years of teaching), practical teaching issues (i.e. “what should a teacher do when” and classroom management), and issues found in field experience (i.e. Field Questions & Concerns) that were highly salient for

the pre-service members. Another topic that also had over 50 messages was NETwork Discussion Topic 3: "Teaching Elementary Literacy." In this topic members asked IS3 many questions regarding how to teach literature because there were no extended course discussion forums for the literacy field experience course. Another topic that also had over 50 messages (64 messages) was NETwork Discussion Topic 5: "Reflecting on Elementary Science-Case Studies." This topic provided an opportunity for students who were taking field experience courses to reflect on the case studies used in science field experience course. In contrast, the NETwork Discussion Topic 4: "Teaching Elementary Mathematics" only had 6 messages for discussing issues of teaching mathematics field experience course. The reason why this topic only had few messages may be because IS2 had all the pre-service teachers/new members using the mathematics extended course discussion forums for the mathematics extended course discussion.

Fourth, the NETwork Discussion Topic 1: "Get to Know You," had many messages including members' identity information and expectations for using NETwork. This topic had more messages coded socialization (29 messages) compared to other discussion topics. The purpose of this discussion topic was for members to share personal information, get to know each other and discuss expectations for NETwork. Thus, more messages addressed socialization were posted in this discussion forum as members were trying to introduce themselves to others or recognize someone they know. Below are three examples of socialization coding identified from members' messages in this discussion topic.

IO2: "Hi, For those of you that didn't see this last semester... My name is IO2. I am a teacher in School C, Indiana. I teach at a very small school that is 6-12th grade... This is my first year teaching, and I am really enjoying it for the most part. If you have any questions or anything let me know."

PN19: “Hello Blue Block! I am PN19 and I am currently a senior at the University of Missouri-Columbia as a pre-service teacher. I would like to teach upper elementary when I am finished. I expect to gain resources from the NETwork.”

PO2: “Hey Friends!! My name is PO2, I'm a current Red Blocker, but I was in Blue Block last semester, and was in the Sakai forum! If you have any questions about Blue Block, please feel free to ask, as I'll probably be asking you guys questions about Red Block! I'm from...Like I said before, I'm here if you need any questions answered, and I'd also like to wish you GOOD LUCK this semester in Blue Block! It's hard work, but you learn SOOO MUCH, I promise!”

Lastly, NETwork Discussion Topic 2: “Discussing What You Want” (33 messages for emotional support and 7 for sharing stress) and Field Experience Discussion: “Field Questions & Concerns” (22 messages for emotional support and 6 for sharing stress) also showed that the discussion boards could be used for emotional support and sharing stress messages. These topics provided members opportunities to share their questions and concerns about future teaching and current field experience. When members were talking about their questions or concerns, other members provided emotional support as well as shared similar concerns/stress. The topic also included members giving suggestions or sharing relevant information. Three examples of how members shared their emotional support and sharing stress in these two forums are presented below. The first example with title: “classroom behavior” was identified from Field Experience Discussion Topic 2: “Field Questions & Concerns,” it is an expression of a members’ concerns and questions when practicing in the field and includes suggestions from professors or other members.

PN14: “I feel that in the younger grade levels such as first grade, there is a lot more classroom management than teaching material. I know first grade is the year where they learn a lot about how to act and be in the classroom. I just want to know is there less material to cover in first grade, or are you expected to be able to cover all the material and teach them how to behave in a classroom that year? To me that would be a lot of work and really scary for a first grade teacher, or do we focus on classroom behavior a little each year?”

IS4: “PN14, this is a really good question. It has been my experience that classroom behavior is "taught" or "handled" at all grade levels (including undergraduate and graduate). The content to be covered at each grade level can be found in the GLE's. I don't believe that first grade has less material to cover, it is just at a different level than older grades.

My personal experience with a first grade room was when I had my former foster daughter... I was a specials teacher at the time and found that I had fewer behavior problems (because the students enjoyed computer lab) than others had in their regular classrooms. One reason for this - my Principal actually spoke to me about this - was my classroom behavior policy... These were tied to rewards - such as a good call home, a pencil, an eraser - that kind of thing. The Principal made this a school reward policy when I stopped teaching specials and went to a regular class." **(Advice from knowledge authority & Emotional support)**

PN12: "PN14, I have noticed the same thing as you, and we are in the same field class this semester. I felt like last semester it was a lot of discipline for being off task or not respecting the teacher and I was in a fourth grade classroom and this semester in the first grade classroom it is teaching of the rules. In my own classroom I want to focus a lot on the rules and appropriate behavior at the beginning of the year so I do not have to constantly be focused on that for the rest of the year. I understand that you will always be providing behavior management strategies everyday but I do not want that to be my only focus." **(Emotional support)**

PN10: "PN14, this is a really good point. I am in a first grade class this semester too! I actually LOVE my placement this semester and being in the first grade. I hope to teach either first or second grade after I graduate...In my classroom, the first graders are very good about being in charge of their own learning and participate very well in both reading and writing workshops. I have also witnessed important math, social studies, and science lessons in the classroom..." **(Emotional support)**

The second example with title: "Teaching what THEY'RE Teaching?" was abstracted from NETwork Discussion Topic 2: "Discuss What You Want," and it involved PNs' interaction around sharing the same concerns and giving emotional encouragement to each other.

PN20: "Okay another random thought. Let's say that you're teaching in a room next year and you're using the methods we've learned in our methods courses: inquiry based instruction, lots reading/literacy, etc. Sounds all good and dandy... but what if you're one of 5 teachers of that particular grade level and you're the only one using this "style" to teach. Do you feel as if that would be hard as you, especially being a new teacher? Do you think that other teachers would be angry that you may not be at the same place as them in the curriculum?"

IS1: "PN20- This is a concern I often hear from prospective teachers-- one of the things I found was that, as a new teacher, I had waaaaay more autonomy than I anticipated. I was given a curriculum and standards to guide me, but HOW I got my students there was up to me. Nobody came to my room and told me HOW to teach-- in fact, as I sat in our common room daily sharing lunch and talking with my colleagues,...Not only was this FUN, but it helped me better develop my lessons by getting to teach them another time with a new group of students!" **(Advice from knowledge authority & Sharing Stress)**

PN10: "Truthfully, this has been a slight fear of mine. However, after reading IS1's response I am feeling much better about being a first year teacher. I would like to think that schools would be very receptive to any teaching methods that are beneficial to its students. I

especially feel that since inquiry based methods are becoming more well-known, schools would be excited for new teachers to start implementing these methods. I think that some schools are going to be more open to different teaching styles, and it is important for us to feel out school districts when we are looking for a job. I feel like that would be a topic we would want to discuss when we are on interviews. It is important that we are in an environment that allows us to teach to our greatest potential. ;)" **(Sharing Stress)**

PN30: "Hey PN20, I think that this is a really good and important issue you are bringing up! bravo!

Like Kristin said, after reading IS1's post, I really felt a lot better too, because I've definitely been worrying about this issue. I think that what scares me the most is I'm learning so much of one method of teaching (inquiry-based) that I don't think I could teach anything BUT that method after graduating from Mizzou. Scary, isn't it? Well, I really think that it comes down to being confident that your method(s) of teaching impact students in a positive way... Since everyone has different strengths and weaknesses, I don't think that it would be unfair to assume that all teachers should teach by the same methods, you know? And even though we might not feel like it, as first-year teachers, we will be able to offer our students something that no other teachers can--we will be able to work with them using a clean slate and an open mind, since this is our first time teaching in a whole-year setting. I feel that we will be willing to learn so much in our first year that we will eventually find what methods work best for us and our classrooms, and that will make all the difference! :)"

(Sharing Stress)

The last example with title: "How Do We Teach Parents?" was identified from NETwork Discussion Topic 2: "Discuss What You Want," and it also involved suggestions and support from not only other PNs but also IS1 and IO3.

PN15: "I was just wondering how we can go about teaching parents how to help their students in different subjects, especially math? It seems like nothing is being taught the same as it used to be. I know that with a lot of the math being done in our fifth grade field class I feel lost. When trying to help the students, I have to figure it out as I go and hope that I am right. If I am this lost after going through methods courses (although I think I have fractions down after last semester) then how can we expect parents to have any chance? If a student is confused by their homework question, they have no one to go to. The parents know less than the child does. One of the people I work with even brought this issue up with me last semester. His sister (who was in third grade) was having trouble with her math homework and asked him for help. He figured it would be easy and began to show her how to do it. Problem was he was showing her the "old fashioned" way, and when she told him that wasn't how they did it he was lost. What are some things we as teachers can do to make the math easier for parents?"

IS1: "Here's a link to a booklet I provided to parents in their "welcome packet" at Open House... you can even order free copies online!
<http://www.ed.gov/parents/academic/help/math/index.html>" **(Advice from knowledge authority)**

PN27: "This is such a great question PN15, and it actually applies to all subjects, not just math. The reason I say this is because when I was reading On Solid Ground chp. 6 one of the quotes that I responded to was about parents pushing their children to read harder texts when they can read the words well, but are not yet able to comprehend the stories. But also in regards to math I struggled when I was in a 5th grade classroom last semester because I

felt like I couldn't help the students who needed help because I didn't want to confuse them with the traditional algorithms that I was taught when I was their age. So anyway I certainly don't have an answer to your question but I would like to hear what other people have to say about this issue... :P ” (**Emotional support**)

IO3: “Try and get your hands on a Wednesday Paper. Read the front page. I heard today that a lot of parents are anti Investigations because teachers can't explain well why they are teaching math differently.

So, What are you going to tell a parent when they ask, "Why is math so 'hard'/different?" or "Why isn't math being taught how I learned it?" “

V.b. Content Analysis: Participation in CR

The purpose of the content analysis for members' CR messages was to examine if the ways members discussed teaching issues could be used to identify patterns of participation in the community of practice. The CR messages are classified into two categories, including topic discussion messages and regular chatting messages, based on the time periods in which messages were posted. In Spring 2007 semester, three topic discussions were scheduled, but only two topic discussions were undertaken. The Topic Discussion 1 was successfully conducted on the intended topic, but the Topic Discussion 2 did not address the intended topic. Additionally, regular chatting messages are categorized into four time periods: Time Period 1, 2, 3, and 4. Before and after the scheduled topic discussions, members also chatted in the CR to ask questions or socialize with each others. Members' chatting messages in both topic discussion and regular chatting were coded by the coding scheme (Appendix 3-I). Table 4.1.27 presents the coding results for members' messages in CR. Two themes were identified through the coding process, including: 1) members' social interaction during the scheduled discussion topics was different depending on what topics were discussed; and 2) members had more socialization messages as well as asking for help or information about finding resources when chatting in the non-scheduled discussions.

First of all, members' social interaction in the scheduled discussion topics was different depending on what members discussed in the topics. As shown in Table 4.1.27, both pre-service teachers/new members and pre-service teachers/old members participated in Topic Discussion 1, while only pre-service teachers/new members and IS1 participated in Topic Discussion 2 and only IS1 showed up for Topic Discussion 3.

Table 4.1.27
Coding Results for CR Messages

CR Discussion Topics	Participants	Sum of Messages	Identity	Socialization	P1 Sharing and comparing of information			P2 Discovery and exploration of dissonance or inconsistency
					P1	P1: Advice from knowledge authority	P1: Guidance from the instructor	
Time Period 1 (1/18-2/20, 34 days)	IS3	2		1	1			
	IS4	2		1		1		
	IO3	1		1				
	PN1	1		1				
	PN2	3			3			
	PN8	1		1				
	PN10	1		1				
	PN11	1			1			
	PN15	1			1			
	PN16	1		1				
	PN17	3		1	2			
	PN18	3		3	1			
	PN21	7		8	8			
	PN22	1		1				
	PN23	1		1				
	PN24	1		1				
	PN26	2		1	1			
	PN27	2		2				
	PN29	5		4	1			
	PN30	1		1				
	PO6	1		1	1			
Total		41	0	31	20	1	0	0
Topic Discussion 1 (2/20)	IS1	46		4	5	13	20	3
	IS4	13			5	6		2
	PN18	28		9	18			1
	PN22	14		4	10			
	PO20	51	2	11	39			1
Total		152	2	28	77	19	20	6
Time Period 2 (2/20-3/5, 14 days)	IS4	2		2	1			
	PN1	4		1	3			
	PN3	1		1				
	PN11	1		1	1			
	PN13	4		2	2			
	PN20	4		1	3			
	PN17	1		1	1			
Total		17	0	9	11	0	0	0
Topic Discussion 2 (3/7)	IS1	9		2	1	6		
	PN1	7		1	9			
	PN13	10			6			1
	Total	26	0	3	16	6	0	1
Time Period 3 (3/11-3/13, 3 days)	PN10	2		2	1			
	PN17	4		1	3			
	PN24	1		1	1			
	Total	7	0	4	4	0	0	0
Topic Discussion 3 (3/20)	IS1	5		3	1		1	
	Total	5	0	3	1	0	1	0
Time Period 4 (3/20-4/26, 38 days)	PN8	3		3				
	PN17	3		3				
	PN24	1		1				
	PN26	3		3				
	Total	10	0	10	0	0	0	0

In Topic Discussion 1 IS1 spent considerable time to clarify participants' insights by posting messages of guidance and giving professional advice as well as some shared in-school experiences. The description below is a message that IS1 used to guide participants' discussion. Additionally, IS4 did not take the lead of the discussion but gave some professional advice and shared in-school experience with the participants. The new pre-service teachers, PN18 and PN22, mostly asked questions about the challenges of being a new teacher. The feedback to PNs' questions came from the instructors and PO20 who was doing his student teaching. In the discussion, PO20 shared his perspectives and feeling about student teaching and in-school experience, and he also asked questions of the ISs and PNs. Also, the PNs showed interest in knowing about PO20's experience in student teaching. One of them directly asked PO20 about his experience in school, the interaction involved IS1's guidance and suggestions from IS4 and PO7.

PN18: "Hi PO20, my name is PN18 I was just wondering how you as a student teacher made it apparent that you expected Respect from your students."

IS1: "Great question, Megan! Often the root of the problem is that expectations haven't been made explicit, or that there are implicit norms that are counter to the stated expectations!"

PN18: "I feel like being so young and in the classroom makes kids feel like your not a "real" teacher"

PO20: "Depends... we have a clap that they'll echo if we do it. That's supposed to get their attention, but it can be lost again in a blink. "

PO20: "Or they "pull a card""

Another example from the topic 1 discussion shows how practical perspectives from the ISs and PO20 helped answer PN18's concerns about how she dealt with issues in the field practice.

PN18: "So earlier in the year I was hit by an autistic child in the classroom"

PN18: "Neither the teacher or the para saw it happen and all I did was say "keep your hands to yourself" and I walked away"

PN18: "I'm still not confident that I did the right thing"

PO20: "Why?"

IS1: "How did the situation end up? Looking back on this, would you have handled it differently?"

PO20: "What do you think you should have done differently?"

IS4: "Well, I found that by making sure the child understood what respect was, was very helpful. Some were unsure even at the 5th grade level what the difference was between disrespect and speaking their mind."

PN18: "Well I haven't had any more problems with the child but I was more worried about any students that may have saw it happen and realizing that I may not have used their system when it comes to violence in the classroom"

PO20: "What is the system?"

IS1: "Yes; the student who hit you, PN18, was being disrespectful-- do you think he/she realized that? How did your response communicate this to the student?"

PN18: "I really don't think he realized it at all"

IS1: "It seems to me that your response was immediate and firm, and that by walking away you avoided escalating the situation. All of that seems positive!"

PO20: "And IS4, respect is a hard concept... A whole lot of my kids still think you can't be fully respectful if you're saying much of anything."

Because PO20 is the only one participant who was not taking field experience courses, he introduced himself by providing his identity information in the chat messages (i.e. For those who don't know me, I was in Dr. IS1's class last semester. Now I am student teaching in a third grade class in...) while other participants did not provide their identity at the beginning of the discussion. Also, participants tended to start their chat with a socialization message (Hi, PO20.....) and move on to their questions and the discussion content.

For Topic Discussion 2, participants did not really discuss the topic: "How can you meet all of your objectives in EVERY subject within the school day?" The PN1 and PN13 basically only asked IS1 about the due time for their assignments, about their field experiences, or repeated questions they have asked in the Discussion Board. Because the chat topic discussion was scheduled for only 1 hour, IS1 left CR about 10 minutes after the full discussion time period. However, PN1 and PN13 remained and talked about their field experiences. Below is an example of the interaction between IS1 and PN13 when IS1 was trying to answer PN13's question.

PN13: "IS1, I have a question- maybe you read it on our discussion board- but if you teach in a district in which there are science specialists that teach science as a special, are you- as a classroom teacher- allowed to teach science in your classroom?"

IS1: "Yes, of course! Many of the local science specialists would like to have classroom

teachers teach in partnership with them”
IS1: “I just wrote a paper (forthcoming in publication) that talks about different models of science specialists--”
IS1: “Some of these are specifically structured to have collaborative teaching done between the specialist and classroom teacher”
PN13: “I was just wondering because my field teacher doesn’t teach any science- do you think that there are a lot of teachers that fit it into their schedule- because I feel like maybe the specialist is a cop out and then teachers feel like they don’t have the science responsibility anymore- but I don’t think that once or twice a week is enough”

IS1 was the only person to enter the chat room for the topic 3 discussion. The total messages generated decreased from topic 1 to 3, 152 messages were posted in Topic Discussion 1, 26 messages were posted in Topic Discussion 2, and 5 for Topic Discussion 3.

Second, members had more socialization messages as well as asking for help or information about finding resources when chatting in the non-scheduled discussions. Differing from the scheduled topics, members rarely discussed teaching issues in these impromptu chats. The analysis of these regular chatting messages was organized into four time periods based on the scheduled topic discussions. Fifty-four out of 90 regular chatting messages were coded as socialization messages and 36 out of 90 messages were IAM phase-one messages. For phase-one messages, one of the 36 messages was advice from IS4, while the other 35 messages were questions asking and responses to questions with shared information. Pre-service teachers/new members were the primary group who participated in the regular chat during the four time periods. One in-service teachers/old members (IO3) and one pre-service teachers/old members (PO3) also participated in the regular chat during the first time period. In addition to socialization, pre-service teachers/new members asked questions about their course work for field experience courses. For example, PN15 and PN17 asked the same question and IS4 responded.

PN15: “I don’t remember where the videos are so if anyone could help me out I would appreciate it...”

PN17: "hey where can I find the video for lesson 6 & 7.1?"

IS: "Hey PN17, you need to go to resources – science resources – video case studies: RPES
– classrooms – seed and eggs."

In the regular chat, members' messages would not always be responded to by others, possibly because the messages were posted for the whole community without specifying to whom they were talking. In these instances, other members might or might not answer their questions. Comparing members' regular chatting in the four time periods, pre-service teachers/new members chatted in CR to clarify their understanding of their assignments and participation in the courses during the first time period. Also, they mostly socialized with each other via saying hello. During the second and third time periods, pre-service teachers/new members asked a few questions about their assignments and course work, while during the fourth time period PNs only posted socialization information in the end of the course. Overall, members seemed to use CR as one of their ways to ask questions and socialize with other members. However, not many pre-service teachers/old members and in-service teachers posted messages in CR.

V.c. Content Analysis: Members' Perceptions of Participation (Serial Interviews)

The purpose of the content analysis for members' serial interview transcripts was to examine changes in members' perceptions about participating in NETwork including how they interact with others and how they used Sakai tools when interacting with others. Members participated in the semester-serial interviews included IO2, PN13, PN25, PO4, and PO6. Thus, fifteen completed serial interview transcripts (5 participants x 3 serial interviews) were coded based on the coding scheme (Appendix 3-F). Four themes were found based on the coding process, including: 1) the participation patterns of the in-service teacher (IO2) who participated in the serial interviews changed over the course of the semester; 2) pre-service teacher/new members' attitudes about participating in NETwork changed through the semester; 3) levels of participation of the pre-service teachers/old members who participated in the serial interviews started low and remained low; and 4) members perceived advantages of DB, CR, and RS when participating in NETwork.

First, the participation patterns of the in-service teacher (IO2) who participated in the serial interviews changed over the course of the semester. During the semester, she introduced herself to other members and read some postings, participated in some discussions via posting and reading messages in the middle of semester and by the last month of the semester was only reading some messages. At the beginning of the semester, she stated that it was beneficial to see different members' perspectives and see their questions about teaching and about getting ideas for the ways to teach different topics and students. In the middle of the semester, she did not believe that the way she taught in school was influenced by what she saw in NETwork; however, when moving to the end

of the semester, she described an experience of applying what she gained from NETwork discussion to help her students. She started the semester feeling that she was not getting much from other members' perspectives but ended up adopting some of what was discussed in NETwork to her current teaching in school. Below is how she described the change of her role from being a helper to someone who also gained knowledge of teaching from other members.

IO2: "I think I get something out of it, because it's useful to read different ideas and tips and just even though they're pre-service teachers it's still good to hear a discussion to see things and think about things that make you think about things and how I'm doing things in my classroom, too."

Also, IO2's sense of community changed through the semester. She originally felt the she was not necessary as a part of the group in NETwork, but more like a helper to provide suggestions to their questions and concerns. In the last interview, she expressed how she came to know more about other members by reading through their postings during the semester, but not necessarily getting closer with other members. However, she always felt comfortable when discussing with other members.

IO2: "when I read through them, they're students, so I read a lot of things that they said that I remember saying when I was in school. Like questions and concerns and things like that. So I don't really feel part of their group, I just feel like I'm kind of a helper.....When you read something that they (other members) wrote, it's kind of tells you what they're like. Like under the time management they were talking about a lot of people were really busy and kind of balancing their time..... I always felt pretty good about it, like I could get on if I had a question to ask. I don't think I've necessarily gotten a lot closer, but I think I've always felt comfortable. I've never felt really uncomfortable messaging or posting on the boards. I've always felt good about that."

Second, pre-service teacher/new members' participation was higher than other member types throughout the semester. However, their attitudes about participating in NETwork changed through the semester. The pre-service teachers/new members described that NETwork was an irritation for most of pre-service teachers at the beginning of semester. However, it changed through the semester. By the end of semester,

the pre-service teachers saw the values of NETwork and thought that NETwork would be very helpful for their student teaching because they would be able to discuss more about the actual teaching things. Below is an example of how one of the pre-service teachers/new members described how she felt.

PN13: "I think that it's just gotten better over the semester because, at the beginning, I know people in my class were just irritated because it was one more thing we had to do and the other blocks were doing it, you know, and things like that. But now it's almost become just like checking your e-mail. You just get on, you see what people are talking about, you throw in your input where you think you have input and at the end of the semester, we're going to have a bunch of—and obviously, you can keep getting back in it—so we're just going to have a bunch of resources that we can keep going back to, which is good because I take notes in class, but I don't write down exactly what people are saying. But on here, you can get on, you can actually see exactly what people were saying. So I think it's nice.....overall, I know we were all kind of irritated at the beginning with having to do this, but overall, I think that it's put together really well. You get on there and you can navigate around really well and so I think it's a good, good site."

Third, for the two pre-service teachers/old members who participated in the serial interviews, their levels of participation started and remained low (logging in about once or twice per week) and primarily consisted of reading activities. For example, PO6 said that she could exchange ideas with other members last semester, but not this semester because she did not know most of pre-service teachers/new members. However, their feeling of participating in NETwork were different from previous semester (Fall 2006) when they were required to participate in some discussion forums. In the Spring 2007 semester, they stated that since participation in NETwork became voluntary, they found it to be more meaningful to them. However, participating in NETwork also became lower priority in their busy schedule once it was not required. Below are sample statements from PO4 and PO6.

PO4: "I actually have been very busy, so I haven't gotten on there very often. So not very much... Things have been so hectic with work and school, I haven't really gotten the opportunity to get on there. I do get the emails, though, about who posted what, and everything."

PO6: "I wasn't as active as I was last semester. Because I don't really know any of the

students who are on Sakai right now. So I feel like last semester we could exchange ideas because we were in the same classes. But I really don't know anybody.....Well, I think it's more meaningful this semester just because it's an option. It's not a requirement for me to do this. And just having that connection of this is going to help us in real life and we see examples of teachers across the country participating."

Lastly, members also saw advantages of DB, CR, and RS. Especially, pre-service teachers felt DB provided them not only opportunities to discuss teaching issues and access to different points of view but also an opportunity to ask questions. Below is an example of how one of the pre-service teachers/new members described it.

PN13: "I think it's more just when we have to post on the discussion board it's a lot more like responding ... Like, if you go in there and read it, it's a lot more like responding to other people. Because there'll be an original question and then people answer it, but it's almost like people start answering other people's instead of going back to the original question, answering that. So it's kind of cool because it's actually like a classroom discussion, where you build off each other instead of just ... Because if it was just the question you couldn't read other people's, I think we'd get a lot of the same thing over and over and over again. So it's kind of neat."

Also, pre-service teachers/new members felt better when they did not have required postings after spring break. When they did not need to worry about how many required messages they need to posted, they started looking for thing that they felt interesting and passionate about. Below is an example of how one of the pre-service teachers/new members felt.

PN13: "I think in class, especially after spring break, because everyone's just ready to be done with school, that I think a lot of people come to class and they have their laptops or they're kind of working on whatever they want to work at rather than being engaged in conversation. But when you go on here... I know that when I get on the discussion board... Er, yeah, in the discussion boards, I actually look for things that I could have input on instead of just posting on the first one I come to, you know? And so it's nice to have a discussion with someone who's maybe passionate about the topic or actually has opinions about the topic instead of just talking about things that the teachers want us to talk about."

The pre-service teachers also stated that they were soon to do student teaching, and some NETwork Discussion Topics, such as "The First Year of Teaching," "Classroom Management," "Tips and Advice," "What should a teacher do?," and etc., provided direct help and caught their attention, which can at least partially explain why the total amount

of messages in these discussion forums are higher than others.

Additionally, CR was one of the tools that members liked most about NETwork. The members indicated that at the beginning of the semester, pre-service teachers/new members were chatting all the time. However, after a few weeks, the participation level of chat room faded out because members' moved their focus to discussion board discussions. Below are examples of how PN13 and PO4 described this experience.

PN13: "I like the chat room...It's kind of funny ...Because we get on and there'll be two of us on, because it gives a little symbol next to their name if they're in the chat room. And so we'll talk. But when we first got it, it was like we were chatting all the time. But now it's kind of faded out. But I like ... There's one part in it for field, the discussion board, where we just give each other fun ideas for lessons and activities, and I think that's cool.....I think that the chat aspect is really good as far as the live chats we do. But the chat room in general is just very hot and cold. Because some days you'll get on there and people are chatting, chatting, chatting. And then some days someone will ask a question but it will go unanswered for days because no one's even checking the chat room..."

PO4: "I really like the Internet chat, or the online discussion. Because I feel like with postings, like you'll get your answer in a few days or so, but like with the chat discussion you get an answer right away. Like, for instance with yesterday, with the student teaching, if you had a question, you got an answer right away. And I like the postings and everything, too, because you can see the interaction between the students and everything, but I think the chat discussion is my favorite part. Because you can get an answer right away. Like, if you're really concerned about something, they'll just get you that answer. I think that's the"

The shared resources, especially the lesson plans, in RS were identified as a benefit by members. For pre-service teachers/new members, they felt reviewing others' lesson plans helped them gain ideas and start their own lesson plan. For pre-service teachers/old member who were taking different field experience courses (different subjects) in Spring 2007, they did not use the lesson plans very much because they were developing lesson plans for different subjects, such as art and music. Below are sample comments from two pre-service teachers.

PN13: "Or the Resources, where we were before with the science, The Learning Cycle Lesson Plans. I think it's just helpful to be able to see other people's, because otherwise you'd be sitting at the computer just trying to come up with something completely on your own. And it's just nice to be able to see the layout that other people use, and things like that.....Because I think, especially as a first year teacher, I think sometimes you're really

scared to make decision on your own. You're like, "This is what I think and maybe it'll be" ... but if you can go back and be like, "Well this is what several people who I went to school with thought," you know, then at least you've got other people thinking the same thing and you're not just going off on your own opinion about things."

PN25: "it was nice to see the variety of topics. I will admit that. Because that's how they were documented, or saved, I guess, on Sakai. And so it was nice to see water cycle, magnets, and electricity. So it was good to see that. That was helpful."

V.d. Content Analysis: Members' Perceptions of Participation (Semester-end Interviews)

The purpose of the content analysis for members' semester-end interview transcripts was to examine members' perceptions of participating in NETwork including how they interacted with others and how they used Sakai tools when interacting with others. Members participated in the semester-serial interviews included IO1, IO15, PN16, PN20, PN27, PN28, PO2, and PO7. A total of eight completed semester-end interview transcripts were coded based on the coding scheme (Appendix 3-G). Six themes were found based on the coding process, including 1) members perceived the information provided from different types of members differently and constructed an identity and role for themselves that related to their position in the community; 2) pre-service teachers who were taking field experience courses perceived the voluntary and required discussions in NETwork differently; 3) members participation in discussion topics was influenced by their interests; 4) members saw advantages of NETwork tools (i.e. DB, CR, and RS); 5) pre-service teachers/new members' attitude of having NETwork as part of their learning changed over the semester; and 6) members stated that a lack of time has been an issue for their participation of NETwork.

First, members perceived the information provided from different types of members differently and constructed an identity and role for themselves that related to their position in the community. In-service teachers who were invited by IS1 to participate in NETwork knew that they had more practical experience than the pre-service teachers in NETwork; thus, they perceived themselves as helpers to provide practical suggestions for their questions. Also, they thought the value participating in NETwork was access to resources, ideas, stories, and examples of teaching. For example, IO1 expressed how he

felt below.

IO1: "...So many of the questions posed or discussions have to do with people who are inexperienced. More my role is coming from an experienced teacher and giving them advice or helping them in terms of, "Hey, this is my situation, it may be different because every class is different. But this may be able to help you." And in terms of other strategies, just opening my eyes to different resources and that sort of thing. That was good."

For pre-service teachers, they perceived the in-service teachers as a group who could provide special insights for in-school experience to help clarify what really works in current educational environments. Thus, pre-service teachers expressed the high value they perceived in gaining practical perspectives from in-service teachers. Below is how PN20 and PN28 expressed how they felt.

PN20: "Yeah, well with the in-service teachers' postings, it was kind of refreshing to read those because those are actually people who are in the field right now. And so a lot of my classmates, we have opinions, but it's nice to either hear someone who's actually in the field saying something different, or you know, agreeing with us. "Yes, this does happen; this is important." And with the professors, they were kind of the same... like the in-service teachers and could actually give you advice on real life experiences..... I mean, all of our classmates, we write about things that we might predict will happen or that we don't think will ever happen, but then when we hear these in-service teachers, they can actually give us examples.....the professor can go back and forth from being the in-service teacher to being with us students, you know? So they're kind of middle ground."

PN28: "because they are experienced teachers, so you take theirs a little heavier than you take your peers, because with experience you can say you've probably tested that or tried that out, so you can say whether it works or not. But at the same time, we're taught that every school is different, every state is different, every group of kids is different. So what they said and what they worked might not work for them next year, and it probably won't even, I mean who says it would work for me? But I also like reading my peers and stuff because they're the ones who experience everything with me. They've been to School A with me, they've been through all the same classes. They've had the same teachers. And so it kind of helps to read their stuff because they're in the same place as you. So it's kind of support from them. But from the experienced teachers, it's kind of more of an enlightening thing. We hear about all this, but does it really work? Do people really do it? So that kind of helped to read from theirs."

Although pre-service teachers knew that they could gain practical and valuable lessons from in-service teachers, some of pre-service teachers/new members also expressed that they were intimidated when interacting with other members who they did not know, especially in-service teachers. The pre-service teachers were uncertain about

how the in-service teachers would react to their questions. That is also the reason why some of pre-service teachers/new members indicated that they preferred to read the messages from someone who they knew. Below is how PN20 and PN28 expressed their feeling.

PN20: “I kind of thought it was little intimidating with the teachers who are out there right now that I don’t know, you know? And I’m full of questions, and so I didn’t know how they would react to that. But I got a lot more comfortable after the chat to see that a lot of them were very open about answering questions and really wanted to. With the teachers, it is intimidating to respond to their responses also, because you kind of want to word it correctly and sound like you know what you’re talking about. But I think I was most comfortable with my classmates, just... because that was more free-riding, and you could just share your opinion whether it was three sentences or three paragraphs, you know.”

PN28: “I’m one of those people that when I read something I like to picture that person. Because it kind of adds to it. You know how they talk. You know how they’d say it. And you know their mannerisms. You know if they’re being sarcastic or not. But when you don’t know them and you’re reading their posts, you just kind of take it for what it is... I much prefer to read my peers’ stuff, just because you can add character to it when you’re reading it. If it’s just somebody you don’t know, for all you know it could be someone—I mean, it’s obviously not some random person off the street posting, because the access is limited, but at the same time, where did they come from? Do they know how much you’re going through?...”

Further, members also perceived the information from the professors and other members differently. They liked to review the messages posted by the professors because they knew that they were knowledgeable people about teaching. For example, PN27 expressed his feeling below.

PN27: “Well on the discussion forums, I kind of like when IS2 posted, my math professor. And when Dr. IS1 would post, I’d tend to look at those because they’re usually not very opinionated and they’re a lot more open, kind of just for a response from students. So I like to look at those. And then, on the live chat, I talked with a couple of the teachers that I ..., but besides that, I haven’t really replied to very many of them.”

Second, pre-service teachers who were taking field experience courses saw differences in the voluntary and required discussion in NETwork. Especially, pre-service teachers/new members indicated the critical difference between the NETwork Discussion Topics and the Mathematics Extended Class Discussion Topics was that in the general Network discussion they had opportunities to interact with other members who were

outside of their field experience courses (i.e. in-service teachers) but not Mathematics Extended Class Discussion Topics. Also, they felt the NETwork Discussion Topics were much more interesting than the Mathematics Extended Class Discussion Topics while the latter was graded as part of their course participation and the former provided more practical issues. Below are the examples from pre-service teachers' perspectives.

PN27: "well I think that this first top part, the NETwork discussion forums, were even more beneficial because those were people who were other than the people in my class. Like for example, in the math discussions, it was just my classmates who I talk to outside of class anyway. But the NETwork discussion forums had people—first year teachers, and people teaching now, and I thought that was really helpful to hear what they had to say about certain things that I use, as pre-service teachers don't know about and can't contribute to the discussion."

PN28:

R: You mean the NETwork discussion forums are more interesting?

PN28: Yeah, because you're not getting a grade for it. Plus, it's more of next year I'm away from everybody. So what can I get now when they're all here, before I leave, kind of thing?

R: So the topics here will be able to prepare you for your student teaching?

PN28: Yeah. And then the math is more of what have you learned.

PO2: "When it is required to post something in the NETwork, I kind of login more to check if anything there that I need to post or discuss. But after it becomes a voluntary thing, I kind of join in the discussions with my own will. I did not check it everyday, but I check it one a while to see if there is anything there that is related to my teaching and what I am doing in class now. It is different when it is required and when it is voluntary."

Third, when participating in NETwork discussion, members decided to participate in discussion topics based on their interests. When the topics were about something that they cared about and found more interesting, they participated more. Also, members liked to participate in fresh topics instead of the older topics in which not many people were responding, because they thought other members rarely reviewed or replied in the older discussion topics. Below is an example from PN16.

PN16: "assumptions. I don't want to post something to that. It just depends on, just for me. So I look at the topic line and if it says something, then I'm like, "Yeah, I could probably have something to say." And then I try and skim through everybody else's posts. And then reply to that. And I look at the date. I mean, if it was two months ago, I'm not going to post again on it.....recent is usually what I do. Although it wouldn't matter if I went to an older one, I think I've posted on a lot of the older ones, so I try and do recent ones instead."

Fourth, members also expressed some advantages of NETwork tools, including DB, CR, and RS. Members described that the format of DB discussion made the discussion more focus comparing to traditional face-to-face discussion. To give an example, PN28 expressed how he felt in the following passage.

PN28:

PN28: ...when you post something you can't take it back. So that's kind of cool, too. If someone wanted to say something, like in a conversation they can, a lot of people like to dance around. But in a post you kind of have to stick to the point. Just because if you go on, no one's going to read all that. So I think the NETwork kind of forces you to stick to the point, say what you want to say.

R: More focused.

PN28: Yeah, it's more focused. That's definitely the way to say it. And so that's what I liked. And I never really with anybody, like if I'm in a conversation with someone and they don't agree with me, sometimes they get defensive and they might turn it into an argument more, not an argument but more of a debate... when we talked about diversity in the classroom, there were a lot of people who get very into it. They're very loud and they think they're right, so they don't listen to anybody else. Well, in here you kind of have to—even though you don't want to read on—you kind of have to read some of their, what they had to say. And you can't interrupt them because it's already posted. And it kind of forces you to narrow your statements, because you can't go on and on be like, "Well, I think this and I think that." It's kind of going to be like, "Well, this is what I've found. This is what I've done." You kind of take "you" out of it. So that's what I like. They have to be more focused in the NETwork than in normal conversation.

Members described that via chatting in CR with other members, such as in-service teachers, who they did not meet face-to-face they came to have a sense of who they are and felt more comfortable to ask them questions via private message tool. Especially, the display of users' names in the CR helped members gain a sense of others' presence as a person. For examples, PN20 and PO2 expressed how they felt about it below.

PN20:

PN20: And that's what was cool about the live chats is to actually see some of Dr. IS1's older students.

R: And kind of help you... gain insight of their identity and also what they are doing.

PN20: Right. And like I said, even with the users present, it makes it a more realistic situation, like you're really having a conversation with someone, not just a whole bunch of different writings.

PN20: That's great. So you can easily perceive that there is a person there?

S: Right!

PO2: "I feel more comfortable to ask questions or send private messages to the inservice

teachers who I have conversation with in the Chat. In this way, it won't be wired to suddenly send them the questions. I feel that after the chat discussion, it kind of help me built up the connection with them."

Also, members stated that they felt supported by NETwork, and one of the reasons was that information and resources shared in NETwork were very helpful for developing lesson plans. Members gained benefits from having a shared repertoire that was supported via Resources. Below are examples from PN27, PO2, and PO7.

PN27: "I feel like I kind of learned more about lesson planning in class and through readings, more so than through the actual discussions. But having the examples and the resources, that was incredibly helpful. And that's great because now we have those, we can use any of those in the future. Yeah, I like that."

PO2: "the teaching support that I have from my professors, such IS1 and the NETwork are very good. I feel that I have been supported by them. The information and resources are very helpful for developing my lesson plans, as well as the discussion provide different perspectives of teaching..... the examples of the Resources provided me ideas to start with my own lesson plans. Also, connecting with my friend who can review my lesson plans help me a lot."

PO7: "Well, I know whenever we did the learning cycle lesson with Dr. IS1, she had us all post them. And we've done so many lesson plans this semester. I mean, we've all had to write them, so we might as well post them so we can all get them...so having all those different Fi-B examples really helped me enforce the idea of what it really looks like.....I looked at some others..... It showed me that different people can interpret the same thing in different ways and can present it different ways, and so it just brings that multi-dimensional part back to where I can teach the same lesson with the same content standards, but someone else might do it completely differently and still teach the same thing."

Compared to information found on the Internet, members stated that the resources shared in NETwork by the professors and other members were more reliable. A comment from PN27 illustrates this point.

PN27 said: "...this is good because some resources, if you're just Googling, are really unreliable. And I feel like this (NETwork) is a good place to come for reliable information and resources."

Fifth, pre-service teachers/new members also expressed confusion and annoyance about using NETwork as part of their course work. They felt that NETwork was just one more thing that added to what they needed to do for the field experience courses.

However, after participating for a few weeks, they started seeing the value of it and preferred to have it as one of the resources they could have in the future. Below are how PN20 and PN28 described their reactions.

PN20: “I mean, at the beginning of the semester it was hard to get used to it. And I think some of my professors were confused because they hadn’t really worked with it, either. But after the first week, it was pretty easy to get used to.”

PN28: “I was really proud of my peers because this is something we’ve never done before. And at first a lot of us were like, “Oh, crap,” we have to post on Sakai, and we didn’t know what Sakai was. So a lot of people would get on quite often and do their thing, and they didn’t just do this half-assed thing, just writing a sentence and post, they would fill out a paragraph or a page and really put in what they could and sent it. It’s awesome.”

Lastly, members expressed that a lack of time has been an issue for their participation of NETwork. The in-service teachers indicated that heavy working loads in their first few years of teaching influenced their participation, as well as pre-service teachers/old members described that heavy working loads for their courses during the semester prevented their participation when they did not use NETwork as part of their courses. They felt they did not have time for participating in NETwork when they were getting busy with their other work. Also, some pre-service teachers/new members explained that the required postings (i.e. 5 postings/weekly) requested from the Mathematics Extended Discussion Board Topics occupied most of their time and kept them from participating in other NETwork Discussion Topics which were voluntary.

Below are stories from in-service teachers and pre-service teachers.

IO15: “well, first off, I’ve actually only logged on a couple times. I would honestly say only a handful of times onto the NETwork. And that’s just due to... it is my first year of teaching and I’ve been extremely busy.”

PN27: “I really, really liked just being able to share ideas and read what everyone else had to say about certain things. The only thing I really didn’t like... is that, for some of our classes, we would be required to have a certain number of posts, so it seems like it was almost more to meet the requirement than to actually put thought into something. And I think, more so, I will use the NETwork more when I’m not doing it so much for a class, but to talk with other teachers and stuff during my first years of teaching.”

PO7: “because my professors didn’t talk about it. We weren’t required to post or weren’t required to talk. I do think, I was just thinking about this when I was coming up here, I for sure during finals week and during the summer, whenever I have time—because I like Sakai, I like the resource, but during this semester it was a time issue. It wasn’t that I didn’t want to participate, it was just that, you know. So I think in the next few weeks when the semester winds down and I have time, I do want to go back and I’m going to go through the resource list.... it’s just a matter of finding the time to do it...”

Result Summary for Research Question 1

To summarize the results presented above, the results can be classified into four categories: 1) members' login frequency; 2) members' participation levels and patterns in DB; 3) members' participation levels and patterns in RS; 4) members' participation levels and patterns in CR. Table 4.1.28 and 4.1.29 summarize members' levels of participation across months and member types.

Table 4.1.28

Average of Activity Frequency for Login, DB, RS, & CR

Included Discussion Activities	Nov 06	Dec 06	Jan 07	Feb 07	March 07	April 07	May 07
Login Frequency	n/a	n/a	102	↘ 85	↘ 69	↗ 78	↘ 43
DB: Posting Activity	Entire DB discussion	n/a	n/a	11.3	↗ 21.4	↘ 17.3	↘ 12.5
	FE & NETwork Only	n/a	n/a	4.2	↗ 13.0	↘ 10.0	↘ 4.7
	NETwork Only	n/a	n/a	2.8	↗ 9.3	↘ 7.3	↘ 3.6
DB: Reading Activity	Entire DB discussion	n/a	n/a	54.1	↗ 396.4	↘ 312.4	↘ 214.9
	FE & NETwork Only	n/a	n/a	6	↗ 152.9	↗ 179.8	↘ 94.8
	NETwork Only	n/a	n/a	3.4	↗ 101.2	↗ 120.3	↘ 64.3
RS: Reviewing Activity	n/a	n/a	13.1	↗ 14.6	↘ 8.0	↗ 22.1	↘ 4.7
RS: Uploading Activity	1.06	↘ .13	↘ 0	→ 0	→ 0	↗ .16	↘ .14
CR Chatting Frequency	n/a	n/a	3.8	↗ 4.0	↘ 1.5	↘ 0.2	↘ 0

Note. n/a represents "not applicable"; ↗ represents "increase"; ↘ represents "decrease"; → represents "no change." The average is the mean number of events per day for the number of days in the month.

Table 4.1.29

Average of Activity Frequency during the Whole Semester

Included Discussion Activities	PN	PO	IN	IO
Login Frequency	292.4 (1)	14.1 (3)	9 (4)	35.3 (2)
Posting Activity	Entire DB discussion	54.4 (1)	2.8 (3)	0 (4)
	FE & NETwork Only	27.7 (1)	2.2 (3)	0 (4)
	NETwork only	19.6 (1)	2.0 (3)	0 (4)
Reading Activity	Entire DB discussion	909.5 (1)	40.3 (3)	13.5 (4)
	FE & NETwork Only	401.3 (1)	42.8 (3)	13.5 (4)
	NETwork only	260.1 (1)	40.6 (3)	13.5 (4)
RS: Reviewing Activity	49.9 (1)	15.3 (2)	5 (3)	4 (4)
RS: Uploading Activity	0.2 (2)	.97 (1)	0 (3)	0 (3)
CR Chatting Frequency	7.2 (2)	26 (1)	0 (4)	1 (3)

Note. Values with in the brackets present the ranking order; 1 to 4 indicates high to low. The average is the mean number of events per member in the member type.

First of all, members' overall login frequency started relatively high in January 2007 and remained fairly consistent throughout the semester but dropped at the end of the semester. Comparing the login frequency across member types, the rank from high to low frequency were pre-service teachers/new members (PNs), pre-service teachers/old members (POs), in-service teachers/new members (INs), and in-service teachers/old members (IOs).

Second, members' levels and patterns of participation for three conditions of DB discussion (i.e. Entire DB, FE & NETwork only, and NETwork only) has some similarities and some differences (refer to Table 4.1.28). Members' posting activity were consistent in that they increased in February but kept decreasing in March, April, and May across three conditions. However, the members' reading activity in the entire DB differed from the other two conditions (FE & NETwork only and NETwork only). The frequency of reading activity in the entire DB dropped in March while reading activity of FE & NETwork only and NETwork only increased in March. This difference is primarily attributed to the reading activity of the Mathematics extended discussion forums which dropped in March and this led to the drop in March for the entire DB.

Comparing the posting and reading activity in three conditions across member types, the rank from high to low frequency as PNs, IOs, POs, and INs were consistent across the three conditions. Additionally, the network density and centralization out-degree and in-degree changed across three conditions. Differing from the entire DB discussion, the FE & NETwork only and NETwork discussions showed that some members stood out when looking at who was reading, but when looking at who was reading who, but the data on being read was more equally distributed across the members. Also, the density of

members' interaction across three conditions became smaller when narrowing the discussion scope down to NETwork only discussion. Moreover, PNs had most intensive interaction within their group, but most of them also read messages that originated from POs, IOs, and INs. Especially PNs read a lot of messages posted by some particular POs and IOs who had more reading activity compared to other POs and IOs. These active POs and IOs also had more reciprocal interaction with PNs. Some POs and INs were identified as peripheral members because they did not post or only posted few messages but had more reading activity. These members were easily ignored by other members because their messages were rarely read by other members.

Further, pre-service teachers/new members who were interviewed showed differing perceptions of voluntary and required discussion indicating a preference for voluntary discussion topics. Also, the nature of the topics was what determined participation. Members stated that they mostly decided to participate in a particular discussion based on the relevance of the discussion topic to their immediate and practical concerns but not by who initiated or posted messages. Overall, members' attitude and perception of their role and NETwork as a community changed in a positive way after throughout the semester. Examining members' discussion messages, members mostly replied to other members by providing information and sharing experience but rarely responded with opposing opinions or deeper negotiation. Also, members with practical teaching experience shared their in-school experience when replying to members' questions or concerns, and members expressed more emotional support when discussing concerns about teaching or field experience.

Third, most of the resources were uploaded by the professors and POs when they

were taking the field experience courses in Fall 2006, while only a few PNs and professors uploaded resources in Spring 2007. Also, members' frequency of reviewing resources was different across member types. The ranking level from high to low of reviewing frequency by member types was PNs, POs, INs, and IOs. Overall, the reviewing activity increased in February, dropped in March, increased again in April, and dropped again in May. Additionally, the density of interaction in RS was very low, indicating lower degree of interaction among members compared to members' interaction in DB. The higher centralization in-degree and low centralization out-degree indicate the group that received information (who reviewed resources) is more centralized than the group of members who had resources reviewed.

Lastly, members' overall chatting frequency was higher during the time periods when discussion topics were scheduled. Chatting frequency increased in February, and dropped gradually in March, April, and May. In addition to professors, PNs were the primary participants in CR discussion topics. In-service teachers and POs were found to have less participation. Compared to the arranged discussion topics, members' ad hoc chatting activity contained more social information. Members participating in discussion topics mostly started their conversation with some socialization sentences and moved to focus more on the discussion topics, which was different from the non-scheduled chatting when included more social information to ask for help or suggestions.

Overall, members' levels and patterns of participation in DB, RS, and CR varied depending on the focus of information content carried by the tools and members who participated in the interaction. Also, members perceived the advantages of DB, RS, and CR through participating in NETwork.

Research Question 2

The second research question was: "How well does the proposed path model explain the relationships among the social constructs of online learning (i.e. sense of community, social ability, perceived ease of use, and perceived usefulness) and explain community outcomes/effects (levels of participation, satisfaction with NETwork experience, and effectiveness of NETwork for Teaching)?" The quantitative data collected via the final survey at the end of the Spring 2007 semester was analyzed to answer this research question. To examine how well the proposed path model explains the relationships among the social constructs of online learning, correlation and path analysis were selected as the most appropriate techniques given the sample size for the study. For the path analysis, the proposed path model with the primary constructs was examined first. Given the limited sample size the sub-constructs of satisfaction and social ability were not included in the proposed model. A total of 66 NETwork members completed the final survey via an internet-based questionnaire in May 2007. Table 4.2.1 presents the demographic information for the 66 cases in the path analysis. Additionally, Table 4.2.2 presents these members' reasons for participating in the NETwork.

Table 4.2.1
Demographic Information for 66 Participants

Demographic Information		Number of Participants	Percentage (%)
Gender	Male	6	9.1
	Female	60	90.0
Age	Under 20	7	10.6
	21-25	55	83.3
	26-30	3	4.5
	>30	0	0
	missing data	1	1.5
Membership	Old member (since Fall06)	36	54.5
	New member (since Spring07)	30	45.5
Teaching Status	Pre-service teacher (Old member)	30	45.5
	Pre-service teacher (New member)	30	45.5
	In-service teacher (Old member)	6	9.1
	In-service teacher (New member)	0	0
Participation of NETwork Discussion	participator	42	63.6
	non-participant	24	36.0
Previous Online Learning Experience	In Sakai	46	69.7
	In Blackboard	48	72.7
	In other systems	2	3.0
	Missing data	14	21.2
Messages Posted in Discussion Board (weekly)	less than 2 postings	37	56.1
	3-5 postings	24	36.4
	6-8 postings	4	6.1
	8-10 postings	1	1.5
Hours Login(weekly)	less than 1 hour	38	57.6
	1-5 hours	28	42.4
	6-10 hours	0	0
	>10 hours	0	0

Table 4.2.2
Reasons for Participating in NETwork

Reasons	Number of Participants	Percentage (%)
For class participation	46	69.7
Professor/instructor' recommendation	16	24.2
Have a place to access good information and lessons	9	13.6
Have a place to access resources and professional supports	9	13.6
Have a place to share information and personal insights	10	15.2
Have a place to go for help and ideas from those in the same situation	9	13.6
Have a place to gain insights and advices from other experienced teachers (pre- and in-service teachers)	11	16.7
Establish and have NETworking connection with other teachers	7	10.6

Note. Members could select all that applied. 14 cases had missing data.

Preliminary Analysis

Prior to the path analysis, the assumptions of normality, linearity, multicollinearity, homoscedasticity, and uni- and multi-variate outliers were examined. First, normality was examined for the skewness and kurtosis of the 9 variables, including SOC, PEU, PU, SA, SPi, SPP, SN, S, CE, LS, and ET. All skewness values (between -.21 and -.70, $< \pm 3$) and kurtosis values (between -.84 and .21, $< \pm 3$) of the variables were found to be satisfactory. The Kolmogorov-Smirnov (K-S) test of the variables found that K-S values (Sig. value between .98 and .15) with non-significant (> 0.1) suggest that there are no major deviations from normality. Additionally, spot checks using scatter plots of some combination of variables were conducted and all indicated satisfactory degrees of linearity. Further, all the tolerance values were greater than 0.1 (between .17 and .32) showing no violation of multicollinearity assumption. A standardized residual plot shows that residuals were roughly rectangular and evenly distributed around the 0 point of the standardized predicted value (X axis), indicating no violation of homoscedasticity. Finally, there were no univariate or multivariate outliers with criteria z scores greater than 3.29 and smaller than -3.29. Thus, no cases were excluded for a total of 66 cases.

After examining the assumptions, the descriptive statistics for the social constructs were obtained and are presented in Table 4.2.3 as well as Cronbach's alpha reliability estimates. The mean values of the social constructs (above 4.54 on a 7 point scale) indicated members' positive perceptions of sense of community, social ability, perceived easy of use and usefulness of learning tools in Sakai environment, satisfaction with the NETwork experience, and effectiveness of NETwork for their current or future teaching. In addition, all social constructs showed satisfactory reliability with Cronbach's alpha

values greater than .80 (Nunnally, 1978). These findings show all social constructs had a high level of reliability.

Table 4.2.3
Descriptive Statistics and Reliability (N=66)

Variables	M	SD	Reliability (# of items)
Sense of Community (SOC)	4.89	.96	.92(20)
Social Ability (SA)	4.93	1.19	.96(18)
Social Presence with Peer (SPp)	5.07	1.32	.92(6)
Social Presence with Instructor (SPi)	4.90	1.34	.91(6)
Social Navigation (SN)	4.83	1.31	.91(6)
Perceived Ease of Use (PEU)	5.14	1.46	.96(4)
Perceived Usefulness (PU)	4.79	1.45	.93(4)
Satisfaction with NETwork experience (S)	4.72	1.61	.95(8)
Site Evaluation (SE)	4.90	1.46	.83(4)
Learning Satisfaction (LS)	4.54	1.87	.97(4)
Effectiveness of NETwork for Teaching (ET)	4.83	1.66	.97(8)

Note. 7 point Likert-type Scale where 1 represented strongly disagree and 7 meant strongly agree were used.

Correlation Analysis

Prior to the path analysis, the inter-correlations among social constructs were examined. Table 4.2.4 presents a correlation matrix of all the social constructs. All of the correlations have statistical significance ($p < .01$). Members' perception of the effectiveness of NETwork for their teaching had significant positive correlation with all of other sub-constructs, especially it had higher correlation with S, SE, LS, SA, and PEU. Members' satisfaction with overall learning in the NETwork highly correlated with sub-constructs of satisfaction and other social constructs, such as PU, SA, SPi, SN, SOC, and SPp (high to low). Also, members' perceptions of sense of community were highly correlated with social ability, satisfaction and their sub-constructs as well as PEU and PU. In addition to the correlation with SOC, social ability had high correlations with its sub-constructs and satisfaction. The sub-constructs of social ability were attained based

on the results of the exploratory factor analysis conducted by Yang et al. (2006). These three sub-constructs were the primary factors of social ability which led to a high correlation between any of the sub-constructs and social ability. Last, members' perception of ease of use and usefulness of the learning tools in the NETwork learning environment had high correlations with SOC, SA, and S, and slightly lower correlations with the SA sub-constructs. The results shown in the Correlation Matrix (Table 4.2.4) show how social constructs are co-related to each other. These results were then used to make decisions for including or dropping constructs for testing the path model.

Table 4.2.4
Correlations among Social Constructs (N=66)

Variables	SOC	SA	SPp	SPi	SN	PEU	PU	S	SE	LS	ET
Sense of community (SOC)	-										
Social ability (SA)	.814**	-									
Social Presence with Peer (SPp)	.733**	.920**	-								
Social Presence with Instructor (SPi)	.743**	.910**	.783**	-							
Social Navigation (SN)	.730**	.879**	.707**	.679**	-						
Perceived ease of use (PEU)	.715**	.720**	.688**	.721**	.539**	-					
Perceived usefulness (PU)	.725**	.741**	.653**	.726**	.627**	.865**	-				
Satisfaction (S)	.771**	.784**	.668**	.733**	.722**	.742**	.810**	-			
Site Evaluation (SE)	.702**	.716**	.630**	.700**	.608**	.720**	.761**	.959**	-		
Learning Satisfaction (LS)	.782**	.792**	.660**	.717**	.769**	.718**	.802**	.975**	.872**	-	
Effectiveness of NETwork for Teaching (ET)	.683**	.722**	.571**	.691**	.694**	.635**	.759**	.900**	.842**	.894**	-

Note. ** $p < .01$, * $p < .05$

Path Analysis

Examination of proposed path model. The research path model was analyzed using Mplus (Muthén & Muthén, 2005). The proposed path model is based on previous literature review. The variables analyzed in the path model were all observed variables. The initial path model is presented in Figure 4.26. In the initial path model, sense of

community ($SOC \Rightarrow S$ & $SOC \Rightarrow ET$), social ability ($SA \Rightarrow S$ & $SA \Rightarrow ET$), and perceived ease of use ($PEU \Rightarrow S$ & $PEU \Rightarrow ET$), and perceived usefulness ($PU \Rightarrow S$ & $PU \Rightarrow ET$) had direct correlation to both satisfaction with NETwork experience and effectiveness of NETwork for teaching. Also, the other direct paths included perceived ease of use to social ability ($PEU \Rightarrow SA$), perceived usefulness to sense of community ($PU \Rightarrow SOC$), social ability to sense of community ($SA \Rightarrow SOC$), and satisfaction with NETwork experience to effectiveness of NETwork for teaching ($S \Rightarrow ET$).

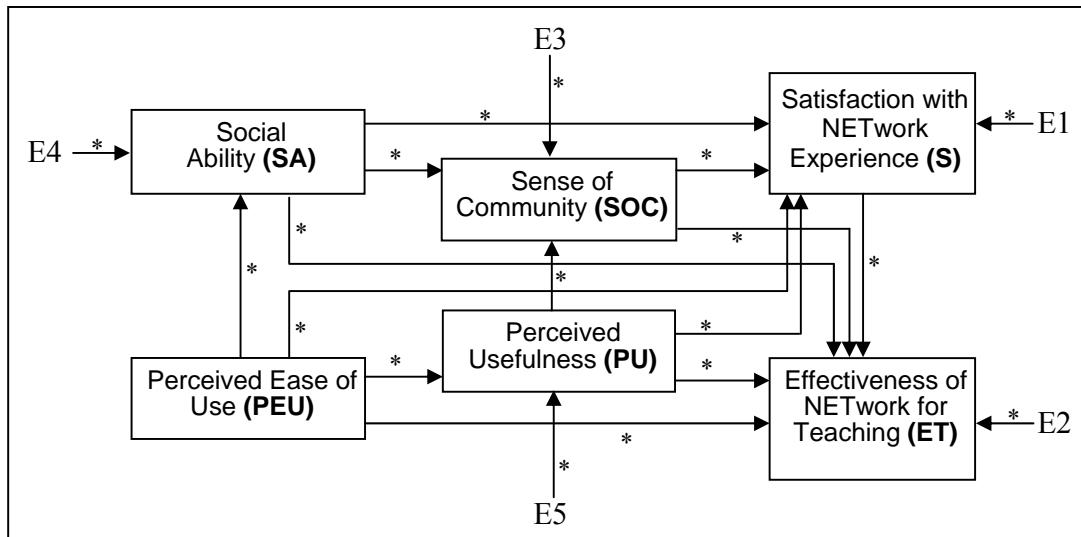


Figure 4.26. Initial Path Model (→ represents direct relationship, E represents residual error)

In the path analysis, the Wald test for dropping parameters was employed, and paths were dropped if they were not statistically significant ($z < 1.96$, $p < .05$) and the chi-square (χ^2) change was smaller than 3.84 ($\chi^2(0) = 3.84$; Kline, 2005) or if the relationship does not make sense based on the theoretical perspectives. During the process of Wald tests, five paths, including PEU to ET, PEU to S, PU to ET, SA to ET, and SOC to ET were dropped because of not achieving significance. After discarding the five non-significant paths, a final path model with best model fit was found. According to

the criteria for a good model fit (non-significant χ^2 value, CFI and TLI $>.95$, SRMR $<.10$, and RMSEA $<.06$) suggested by Hu and Bentler (1999), most of the criteria were met, suggesting a good model fit. Although the chi-square value for the final path model was 15.76 ($p < .05$) significant indicating a poor fit, the comparative fit index (CFI) was .99, the Tucker-Lewis Index (TLI) was .96, and the standardized root mean square residual (SRMR) was .05, which also indicated the data fit the model well. Also, the standardized root mean square error of approximation (RMSEA) was .13 which did not meet the criteria of a good fit, but the confidence interval of RMSEA was found to be between .00 and .24 which included .05 and indicated a good fit. It still suggested a good fit of the model. Because the achieved statistically significant chi-square value could be due to the small sample size of this study, an alternative index of fit was used to further examine the model fit. According to Byrne (2001), it suggests that if a χ^2/df ratio less than 5, the model is considered to be indicative of a good model fit (Hayduk, 1987). The χ^2/df ratio of this model is 2.25 (15.76/ 7 = 2.25), indicating a good model fit. Thus, overall the data fits the model well. Table 4.2.5 presents the fit indices of goodness for this over-identified model (15 unique pieces of information – 10 estimated parameters = 5). Additionally the final model with R^2 values is presented in Figure 4.27.

Table 4.2.5
Model Fit Indices

Model	χ^2	P	CFI	TLI	SRMR	RMSEA	RMSEA 90% C. I.
Criteria	N/A	$>.05$	$>.95$	$>.95$	$<.10$	$<.06$	
Results of the Final Model	15.76	.03	.98	.96	.05	.14	.04 ~ .23

Note. N=66 (Hu & Bentler, 1999)

In the final path model, the correlation coefficients of the direct paths range from .23 to .90 and are statistically significant at $p < .05$ or .001. The R^2 's means indicate that approximately 80% of the variance of effectiveness of NETwork for teaching is

explained by their overall satisfaction of learning in the NETwork community. Also, members' perception of sense of community, social ability, usefulness of learning tools contribute to explaining approximately 72% of the variance of members' overall satisfaction with NETwork experience. Also, social ability and perceived usefulness account for 68% of the variance in members' sense of community. Last, members' perception of ease of use of learning tools directly accounted for about 75% of variance of members' social ability and approximately 52% of variance of perceived usefulness of learning tools in the NETwork.

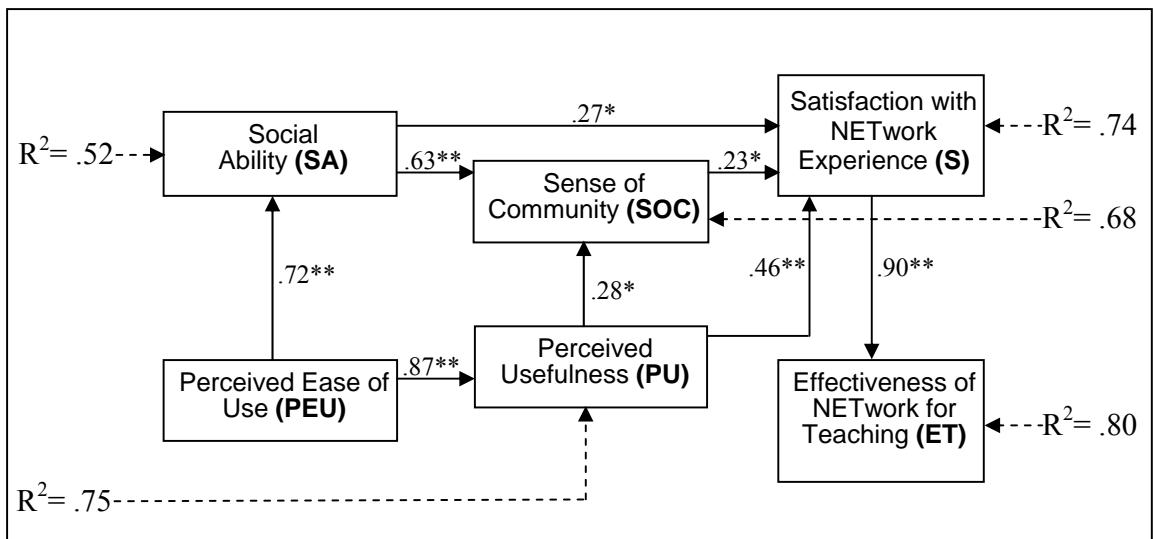


Figure 4.27. Final Path Analysis Model with R^2 Values (* $z > 1.96, p < .05$; ** $z > 3.29, p < .001$ statistically significant; —→ represents significant path, ---→ represents variance explained)

Members' perception of sense of community did not have a direct impact on their perception of effectiveness of NETwork for their teaching as had been expected ($SOC \Rightarrow ET$) and included in the initial path model. Also, members' perception of satisfaction with NETwork experience was the only influential factor to how they perceived the effectiveness of NETwork for their teaching ($S \Rightarrow ET$). In the proposed path model, social ability had been expected to influence members' satisfaction via the

mediation of sense of community. However, in the final model, members' perception of their satisfaction with NETwork experience was directly explained by their perception of social ability ($SA \Rightarrow S$).

Additionally, the mediating relationships among the variables in the final path model were examined. According to Frazier, Tix, and Barron (2004), a mediator is defined as a variable that accounts for the relation between a predictor and a dependent variable. Five potential mediating relationships, including $PU \Rightarrow SOC \Rightarrow S$, $PEU \Rightarrow PU \Rightarrow S$, $SA \Rightarrow S \Rightarrow ET$, and $SOC \Rightarrow S \Rightarrow ET$, were identified. Based on the examining steps presented in Frazier, Tix, and Barron (2004), a full mediator is identified when the relationship between a predictor and a dependent variable becomes non-significant after adding direct relationship between the mediating variable and the dependent variable. After the examination, members' perceptions of usefulness of learning tools was found to be a full mediator for the relationship between perceived ease of use and satisfaction with NETwork experience ($PEU \Rightarrow S$), as well as satisfaction with NETwork experience was a full mediator for both the relationships between sense of community and effectiveness of NETwork for teaching ($SOC \Rightarrow ET$) and social ability and effectiveness of NETwork for teaching ($SA \Rightarrow ET$). Additionally, members' perception of sense of community was found to be a partial mediator for the relationship between perceived usefulness and satisfaction with NETwork experience. The procedures for establishing the full mediating relationships are illustrated in Figure 4.28.

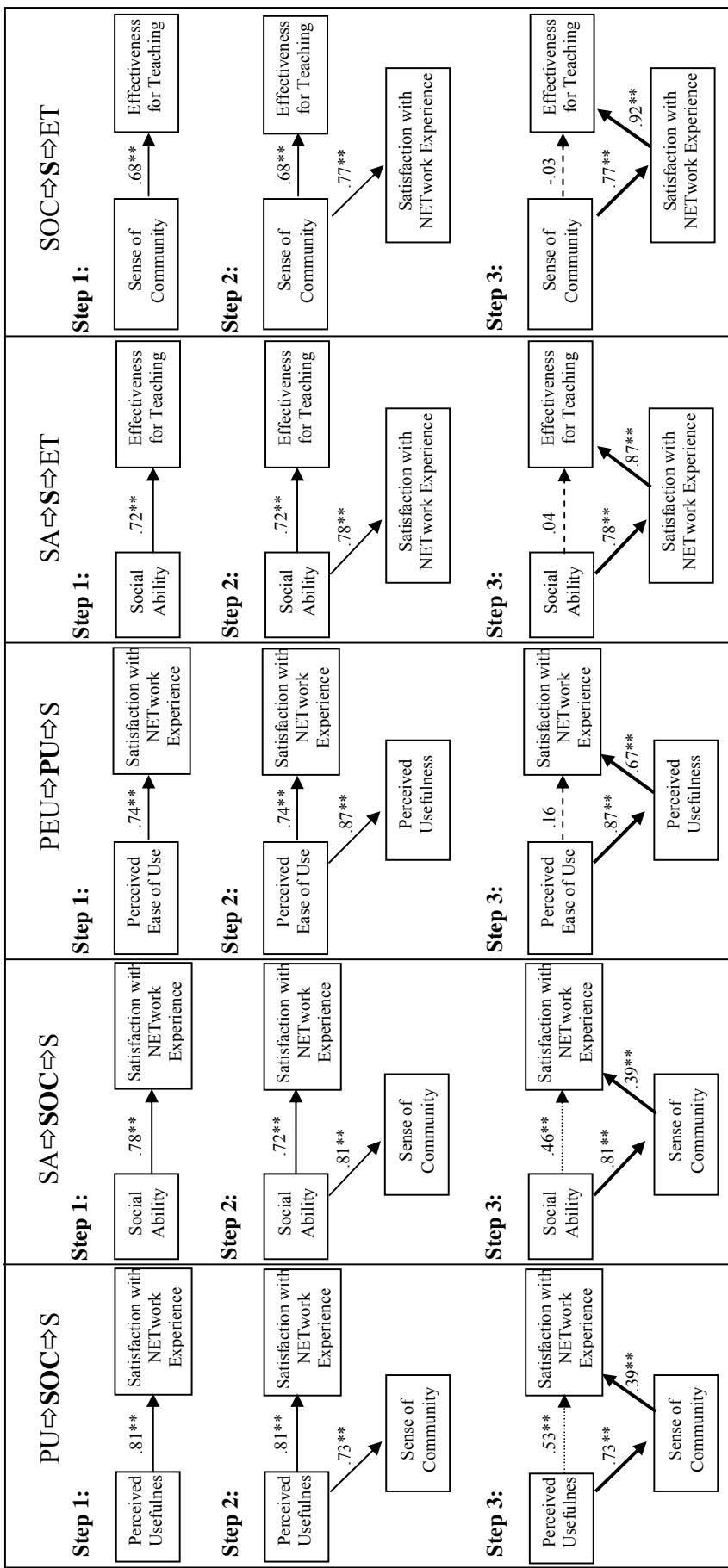


Figure 4.28. Mediator Identification (* $z > 1.96, p < 0.05$; ** $z > 3.29, p < 0.001$ statistically significant; - - - - - represents non-significant path, \longrightarrow represents significant path without decreasing strength; \longrightarrow represents path with significant value)

Examination of SA Sub-constructs. To further examine the relationships, social ability was replaced with its sub-constructs, including social navigation (SN), social presence with instructor/professor (SPi), and social presence with peers (SPp). Due to the small size of the sample in the final survey, the examinations were conducted separately to ensure the sample size met the required minimum sample size (at least 5 cases per parameter to be estimated). Thus, relationships among social ability's sub-constructs and perceived ease of use and usefulness were examined as the first set. Later, a second set of relationships among social ability's sub-constructs, sense of community, and satisfaction were investigated.

In the path analysis for the first examination, two non-significant paths ($PEU \Rightarrow SN$ & $PU \Rightarrow SPp$) were dropped based upon Wald tests ($z < 1.96, p < .05$; χ^2 change < $\chi^2(0)=3.84$; Kline, 2005). A final path model presented in Figure 4.29 was achieved. Based on the criteria suggested by Hu and Bentler (1999), the indices reported in Table 4.2.6 suggest a good model fit for this over-identified model (10 unique pieces of information – 8 estimated parameters = 2).

Table 4.2.6
Model Fit Indices (Set 1)

Model Criteria	χ^2	P	CFI	TLI	SRMR	RMSEA	RMSEA 90% C. I.
Criteria	N/A	>.05	>.95	>.95	<.10	<.06	
Results of the Final Model	2.05	.36	1.00	1.00	.04	.02	.00 ~ .25

Note. N=66 (Hu & Bentler, 1999)

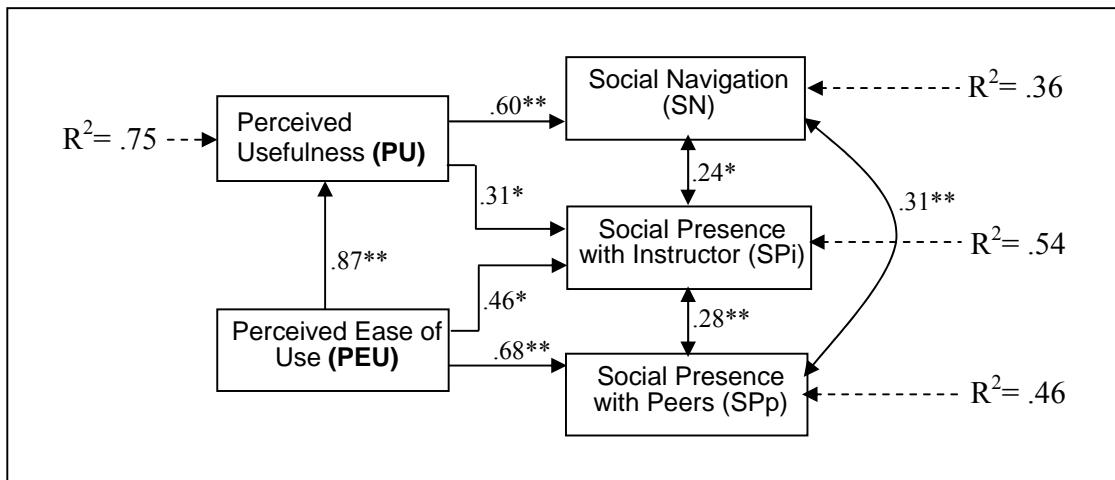


Figure 4.29. Final Path Analysis Model (Set 1) with R^2 Values (* $z > 1.96, p < .05$; ** $z > 3.29, p < .001$ statistically significant; → represent significant direct path, ←→ represents significant correlation paths, - - - → represents variance explained)

In the final path model of set 1, the correlation coefficients of the direct paths range from .24 to .87 and are statistically significant at $p < .05$ or .001. The R^2 's means showed approximately 87% of the variance of perceived usefulness of learning tools was explained by members' perception of ease of use of the tools. Also, members' perception of ease of use and usefulness of learning tools contribute to explaining approximately 54% of the variance of members' perception of the professors'/instructors' presence. Members' perception of usefulness of learning tools accounted for 36% of the variance of their perception of social navigation in the learning environment as well as perceived ease of use explained 46% of the variance of members' perceptions of other members/peers' social presence. Last, the correlation between the sub-constructs of social ability ranged from .24 to .31.

Additionally, two possible full mediating relationships among the variables in the set 1 final path model were examined. Based on the steps presented in Frazier, Tix, and Barron (2004), members' perception of usefulness of learning tools was identified as a

full mediator for the relationship between perceived ease of use and social navigation ($PEU \Rightarrow SN$). When adding the direct path between perceived usefulness and social navigation ($PU \Rightarrow SN$), the value of the direct path from perceived ease of use to social navigation ($PEU \Rightarrow SN$) not only dropped but also became non-significant. However, members' perception of usefulness of learning tools was found to only partially mediate the relationships between perceived ease of use and social presence with instructor ($PEU \Rightarrow SPi$). After adding the direct path between perceived usefulness and social presence with instructor ($PU \Rightarrow SPi$), the path value between perceived ease of use and social presence with instructor ($PEU \Rightarrow SPi$) dropped but remained significant. The procedures for establishing the full mediating relationships are illustrated in Figure 4.30.

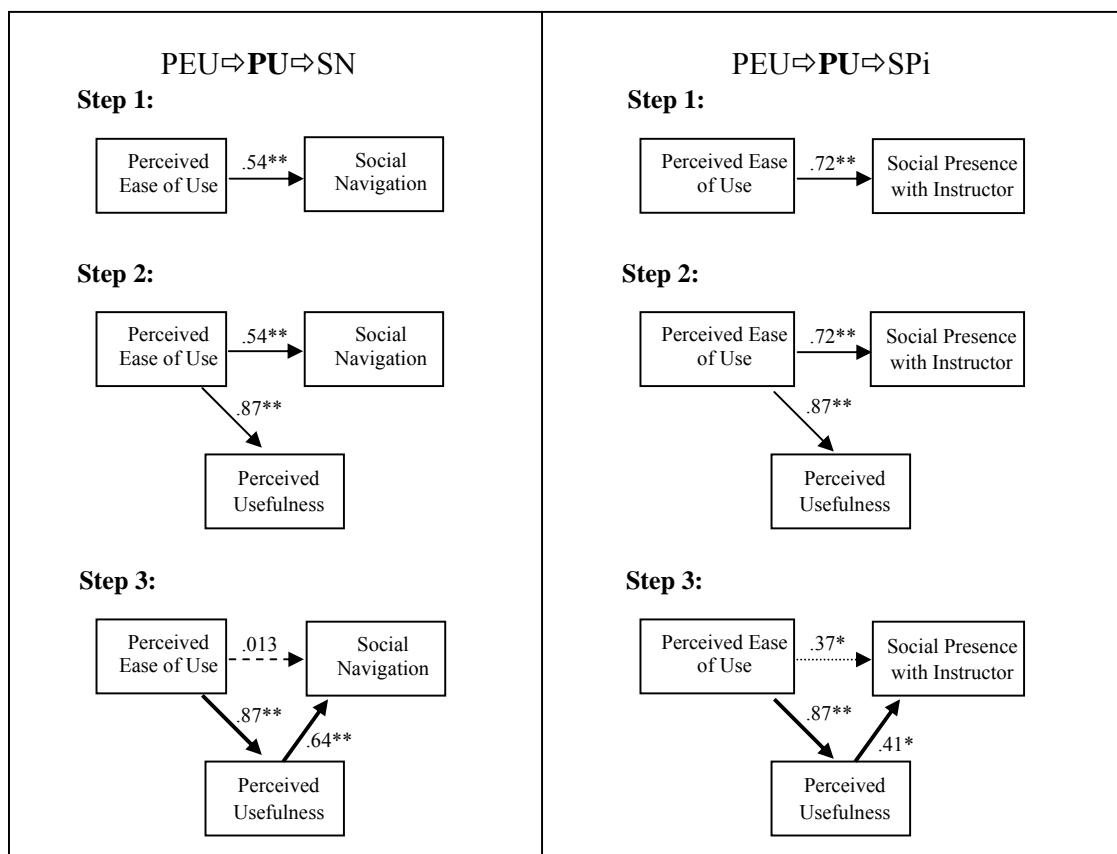


Figure 4.30. Mediator Identification (Set 1) (* $z > 1.96, p < .05$; ** $z > 3.29, p < .001$ statistically significant; $\cdots\cdots\rightarrow$ represents weaken path with significant value, $- - -\rightarrow$ represents non-significant path, \rightarrow represents significant path without decreasing strength)

For the second set of constructs, the path analysis results were used to discard two non-significant paths ($SPP \Rightarrow S$ & $SPP \Rightarrow SOC$; $z < 1.96, p > .05; \chi^2$ change $< \chi^2(0) = 3.84$). Although the standardized root mean square error of approximation (RMSEA) was .11 and did not meet the criteria of good fit, the confidence interval of RMSEA was found between .00 and .29 including .05. These findings suggest a marginal fit of the model. The other indices for the goodness of the model fit presented in Table 4.2.7 indicate a good model fit for this over-identified model (10 unique pieces of information – 8 estimated parameters = 2). Thus, overall the data fits the model well. To visualize the relationships among the sub-constructs of social ability, the final path model is presented in the Figure 4.31.

Table 4.2.7
Model Fit Indices (Set 2)

Model Criteria	χ^2	P	CFI	TLI	SRMR	RMSEA	RMSEA 90% C. I.
Criteria	N/A	>.05	>.95	>.95	<.10	< .06	
Results of the Final Model	3.57	.17	.99	.97	.02	.11	.00 ~ .29

Note. N=66 (Hu & Bentler, 1999)

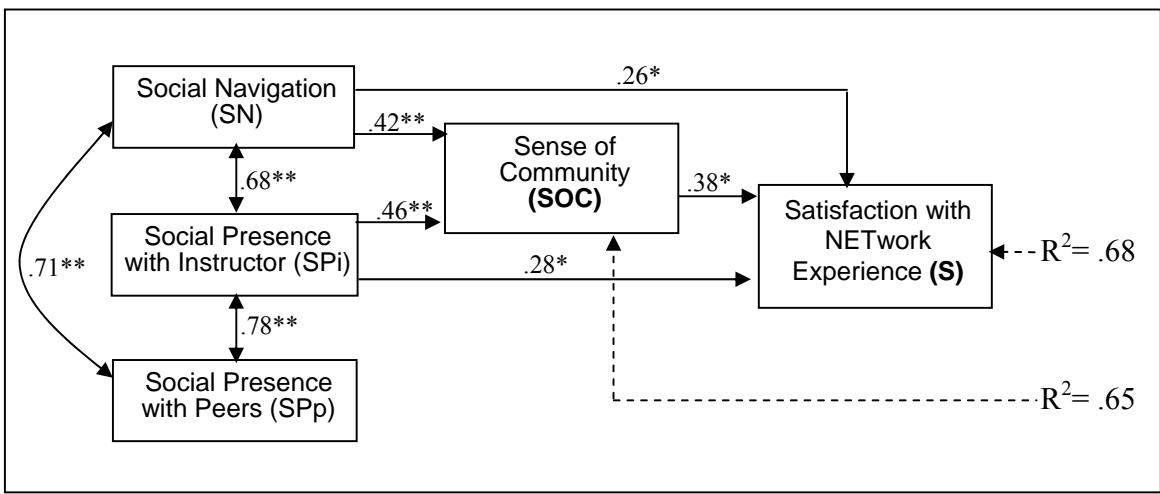


Figure 4.31. Final Path Analysis Model (Set 2) with R^2 Values (* $z < 1.96, p < .05$; ** $z < 3.29, p < .001$ statistically significant; → represent significant direct path, ←→ represent significant correlation paths, →→ represent variance explained)

In the final path model, the correlation coefficients of the direct paths range from .26 to .78 and are statistically significant at $p < .05$ or $.001$. The R^2 's means showed approximately 68% of the variance of members' satisfaction with NETwork experience is explained by their perception of social navigation, sense of community, and the instructor's social presence. Also, members' perception of social navigation and the instructor's social presence contribute to explaining approximately 65% of the variance of members' perception of sense of community. Last, the correlation between the sub-constructs of social ability ranged from .68 to .78, which indicated a high correlation among the sub-constructs of social ability.

Additionally, two possible full mediating relationships among the variables in the set 2 final path model were examined. After following the procedures for identifying mediating relationships (Frazier, Tix, & Barron, 2004), sense of community was found to only partially mediate the relationships between members' perception of social navigation and social presence with instructor to their satisfaction with NETwork experience. When adding the direct path between sense of community and members' satisfaction with NETwork experience ($SOC \Rightarrow S$), the value of the direct path from social navigation to satisfaction with NETwork experience ($SN \Rightarrow S$) remained significant, as well as the path value between members' perception of social presence with instructor and their satisfaction with NETwork experience ($SPi \Rightarrow S$). Thus, sense of community did not serve as a full mediator in this path model. The procedures for establishing the mediating relationships are illustrated in Figure 4.32.

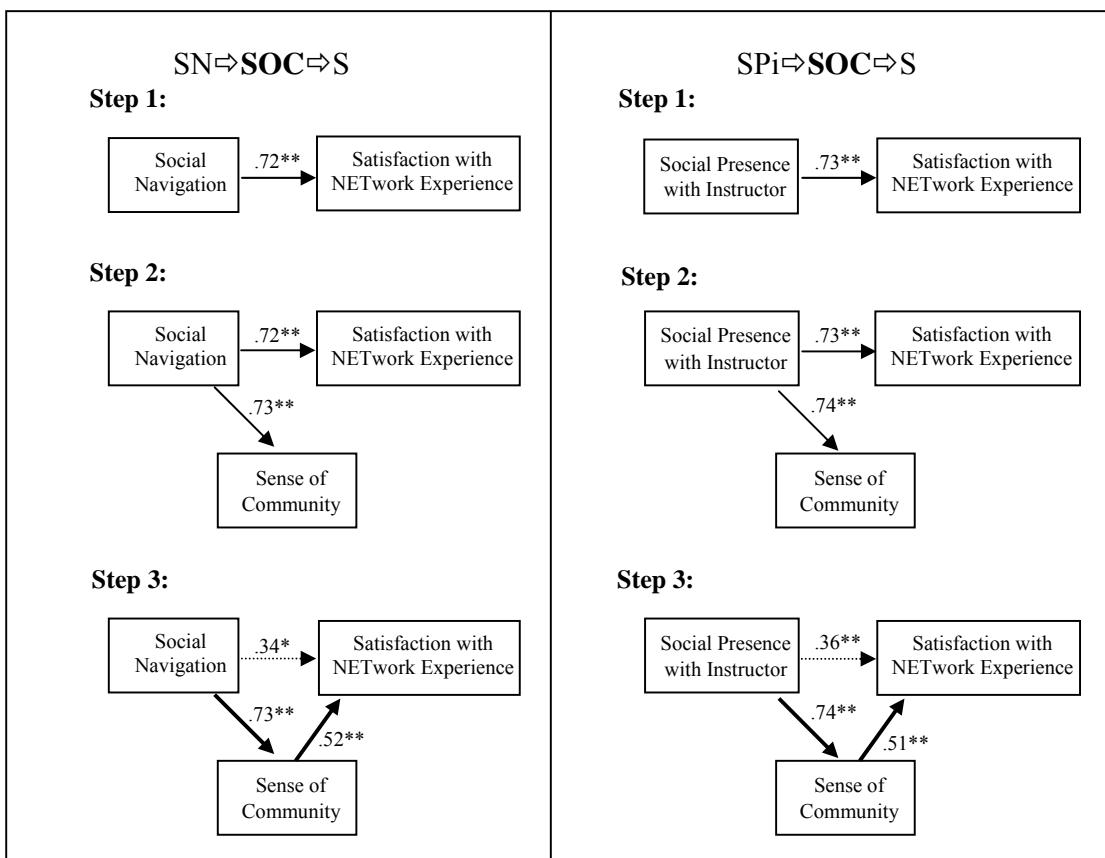


Figure 4.32. Mediator Identification (Set 2) ($z > 1.96, p < .05$; ** $z > 3.29, p < .001$ statistically significant; represents weaken path with significant value, —→ represents significant path without decreasing strength)*

Result Summary for Research Question 2

To summarize the results presented above, a final path model was constructed based on the initially proposed model and two path models of relationships among sub-constructs of social ability, perceived ease of use and usefulness of Sakai tools, sense of community, and satisfaction with NETwork experience were constructed. In the final path model which examined relationships among the primary social constructs (i.e. PEU, PU, SA, SOC, S, and ET), members' satisfaction with NETwork experience was the only direct factor impacting members' perceptions of effectiveness of NETwork for teaching. Social ability, sense of community, and perceived usefulness directly impacted members' satisfaction with NETwork experience. Also, social ability and perceived usefulness help explain members' sense of community, while members' perception of ease of use directly influences their social ability and perceived usefulness. Last, members' perception of usefulness of Sakai tools was identified as a mediator for the relationships between perceived ease of use and satisfaction. Additionally, satisfaction of members with their NETwork experience was a mediator for the relationship between social ability to effectiveness of NETwork for teaching ($SA \Rightarrow ET$) and was a mediator for the relationship between sense of community to effectiveness of NETwork for teaching ($SOC \Rightarrow ET$).

In addition to the final path model of the primary social constructs, the path models were examined for the interdependent relationships among the sub-constructs of social ability and other primary social constructs. The first set were the relationships among the sub-constructs of social ability (SN, SPi, and SPP) and members' perceptions of ease of use (PEU) and usefulness of Sakai tools (PU). Members' perception of usefulness was found to significantly explain the relationship between social navigation and social

presence with instructor. Members' perception of ease of use of Sakai tools mediated the relationship between their perception of social presence with instructor (SPi) and social presence with peers (SPp). Also, members' perception of ease of use did not directly impact social navigation but mediated between perceived usefulness and social navigation. The second set to be examined were the relationships among the sub-constructs of social ability (SN, SPi, and SPp), sense of community (SOC), and satisfaction with NETwork experience (S). Members' perceptions of social navigation (SN) and social presence with instructors (SPi) directly explain SOC and S, but members' perceptions of social presence with peers (SPp) did not directly explain SOC or S. Also, SOC was not a mediator for the relationships between any sub-constructs of social ability to satisfaction. Overall, three models reported in this section had good model fit and help explain the interdependent relationships among social constructs.

Research Question 3

The last research question was: “3. How do members’ perceptions (sense of community, social ability, ease of use, usefulness, satisfaction with their NETwork experience, and of the effectiveness of NETwork for supporting teaching) change through participating in the community?” Both quantitative and qualitative data were analyzed to answer this research question. The quantitative data, collected from the first survey (pre-test) and final survey (post-test), were analyzed by dependent-samples t-tests to examine if members’ perceptions of social constructs changed after participating in the NETwork. The qualitative data, including transcripts of serial interviews and semester-end interviews, were analyzed to provide descriptive information to support what was found in the one-way repeated measurements.

Dependent-samples t-tests were employed for comparing an initial assessment with a final assessment of NETwork members’ ratings of social constructs of online learning (i.e. SOC, SA, PEU, PU, S, and ET). A total of 49 NETwork members participated in both the first survey and the final survey via the Internet. Table 4.3.1 presents the demographic information for 49 cases analyzed in the one-way repeated measurements. Table 4.3.2 shows these members’ reasons for participating in the NETwork.

Table 4.3.1
Demographic Information for 49 Participants

Demographic Information		Number of Participants	Percentage (%)
Gender	Male	3	6.1
	Female	46	93.9
Age	Under 20	6	12.2
	21-25	41	83.7
	26-30	2	4.1
	>30	0	0
Membership	Old member (since Fall06)	26	53.1
	New member (since Spring07)	23	46.9
Teaching Status	Pre-service teacher (Old member)	24	49.0
	Pre-service teacher (New member)	23	46.9
	In-service teacher (Old member)	2	4.1
	In-service teacher (New member)	0	0
Participation of NETwork Discussion	participator	37	24.5
	non-participator	12	75.5
Previous Online Learning Experience	In Sakai	44	89.8
	In Blackboard	46	93.9
	In other systems	3	6.1
Messages Posted in Discussion Board (weekly)	less than 2 postings	20	40.8
	3-5 postings	10	38.8
	6-8 postings	5	10.2
	8-10 postings	5	10.2
Hours Login(weekly)	less than 1 hour	23	46.9
	1-5 hours	26	53.1
	6-10 hours	0	0
	>10 hours	0	0

Table 4.3.2
Reasons for Participating in NETwork

Reasons	Number of Participants	Percentage (%)
For class participation	45	91.8
Professor/instructor' recommendation	14	28.6
Have a place to access good information and lessons	8	16.3
Have a place to access resources and professional supports	8	16.3
Have a place to share information and personal insights	9	18.4
Have a place to go for help and ideas from those in the same situation	8	16.3
Have a place to gain insights and advices from other experienced teachers (pre- and in-service teachers)	9	18.4
Establish and have NETworking connection with other teachers	6	12.2

Note. Members could select all that applied.

Preliminary Analysis

Before conducting the dependent-samples t-tests, the assumptions of independence of the observations, normality, linearity, homogeneity of variance, and univariate outliers were examined. First, normality was checked for the skewness and kurtosis of the 9 social constructs (Pre & Post surveys, $9 \times 2 = 18$ variables). All skewness values (between -.231 and -.828, $< \pm 3$) and kurtosis values (between 1.219 and -.857, $< \pm 3$) of the variables were found to be satisfactory. Also, the Kolmogorov-Smirnov (K-S) test of the variables found that K-S values (Sig. value between .908 and .293) were non-significant (> 0.1) indicating that the data of the variables are normally distributed. Second, spot checks using scatter plots of some combination of variables were conducted and supported assumptions of linearity. Third, the Levene test for equality of variances was conducted and found non-significant Levene values ($> .05$) suggesting that the variability of data for each of the groups was similar and satisfying the assumption of homogeneity of variance. Last, there were no univariate outliers found in the examination with criteria z scores greater than 3.29 and less than -3.29.

Members were then classified as one of 3 types based on participation status, participant (login at least once) /non-participant (never login after Jan. 2007): membership status, new member (joined NETwork since Spring 2007)/ old or experienced member (joined NETwork since Fall 2006), and teaching status (pre-service teacher/in-service teacher). Based on the 3 types of classification, nine meaningful comparisons were conducted to examine if different types of members perceived the social constructs differently.

The number of the paired cases for the analysis is relatively small. According to

Stevens (1996), when the group size is small, there is a possibility that a non-significant result may result from insufficient power, which indicates a risk of Type II error. Stevens (1996) suggests adjusting the alpha level (from traditional .05 to a cut-off of .10 or .20) to compensate for the small group sizes (Pallant, 2001). Given the small group sizes in this study, a range of cut-off alpha levels are used for comparisons to help avoid making Type II errors (risk of accepting a null hypothesis that should have been rejected.). The levels are set at 0.05 (***)¹, .10 (**) and .20 (*). However, in minimizing the risk of making Type II errors, the risk of making Type I errors becomes relatively higher compared to using the lower cut-off alpha level. Thus, to further contend against the risk of Type I errors caused by adjusting alpha values from .01 or .05 to .10 or .20, the effect sizes were calculated to provide further information for judging the comparisons. Table 4.3.3 shows the survey participation of members that were examined through the various comparisons.

The members included in the different dependent-samples t-tests were identified based on their completing both surveys. For example, if the dependent-samples t-test was for survey 07 pre- and post-test, the cases that were included in both surveys and fell in to the selected member types were identified for the analysis. The dependent-samples t-tests include two phases. In the first phase, the comparison focused on pre-test and post test from Spring 2007. However, some analyses (phase 2) were made using data collected from the pilot study in Fall 2006.

Phase I Dependent-samples T-tests

The purpose of the phase I dependent-samples t-tests is to examine if members' perceptions of the social constructs changed after participating in the NETwork after one

semester. Table 4.3.3 summarizes the member types and survey data that were employed in the dependent-samples t-tests.

Table 4.3.3

Comparisons via Dependent-samples T-test (for Surveys in 2007)

Members	Surveys' Implementation		Current Study Spring 2007		Dependent- samples T-test (DS T-test)	
	Survey07 -Pre	Survey07 -Post	Survey07 -Pre	Survey07 -Post		
Pre-service teachers/ New members (all, N=23)	X	X			DS T-test 1	
Pre-service teachers/ Old members (all, N=24)	X	X			DS T-test 2	
Pre-service teachers/ Old members (participants only, N=12)	X	X			DS T-test 3	
Pre-service teachers (all, N=47)	X	X			DS T-test 4	
Pre-service teachers (participants only, N=35)	X	X			DS T-test 5	
Both In-service/Pre-service teachers (all, N=49)	X	X			DS T-test 6	
Both In-service/Pre-service teachers (participants only, N=37)	X	X			DS T-test 7	

Note. a. Participants represent people who at least login to community site once. B. New members represents NETwork members joined the community since Spring 2007 and Old members are people who joined since Fall 2006. c. Survey07 presents surveys conducted during Winter semester of 2007.

DS T-test 1: Pre-service teachers/New members. This dependent-samples t-test was conducted to evaluate if pre-service teachers who are new members joining since Jan. 2007 (shown as “pre-service teachers/new members” below) perceive social constructs differently after participating in the NETwork. The results shown in Table 4.3.4 indicate only two variables (perceived ease of use and perceived usefulness) have significant differences between the pre- and post-test.

Table 4.3.4

Results of DS T-test 1

Constructs	Survey07- Pre		Survey07- Post		90% C.I.		T-test	
	M	SD	M	SD	Lower	Upper	t	Sig. (2-tailed)
Sense of Community (SOC)	4.45	1.30	4.66	1.25	-.63	.22	.84	.41
Social Ability (SA)	4.56	1.40	4.59	1.53	-.43	.37	.14	.89
Social Presence with Peer (SPp)	4.59	1.42	4.78	1.63	-.68	.31	.66	.52
Social Presence with Instructor (SPi)	4.54	1.28	4.38	1.60	-.31	.63	-.58	.57
Social Navigation (SN)	4.56	1.69	4.62	1.69	-.43	.30	.30	.77
Perceived Ease of Use (PEU)	3.97	1.87	4.52	1.77	-1.06	-.05	1.89**	.07
Perceived Usefulness (PU)	3.75	1.79	4.15	1.64	-.86	.05	1.52*	.14
Satisfaction with NETwork experience (S)	3.75	1.72	3.97	1.87	-.82	.39	.62	.55
Site Evaluation (SE)	3.91	1.68	4.35	1.76	-1.02	.15	1.28	.21
Learning Satisfaction (LS)	3.59	1.87	3.59	2.15	-.70	.70	.00	1.00
Effectiveness of NETwork for Teaching (ET)	3.90	1.76	4.11	2.01	-.89	.48	.52	.61

Note. N=23, all Pre-service teachers/New members; * p < .20, **p < .10, *** p < .05

The obtained mean value of perceived ease of use (PEU) shows that pre-service teachers/new members perceived significant higher ease of use of the NETwork tools after participating in the NETwork (post test: $M=4.52$, $SD=1.87$; pre test: $M=3.97$, $SD=1.77$; $t(22) = -1.89$, $p < .10$). Additionally, there was a significant increase of pre-service teachers/new members' perception of usefulness in the post-test (post-test: $M=4.15$, $SD=1.64$; pre-test: $M=3.75$, $SD=1.79$; $t(22) = -1.52$, $p < .15$). Also, the effect sizes for the variables with significant differences were calculated to support that the differences result from members' participation of NETwork. According to Cohen (1998), eta squared (range from 0 to) close to .01 indicates a small effect, .06 is moderate effect, and .14 is large effect. Thus, the eta squared values for PEU (eta squared = .14) and PU (eta squared = .10) indicate large effects, which indicate pre-service teachers who are new members perceived greater ease of use and usefulness of NETwork tools after participating in the NETwork for one semester.

DS T-test 2: Pre-service teachers/Old members. This dependent-samples t-test was implemented to evaluate if pre-service teachers who are experienced/old members joining since Fall 2006 (shown as “pre-service teachers/old members” below) perceive social constructs differently after participating in the NETwork. The results shown in Table 4.3.5 indicate four variables, including social navigation (SN), satisfaction with NETwork experience (S), site evaluation (SE), and effectiveness of NETwork for teaching (ET), have significant differences between the pre- and post-test.

Table 4.3.5
Results of DS T-test 2

Constructs	Survey07-Pre		Survey07-Post		90% C.I.		T-test	
	M	SD	M	SD	Lower	Upper	t	Sig. (2-tailed)
Sense of Community (SOC)	5.00	.69	5.12	.58	-.39	.07	1.22	.24
Social Ability (SA)	5.13	1.02	5.32	.85	-.55	.17	.90	.38
Social Presence with Peer (SPp)	5.14	1.11	5.34	1.08	-.70	.29	.70	.49
Social Presence with Instructor (SPi)	5.33	1.16	5.33	.90	-.40	.38	.03	.97
Social Navigation (SN)	4.93	1.12	5.29	.83	-.76	.04	1.55*	.14
Perceived Ease of Use (PEU)	5.34	1.24	5.55	1.03	-.62	.21	.86	.40
Perceived Usefulness (PU)	5.41	1.19	5.50	1.05	-.52	.33	.38	.71
Satisfaction with NETwork experience (S)	5.24	1.16	5.59	.91	-.76	.06	1.46*	.16
Site Evaluation (SE)	5.21	1.17	5.58	.90	-.79	.04	1.56*	.13
Learning Satisfaction (LS)	5.28	1.20	5.60	1.02	-.76	.11	1.27	.22
Effectiveness of NETwork for Teaching (ET)	5.30	1.33	5.70	.96	-.86	.07	1.47*	.16

Note. N=24, all Pre-service teachers/Old members; * $p < .20$, ** $p < .10$, *** $p < .05$

The obtained mean value of social navigation (SN) shows that pre-service teachers/old members perceived significant higher social navigation after participating in the NETwork (post test: M=5.29, SD=.83; pre test: M=4.93, SD=1.12; t(23)= -1.55, $p < .20$). Pre-service teachers/old members' perception of satisfaction with NETwork experience (post-test: M=5.59, SD=.91; pre-test: M=5.24, SD=1.16; t(23)= -1.46, $p < .20$) and site evaluation (post-test: M=5.58, SD=.90; pre-test: M=5.21, SD=1.17; t(23)= -1.56, $p < .20$) in the post-test is significantly greater than that in the pre-test. Pre-service teachers/old members expressed a significant increase of the effectiveness of NETwork for teaching (ET, post test: M=5.70, SD=.96; pre test: M=5.30, SD=1.33; t(23)= -1.47, $p < .20$) after participating in the NETwork. Additionally, the eta squared values for SN (eta squared = .09), S (eta squared = .09), SE (eta squared = .10), and ET (eta squared = .09) indicate large effects, which supports that pre-service teachers who are experienced members perceived greater SN, S, SE, and ET after participating in the NETwork for one semester.

DS T-test 3: Pre-service teachers/Old members (participants only). This dependent-samples t-test was implemented to evaluate if pre-service teachers who are experienced/old members joining since Fall 2006 and login to NETwork at least once (shown as “pre-service teachers/old members (participants only)” below) perceive social constructs differently after participating in the NETwork. The results shown in Table 4.3.6 indicate five variables, including social navigation (SN), satisfaction with NETwork experience (S), site evaluation (SE), learning satisfaction (LS), and effectiveness of NETwork for teaching (ET), have significant differences between the pre- and post-test.

Table 4.3.6
Results of DS T-test 3

Constructs	Survey07-Pre		Survey07-Post		90% C.I.		T-test	
	M	SD	M	SD	Lower	Upper	t	Sig. (2-tailed)
Sense of Community (SOC)	5.00	.84	5.18	.61	-.60	.25	.76	.47
Social Ability (SA)	5.00	1.29	5.41	.72	-.98	.15	1.32	.21
Social Presence with Peer (SPp)	5.04	1.37	5.46	.94	-1.24	.41	.91	.38
Social Presence with Instructor (SPi)	5.15	1.48	5.40	.80	-.93	.43	.66	.52
Social Navigation (SN)	4.79	1.33	5.37	.73	-1.08	-.08	2.09**	.06
Perceived Ease of Use (PEU)	5.31	1.34	5.73	1.07	-1.15	.32	1.02	.33
Perceived Usefulness (PU)	5.42	1.37	5.75	1.01	-1.13	.46	.76	.47
Satisfaction with NETwork experience (S)	4.95	1.26	5.82	.82	-1.41	-.40	2.93***	.01
Site Evaluation (SE)	4.92	1.31	5.85	.71	-1.52	-.36	2.90***	.01
Learning Satisfaction (LS)	4.98	1.25	5.79	1.01	-1.35	-.28	2.74***	.02
Effectiveness of NETwork for Teaching (ET)	5.25	1.58	5.85	.78	-1.28	.09	1.56*	.15

Note. N=12, Pre-service teachers/Old members (participants only); * p < .20, **p < .10, *** p < .05

The obtained mean value of social navigation (SN) shows that pre-service teachers/old members (participants only) perceived significant higher social navigation after participating in the NETwork (post test: M=5.37, SD=.73; pre test: M=4.79, SD=1.33; t(11)= 2.09 , p < .10). Pre-service teachers/old members’ (participants only) perception of satisfaction with NETwork experience (post-test: M=5.82, SD=.82; pre-test: M=4.95, SD=1.26; t(11)= 2.93, p < .05), site evaluation (post-test: M=5.85, SD=.71; pre-test: M=4.92, SD=1.31; t(11)= 2.90, p < .05), learning satisfaction (post-test: M=5.79,

$SD=1.01$; pre-test: $M=4.98$, $SD=1.25$; $t(11)= 2.74$, $p < .05$) in the post-test is significantly greater than that of the pre-test. Pre-service teachers/old members (participants only) expressed a significant increase of the effectiveness of NETwork for teaching (ET, post test: $M=5.85$, $SD=.78$; pre test: $M=5.25$, $SD=1.58$; $t(11)= 1.56$, $p < .20$) after participating in the NETwork. Additionally, the eta squared values for SN ($\eta^2 = .28$), S ($\eta^2 = .44$), SE ($\eta^2 = .43$), LS ($\eta^2 = .41$), and ET ($\eta^2 = .18$) indicate large effects, which indicate pre-service teachers who are experienced members and participated in NETwork activities perceived greater SN, S, SE, LS, and ET after participating in the NETwork for one semester.

DS T-test 4: Pre-service teachers. This dependent-samples t-test was implemented to measure if pre-service teachers perceive social constructs differently after participating in the NETwork. The results shown in Table 4.3.7 indicate six variables, including sense of community (SOC), social navigation (SN), perceived ease of use (PEU), perceived usefulness (PU), satisfaction with NETwork experience (S), and site evaluation (SE) have significant differences between the pre- and post-test.

Table 4.3.7
Results of DS T-test 4

Constructs	Survey07-Pre		Survey07-Post		90% C.I.		T-test	
	M	SD	M	SD	Lower	Upper	t	Sig. (2-tailed)
Sense of Community (SOC)	4.73	1.06	4.91	.99	-.41	.05	1.34*	.19
Social Ability (SA)	4.85	1.24	4.96	1.27	-.38	.15	.72	.48
Social Presence with Peer (SPp)	4.87	1.29	5.06	1.39	-.53	.14	.97	.34
Social Presence with Instructor (SPi)	4.94	1.27	4.87	1.36	-.22	.37	.42	.68
Social Navigation (SN)	4.75	1.42	4.96	1.35	-.48	.05	1.37*	.18
Perceived Ease of Use (PEU)	4.67	1.71	5.05	1.52	-.70	-.06	2.00**	.05
Perceived Usefulness (PU)	4.60	1.71	4.84	1.52	-.55	.06	1.36*	.18
Satisfaction with NETwork experience (S)	4.51	1.63	4.80	1.66	-.64	.07	1.36*	.18
Site Evaluation (SE)	4.57	1.57	4.98	1.51	-.75	-.06	1.98**	.05
Learning Satisfaction (LS)	4.45	1.77	4.62	1.94	-.56	.23	.70	.49
Effectiveness of NETwork for Teaching (ET)	4.62	1.69	4.92	1.74	-.70	.09	1.28	.21

Note. N=47, all Pre-service teachers; * $p < .20$, ** $p < .10$, *** $p < .05$

The obtained mean value of sense of community indicates that pre-service teachers perceived higher sense of community after participating in the NETwork (post test: M=4.91, SD=.99; pre test: M=4.73, SD=1.06; t(46) = 1.34, $p < .20$), as well as the mean value for social navigation (post test: M=4.96, SD=1.35; pre test: M=4.75, SD=1.42; t(46) = 1.37 , $p < .20$) was found to be significantly higher in the post-test. Also, pre-service teachers expressed an increase in their perception of ease of use (post test: M=5.05, SD=1.52; pre test: M=4.67, SD=1.71; t(46) = 2.00, $p < .10$) and usefulness (post test: M=4.84, SD=1.52; pre test: M=4.60, SD=1.71; t(46) = 1.36, $p < .20$) of the NETwork learning tools in Sakai. Pre-service teachers' perception of satisfaction with NETwork Experience (post-test: M=4.80, SD=1.66; pre-test: M=4.51, SD=1.63; t(46) = 1.36, $p < .20$) and site evaluation (post-test: M=4.98, SD=1.51; pre-test: M=4.57, SD=1.57; t(46) = 1.98, $p < .10$) in the post-test is significantly greater than that in the pre-test. Additionally, the eta squared values for SOC (eta squared = .24), SN (eta squared = .04), PEU (eta squared = .08), PU (eta squared = .04), S (eta squared = .04), and SE (eta squared = .08) indicate moderate and large effects, which support the finding that members who are pre-service teachers perceived greater SOC, SN, PEU, PU, S, and SE after participating in the NETwork for one semester.

DS T-test 5: Pre-service teachers (participator only). This dependent-samples t-test was conducted to examine if pre-service teachers who login to NETwork at lease once (present as “pre-service teachers (participants only)” below) perceive social constructs differently after participating in the NETwork. The results shown in Table 4.3.8 indicate five variables, including social navigation (SN), perceived ease of use (PEU), perceived usefulness (PU), satisfaction with NETwork experience (S), and site evaluation (SE) have

significant differences between the pre- and post-test.

Table 4.3.8
Results of DS T-test 5

Constructs	Survey07-		Survey07-		T-test		t	Sig. (2-tailed)		
	Pre		Post		90% C.I.					
	M	SD	M	SD	Lower	Upper				
Sense of Community (SOC)	4.64	1.18	4.84	1.09	-.50	.11	1.10	.28		
Social Ability (SA)	4.71	1.36	4.87	1.35	-.48	.15	.87	.39		
Social Presence with Peer (SPp)	4.74	1.40	5.01	1.46	-.68	.14	1.10	.28		
Social Presence with Instructor (SPi)	4.75	1.36	4.73	1.45	-.35	.39	-.08	.93		
Social Navigation (SN)	4.64	1.56	4.88	1.47	-.53	.05	1.41*	.17		
Perceived Ease of Use (PEU)	4.43	1.81	4.94	1.65	-.90	-.11	2.16***	.04		
Perceived Usefulness (PU)	4.32	1.82	4.70	1.63	-.76	.00	1.67*	.10		
Satisfaction with NETwork experience (S)	4.16	1.66	4.60	1.81	-.88	-.01	1.73**	.09		
Site Evaluation (SE)	4.26	1.62	4.86	1.64	-1.03	-.19	2.44***	.02		
Learning Satisfaction (LS)	4.06	1.79	4.34	2.11	-.77	.21	.96	.35		
Effectiveness of NETwork for Teaching (ET)	4.37	1.80	4.71	1.88	-.83	.15	1.17	.25		

Note. N=35, Pre-service teachers (participants only); * p < .20, **p < .10, ***p < .05

The obtained mean value of social navigation (post test: M=4.88, SD=1.47; pre test: M=4.64, SD=1.56; t(34) = 1.41, p < .20) was found to be significantly higher after pre-service teachers (participants only) participated in the NETwork. Also, pre-service teachers expressed an increase of their perception of ease of use (post test: M=4.94, SD=1.65; pre test: M=4.43, SD=1.81; t(34) = 2.16, p < .05) and usefulness (post test: M=4.70, SD=1.63; pre test: M=4.32, SD=1.82; t(34) = 1.67, p < .20) of the NETwork learning tools in Sakai. Pre-service teachers' perception of satisfaction with NETwork experience (post-test: M=4.60, SD=1.81; pre-test: M=4.16, SD=1.66; t(34) = 1.73, p < .10) and site evaluation (post-test: M=4.86, SD=1.64; pre-test: M=4.26, SD=1.62; t(34) = 2.44, p < .05) in the post-test is significantly greater than that in the pre-test. Additionally, the eta squared values for SN (eta squared = .06), PEU (eta squared = .12), PU (eta squared = .08), S (eta squared = .08), and SE (eta squared = .15) indicate moderate and large effects, which supports the finding that members who are pre-service teachers and participated in NETwork activities perceived greater SN, PEU, PU, S, and

SE after participating in the NETwork for one semester.

DS T-test 6: Both In-service and Pre-service teachers. This dependent-samples t-test was to examine if both in-service and pre-service teacher in the NETwork community perceived social constructs differently after participating in the NETwork. The results shown in Table 4.3.9 indicate five variables, including social navigation (SN), perceived ease of use (PEU), perceived usefulness (PU), satisfaction with NETwork experience (S), and site evaluation (SE) have significant differences between the pre- and post-test.

Table 4.3.9
Results of DS T-test 6

Constructs	Survey07-Pre		Survey07-Post		90% C.I.		T-test	
	M	SD	M	SD	Lower	Upper	t	Sig. (2-tailed)
Sense of Community (SOC)	4.74	1.05	4.91	.99	-.39	.05	1.27	.21
Social Ability (SA)	4.87	1.25	4.98	1.26	-.36	.14	.75	.46
Social Presence with Peer (SPp)	4.90	1.29	5.08	1.37	-.50	.15	.92	.37
Social Presence with Instructor (SPi)	4.98	1.28	4.90	1.36	-.20	.36	-.46	.65
Social Navigation (SN)	4.73	1.45	4.97	1.35	-.49	.02	1.55*	.13
Perceived Ease of Use (PEU)	4.72	1.69	5.10	1.51	-.68	-.07	2.07***	.04
Perceived Usefulness (PU)	4.62	1.70	4.87	1.50	-.54	.05	1.41*	.16
Satisfaction with NETwork	4.55	1.62	4.83	1.66	-.61	.06	1.37*	.18
Site Evaluation (SE)	4.63	1.57	5.00	1.51	-.71	-.05	1.92**	.06
Learning Satisfaction (LS)	4.47	1.75	4.65	1.94	-.56	.21	.76	.45
Effectiveness of NETwork for Teaching (ET)	4.64	1.69	4.93	1.72	-.67	.10	1.26	.22

Note. N=49, Both In-service and Pre-service teachers (all members); * $p < .20$, ** $p < .10$, *** $p < .05$

The obtained mean value of social navigation (post test: M=4.97, SD=1.35; pre test: M=4.73, SD=1.45; $t(48) = 1.55, p < .20$) was found to be significantly higher after both in-service and pre-service teachers participated in the NETwork. Also, both in-service and pre-service teachers expressed an increase of their perception of ease of use (post test: M=5.10, SD=1.51; pre test: M=4.72, SD=1.69; $t(48) = 2.07, p < .05$) and usefulness (post test: M=4.87, SD=1.50; pre test: M=4.62, SD=1.70; $t(48) = 1.41, p < .20$) of the

NETwork learning tools in Sakai. Both in-service and pre-service teachers' perception of satisfaction with NETwork Experience (post-test: $M=4.83$, $SD=1.66$; pre-test: $M=4.55$, $SD=1.62$; $t(48) = 1.37$, $p < .20$) and site evaluation (post-test: $M=5.00$, $SD=1.51$; pre-test: $M=4.63$, $SD=1.57$; $t(48) = 1.92$, $p < .10$) in the post-test were significantly greater than that of the pre-test. Additionally, the eta squared values for SN (eta squared = .05, PEU (eta squared = .08), PU (eta squared = .04), S (eta squared = .07), and SE (eta squared = .04) indicate moderate and large effects, which support the finding that NETwork members perceived greater SN, PEU, PU, S, and SE after participating in the NETwork for one semester.

DS T-test 7: Both In-service/Pre-service teachers (participator only). This dependent-samples t-test was to examine if both in-service and pre-service teacher (participator only) (shown as "In-service/Pre-service teachers (participator only)") in the NETwork community perceived social constructs differently after participating in the NETwork. The results shown in Table 4.3.10 indicate five variables, including social navigation (SN), perceived ease of use (PEU), perceived usefulness (PU), satisfaction with NETwork experience (S), and site evaluation (SE) have significant differences between the pre- and post-test.

Table 4.3.10
Results of DS T-test 7

Constructs	Survey07-Pre		Survey07-Post		90% C.I.		T-test	
	M	SD	M	SD	Lower	Upper	t	Sig. (2-tailed)
Sense of Community (SOC)	4.65	1.16	4.83	1.08	-.47	.11	1.05	.30
Social Ability (SA)	4.74	1.36	4.90	1.34	-.46	.14	.90	.37
Social Presence with Peer (SPp)	4.80	1.40	5.04	1.43	-.63	.15	1.04	.31
Social Presence with Instructor (SPi)	4.81	1.37	4.78	1.44	-.33	.38	-.13	.90
Social Navigation (SN)	4.62	1.58	4.89	1.46	-.55	.01	1.64*	.11
Perceived Ease of Use (PEU)	4.51	1.79	5.01	1.64	-.88	-.12	2.24***	.03
Perceived Usefulness (PU)	4.37	1.81	4.74	1.60	-.73	-.01	1.73**	.09
Satisfaction with NETwork experience (S)	4.23	1.66	4.65	1.81	-.83	-.01	1.74**	.09
Site Evaluation (SE)	4.34	1.63	4.91	1.64	-.96	-.16	2.36***	.02
Learning Satisfaction (LS)	4.11	1.77	4.40	2.10	-.75	.18	1.03	.31
Effectiveness of NETwork for Teaching (ET)	4.42	1.79	4.73	1.84	-.78	.15	1.14	.26

Note. N=37, Both In-service and Pre-service teachers (Participators only); * p < .20, **p < .10, *** p < .05

The obtained mean value of social navigation (post test: M=4.89, SD=1.46; pre test: M=4.62, SD=1.58; t(36) = 1.64, $p < .20$) was found to be significantly higher after both in-service and pre-service teachers (participants only) participated in the NETwork. Also, both in-service and pre-service teachers (participants only) expressed an increase in their perception of ease of use (post test: M=5.01, SD=1.64; pre test: M=4.51, SD=1.79; t(36) = 2.24, $p < .05$) and usefulness (post test: M=4.74, SD=1.60; pre test: M=4.37, SD=1.81; t(36) = 1.73, $p < .10$) of the NETwork learning tools in Sakai. Both in-service and pre-service teachers' (participants only) perception of satisfaction with NETwork Experience (post-test: M=4.65, SD=1.81; pre-test: M=4.23, SD=1.66; t(36) = 1.74, $p < .10$) and site evaluation (post-test: M=4.91, SD=1.64; pre-test: M=4.34, SD=1.63; t(36) = 2.36, $p < .05$) in the post-test were significantly greater than that of the pre-test. Additionally, the eta squared values for SN (eta squared = .07), PEU (eta squared = .12), PU (eta squared = .08), S (eta squared = .08), and SE (eta squared = .13) indicate moderate and large effects, which support the finding that members who participated in NETwork activities perceived greater SN, PEU, PU, S, and SE after participating in the

NETwork for one semester.

Comparison of DS T-tests' results for phase I. Based on the dependent-samples t-tests above, 3 sets of the comparisons (DS T-test 2 v.s. DS T-test 3; DS T-test 4 v.s. DS T-test 5; DS T-test 6 v.s. DS T-test 7) were examined. Table 4.3.11 summarizes results of the dependent-samples t-tests for the three sets of comparisons.

Table 4.3.11

Comparison of DS T-tests' Results for Phase I

Comparison	Construct with Sig.	Survey07- Pre		Survey07- Post		90% C.I.		T-test	
		M	SD	M	SD	Lower	Upper	t	Sig. (2-tailed)
RM2: Pre-service teachers/ Old members (all, N=24)	SN	4.93	1.12	5.29	.83	-.76	.04	1.55*	.14
	S	5.24	1.16	5.59	.91	-.76	.06	1.46*	.16
	SE	5.21	1.17	5.58	.90	-.79	.04	1.56*	.13
	ET	5.30	1.33	5.70	.96	-.86	.07	1.47*	.16
RM3: Pre-service teachers/ Old members (participants only , N=12)	SN	4.79	1.33	5.37	.73	-1.08	-.08	2.09**	.06
	S	4.95	1.26	5.82	.82	-1.41	-.40	2.93***	.01
	SE	4.92	1.31	5.85	.71	-1.52	-.36	2.90***	.01
	LS	4.98	1.25	5.79	1.01	-1.35	-.28	2.74***	.02
	ET	5.25	1.58	5.85	.78	-1.28	.09	1.56*	.15
RM4: Pre-service teachers (all, N=47)	SN	4.75	1.42	4.96	1.35	-.48	.05	1.37*	.18
	PEU	4.67	1.71	5.05	1.52	-.70	-.06	2.00**	.05
	PU	4.60	1.71	4.84	1.52	-.55	.06	1.36*	.18
	S	4.51	1.63	4.80	1.66	-.64	.07	1.36*	.18
	SE	4.57	1.57	4.98	1.51	-.75	-.06	1.98**	.05
RM5: Pre-service teachers (participants only , N=35)	SN	4.64	1.56	4.88	1.47	-.53	.05	1.41*	.17
	PEU	4.43	1.81	4.94	1.65	-.90	-.11	2.16***	.04
	PU	4.32	1.82	4.70	1.63	-.76	.00	1.67*	.10
	S	4.16	1.66	4.60	1.81	-.88	-.01	1.73**	.09
	SE	4.26	1.62	4.86	1.64	-1.03	-.19	2.44***	.02
RM6: Both In-service/Pre-service teachers (all, N=49)	SN	4.73	1.45	4.97	1.35	-.49	.02	1.55*	.13
	PEU	4.72	1.69	5.10	1.51	-.68	-.07	2.07***	.04
	PU	4.62	1.70	4.87	1.50	-.54	.05	1.41*	.16
	S	4.55	1.62	4.83	1.66	-.61	.06	1.37*	.18
	SE	4.63	1.57	5.00	1.51	-.71	-.05	1.92**	.06
RM7: Both In-service/Pre-service teachers (participants only , N=37)	SN	4.62	1.58	4.89	1.46	-.55	.01	1.64*	.11
	PEU	4.51	1.79	5.01	1.64	-.88	-.12	2.24***	.03
	PU	4.37	1.81	4.74	1.60	-.73	-.01	1.73**	.09
	S	4.23	1.66	4.65	1.81	-.83	-.01	1.74**	.09
	SE	4.34	1.63	4.91	1.64	-.96	-.16	2.36***	.02

Note. * p < .20, **p < .10, ***p < .05

The difference between the participants who were identified for DS T-test 2 and DS

T-test 3 is that members for DS T-test 2 who did not login in the NETwork after Jan. 2007 were excluded from DS T-test 3. The comparison of the results of DS T-test 2 with DS T-test 3 shows that the level of the significant difference is reduced by adding experienced pre-service teachers with no participation into the measurement (DS T-test 2). When the dependent-samples t-test for experienced pre-service teachers did not consider the perception of the members who did not participate in NETwork after Jan. 2007, the level of the significant difference of the SN, S, and SE became stronger (criteria met changed from $p < .20$ to $p < .05$) while ET remained the same. Also, members' perception of LS which was not significant in DS T-test 2 showed a significant increase in DS T-test 3 ($p < .05$). The results of the comparison indicate that experienced pre-service teachers' (with no participation) perception reduced the observed differences between pre and post-tests.

Similar results were found in the comparisons of DS T-test 4 with DS T-test 5 and DS T-test 6 with DS T-test 7. For the comparison of DS T-test 4 and DS T-test 5, the level of the significant difference of the PEU and SE became stronger (criteria met changed from $p < .10$ to $p < .05$) as well as S (criteria met changed from $p < .20$ to $p < .10$). The level of significant difference of SN and S remained the same in both DS T-test 4 and DS T-test 5. For the comparison of DS T-test 6 and DS T-test 7, the level of the significant difference of SN and PEU remained the same while PU and S (criteria met changed from $p < .20$ to $p < .10$) and SE (criteria met changed from $p < .20$ to $p < .10$) became stronger. Although some members who did not participate in NETwork in Spring 2007 did complete both surveys. Their perceptions did not reflect experiences of interacting with other members in Spring 2007. Thus, the results presented participators

in Table 4.3.12 represent changes in members' perceptions due to participation in NETwork during Spring 2007.

Table 4.3.12

Comparison of DS T-tests' Results for Phase I (Participators Only)

Comparison	Construct with Sig.	Survey07- Pre		Survey07- Post		90% C.I.		T-test	
		M	SD	M	SD	Lower	Upper	t	Sig. (2-tailed)
RM1: Pre-service teachers/ New members (all, N=23)	SN	3.97	1.87	4.52	1.77	-1.06	.05	1.89**	.07
	S	3.75	1.79	4.15	1.64	-.86	.05	1.52*	.14
RM3: Pre-service teachers/ Old members (participators only , N=12)	SN	4.79	1.33	5.37	.73	-1.08	-.08	2.09**	.06
	S	4.95	1.26	5.82	.82	-1.41	-.40	2.93***	.01
	SE	4.92	1.31	5.85	.71	-1.52	-.36	2.90***	.01
	LS	4.98	1.25	5.79	1.01	-1.35	-.28	2.74***	.02
	ET	5.25	1.58	5.85	.78	-1.28	.09	1.56*	.15
RM5: Pre-service teachers (participators only , N=35)	SN	4.64	1.56	4.88	1.47	-.53	.05	1.41*	.17
	PEU	4.43	1.81	4.94	1.65	-.90	-.11	2.16***	.04
	PU	4.32	1.82	4.70	1.63	-.76	.00	1.67*	.10
	S	4.16	1.66	4.60	1.81	-.88	-.01	1.73**	.09
	SE	4.26	1.62	4.86	1.64	-1.03	-.19	2.44***	.02
RM7: Both In-service/Pre-service teachers (participators only , N=37)	SN	4.62	1.58	4.89	1.46	-.55	.01	1.64*	.11
	PEU	4.51	1.79	5.01	1.64	-.88	-.12	2.24***	.03
	PU	4.37	1.81	4.74	1.60	-.73	-.01	1.73**	.09
	S	4.23	1.66	4.65	1.81	-.83	-.01	1.74**	.09
	SE	4.34	1.63	4.91	1.64	-.96	-.16	2.36***	.02

Note. * p < .20, **p < .10, ***p < .05

As shown in Table 4.3.12, pre-service teachers who joined the NETwork community since Jan. 2007 perceived higher social navigation and satisfaction with NETwork Experience after participating in NETwork for 4 months. For pre-service teachers who had been participating in NETwork since Fall 2006 and kept participating in the NETwork activity in Spring 2007, in addition to social navigation, satisfaction with NETwork experience, site evaluation, and learning satisfaction, their perceptions of the effectiveness of NETwork for teaching significantly increased after participating in NETwork for 9 months. Overall, for most NETwork members who participated in NETwork during Spring 2007, they expressed a significant increase in their perceptions of social navigation (SN), perceived ease of use (PEU), perceived usefulness (PU),

satisfaction with NETwork experience (S), and site evaluation (SE).

Phase II Dependent-samples T-tests

Length of time participating in a community of practice may be an important influence on how members experience the community and on the impact of community. For example, a time period of one semester may be too short to find any changes in members' perception of sense of community. Thus, the purpose of implementing the phase II comparisons (comparison 8 and 9) was to examine if time length between implementing pre and post surveys impacts the significance of members' perception change. Table 4.3.13 summarizes the member types and survey data that were employed in the comparisons.

Table 4.3.13

Dependent-samples T-tests (for Surveys in 2006 & 2007)

Members	Surveys' Implementation		Pilot Study Fall 2006	Current Study Spring 2007		Dependent-sample T-test (DS T-test)
	Survey06- Pre	Survey06- Post	Survey07 -Pre	Survey07 -Post		
Old Members for Survey06 pre-test & Survey07 post-test (all, N=10, no in-service teachers)	X			X	X	DS T-test 8
Old members for Survey06 post-test & Survey07 post-test (all, N=9, only 1 in-service teacher)			X		X	DS T-test 9

Note. a. Old members are people who joined since Fall 2006. b. Survey06 means surveys implemented during Fall semester of 2006, while Survey07 presents surveys conducted during Spring semester of 2007.

Only the members who both participated in the survey06 pre-test collection in pilot study and the survey07 post-test were identified for the comparison 8. Members who both participated in the Survey06 Post-test and the Survey07 post-test were analyzed in comparison 9. In fact, only experienced members who participated in NETwork since Fall 2006 have the possibility of completing the Survey06 pre- and post-test. However, the social constructs of the surveys implemented in Fall 2006 and Spring 2007 are slightly different. For example, social ability and its sub-constructs were not included in

the pre-test conducted in Fall 2006, nor were the members' perception of satisfaction with NETwork experience and its sub-constructs included in Fall 2006 surveys. The examination focused on the social constructs which were included on all the surveys completed during both Fall 2006 and Spring 2007.

DS T-test 8: Old Members for Survey06 pre-test & Survey07 post-test. The purpose of the dependent-samples t-test was to examine if experienced members who both participated in survey06 pre-test and survey07 post-test (shown as "old members (survey06 pre & survey07 post)") in the NETwork community perceived social constructs differently after participating in the NETwork. The results shown in Table 4.3.14 indicate that four variables, including sense of community (SOC), perceived ease of use (PEU), perceived usefulness (PU), and effectiveness of NETwork for teaching, had significant differences between the survey06 pre-test and survey07 post-test (8 month difference).

Table 4.3.14
Results of DS T-test 8

Constructs	Survey06-		Survey07-				T-test	
	Pre	Post	M	SD	Lower	Upper	t	Sig. (2-tailed)
Sense of Community (SOC)	4.48	.49	5.25	.60	-1.14	-.412	3.92***	.00
Perceived Ease of Use (PEU)	5.08	.90	5.73	.96	-1.29	-.01	1.86**	.09
Perceived Usefulness (PU)	4.53	.91	5.88	.91	-1.85	-.85	4.97***	.00
Effectiveness of NETwork for Teaching (ET)	4.28	1.18	6.26	.86	-2.46	-1.51	7.69***	.00

Note. N=10, old members participate in survey06-pre & survey07-post; * $p < .20$, ** $p < .10$, *** $p < .05$

The obtained mean value of sense of community (post test: M=5.25, SD=.60; pre test: M=4.48, SD=.49; $t(9) = 3.92, p < .05$) was found to be significantly higher after old members (survey06 pre & survey07 post) participated in the NETwork. Also, old members (survey06 pre & survey07 post) perceived higher ease of use (post test: M=5.73, SD=.96; pre test: M=5.08, SD=.90; $t(9) = 1.86, p < .10$) and usefulness (post test:

$M=5.88$, $SD=.91$; pre test: $M=4.53$, $SD=.91$; $t(9) = 4.97$, $p < .05$) of the NETwork learning tools in Sakai. The old members' (survey06 pre & survey07 post) perception of the effectiveness of NETwork for Teaching (post-test: $M=6.26$, $SD=.86$; pre-test: $M=4.28$, $SD=1.18$; $t(9) = 7.69$, $p < .05$) in the post-test is significantly greater than that in the pre-test. Additionally, the eta squared values for SOC (eta squared = .63), PEU (eta squared = .28), PU (eta squared = .73), and ET (eta squared = .87) indicate moderate and large effects, which support the finding that the older members who completed both survey06 pre-test and survey07 post-test perceived greater SOC, PEU, PU, and ET after participating in the NETwork.

DS T-test 9: Old Members for Survey06 post-test & Survey07 post-test. The purpose of this dependent-samples t-test was to examine if experienced members who both participated in survey06 post-test and survey07 post-test (shown as “old members (survey06 post & survey07 post)”) in the NETwork community perceived social constructs differently after participating in the NETwork. The results shown in Table 4.3.15 indicate three variables, including sense of community (SOC), social navigation (SN), and perceived ease of use (PEU) have significant differences between the survey06 post-test and survey07 post-test (5 month difference).

Table 4.3.15
Results of DS T-test 9

Constructs	Survey06-Post		Survey07-Post		90% C.I.		t	Sig. (2-tailed)	T-test	
	M	SD	M	SD	Lower	Upper				
Sense of Community (SOC)	4.99	.56	5.31	.51	-.60	-.04	2.14**	.07		
Social Ability (SA)	5.73	.59	5.55	1.09	-.29	.66	-.73	.49		
Social Presence with Peer (SPp)	5.59	.69	5.54	1.37	-.65	.76	-.14	.89		
Social Presence with Instructor (SPi)	5.68	.76	5.70	1.23	-.47	.44	.08	.94		
Social Navigation (SN)	5.93	.72	5.41	.98	-.11	1.15	-1.53*	.16		
Perceived Ease of Use (PEU)	5.42	.65	5.92	.94	-1.06	.06	1.66*	.14		
Perceived Usefulness (PU)	5.53	1.13	5.89	.95	-1.02	.30	1.02	.34		
Effectiveness of NETwork for Teaching (ET)	5.91	.75	5.99	.84	-.47	.30	.40	.70		

Note. N=9, old members participate in survey06-post & survey07-post; * $p < .20$, ** $p < .10$, *** $p < .05$

The obtained mean value of sense of community (post test: M=5.31, SD=.51; pre test: M=4.99, SD=.56; t(8) = 2.14, $p < .10$) was found to be significantly higher as well as were the mean values for ease of use of the NETwork learning tools in Sakai (post test: M=5.92, SD=.94; pre test: M=5.42, SD=.65; t(8) = 1.66, $p < .20$). However, old members (survey06 post & survey07 post) perceived lower social navigation (post test: M=5.41, SD=.98; pre test: M=5.93, SD=.72; t(8) = -1.53, $p < .20$) after participated in the NETwork in Spring 2007. Additionally, the eta squared values for SOC (eta squared = .36), SN (eta squared = .23), and PEU (eta squared = .26) indicate moderate and large effects, which support the findings that older members completed both survey06 post-test and survey07 post-test perceived greater SOC, SN, and PEU after participating in the NETwork.

Comparison of DS T-tests' results for phase II. Based on the dependent-samples t-tests above, 1 set of the comparisons (DS T-test 8 v.s. DS T-test 9) is presented. Table 4.3.16 summarizes results of the dependent-samples t-tests for the comparison.

Table 4.3.16

Comparison of DS T-tests' Results for Phase II

Comparison	Construct with Sig.	Survey06-Pre/Post		Survey07-Post		90% C.I.		T-test	
		M	SD	M	SD	Lower	Upper	t	Sig. (2-tailed)
RM8: Old Members for Survey06 pre-test & Survey07 post-test (all, N=10, no in-service teachers) [8 months difference]	SOC	4.48	.49	5.25	.60	-1.14	-.412	3.92***	.00
	PEU	5.08	.90	5.73	.96	-1.29	-.01	1.86**	.09
	PU	4.53	.91	5.88	.91	-1.85	-.85	4.97***	.00
	ET	4.28	1.18	6.26	.86	-2.46	-1.51	7.69***	.00
RM9: Old members for Survey06 post-test & Survey07 post-test (all, N=9, only 1 in-service teacher) [5 months difference]	SOC	4.99	.56	5.31	.51	-.60	-.04	2.14**	.07
	PEU	5.93	.72	5.41	.98	-.11	1.15	-1.53*	.16
	SN	5.42	.65	5.92	.94	-1.06	.06	1.66*	.14

Note. * $p < .20$, ** $p < .10$, *** $p < .05$

Both participants identified for DS T-test 8 and DS T-test 9 analyses joined the

NETwork in Fall 2006 and completed the survey07 post-test. The difference between the participants who were identified for DS T-test 8 and DS T-test 9 is that members for DS T-test 8 completed both Survey06 pre-test and Survey07 post-test (8 months difference) and members for DS T-test 9 completed both Survey06 post-test and Survey07 post-test (5 months difference). By comparing the results of DS T-test 8 and DS T-test 9, it is found that the level of the significant difference of SOC (changed from $p < .05$ to $p < .10$) and PEU (changed from $p < .10$ to $p < .20$) was reduced when the time difference between implementing two surveys is reduced from about 8 months to 5 months. Also, the level of the significant difference of ET (criteria met $p < .05$) and PU (criteria met $p < .10$) were found to be significantly different when the time difference between two surveys is about 8 months (2 semesters). The results of the comparison indicate the possibility that some social constructs needed longer time periods to have changed perceptions.

Content Analysis: Members' Perceptions of Social Constructs (Serial Interviews)

The purpose of the content analysis for members' serial interview transcripts was to examine changes in members' perceptions of participating in NETwork, such as their sense of community, social ability, perceived ease of use, perceived usefulness, satisfaction with NETwork experience, and effectiveness of NETwork for teaching. The five members participated in the serial interviews were IO2, PN13, PN25, PO4, and PO6. Thus, fifteen completed serial interview transcripts were coded following the coding scheme (Appendix 3-F). Seven themes were found for members' perceptions of social constructs after participating in NETwork. These seven themes are: 1) members' appreciated the ways NETwork supported their learning to teach similarly but with a few differences across member types; 2) in-service teachers/old members and pre-service teachers saw the contribution of NETwork discussion to their perceptions of a good teacher's characteristics; 3) members wanted to keep NETwork memberships because they wanted to keep accessing diverse insights about teaching and teachers across states; 4) members indicated an increase in teaching confidence resulting from participating in NETwork activities; 5) members' sense of community changed positively throughout the semester; 6) members perceptions of the social presence indicator in the "present box" of Sakai site became more positive throughout the semester; and 7) in-service teachers/old members and pre-service teachers identified advantages of the notification tool, daily email digest, to facilitate their participation in NETwork.

First of all, the ways different types of members appreciated how NETwork supported their learning to teach were similar but with some differences. The in-service teacher (IO2) who participated in serial interviews expressed that having opportunities to

hear different ideas and questions from the pre-service teachers helped her to teach in school and feel connected to other members in NETwork. For example, she described her experience in applying what she gained from NETwork discussion to help her students. She adjusted her way to teach astronomy because she saw a discussion about misconceptions in astronomy.

IO2: “I think it (NETwork) is useful always to get different opinions, because you might not agree with everything they say, but you might be able to take a piece of it and apply it to your situation. It just let me see other people on the board and see what their experiences are....most of them are pre-service teachers, so it’s interesting to see the questions that they have....I think I get something out of it, because it’s useful to read different ideas and tips and just even though they’re pre-service teachers it’s still good to hear a discussion to see things and think about things that make you think about things and how I’m doing things in my classroom, too.....

Well, some of the misconceptions in astronomy. I just took some of those and talked to the kids about them and see what they thought about it, if that’s what they thought and we talked about meteors and meteorites and meteroids this block, and a couple of the things in there had to do with that..... Yeah, I think that some of them (IO2’s students) were confused. They didn’t know. And then after I cleared it up, I think they understood. So it was good that we started a discussion and kind of got some of those misconceptions cleared up. I might not have thought about it before. I might not have even touched on it, not thinking, just assuming that they knew something that they might not have known.....like the classroom management, the discussion forums and some of the ideas for science, and then of course the resources there are a big help, too. Like, I’ve already been able to use some of that this year.”

Similar to the in-service teacher, pre-service teachers (PN13, PN25, PO4, and PO6) stated that NETwork brought them access to diverse viewpoints of teaching issues, strategies, lesson ideas, and teaching experiences from in-service teachers, other pre-service teachers who were in different field experience courses, pre-service teachers who did not feel comfortable to talk in the field experience classes, and professors. These multiple insights helped shape their thinking about teaching, preparing themselves for elementary teaching in ways they had not thought about before, gaining more knowledge of students in different grade levels and classroom management, and becoming more open-mind. For example, PN13 explained that she started realizing the importance of parents’ involvement in their teaching after participating in NETwork Discussion Topics:

“Parents.” Her understanding of teaching in school became more realistic. Below are examples of how pre-service teachers described how they appreciated the great opportunities to get diverse viewpoints and ideas via NETwork discussion.

PN13: “I think that there’s just been some discussions about the importance of getting parents involved and how to get parents involved, and that’s just been drilled into us since the beginning of the semester. And so I think a lot of us are just starting to realize how important it really is...we used to think that we were just going to have our classroom and it was going to be perfect, and it didn’t matter what was going on outside, but now, a lot of parents want to come in and volunteer in the classroom and do stuff like that.....also because I know that a lot of us are nervous about going into student teaching and things, so I think it’s neat that people who are already out in the field can come back and comment to us. Because we don’t really get a lot of that. We have our professors, and we have the one teacher we’re assigned to field with, but it’s nice to get a broad spectrum of people.”

PO6: “I think with anybody else’s opinion you can form your opinion through that... it’s good to have other people’s feedback and you learn so much from discussion... it helps shape what you think. Because you can read about other people’s posts and decide, “Oh, I kind of agree with that,” or “Oh, I don’t agree with that,” or “Maybe I should think of it this way.” It’s helpful.”

PN25: “There are some people who are fairly vocal in class, and so those responses you can kind of guess what they’re going to say a little bit, to some extent. But this kind of helps with some of the quieter students in our class. You kind of get a thought of what they’re feeling...well, take Mr. IO3, for example. He’s not part of our Blue block, but I appreciated his opinion because it was a valuable comment. He wasn’t just commenting for the sake of commenting. He was commenting because he had something insightful to share. So I think if people post something that is going to be relevant to us, then that’s wonderful.”

PN13: “I think it makes you have an open mind as far as hearing things. But at the same time, I also think it makes you more opinionated because you get on here and you just start really inserting your opinion into other peoples’ stuff. And I think that’s good because they’re doing the same thing, so it’s almost like arguing on it, because you’re being like, “This is the way I’ve seen it. This is the way it’s done.” And then you’ve got someone else saying the exact opposite. And so, at the end of the day, you’ve got these tools that you can use in your classroom even though you might not agree with one. Because I know I’m not going to be successful at everything I try in the classroom... But at least you have the opinions of people who don’t think like you, but might think like your kids. And so it will be nice to have that in your classroom.”

Also, one of pre-service teachers/new members felt that having other pre-service teachers/old members from other blocks comment on their messages was helpful, which was how NETwork was different from other course systems in which they had participated. Also, pre-service teachers/old members felt they were being helpful by sharing their ideas through commenting to the pre-service teachers/new members who

were taking the field experience courses that they have taken. Below are examples from PN13's and PO4's experience.

PN13: "I like that, because I do talk to some of the people from other blocks, and they can comment on our posts, and it's kind of cool, because a lot of it is things we're doing in the field that give us ideas for things, like I can do in field, and so just having other people comment on it is really helpful. Because, like you said, in Blackboard there are discussion boards, but really it's just communication with the teacher. No one was really commenting on each others' (ideas). It was more commenting to our professor."

PO4: "because it's kind of neat, though, because they're doing the same things that we were at this time last semester. So it's kind of cool to see their ideas and what they're thinking about everything."

Some discussion topics in NETwork also led pre-service teachers to think about additional preparation they needed before becoming an elementary teacher. For example, PO4 realized that she needed to start preparing books for her future teaching after seeing the discussion topic of classroom library in NETwork.

PO4: "It was about the classroom library, about how many books you're supposed to have in the classroom and everything. And that connected to me in a way, because I have no books at all. I probably have maybe 10 or 15 books. So reading that (the discussion board topic: classroom library) helped me to realize that you have to have a lot of resources for kids to look at. So I think I need to do more book orders in my literacy class and everything... I think I need to start my collection more. Like, I read over that and I was like, "Wow, that's really true." Kids love to read books. So that's really helped me to realize like I have to go out and get books, because kids are going to depend on that. I think that one really helped me decide that I need to go out and get books."

Additionally, pre-service teachers/new members explained that members were very respectful when replying to others messages. The way members interacted in NETwork also helped them conceive ideas about how to facilitate her students' discussions in class.

Below is how PO6 described her feeling.

PO6: "I think that in general Sakai has taught me that you have to facilitate discussions with your kids and hope that they will want to discuss with each other more than raising their hand and only asking you questions as a teacher. That they'll ask each other questions and they'll bring up things to each other, so I think more than what I myself am learning from Sakai, I am just realizing ways to actually present information. And so it's kind of, it can be a metaphor for the way that you actually teach in your class."

The pre-service teachers/new members also explained that NETwork was really

helpful for their understanding of teaching because they could have extended discussions of issues that they did not have time to talk about in the field experience classes.

Sometimes what they discussed in NETwork also provided benefits back to their subject learning in the field experience courses because the professors sometimes brought interesting topics back to their field experience courses. Also, they saw how integrating NETwork with field experience courses could improve discussions and save more time for covering more issues. Below is an example from PN13's experience.

PN13: "I think it started in class,... And we talked about parental involvement and things like that, but I think then it started getting, like in science we had some parents come in and actually talk to them about their involvement in school and things like that. So it's just starting to overlap in every class. And then we end up talking about it on Sakai.....I think that with effects to class, I think that Sakai (NETwork) is much more beneficial than we had, like WebCT and Blackboard, because we take ideas from this and bring it back to class, too, so I think class discussions are benefited from having this, too. And so obviously, having better class discussion, being able to discuss on here, is going to make, just going to open you up to having a lot more broad views on topics, instead of just your own view."

Second, both in-service teachers/old members and pre-service teachers said that the NETwork discussions contributed to their perceptions of good teachers' characteristics. For example, IO2 stated that the characteristics of a good teacher were that teachers need to be open to new lesson plans and ideas, be creative, be caring, be knowledgeable in the subject area, be willing to change, and have good communication skills. She explained that some of her beliefs were established by reviewing what others had said as parts of discussion in the NETwork. Below she states why she believes communication skills was an important characteristic of a good teacher.

IO2: "it does give me information about new ideas and new ways, even like in classroom management or in astronomy or whatever it is I'm teaching, so yeah, it does.....Like, one of the classroom management postings was about kids that were unruly or disruptive, and they talked about how they called the parents and sat down in a meeting, so I think that that reminded me that communication with parents was really important. And that's an important skill, communication."

One of pre-service teachers/new members described how others serve as models for

good characteristics in Network.

PN13: “you can just see characteristics in my fellow students in their posts. You can see that PN1 is really good at this, and when you see those characteristics, you can see like, “I should work on that.” Stuff like that.”

Third, members expressed their desire to keep NETwork memberships in the future because they value the diverse insights and perspectives of teaching as well as being able to connect to teachers across states with whom they learned to be teachers together (for pre-service teachers). For example, IO1 indicated that she wanted to be a member in the future because she thought it is really useful for getting ideas and resources and having opportunities to connect to other teachers across states, and she could see the potential of having pre-service teachers discuss their practical experience with her once they teach in schools. Similar to IO1, PO4 also expressed a desire to keep connected with other members via NETwork. Below are how they described their perspectives.

IO1: “It would be nice to be able to connect to other teachers around the state, the United States, and get new ideas for lesson plans and all that stuff.....I've gotten a lot of good ideas and I know they're mostly pre-service teachers now, but it does have the potential to connect me with other teachers who are in the field... And having the resources site on there so it's easy, I can hop on there if there's something I'm looking for. So definitely it could be useful to me as a teacher.”

PO4: “I think it's important to keep in connection with people that I met here. But like IO1, for instance, if it wasn't for the NETwork I would have never seen ideas that he had about his first year of teaching. I would have never gotten that opportunity to talk to a first-year teacher and see what the difficulties are, or what goes good the first year. Or anything like that. So I think the NETwork provides that connection to other people whom you wouldn't have connections with unless you were part of the NETwork...I think it's good to have a connection between people you meet here, but it's also good to have that connection between others who aren't here and whom you can't talk to on a one-on-one basis. I think the NETwork does a good job of providing that opportunity to actually talk to others you really can't keep in contact with.”

Also, pre-service teachers explained that being able to talk to other teachers across states helped them prepare to teach in different cities and teach students from different states. For example, PN13 stated that it was great to get feedback from teachers from other states because it can help prepare them for varied situations different from those

they learned in their classes. The pre-service teachers recognize that it is good to know about differences in teaching practices or curriculum across states.

PN13: “I know that right now I’m planning on teaching in State A, but it would be helpful to see other perspectives from around, in case we don’t end up teaching here. Because all of our field work is here in City A. I plan on going back to City B for student teaching, so even just going that far can change everything about the way you teach and so I think that would be interesting.....I think that even though you don’t go teach, like if I don’t go from here and teach in California, you might get a kid from California in your classroom, too. So either way you’re going to have to relate to what they’re learning there, how they’re learning there. So it would be interesting to see how classroom management and behavior issues differ from all around.....So it’s nice to get the feedback of people from all over, that we can see how it compares to what we’re actually getting here...for example with math, we learn a lot about investigations in math and new curriculum, and I’m going back to a school district that uses investigations, but I know my roommate, she’s going to a school district that doesn’t. And so we can bounce ideas off of people who also don’t use it, or also do use it. So it’s nice to see how our teaching practices and our curriculum compare to other states.”

The pre-service teachers indicated that NETwork gave them opportunities to connect to other pre-service teachers who they would not have met (in different block) but in the future would be doing student teaching together. Pre-service teachers indicated that they felt NETwork would be a very helpful support when they were doing student teaching. Below is how PN13 described how she saw Network helping in the future.

PN13: ”And I know several people who are going to School C with me to student teach next year, and so it’s nice to be able to bounce ideas off of them also, because... like PO7, I’ve never had a class with him, but he’s at my school with me next year, so it’s nice to be able to respond to his posts and things like that.....I think it will just be completely different, because in student teaching we’re going to get on there and talk more about actual teacher things. And right now, we get on there and we talk about things we’re learning in class. And so it’ll just be different.”

Fourth, members indicated an increase in their teaching confidence resulting from participating in NETwork activities. The in-service teacher (IO2) said that talking to other people was helpful to improve her teaching confidence, while pre-service teachers explained that seeing others’ viewpoints and having others agree or compliment their points of view helped enhance their teaching confidence for future teaching. In addition to the contribution of NETwork to members’ teaching confidence, the improvements to

teaching confidence come from many other sources, such as gradual in-school experience, field experience, and courses taken. Below are statements from IO's and PO4's .

IO2: "I think just experience has helped me feel more confident. But things from the, let's say like different ideas and just kind of hearing people who have the same questions as I had when I was in their position made me feel a little more confident where I am. And having them, hearing their questions and being like, "Oh, well, I'm already there. I've done that and I know how it works" makes me feel confident. And I can help them be like, "This is how I did it." Like the organization thing, because I'm really into organization. That's one of my things. So it's interesting to see that question."

PO4: "Because if you say something that you are passionate about, or an issue that you want answers about, and if somebody's like "Oh, I agree with PO4. She's got a really good idea." That boosts your confidence...I think it's a good way to make yourself feel better, because you may never know if you have a good idea or if others might like your idea that you have unless you get on there and be like, "This is what I think about this issue." And then others could get on there and be like, "Wow, I never thought of it that way," or "PO4 makes a really good point," or something like that. So definitely I think that can help you improve..... Or I think if people learn from their mistakes, if somebody disagrees with you, you can build your knowledge about that certain topic that you have on there and it might bring your confidence down a little bit, but in the end it might bring it up because you might learn more. And you might not know something without looking at the web site (NETwork) or seeing the different perspectives and ideas of what people think. So I think negative stuff is also positive because it broadens your horizons and you can see different perspectives and ideas of people."

Fifth, members' sense of being a group changed positively through the semester.

However, one (PN25) pre-service teachers/new member said that changes in sense of community might be result a little from participating in NETwork but that the students were around each other every day. The other pre-service teacher (PN13) stated in the second interview that her sense of community increased because she was able to read in-service teachers' and pre-service teachers/old members' postings. Also, PN13 felt she came to know more about other members through their comments and feedbacks. She said she especially noticed this when she found herself looking for POs' and in-service teachers' postings as much as postings from PNs she talked with every day. Below are examples identified from pre-service teachers/new members' statements.

PN25: "as the year has gone on, I feel like we have become a group, but it has to be because we are around each other so much. And especially, initially half of us knew each other really well and the other half knew each other really well, but we didn't really mesh a

whole lot at the very beginning. And now I feel like we are, for the most part, doing that. Sakai probably helps maybe a little bit, but I would have to attribute that just because we're around each other so much."

PN13: "I think it's probably increased because, well, obviously since I see a lot of the people all day, every day, but even the people I don't see all day who are maybe in a different block, or the people who are out teaching wherever, I feel like we're getting to know each other a little bit better because when they give their input,... I mean, we've never met, half of them, or most of them, but you kind of start to get a feel of what kind of teacher they are and who they are. And I think they do the same when they're assessing our opinions about things..... Well I know that, for one, it's really helpful with the people like PO7 that's in here and PO2 who posts sometimes. They were in these classes over in last semester, so it's really helpful to... I can get on there and I can send them a private message or just send a message on the discussion board, and even if they don't know what to tell me to do, they'll have an opinion about, like what they did last semester, or, you what Dr. IS1 told them and so it's really helpful to get on there and see. But with the teachers, for the most part, I think that any of them will answer your questions..... I know IO3. He's really good about getting on and answering questions, especially with classroom management questions. So that's helpful..."

The in-service teacher (IO2) did not perceive herself as a member of the group of pre-service teachers, but she felt comfortable interacting with them in NETwork. Also, she felt like she grew to know more about other members through reading their postings gradually through the semester.

IO2: "don't feel like I know any of them, but I do feel like if I had a question or I had thought something they posted was interesting and I had a comment on it, I wouldn't have any problem posting back. I mean, I feel connected in that way."

Sixth, at the beginning of the Spring 2007 semester, the in-service teacher (IO2) stated that seeing another members' name displaying on the present box in Sakai did not make her feel anything. Instead, it just indicated to her that someone is there. However, IO2's feelings changed after participating in NETwork for about two months when she reported that seeing others' names displaying in the present box made her feel that she was not alone and the community was active. Below are the statements from IO2 from the first and second interviews.

IO2 (first interview): "I didn't really think too much about it (the names display on the present box). I was just thinking, "OK, somebody else is on the site, too." And that's about it."

IO2 (second interview): “I mean, I don’t feel like I’m alone, but I have looked through the people, just kind of glanced through to see what they’re saying…… It makes me feel that I guess people are on the site and it’s active and that people… Because sometimes you look at web sites and you know it’s not been updated for so long, or nobody’s on there. So I guess it makes me feel like people are actively using this site……I like knowing that other people are there and they’re going to read my messages or I can read theirs. I mean it keeps the site really… and I know that if I post something somebody is going to read it, so I’ll probably get a response.”

Similarly to IO2, pre-service teachers mentioned that seeing others’ names displaying on the present box told them members were actively working on something in NETwork. They would then expect to see some new postings or responses to their postings. When seeing many names displaying in the present box, pre-service teachers felt more like part of a community and it seemed easier to post because of seeing new postings from others. Below is how pre-service teachers described their perspectives.

PN13: “I think that it’s easier to post when there’s a lot more people on here because then there are going to be new things being posted all the time……I mean if you’re the only one in the room, there’s only so many times that you can post before you’re replying to yourself. So it’s nice when there’s a whole group of people in there and you know that you’re posting and then they can respond, and you can respond back. Because if you’re the only one in there, you’re really just having a conversation with yourself, I suppose. So it’s nice to have other people in there who are going to be there to respond to you……I think that when there’s more people there, it just feels… Like you were asking earlier, it just feels more like part of a community instead of just being in there on your own.”

PO4: “Because I kind of feel lonely if I’m the only one on there. I’m kind of like, “No one else is on here. OK, I’ll get off.” But if somebody else is on, then maybe you can discuss ideas or send them a private message about, “Oh, how do you feel about this?” Or something. So I kind of feel it motivates me in a way if more people are on there, to read more discussion postings and everything, because if I’m the only person in there, I kind of feel like I don’t really have much to do, so I’m just going to get out of it. So I think that influences me to talk to other people and even though I don’t really post, to read other people’s postings and everything. I like that resource.”

Also, pre-service teachers explained that the blue dots which indicated that members were in the chat room helped them decide to go to the chat room for chatting or sending private messages to particular members. Below is how two of the pre-service described their feelings about chat room interaction.

PO6: “I try to look and see if they’re in the chat room, I think. Because doesn’t that little blue thing appear if they’re in the chat room… Yeah, I think that’s really nice, because then you can go in there and chat with them online. But then it also makes me look for different

posts. Like, you know how on the discussion board it shows who last posted, something like on here. It's kind of interesting, because if they're online and they've just posted, you can read what they think about something, and then maybe you can reply to them. I think it's a really nice way to see who sent the last message and who posted, and I think that's really good. So the little box helps me to see who's online, who's posting, and then I can quickly respond to them or reply to them, or something."

PN13: "Well, when you can see users present and they'll tell you if they're in the chat room, that's how I know for me to get into the chat room. Because there's no reason to get in if there's no one else in it."

Further, PO4 said that seeing others' names on the present box helped her to interact with other members. She stated that seeing others' names displaying on the present box prompted her to participate more.

PO4: "I remember last semester PO7 was on, or something, and I'd send him a private message, like "Oh, what are you posting under?" Or just like a little funny message. I think that's good because it allows you to see who else is on there, so then you can interact with them.....I think it could make you want to participate more, knowing, "Oh, he's online." Because actually PO7 and I, we were going to a conference, and it was like 7:00 in the morning, and we were both online, and we were the only two on Sakai, and it was so funny, because we were like, "Oh, my god, we're such nerds, being on Sakai at 7:00 in the morning, before we go to an educational conference." It was kind of funny. And if that wasn't there, then I would not have known that he was online. I like that."

Lastly, the in-service teacher/old member (IO2) and the pre-service teachers reported that the daily email digest (Sakai notification tool) helped them to better participate in NETwork. For example, IO2 saw the daily email digest as a reminder to her about recent discussion topics and what was happening in NETwork.

IO2: "I think every day is good. It wouldn't have to be every day. It could be every other day, or whenever something comes up. But I think every day is fine, if that's what works. I mean, it works for me just to check my e-mail and see what's going on and it reminds me that it's there and it reminds me to keep me updated if there's something I do want to see. So I think it's good they way it is, really.....I think it pretty much boils down to the E-mail Digest. Because when I get that—I don't always think about the NETwork—but when I get that, it reminds me to go to it. But I think when I get that it will trigger my mind to go to the NETwork, and if there's a topic I see when I'm like, "Oh, I'm really studying that," I'll go to, or if there is some topic that I really want to find a new lesson plan for, or I really want to find something else about it, I'll probably just go to it anyway and look and see."

One of the pre-service teachers/new members also used the email digest to help her lead the discussion for an extended course discussion topic. But she only really used the digest for the discussion activity because she felt she could get the same information from

within NETwork.

PN25: "...only because I'm a discussion leader. Prior to looking at this morning I wouldn't have really cared, to be honest, but now, since I know I need to keep posting, I want to see if people have posted to mine, and it's just a shortcut. If I didn't have that notification, I would just look on the NETwork."

The pre-service teachers/ old members, liked the email digest because they were able to figure out who had responded to their messages without always checking in NETwork. Also, if they did not have time to review others' responses right after receiving the email digest, they would be able to plan ahead to arrange time for it.

PO4: "I think that's a good idea, because then you can see how many people posted. Because just to, say, like what they posted to on there also? So then you can see if your question was posted under "Help Me, I'm Lost," and you get that e-mail and it says "So-and-so replied to "Help Me, I'm Lost," then you know that your post has been answered. So you can go on there and check and see what they said.....maybe if I had posted something on the NETwork and then we got the E-mail Digest, maybe if I couldn't go on that day, if I read the e-mail, perhaps maybe I would make room or time to get on the NETwork and check and see. I think that's really helpful, actually, because if you post something on there and you want an answer right away, that's a good way to keep that.....I don't remember which one it was—but after reading over the Digest, I was like, "Oh, I really want to read about that." And so I got on and looked at it."

Content Analysis: Members' Perceptions of Social Constructs (Semester-end Interviews)

The purpose of the content analysis for members' semester-end interviews was to examine members' perceptions of participating in NETwork, including their sense of community, social ability, perceived ease of use, perceived usefulness, satisfaction with NETwork experience, and effectiveness of NETwork for teaching. The members who participated in the semester-end interviews were IO1, IO15, PN16, PN20, PN27, PN28, PO2, and PO7. Thus, eight completed semester-end interview transcripts were coded based on the coding scheme (Appendix 3-G). Eight themes were found regarding members' perceptions of social constructs after participating in NETwork. These eight themes are: 1) members expressed that NETwork provided them access to diverse insights about teaching and to practical experiences (i.e. teaching philosophy, a good teacher's characteristics, knowledge of potential students, and class management, etc.); 2) members felt that they were not alone when facing teaching problems or issues because NETwork provided a safe space for them to share positive and negative teaching experiences; 3) members felt that NETwork provided them wide opportunities to connect to other teachers across the nation; 4) members perceived NETwork as part of their teaching support system for finding help when needed; 5) members' teaching confidence increased after seeing other members' concerns and problems and by engaging with diverse insights in discussion ; 6) members expressed how their participation helped build a sense of community in NETwork; 7) the social present box displaying members' names when they were online helped members experience social presence and social navigation; and 8) the topic information shown through the notification tool, daily email digest, influenced members' decisions about logging-in to NETwork.

First of all, members discussed how NETwork provided them access to multiple and diverse insights from others' experiences of teaching such as both successful and failed teaching strategies which contributed to their perspectives on teaching philosophy, a good teacher's characteristics, understanding of their potential students, knowledge and skills of class management and assessment, teaching ideas, and practical teaching experience. Below are experience addressed by different types of members.

IO1: "I think it helps that when you look at what other people are thinking and how they go about doing something. At least my mentality is whenever I go and I look at what other people are doing or looking in terms of their point of view is...take something from that. How can I implement that into my teaching.....it's just like different strategies. You know, the more strategies that you have in terms of going about a topic, I think the better... I mean, I have four hundred kids during the week. And I do the same basic lesson, but I have to use different examples in every class. And sometimes I just run out of examples.....I think that just listening to other people's experiences is always a very powerful tool to use. We can learn from other people's experiences and their successes and failures... I think the experiences in terms of how you go about doing it and getting that NETwork is very powerful."

PN20: "things like potential students and students with disabilities and parents and difficult parents and all that stuff that we don't sit and talk about in class is what was discussed here (NETwork), which I think was the most beneficial thing about it. And I mean, our professors did a really good job of not taking exactly what we did in class and bringing it on Sakai, and it's just a different feel than what most classes are. "

PN28: "...because what a fifth grader does and what a second grader does are two totally opposite things. But at the same time, some of what they do are the same. Like, a fifth grader does that? Like, my second graders do that. But you don't realize that maybe since second grade they haven't even talked about that. And so they kind of need to restart it again. So it's kind of cool just to see where, kind of get a very skin-deep idea of what each grade encompasses, what the curriculum they have, and so that's very cool."

PO7: "I think just seeing that people were talking about schools from other areas, and I think hearing stories that were like what I've experienced, and knowing that this happens everywhere. It's not just this kid. It's not just this school or this city. This is an ongoing problem and the society of education."

Pre-service teachers who were doing the field experience courses, said that they were unable to share their experience in class and also wanted to discuss more about what they were going to face soon in the coming stage of student teaching. They felt that NETwork gave them more opportunities to discuss and share field experience among

pre-service teachers, and that they were more able to discuss issues that related to their practical concerns about teaching. They also appreciated having access to in-service teachers' in-school experiences. Below is how participants described having access to diverse insights.

PN16: "it's good for discussions about field work, especially, because we don't actually talk a lot about what goes on in different field classrooms. And so actually this is one of the best places that I get different little stories about the other second grade classrooms... We each taught a lesson and we all wrote our individual reflections on it. But a lot of times we don't just talk about them in class. And sometimes this is good because it's not a teacher-facilitated discussion. I mean anyone can bring up any issue and it's kind of easier to do that on this (NETwork) than it is in the classroom.....Like sometimes people just post, like, what are you nervous about? You know? And there's not really time in the class to talk about that... If it's just stuff that there's not time to talk about, we can just talk about it on here (NETwork)."

However, asking members how much participating in NETwork contributed to their insight about good teachers' characteristics and what kind of teacher they are/would like to be, led to different answers. IO15 who did not participate very much in NETwork said that her perspectives on a good teacher's characteristics were from different sources, such as previous learning experiences, learning communities that she has been part of while growing up, where she was educated, and even the current teaching in-school teaching experience. By participating in NETwork might not necessarily help construct her perspectives of good teachers' characteristics. Differing from IO15, IO1, PNs and POs said that participating in NETwork helped them build an understanding of the characteristics of a good teacher by listening to others' viewpoints about teaching. This contrast in answers shows that how members' perceive the contribution of NETwork to their teaching perceptions may be influenced by their levels of participation in NETwork. Also, while Network may make some contributions there is no doubt members' teaching perceptions are established through the stages of learning to be teachers and teaching experiences. Below are examples from how IO15 and PN20 discussed their experience

when they were asked: "Is there anything from the NETwork construct your ideas of good teachers' characteristics?"

IO15: "I think it's mostly, that's come from my previous learning experience. I think it's a matter of my reflection of the learning communities that I've been a part of where I grew up, where I was educated, and even from my experiences today in school..... I think it's not necessary just because my interaction on the NETwork has been low."

PN20: " Well, I think in the all member discussion forums with the in-service teachers, I think that's been a big help. And then with the field discussions that we have, and we all kind of talk about different things we've seen and what different things our host teachers do. And like I said, we don't have any classes where we have a chance to talk about that.....Right. And so just to talk about what we see teachers doing and... because, you know, we can read out of a textbook every single day, but that stuff doesn't hit home, like actually seeing it.....Which, I mean, it's hard to pinpoint if it changed from my classes or my classmates on Sakai, but I think the culmination of all the aspects are what changed it. I couldn't be who I am just because of a professor, or just because of the NETwork, but all three or however many aspects are working together is what formed it all together."

Second, members said that participating in the NETwork discussions helped them feel that they were not alone when facing teaching problems or issues and NETwork provided them a safe space for sharing their positive (i.e. excitement of field experience) and negative (i.e. fear, concerns, and stress) feelings about teaching. For example, IO15 felt that members in NETwork shared their thoughts honestly, which made her feel safe and comfortable when sharing her perspectives even though she had not even met most of members.

IO15: "I think the thing that I like most about the NETwork is just the fact that the people were honest. And that they really were inviting. I mean, I think that had I spent more time with the NETwork, I feel like I really could have not necessarily, you know, met the people face to face, but actually felt like I had some rapport with them had I interacted more. Because they were very welcoming people.....I think the way I used the NETwork, it definitely made you feel like you weren't alone, like you're not the only person with that problem. I think the use of the NETwork definitely enabled me as a teacher to feel like it's OK with whatever's happening because there's other people in your shoes, and even just being a person who's just reading through the discussions and not necessarily interacting as much, I think that even through that. It's sort of like a self-motivator in some ways of knowing you're not alone. It's OK.....And I think that definitely helps with feeling that and then feeling the security, the comfort level of the NETwork and the interaction level, I think it really felt inviting. I mean, definitely."

Third, NETwork not only provided a long-term shared space for members but also

wide opportunities to connect to other teachers across the nation. Pre-service teachers stated that they felt it would be helpful for their teaching because of the ability to have extended connections with members who they took courses with and had conversation with. Below are examples from two pre-service teachers' description about the benefits of having connection with other members after graduating.

PN27: "...I think, when I don't have the school work, like just talking mostly to the people who are out doing the teaching right now... because even, like, Dr. IS1 for example, has been a teacher, but she's not actually in that setting right now, in the elementary setting. So I think it's most helpful. And I also think it will be cool to keep in touch with everyone I'm in class with right now when they're student teaching in City B or City C, or at different schools, because we're not going to see each other as much. And sharing lesson plans and ideas and strategies and experiences is just very helpful."

PN28: "The NETwork definitely holds some value. I mean, you do get to communicate with people with whom you normally wouldn't. And also, like next year when we are student teaching, we're not all down the block from each other. Some people, I know a couple of them are out of state, and they can still talk to us like they're next door. So I mean, that's real value in the fact that it kind of shrinks the world, and the things you're experiencing in City C, they might be experiencing the same thing in California. So just to know that you're not alone, that's also something that the NETwork can do."

Another two examples of how members perceived the benefits of connecting to other teachers in different states via NETwork are listed below. Both in-service teachers and pre-service teachers expressed that they did not feel a lot of global collaboration for now because NETwork was just beginning to establish the community. However, they all could anticipate the potential and power of having connections with other teachers across states after having some experience in working with the other teachers in Network from Indiana or California via NETwork.

IO1:

IO1: I think that, right now, in terms of my experience, it's still very limited just because the NETwork is still so, um, new. Because it's primarily done with the students. But I think as those students begin to graduate and move on and the NETwork begins to grow and people begin to spread out across the country, I think then it'll become a great source.

R: So actually, at this point, you might not feel like the people are all around the country at this point, but you can see the potential that it might become. Like the teachers are all distributed to other places teaching.

IO1: Right, right, exactly.

PN27: “At this point, I actually haven’t really, but I do absolutely see the opportunity for it. But like I said, I haven’t been as active as I could be, so I know that the chance is out there, but I haven’t experienced it quite as much firsthand, although I did see that I had a response from someone I didn’t know. So yeah, it’s definitely out there, the possibility, it’s just whether or not you take advantage of it.....just community to be a part of. I keep saying this, but when we graduate... because then... yeah, and like I said, IO1 is in California, and then you get to hear about... because different places are experiencing different things and different teaching styles, different schools. So it’s really cool to get to discuss all of that and compare and contrast along the spectrum.”

For one of pre-service teachers/old members who had experience in chatting with IO1 in CR, he expressed the benefit of knowing different teachers in other states and the value of meeting him in a conference.

PO7: “...with IO1—and I think especially because Dr. IS1 talked to me a lot about IO1, because she said that we’re similar in a lot of ways, and so she told me stories about him. And at NSTA, the national conference for science that was in City C, I met him. He was here from California, and I got to meet him.....I think that’s actually the great thing about it (NETwork), is that we can connect, it’s a tool to help us not only if we’re in the same building at different computers typing, but we can be, I can be wherever. Like IO1 can be in California, but we’re just as connected. I think this is sort of like the virtual meeting room where everyone can come in and conference on things. So I think that access, the fact that it’s so accessible, is really helpful.”

Fourth, members expressed that in addition to the variety of teaching support they had from the universities, their schools, or people they know, NETwork would be a support they could refer to and find help. For the IOs, they felt the people they worked with in schools and districts were their primary teaching support, but they also perceived NETwork as a teaching support for them if they utilized it more.

IO15: “I think that the NETwork definitely could provide wonderful resources for me. I think it’s just a matter of me utilizing the NETwork to its fullest potential for those resources.”

The pre-service teachers felt NETwork would be a great resource to have after they graduated from school because it provides opportunities for them to connect with their previous peers, other pre-service teachers, in-service teachers, and university professors. Below are statements about Network as a resource.

PN16: “I think when all of us are together we don’t necessarily want to talk about things

that we saw in field and things that we've learned. And so to be able to get on here and read what one of my good friends thinks is good. Not even necessarily a good friend but one of my classmates whom I never talk to, to get on here and see, and think, "Man, I really agree with what they said." And I never knew that. I think definitely, the support is great..... I mean there's going to be times when we can't call each other and talk on the phone for twenty minutes. I like the private message aspect of it, too, because you don't always know someone's e-mail address, but if you just want to say hi or something, that's a great way."

PO2: "I actually feel that I am a part of the group. The way the NETwork is constructed that make me feel that I will be able to connect to my previous classes and professors as well as the friends who I met in the programs. After we all graduate from MU, NETwork will be a place where I can always go to looking for support and feedback."

Fifth, members stated that their teaching confidence increased after finding out how other member thought about issues and what problems and concerns other members had. The members also explained that their teaching confidence was constructed not only from participating in NETwork but also from their field experiences and school teaching.

Below is how different types of members described changes in their teaching confidence.

IO15:

IO15: I think that it helps by just knowing that someone took the time to think about it and listen. And just having another person maybe re-explaining something in a different way, or just having somebody answer it who maybe is detached from the situation, because sometimes things happen at your school and you don't want to necessarily... Maybe you're afraid to talk to the people at your school, and being able to do it to the NETwork where people from all different school districts and different people from different schools, I think that it's easier to approach and ask, sometimes, people from different communities in that sense.

R: So you also feel like, when you see some discussion in the NETwork or people replying to your postings, it helps you construct your teaching confidence as well?

IO15: I think so, definitely.

PN16: "It's kind of nice to see that and to focus on what you think they do well, and see what someone says about you...it just builds confidence.... Just seeing that the things I'm nervous about or worried about everyone else is, too. And even people I really, really respect in the class and think they seem so pulled together, they're talking about stuff, too, that makes them nervous. And it's good to see that you're not the only one who's worried and nervous.....it makes me feel at least like we're all basically in the same situation and the things I'm not sure about other people aren't sure about, either."

PN20: "just to get on Sakai and look at everyone else's thoughts and feelings about going into teaching and their concerns and what they're excited about. I mean that automatically raises my confidence to see that there are people who are feeling the same things I am and I'm not alone. And, like I said, that immediately raises my confidence. And to see people agreeing with what I have to say and when the professors respond back to me and I get my questions answered, that all makes me feel a lot better about what I'm doing."

PO2: "By participating in the NETwork discussion where people reply to my suggestions

and I reflect what I really know to help others give my confidence of the teaching knowledge and skills that I have learned. When I posting something in the discussion board, I can see what I have learned and experienced and share it with others. I also want to be able to help others who are new as I was.”

Sixth, The pre-service teachers/old members were using the NETwork along with their field experience courses in Fall 2006. During Spring 2007, they did not have any field experience courses using NETwork as part of their courses. Thus, they felt a rise in the sense of community came slower, and the way they perceived their role in the community changed to more like an outsider looking in. Below are how the two pre-service teachers/old members described the way they felt.

PO2: “I feel that I have felt very high sense of community since I have been posted so many in the previous semester, but this semester I do not have that much time to post. I did not post as many as I was. However, I still feel a sense of being in the group. When the time goes by, I feel the sense of community is gradually increased, but this semester I kind of moving to be a voluntary participant. I might influence a little bit of the speed the increase of the sense of community.”

PO7: “the couple of times I logged-in this semester (Spring 2007), I think because there were so many new people and I didn’t know most of them,... Last semester I felt like I was on the inside looking out, and this semester when I logged-in it was like I was on the outside looking in. And I think it’s because I know that all these people are talking are in one block together. They all know each other. They’re all feeding off these really big conversations, and it’s really more intimidating to jump into the conversation when you know that all these people already have all these pre-established relationships and they’re talking. They could be like, “Who is this person commenting?”

However, the in-service teachers/old members, felt their sense of community increase gradually and felt more comfortable in participating in NETwork discussion when they participated more in NETwork activities and exposing themselves more to the NETwork discussion.

IO1: “I’m more comfortable going around in the NETwork just because, just like anything else, the more exposure you have to things, the more comfortable you’re going to be. And plus, you know, when you meet somebody who’s a member there, then they can also... you know, it goes both ways. Most of them see each other every day in class, whereas they can’t see me. And so then I think that that’s a pretty powerful thing.....I definitely still feel like I’m a part of the community just because I participate in terms of that, I’m reading that...knowing what’s being said and what’s being talked about. That really kind of helps me feel more a part of the community, definitely”

Also, discussion in NETwork not only provided pre-service teachers/new members chances to talked with other in-service teachers or pre-service teacher who were not taking field experience courses with them, but also some other classmates who they would not have had any conversation with outside of class. Learning what others' think also increased their feeling of being part of a group. Below is how PN28 explained his feeling.

PN28: "because some of these people I would never talk to outside of class, so it's kind of like, "Well, this is how I can get their input." Because I really don't talk to them in class. And so it's kind of a way to get to know someone without actually getting to know everybody, kind of thing. Because by reading their posts you get to see how they view things, like school, the way of teaching the classroom at School A. So it's kind of cool in that sense, in that you can get perspectives from people you normally wouldn't get them from. And so I guess that would make me feel more part of a group, just because I see them every day, but I don't talk to them. But at the same time I know what they're thinking and I know what they're feeling. So I mean that can increase the sense of a group."

Seventh, pre-service teachers said seeing members in the present box of Sakai made them feel a sense of community. When they were working in NETwork and saw others' names appearing when logging-in, they felt someone was working with them at the same time. They also said that seeing someone who they knew caught more of their attention.

PO2: "When I saw someone's name is listed in the present box, I felt that someone was also working in the NETwork at the time when I was there. If I saw someone that I know, I would like to chat with them. I may go the chat room..."

However, the in-service teachers who did not know most pre-service teachers using NETwork did not feel that seeing others' names appearing in the present box made them feel any different because they did not really know them. Seeing someone you know has a different impact than seeing someone you do not know.

IO15: "I didn't really feel any different. I mean, I really didn't mind it, honestly. I didn't really feel one way or the other, because I felt like the people I knew who I went to school that were in my class with IS1, like, I've not stayed in contact at all with. So the students who are now using the NETwork and the teachers who are using the NETwork now, I have no clue who they are.... I think that if I saw a friend on there or something like that, I think I might feel a little bit different about it"

Additionally, seeing others in the present box of Sakai also influenced how pre-service teachers/new members acted in NETwork. Working in the NETwork without seeing anyone in the present box, could lead to feelings of isolation. Members checked others' presence to see who might be currently posting messages that he/she could reply. Also, seeing the total amount of other members' posting in DB influenced some pre-service teachers/new members' posting behavior could lead to members feeling a need to post more. Below are two comments about the social nature of Network from pre-service teachers/new members.

PN28: "sometimes if I did sign on I'm the only one, I was like, "Oh, I must be a loser because I'm the only one on Sakai right now, doing my homework." But occasionally, that would be full, and you're like, "Well, then people are doing it." And sometimes, too, I'd reference who was in the box to see new posts. Because sometimes we wouldn't have new posts for weeks. And I'm not going to go to something and reply when I've already replied. Or just add, because I don't have anything to add. And so I just try and see where they had posted so I could respond to them. That did influence where I went in the NETwork, if I saw people were on."

PN27: "the only thing is, like for the math class, we're supposed to be posting three times a week. And since you can see how many posts everyone else has, like sometimes when I see someone has 150 posts, I'm like, "OK, I'd better do a couple posts." But see, that's kind of like the negative side of it, because I don't want to post just to do it, I want to do it when I genuinely have something worthwhile [to say]. You know what I mean? But as far as being influenced, I think that was kind of the only factor. When people say stuff and... I mean, unless they say something, I feel like responding to them, that would influence me as well. And sometimes I read stuff and I just don't have anything to say, but it's still helpful to read what everyone else is saying, even though I might not have my own input at the time."

Lastly, the notification email digest that was sent to members every day also influenced members' behaviors of logging-in to NETwork. Although some of members did not really use or reviewed it when they received it, the members who read the email digest said that the information in the email digest gave them a quick review of what was being discussed in the NETwork. If they saw some interesting topics, they would login to NETwork and check out the posts. They also explained that relative to the pull of seeing an interesting topic, the information about who posted the information did not really

influence their decision of logging-in. For example, PN20 described her experience below.

PN20: “Well, the member listing with all the numbers of posts, I mean that kind of makes you think, “Well I should probably get on there and look for some more conversations.” And then the e-mails, like I was saying earlier, if I get on and see that someone else has posted on a topic, then I’ll get on there and look. And then also, when you start a new thread, it’s kind of fun to get on there and see what people have written back to you.”

Members who did not often use email notification pointed out that they did not need a daily notification but weekly would be great. A number of pre-service teachers/new members who felt an expectation to log-in to NETwork every day; felt they did not need the email digest because they could see the activity information within Network. However, some of the PS said that it was helpful to see who was acting and what was happening in NETwork.

Result Summary for Research Question 3

Overall, when examining changes in all pre-service teachers’ perceptions of social constructs, significant changes were found in perceptions of social navigation, perceived ease of use and usefulness of Sakai tools, and satisfaction with NETwork experiences after participating in NETwork. In comparing new members with old members, pre-service teachers/new members showed significant changes in their perceptions of ease of use and usefulness of Sakai tools (refer to Table 4.3.4), while pre-service teachers/old members (participants only) showed significant changes in their perception of social navigation, perceived usefulness of Sakai tools, satisfaction with NETwork experience, and effectiveness of NETwork for teaching (refer to Table 4.3.6). Similar levels of change, including significant results for SN, PEU, PU, S, and SE were found across IOs, POs, and PNs.

Although members’ perception of effectiveness of NETwork for teaching and sense

of community did not show significant changes in the quantitative data, members who participated in serial and final interviews expressed the effectiveness of NETwork for their current and future teaching and reported about changes in their sense of community which came from interacting with others in DB or CR. Evidence of changes in perceptions of pre-service teachers/old members' when examining changes from first and post surveys implemented in Fall2006 to the final survey conducted in Spring 2007 suggests that change in some social constructs may should be looked at over longer time periods than just one semester.

Chapter Summary

The purpose of this study was to understand the nature of participation, social constructs, and learning in a Community of Practice. This chapter presented the results of the study, including 1) members' levels and patterns of participation in Discussion Board, Chat Room, and Resources; 2) examination of proposed path model which visualizes interdependent relationships among social factors; and 3) changes in members' perceptions of sense of community, social ability, ease of use, usefulness, satisfaction with their NETwork experience, and the effectiveness of NETwork for supporting their teaching after participating in NETwork. Chapter five presents a discussion and draws implications for research and practice from these results.

CHAPTER V

DISCUSSION AND IMPLICATIONS

Introduction to the Chapter

This chapter presents a summary of the findings, and discusses key results for advancing the knowledge base about participation and learning in communities of practice. This chapter includes five sections: 1) summary of the study; 2) discussion of the results; 3) limitations; 4) implications and recommendations for further study; and 5) conclusion.

Summary of the Study

Research Purpose and Questions

The purposes of this study were to understand the nature of participation, social constructs, and learning in a Community of Practice and to test a model of how well the social constructs of the online learning community explain the effectiveness of professional development in the community. Based on the research purposes, three research questions were asked in this study:

1. How do members participate in the primary learning activities through Chat Room discussion, Discussion Board discussion, and information sharing in Resources?
 - 1a. What are the characterizations of member activity that represent different levels of participating in the community, and to what extent did members participate?
 - 1b. What are the characterizations of member activity that represent different patterns of participating in the community? Are there differences in the patterns of participation for experienced members and new members and for pre-service and in-service teachers?

2. How well does the proposed path model explain the relationships among the social constructs of online learning (i.e. sense of community, social ability, perceived ease of use, and perceived usefulness) and explain community outcomes/effects (satisfaction with NETwork experience and effectiveness of NETwork for Teaching)?
3. How do members' perceptions (sense of community, social ability, ease of use, usefulness, satisfaction with their NETwork experience, and of the effectiveness of NETwork for supporting teaching) change through participating in the community?

Research Procedure

A total of 92 NETwork members were invited to participate in the present study. Four types of data: CANS log files, two surveys, discussion content (in DB and CR), and interviews were collected to triangulate members' participation and perceptions of participation in NETwork. Multiple techniques of data analysis were utilized. First of all, CANS log files were analyzed via social network analysis with visualization tools to examine members' participation levels and patterns in DB, CR, and RS as well as their overall login frequency. Additionally, path analysis was employed to examine the proposed model and sub models of the relationships among social constructs. Also, changes in perceptions of the social constructs after participating in NETwork were examined via dependent-sample t-tests. Further, content analysis with targeted coding schemes was applied to analyze DB messages, CR messages, and serial and final interviews' transcripts.

This chapter will provide answers to the three research questions by discussing seven primary results identified from the findings presented in chapter four. Findings and subsequent discussion are organized by the research questions. For research question one,

there are four key findings. First of all, members' levels and patterns of participation were different across time, tools (i.e. Discussion Board, Chat Room, and Resources), and member types, and were influenced by the norms, policies, and practices of the community. Second, members' identity and levels of participation are reciprocally associated, illustrating how members' identities are formed via participation and non-participation in a community of practice (Wenger, 1998). Third, there were similarities and differences in members' usage of CMC tools, and members showed growth in their knowledge and skills for teaching via mutual engagement, creating joint enterprise, and establishing shared repertoire supported by CMC tools. Fourth, lack of time influences members' levels of participation.

For research question two, there are two key findings. First, the final model uses SOC, SA, PEU, and PU to explain 74% and 80% respectively of variance in members' satisfaction with NETwork experience and effectiveness of NETwork for Teaching. Second, the relationships among sub-constructs of SA and other social constructs provided more articulation of how SN, SPp, and SPi relate to members' perceptions of PEU and PU of Sakai tools, SOC, and S.

For research question three, there are two key findings. First, members' perceptions of social constructs of online learning significantly changed after participating in NETwork activities. However, members' perceptions of some social constructs might need more time to measure the differences. Second, after participating in NETwork activities, members expressed the belief that participating in NETwork helped their current and future school teaching.

Discussion of the Findings

Research Question 1: How do members participate in the primary learning activities through Chat Room discussion, Discussion Board discussion, and information sharing in Resources?

Finding 1: Members' levels and patterns of participation were different across time, tools (i.e. Discussion Board, Chat Room, and Resources), and member types, which were influenced by the norms, policies, and practices of the community.

Members' login frequency, posting and reading activity in DB, uploading and reviewing activity in RS, and chatting frequency in CR were examined to characterize members' levels and patterns of participation in NETwork. Table 4.1.28 (p.222) shows members started with a highest login frequency in the first month of the Spring 07 semester, and maintained fairly high levels across the next 3 months before dropping in the last month. Also, members' DB activity, including posting and reading activity, mostly increased in February and March and dropped gradually in April and May for all member types. However, when examining the frequency of reading activity, including the Mathematics extended discussion, members reading activity was seen to drop in March, indicating that the particular practices of requireaad Mathematics extended discussion affected the levels of reading activity for the entire DB. Additionally, members' uploading activity in RS was rare and only happened in April. Most of the resources reviewed by members in Spring 2007 were uploaded by pre-service teachers/old members in Fall 2006. Also, members' reviewing activity in RS increased in February, dropped in March, and then increased in April when most of the pre-service teachers/new members and some pre-service teachers/old members were utilizing the resources to help

complete their final project for field experience courses. Last, members' participation in CR was not as high as that in DB even though they expressed a preference for synchronous discussion. The chatting frequency increased when a topic discussion was scheduled. February is the month that had the most activity in CR because of the scheduled successful topic discussion.

Similar to what was found in prior studies (Fusco, 2002; Kling and Courtright, 2003) examining members' levels of participation in teacher online learning communities (Tapped In and ILF), time is a variable related to members' levels of participation. While Kling and Courtright (2003) examined members' participation across a longer time period, such as 9 months, 1 year, or 3.5 years, than the present study, the present study provided detailed monthly and daily trajectories of more forms of members' participation. These trajectories provide a picture for comparing members' changes in participation across time and member types simultaneously. The results show members' participation levels varied across communication tools. Although prior studies used time as a variable to examine changes in the levels and patterns of participation, the forms of examination were limited to only login frequency and number of messages posted. Fusco (2002) employed members' login frequency as a way to assess members' levels of participation, and Kling and Courtright (2003) used both login frequency and members' numbers of messages posted to describe members' levels of engagement and participation. Going beyond prior research (Gray & Tatar, 2004; Fusco, 2002; Kling and Courtright, 2003), the present study utilized multiple indicators, including members' posting and reading activity in DB, chatting activity in CR, resources reviewing and uploading activity in RS, to show a broad range of behaviors for interacting and participating in activities via these

tools. Additionally, Fusco (2002) and Kling and Courtright (2003) addressed members patterns of participation by presenting the average of members' login frequency during a particular time period, which was limited to providing the overall change of a group of members' participation by logging-in or posting messages.

According to Preece (2000) and Wenger (1998), members in an online learning community are governed by policies and norms generated and practices undertaken in the community. The findings reported in chapter 4 support this premise by showing that participation was shaped by expectations, roles and events of the community. Table 4.1.29 (p.222) shows that members' levels of participation varied across member types and were influenced by the requirements of the field experience courses, how the discussion activities were arranged, how others participated in the discussion, and how members socially interacted with each other. Pre-service teachers/new members (PNs) were the most active members logging-in the community, posting and reading messages in DB, and reviewing resources in RS. One of the reasons why PNs had the highest participation was because their field experience courses required participation in the community, while other members participated in NETwork voluntarily. Some of the participation in NETwork activities were counted as a part of PNs' course work, such as their participation in the Mathematics Extended Discussion. Interestingly, the PN's participation in the required Mathematics Extended Discussion created a preference for voluntary NETwork discussion forums. Among the old members who participated since Fall 2006, in-service teachers/old members (IOs) were the group that had second highest login frequency and posting and reading messages in DB. Although the average of IOs' levels of participation in DB is higher, the number of POs participating in NETwork is

higher than IOs. Therefore, when looking at the total amount of members' participation levels, POs is higher than IOs. Also, examining the reviewing activity in RS, pre-service teachers were found to have higher reviewing activity than in-service teachers, and resources were mostly uploaded by pre-service teachers and the professors. Although in-service teachers did not upload any resources, they did review the resources and gained some ideas about practical teaching issues. The invitation to pre-service teachers to upload their completed lesson plans explains why most of the resources were uploaded by the pre-service teachers, especially POs. Further, pre-service teachers (especially PNs) were the member types who participated most in CR, while only one of the in-service teachers/old members participated in a CR discussion. These findings show that the variations in levels of participation can be explained by the policies, norms, and practices of the community.

Additionally, Lave and Wenger (1991) indicated that activities, which are inherently social and shaped by the context, influence one's sense of identity, how and what is learned, and the meaning of practice. The way members interacted with each other and how they perceive social constructs in online learning and what they have learned in NETwork supports Lave and Wenger (1991) assertion. For example, PNs interacted with some particularly active POs and in-service teachers. Their understanding of practical teaching and teaching in science was shaped not only by the courses they were in but also via conversation with teachers who had practical experiences. PNs were found to have more interaction and had higher SOC within the PNs group than with the other role groups. PNs explained in the interviews that it was because that they were taking courses together and frequently met during the semester. Also, members' varying

levels of participation can be explained by the practice and their role in the community, which lead to different levels of participation and different perceptions of their identities as well. For example, the POs and IOs who had the most reading activity, had more reciprocal interaction with PNs. Some POs who were less active, did have substantial reading activity within the PO group. Some POs and INs who had little posting activity but more reading activity were identified as peripheral members, and these members were relatively ignored by other members in the community.

Prior studies of learning communities have not used social network analysis to visualize members' levels and patterns of participation. To better show members' interaction patterns, this study provided not only members' trajectories of participation in DB, RS, and CR across member types or individuals but also diagrams and statistical results of social network analysis to visualize and present detailed interaction patterns among different member types and of the community as a whole. Although Wenger (1998) provided a framework of members' interaction in a community of practice indicating a complex and always-changing forms of interaction, previous studies examining teachers' participation and interaction in teacher online learning communities mostly used login frequency or number of postings in DB to represent members' levels and patterns of participation. However, this set of information only provides a limited view of members' actual participation in online teacher communities. To better understand the complex and interdependent nature of interaction in a teacher online learning community, this study presented members' actual levels and patterns of participation in a teacher online learning community via multiple indicators of online participation and visualization and statistical indices of social network analysis.

Finding 2: Members' identity and levels of participation are reciprocally associated, illustrating how members' identities are formed via participation and non-participation in a community of practice (Wenger, 1998).

Wenger (1998) indicated that members' identities are formed via participation and non-participation (i.e. being an outsider or peripheral and marginalized participant). The present study found that members' levels of participation and the way they perceived their role in the community were reciprocal. Members' perceptions of their identities in the community were shaped through discussions with others, learning from diverse perspectives about practical teaching, and associating with others during community events. The PNs, POs, and in-service teachers perceived their role and NETwork as a community differently. PNs started with an attitude that participating in NETwork was annoying because they felt the required participation was something extra added to their original course work load. However, this attitude changed after participating in some voluntary discussions in NETwork because they learned that the discussion topics were relevant to their immediate and practical concerns they had for future teaching. They found value in having interactions with members with practical teaching experience. For example, pre-service teachers explained that they liked to review information or suggestions provided by in-service teachers who had more contemporary practical teaching experiences and pre-service teachers/old members who had already completed the field experience courses the PN's were now taking. After participating in NETwork, they started viewing it as a supportive resource for their learning to teach.

The POs, who had already participated in NETwork for one semester, started participating in Spring 2007 with a clear understanding of the value of NETwork.

However, they stated that their current work load of other field experience courses kept them from participating more in NETwork. Also, they perceived themselves as an outsider looking into what PNs were discussing about their field courses. Thus, they felt a drop in their own participation and a lower sense of community in NETwork during the Spring 2007 semester. Many POs were characterized as lurkers in Spring 2007 because they read others messages but seldom posted messages in DB. Their participation and their sense of their role in the community changed from having a central role in Fall 2006 to peripheral participation in Spring 2007. The in-service teachers saw themselves as a helper to share practical teaching experience with pre-service teachers at the beginning of the semester; however, as they participated in the discussion and interacted with other members, they found that they gained ideas from the multiple insights of members (including pre-service teachers and other in-service teachers) about teaching. They even found that they applied what they read about in the discussions to their in-school teaching.

Both pre-service teachers' and in-service teachers' attitudes and perceptions about their role and about NETwork as a community changed in a positive way. The members expressed an interest in keeping their NETwork membership in the future. To summarize, the different member types in this online teacher community perceived their identities differently and these perceptions influenced their levels of participation. Also, their identities were shaped through interacting with other members in the online community of practice.

Finding 3: *There were similarities and differences in members' usage of CMC tools, including discussion board, chat room, resources, social presence box, and daily email*

digest. Members showed growth of their knowledge and skills for teaching via mutual engagement, creating joint enterprise, and establishing shared repertoire supported by CMC tools.

Members used CMC tools (i.e. discussion board, chat room, resources, social presence box, and daily email digest) provided in NETwork both similarly and differently. The advantages of discussion in DB identified by NETwork members were to have more focused discussions and to access other members' diverse insights about teaching issues (i.e. hearing members who were not used to expressing their ideas in face-to-face discussion setting, extending discussions inform the field experience courses to address specific concerns, and discussing with other pre- or in-service teachers they could not meet in person). Khine and Lourdsuamy (2003) found that teachers responded positively as online discussion forums increased opportunities for discussing problems and gaining feedback from others. Also, Killian and Willhite (2003) found that students felt it was helpful to have access to insights of students who were not used to speaking up in face-to-face class. These students' insights were more often revealed in asynchronous discussions. Bodzin and Park (2000) showed how having a permanent record of the discussion content helped students track and link ideas and the flow of the discussion. Overall, the way members in the current study perceived the advantages of DB is consistent with these and other prior studies (Pena-Shaff & Nicholls, 2004; Romiszowski & Mason, 2004; Nonis, Bronack, & Heaton, 2000). The asynchronous discussion forums provided opportunities for anytime and anywhere sharing of ideas.

Although online discussions are identified as valuable ways to communicate in online learning environments, previous studies have found that discussion threads

sometimes stop more quickly than expected because of too many participants and superficial content (Cheung & Hew, 2005; Hewitt, 2006). Also, Rovai (2002) identified that having criticism or showing tension in DB was a factor weakening students' sense of community. Although there were about 53 members who participated in NETwork during Spring 2007, the discussion was found to persist and stay focused. During synchronous or asynchronous discussion in NETwork, members provided emotional support and sharing of stress when discussing their concerns or questions about practical teaching and field experience. This was found to be one of the primary reasons why members had valued the interaction in DB and had a greater appreciation of the NETwork discussion at the end of the semester. Additionally, NETwork members also mentioned that synchronous chat discussion gave them opportunities to ask questions regarding their concerns and gained immediate responses from knowledgeable authorities. They also said that the display of members' names in CR helped them gain a sense of social presence. The pre-service teachers also appreciated learning more about other members who were not in the field experience course through the direct interaction with them in CR. Differing from asynchronous discussion, the immediacy of synchronous chatting promoted members' sense of community more quickly. The scheduled topic discussions were more focused with fewer social messages compared to the non-scheduled chatting. Members' participation in CR was higher when a topic discussion was scheduled, meaning members did not depend on CR for communication and their participation depended more on how the professor arranged the chat discussion.

Further, Kling and Courtright (2003) found that members, including pre- and in-service teachers, in ILF did not show the levels of engagement and critical reflection

expected. They described how members' discussion primarily consisted of questions or opinions that were irrelevant to discussing planned video topics. However, the present study found that NETwork members who participated in DB and CR topic discussions were engaged and focused on the arranged topics by sharing their experiences and suggestions. Differing from Kling and Courtright (2003), professors facilitating members' discussion guided the discussion by providing appropriate prompts, questions, or suggestions; thus, while members did have some social conversation the discussions were always relevant to the topics. To conclude, effective online discussion needs to have members' continued participation and presence and supportive CMC tools (Watson, 1997). However a discussion facilitator, such as professors or members with authority, may also be needed to facilitate and monitor the discussion. Additionally, the present box and daily email digest (social awareness notification tools) were identified by the members to be very helpful. Members gained a sense of other members' social presence when seeing their names showing in the present box as well as feeling not alone when working in NETwork. These remarks by members show that social awareness can foster a shared sense of community for maintaining work relationships and communication (Dourish & Bly, 1992). The information content in daily email digest provided members an overview of discussion topics and what happened during the past day, which was found by members to be very helpful as it reminded them to participate in the discussion or provided them information about discussion content when they were off NETwork. Overall, the results of members' usage of DB, CR, RS, and other social awareness tools in Sakai supported what previous studies have shown. Previous studies found that CMC tools can deliver social awareness information and facilitate social interaction in online

learning environments (Carroll, et al., 2003; Alavi, 1994; Dourish & Bly, 1992) as well as facilitate communities of practitioners for solving practical problems (Jonassen, et al., 1995). These results were consistent with prior research that studied teachers' professional learning (Gray & Tatar, 2004; Job-Sluder & Barab, 2004) and found CMC tools can foster and support members' asynchronous and synchronous discussion.

According to Wenger (1998), mutual engagement of participants, joint enterprise, and shared repertoire are three dimensions of the community of practice. The discussions in DB and CR showed NETwork members' mutual engagement as well as joint enterprise for teaching practice. Wenger (1998) said that "Practice does not exist in the abstract. It exists because people are engaged in actions whose meanings they negotiate with one another" (p. 73). In NETwork, members were engaged not only in NETwork discussion and chat room discussion but also sharing resources in Resources. During the interaction, they negotiated meanings of practical teaching and of what others presented in the community. For example, they discussed the strategy: "Give me 5" on the discussion board, where through discussion they negotiated a common meaning for using this strategy in practice. To give another example, members reviewed others' examples of "learning circle" lesson plans shared in Resources. This review brought them holistic insights for improving their own lesson plans. Additionally, joint enterprise is a source of community coherence and is generated via members' collective processes of establishing members' mutual accountability (Wenger, 1998). Member's growth in understanding teaching knowledge and skills as expressed in the NETwork discussion and interviews revealed joint enterprise in teaching practices. Members expressed how they appropriated others diverse insights into their own thinking and opinions. For example, pre-service

teachers mentioned that a good teacher should be able to communicate with parents efficiently after participating in the NETWork discussion topic: “Parents.” The growth of members’ joint enterprise is a result of interacting with others in the community. Further, shared repertoire is developed in a pursuit of joint enterprise when negotiating meanings of practice. One substantial example is that the resources shared in RS by professors or other members in NETWork were recognized by members to be supportive for their learning to teach. Members utilized the shared repertoire of lesson plans, teaching materials, and standards to develop their own lesson plans and teaching ideas. Also, members’ insights and resources (i.e. links for standards or lesson plans) presented in DB or CR were part of the shared repertoire that members used as resources for negotiation. Overall, this study provides evidence of how members in an online teacher community of practice interacted and grew via mutual engagement, creating joint enterprise, and establishing shared repertoire in DB, CR, and RS.

Finding 4: Lack of time influences members’ levels of participation.

The present study found that lack of time was a reason that kept in-service teachers and pre-service teachers from greater participation in the community. Busy in-school teaching schedules occupies most of in-service teachers’ time and busy studying schedules for field experience courses occupies pre-service teachers. These time constraints were the primary reasons why they did not participate in Chat Room discussion although they perceived it was a great way to get immediate feedback or suggestions. Overall, members had higher interaction density in DB compared to RS and CR, and pre-service teachers had more participation than in-service teachers. The latter is consistent with findings from Kling and Courtright (2003) that showed in-service

teachers' participation was less and increased more slowly when compared to pre-service teachers.

Research Question 2: *How well does the proposed path model explain the relationships among the social constructs of online learning (i.e. SOC, SA, PEU, and PU) and explain community outcomes/effects (S and ET)?*

Finding 1: *The final model uses SOC, SA, PEU, and PU to explain 74% and 80% respectively of variance in members' satisfaction with NETwork experience and effectiveness of NETwork for Teaching.*

A final path model was achieved for relationships among the social constructs of members' online learning experience in NETwork and is summarized below. First of all, members' satisfaction with NETwork experience was the only direct factor impacting members' perceptions of effectiveness of NETwork for teaching, which means members felt the effectiveness of NETwork for their teaching only when they felt satisfied with learning in NETwork. Differing from prior studies (Tsai et al., 2008; Lin et al., 2006) that utilized statistical models to visualize the relationships among social constructs of online learning, an additional variable, members' perception of effectiveness of NETwork for teaching, was added in this study. Members' satisfaction with NETwork experience was a mediator for the relationships of social ability to effectiveness of NETwork for teaching ($SA \Leftrightarrow ET$) and of sense of community to effectiveness of NETwork for teaching ($SOC \Leftrightarrow ET$), which mean members' social ability and sense of community influenced their perceptions of the effectiveness of NETwork experience indirectly. These mediating relationships are new discoveries in the final path model and extend previous models.

Additionally, social ability, sense of community, and perceived usefulness directly

impact members' satisfaction with NETwork experience, meaning members with higher social ability and sense of community felt much more satisfied with their learning experience, as well as members who felt the Sakai tools were useful for their learning and interaction in NETwork were much more satisfied with their learning experience. Also, social ability and perceived usefulness account for significant variation in members' sense of community, indicating members had higher sense of community when they felt the usefulness of Sakai tools to facilitate their learning and to socially interact with others in NETwork. This result supports the insight that social interaction can be supported by CMC tools if the tools are utilized effectively and members feel the usefulness of the tools for their learning (Tu & Corry, 2003; Lavooy & Newlin, 2003; Tu & McIsaac, 2002).

Further, members' perception of ease of use directly influences their social ability and perceived usefulness, meaning that members needed to feel the ease of use of Sakai tools before they can perceive the usefulness of Sakai tools and utilize them to socially interact with others. Also, members' perception of usefulness for Sakai tools was a mediator for the relationships between perceived ease of use and satisfaction, indicating members' perception of ease of use contributes to their satisfaction after they really feel the usefulness of the Sakai tool. This finding is consistent with Hillman, Willis, and Gunawardena (1994) that argued users' learning is obstructed if they can not interact easily through the medium/tools. Thus, ease of use of the tools is one of the most basic requirements for establishing an online learning community.

Differing from the results of Tsai et al. (2008) sense of community fully mediates the relationships between social ability and satisfaction with NETwork experience. The

present study found that social ability was only partially mediated by sense of community to satisfaction but had a direct impact on members' satisfaction with NETwork experience. This direct relationship between social ability and satisfaction is consistent with the relationship between social ability and learning satisfaction identified in Lin et al., (2006). The difference between Tsai et al. (2008) and Lin et al. (2006) is that the former examined the relationships of multiple social constructs of online learning simultaneously while the latter only examined the single relationship between two constructs (SA and S). Based on the findings of these two prior studies, it was expected that members' social ability would not directly impact their satisfaction with NETwork experience when considering sense of community and other social constructs simultaneously. However, this study found that the direct relationship between social ability and satisfaction with an online learning experience exists even when adding sense of community in the model. The full mediating role of sense of community for social ability to satisfaction with online learning experiences found in Tsai et al. (2008) were not confirmed in this study.

Additionally, members' sense of community was only a partial mediator for the relationship between perceived usefulness and satisfaction with NETwork experience ($PU \Leftrightarrow S$) in the present study which is also inconsistent with what Tsai et al. (2008) found. These inconsistencies might be caused by the significant direct relationships between social ability and satisfaction with NETwork experience ($SA \Leftrightarrow S$) and perceived usefulness and satisfaction with NETwork experiences ($PU \Leftrightarrow S$) that were found non-significant in Tsai et al. (2008). Having differences in the direct relationships between perceived usefulness and satisfaction may be related to having different contexts

of this study (an online learning community including pre-service teachers who were taking field experience courses and other pre-service and in-service teachers who participated voluntarily) and Tsai et al. (2008) (online courses).

Finding 2: *The relationships among sub-constructs of social ability and other social constructs provided deeper understanding of how social navigation, social presence with peers, and social presence with instructors related to members' perceptions of ease of use and usefulness of Sakai tools, sense of community, and satisfaction of participating in NETWork, which was not examined in previous studies.*

Going beyond prior studies (Tsai, et al., 2008; Lin, et al., 2006), this study provided further examination of the interdependent relationships among sub-constructs of social ability (SN, SPi, and SPp) and other primary social constructs (i.e. SOC, SA, PEU, and PU). In addition to the final path model of the primary social constructs, the interdependent relationships among the sub-constructs of social ability and other primary social constructs were examined based on the primary relationships identified in the final path model ($SA \Rightarrow SOC$, $SA \Rightarrow S$, $PEU \Rightarrow SA$). Two sets of the relationships among sub-constructs of social ability and other social constructs were found interesting. The first set was an examination of the relationships among the sub-constructs of social ability (SN, SPi, and SPp) and members' perceptions of ease of use (PEU) and usefulness of Sakai tools (PU). The results indicate that members' perceptions of usefulness of Sakai tools (PU) were significantly associated with social navigation (SN) and social presence with instructors (SPi). Prior studies (Tsai et al., 2008; Lin, et. al., 2006; Lin, 2005) as well as the analysis of this study showed that there was no significant relationship between perceived usefulness (PU) and the main construct, social ability (SA). However, in the

examination of sub-constructs a significant relationship between members' perceptions of usefulness was found with social navigation and social presence with instructor. This indicates members who perceived the usefulness of Sakai tools had better sense of instructors' social presence and were more influenced by what others did. Also, perceived usefulness was found to fully mediate the relationship between perceived ease of use and social navigation (PEU \leftrightarrow SN). It is possible that there is a direct influence from perceived usefulness to social ability which did not identified in the final path model and Tsai et al. (2008). Thus, the direct relationship from perceived usefulness to social ability in the path model is suggested for a further examination. Further, members' perception of ease of use of Sakai tools directly impact their perception of social presence with instructors (SPi) and social presence with peers (SPp), meaning members who perceived high ease of use for Sakai tools had a better sense of social presence with instructors and with peers in NETwork. Although members' perception of ease of use did not directly impact social navigation, their perception of usefulness fully mediated the relationship between ease of use and social navigation. To summarize, this study not only confirmed the relationship between perceived ease of use and social ability found in Tsai et al. (2008) but also provides deeper insights of how perceived ease of use influences the sub-constructs of social ability and suggests a direct relationship between perceived usefulness and social ability for further examination.

The second set was an examination of the relationships among the sub-constructs of social ability (SN, SPi, and SPp), sense of community, and satisfaction with NETwork experience. Members' perceptions of social navigation (SN) and social presence with instructors (SPi) were found to directly influence sense of community (SOC) and

satisfaction with NETwork experience (S), while social presence with peers (SPp) did not have any direct impact on sense of community and satisfaction with NETwork experience. Also, sense of community only partially mediated the relationships between sub-social constructs of social ability and satisfaction with NETwork experience. Similar to the final path model sense of community was not a full mediator for the relationship between social ability and members' satisfaction ($SA \Rightarrow S$), SOC was only a partial mediator for the relationships between sub-constructs of social ability and members' satisfaction with NETwork experience ($SN \Rightarrow S$ and $SPi \Rightarrow S$). After adding sense of community in the mediator identification models, these two relationships ($SN \Rightarrow S$ and $SPi \Rightarrow S$) weakened but remained significant. To summarize, in addition to Tsai et al (2008) and the final path model that only examined the relationships among sense of community, satisfaction, and social ability as a whole, this study provided new insights for understanding how different sub-constructs of social ability influence sense of community and satisfaction with NETwork experience.

Research Question 3: How do members' perceptions (sense of community, social ability, ease of use, usefulness, satisfaction with their NETwork experience, and of the effectiveness of NETwork for supporting teaching) change through participating in the community?

Finding 1: Members' perceptions of social constructs of online learning significantly changed after participating in NETwork activities. However, members' perceptions of some social constructs might need longer time to measure the differences.

Members who participated in NETwork in Spring 2007 semester had significant changes from early in the semester to later in the semester in their perceptions of social

navigation (SN), ease of use (PEU) and usefulness (PU) of Sakai tools, satisfaction with NETwork experience (S), and effectiveness of NETwork for teaching (ET) (refer to Table 4.3.10). However, by separating pre-service teachers into new members (PNs) and old members (POs), it can be seen that PNs who only participated in NETwork for one semester had significant differences only for their perception of ease of use (PEU) and usefulness (PU) of Sakai tools (refer to Table 4.3.4). For pre-service teachers/old members who had participated in NETwork for two semesters, there were significant differences within the Spring semester in their perception of social navigation (SN), perceived usefulness of Sakai tools (PU), satisfaction with NETwork experience (S), and effectiveness of NETwork for teaching (ET) (refer to Table 4.3.6). Comparing the significant changes of pre-service teacher/new members' and pre-service teacher/old members' perceptions, it is possible that the significant changes of social navigation and satisfaction with NETwork experience need more time to develop.

Although members' perceptions of effectiveness of NETwork for teaching, sense of community, and social ability were not significantly different in the quantitative data, members who participated in interviews expressed the effectiveness of NETwork for their current or future teaching, changes in their sense of community via interacting with others in DB or CR, changes in their perception of other members' social presence via Sakai tools, and how effective they used the Sakai tools to socially interact with other members. These qualitative results may indicate that some changes take longer to develop or perhaps are not as widespread across the community as others. Additionally it should be noted that the early scores for social constructs satisfaction and effectiveness are all relatively high. To verify if some social constructs need longer time periods to

show significant differences, an examination of pre-service teachers/old members' (POs) perception after participating two semesters in NETwork found that POs who responded to the first survey in Fall 2006 and the final survey in Spring 2007 semester had significant differences in their perceptions of sense of community (SOC), perceived ease of use (PEU) and usefulness (PU) of Sakai tools, and effectiveness of NETwork for teaching (ET). Measures of social ability were first measured in the final survey in Fall 2006. Thus, an examination of POs' perceptions of SA in the final survey in Fall 2006 and the final survey in Spring 2007 was possible and showed that social navigation had significant change. Statistically, with a small sample size (only 10 or 9 POs' responses) in these two extended examinations, the t-test results tend to be non-significant. However, as shown in the extended examinations, SOC, PEU, PU, ET, and SN were found significant, indicating the value of measuring members' (i.e. PNs) perceptions of these social constructs, including SOC, ET, SN, or SA, over a longer-time-period of participation in NETwork.

Finding 2: *After participating in NETwork activities, members expressed the effectiveness of participating in NETwork for their current or future in-school teaching.*

Members stated that they perceived the effectiveness of NETwork for their teaching via gaining diverse insights of others' teaching experiences, discussing and discovering good teachers' characteristics, discussing the characteristics of their current or potential students, gaining knowledge and skills of class management and assessment, teaching ideas, working with parents, and having emotional support from other members. To be more specific, pre-service teachers experienced a growth in their understanding of practical teaching issues via discussing contemporary teaching experiences and concerns

with in-service teachers, other pre-service teachers, and professors. Additionally, members' teaching confidence were enhanced by seeing others' experience, questions, and concerns about teaching and by answering or providing help to others in the NETwork community. For example, in-service teachers stated that talking to other people was helpful to improve their teaching confidence, while pre-service teachers felt seeing others viewpoints and hearing others' agreement or compliments for their teaching insights enhanced their teaching confidence. These findings are consistent with what Brown and Duguid (2000) found that members learn to be practitioners by working and talking about practice. In Brown and Duguid (2000), they concluded that "practice is an effective teacher and the community of practice is an ideal learning environment." Also, the result confirms that pre-service and in-service teachers benefit from being members of a community with a sense of belonging and having others to ask for support (Wellman & Gulia, 1999).

Further, members expressed that the more they kept themselves exposed to or participated in the NETwork discussion and activity, the more they felt an increase in their sense of community and felt comfortable interacting with other members. This finding is consistent with prior studies (Wang, Sierra, & Folger, 2003; Brown, 2001; Moller et al., 2000) showing that students' active participation can sustain a learning community and establish a sense of community. Also, Rovai (2003, 2002a) showed that members' sense of community also influenced learners' participation and outcomes as well as Laffey et al. (2006) demonstrated that social ability influence learners' participation. Similar to Rovai (2003) and Laffey et al. (2006), this study found that sense of community directly influences members' satisfaction with NETwork experience which

directly impacts members' perception of effectiveness of NETwork for their teaching. Also, in the qualitative results, members' feeling a sense of other members' social presence was found to help establish their sense of community which also confirmed the significant direct and indirect relationships between members' perception of social presence with instructors and peers identified in the Set 2 final path model (Figure 4.32). And seeing the name of someone who they know caught members' attention and promoted their participation in DB and CR. To be more specific, members described that seeing others' name appearing in the presence box made them feel someone was working with them at the same time and encouraged them to read or check if any new postings were created by these present members. It was found that other members' social presence influenced the way and what members acted in the community, identifying the relationship between social presence and social navigation. To summarize, NETwork is an evolving community of practice (Wenger, 1998) where members' growth, participation, interaction, and feeling of the community are interwoven and highly associated. Members' behaviors and feelings were influenced by what others did, what they saw, and what they accessed in the community. The growth of the community includes not only individual members' growth but the implicit changes and improvement of the community itself.

Limitations

When considering the findings in this study, five limitations need to be noted. These limitations include: 1) chat room CANS data could not be used for social network analysis and CR discussions were a more limited part of this study than originally expected; 2) the data of members' reading activity was adjusted from the actual recorded

CANS data; 3) extended course discussion amplified PNs' participation levels; 4) the sample size of the path analyses was small; and 5) four-months might not be long enough to measure changes in members' perceptions of online learning experience.

First of all, due to the design of chat room in Sakai environment, each message sent by members was recorded as a new event without any identification of where this message was going to in CANS. Also, members' reading activity in chat room was not recorded in CANS. It was impossible for CANS to identify who was reading which message and correctly record it. The only way to show members' interaction in CR was to review all the messages and identify who was sending a message to whom from the content of the messages. However, some messages did not contain information about who were the recipients for a particular message. Mostly, messages were addressed to all the participants. Thus, this study did not analyze members' social interaction patterns in CR via social network analysis. Although the content analysis of content of chat room messages showed some patterns of how members interacted in the chat room, there was no information to unfold members' actual reading activity in the chat room. Additionally, the implementation of the scheduled chat room topic discussions was not as successful as expected. Topic discussion 1 was the only successful chat room discussion focusing on the discussion content, while topic discussion 2 only included some questions about field experience courses. Thus, it is difficult to have a significant comparison of members' levels and patterns of participation in scheduled chat room topic discussions.

Second, the data of members' reading activity were adjusted from the actual recorded CANS data. The discussion board in Sakai is not thread-based. Under a given topic, members' responses were listed directly based on when they posted their message.

Thus, while it is clear in CANS data who created which messages at what time, reading activity was recorded in CANS as one event when they opened the discussion topic containing several messages. Also, the subject authors (who posted the message) for the messages members were reading was recorded as the member who posted the first message in the discussion topic. Thus, the CANS data for members' reading activity was biased. For example, one member might open the discussion topic many times and they read the messages replied to the first messages. In this case, the subject authors for members' reading activity should be the authors who replied to the first messages. However, there is no way to ensure what exact messages members read every time they opened the discussion topic. Thus, the purpose of adjusting the recorded biased CANS data for reading activity was to correct the bias to be more representative of actual behavior. Members' reading activity was adjusted based on the number of openings of a discussion topic. For example, if they opened a discussion topic, they were assumed to read all the messages, including the initial messages and all the replied messages. But after they opened the topic once, they were assumed to read only the new messages. Thus, the subject author of the reading activity would be the author of the most recent new messages. For example, if they open a topic three times within one day after reading the first messages two days ago, the reading activity of CANS data was adjusted to be three reading events with the subject authors being the authors of the new replies within the topic. Therefore, members' reading activity as reported by CANS were adjusted to a more complete articulation of members' reading activity in DB.

Third, the NETwork community supported members' field experience courses in Science, Literacy, and Mathematics in order to recruit new members from these courses.

However, the professors for each course did not use Network in the same way. For example the professor who taught the mathematics field experience course utilized NETwork more as a course site instead of an online teacher community. The mathematics course had required course discussions which may have influenced how members participated in NETwork voluntary discussions during the semester. Also, some issues about teachers' experiences discussed in the mathematics extended course discussion were actually started in NETwork voluntary discussions. When the required discussion topics in the mathematics extended discussion were similar to the voluntary discussion topics in NETwork discussion, members felt it was redundant and were confused about where to post their thoughts. Thus, pre-service teachers/new members' participation of the teacher online learning community was influenced by the requirements of the mathematics filed experience course.

Fourth, the sample size of the path analyses was small although the percentage of members' participation in the first survey and final survey were 54.35% and 71.74%. Kline (2005) suggests 10 times as many cases as estimated parameters (or ideally 20 times) for path analysis is adequate, and he also states that 5 times or less is insufficient for significance testing of the path model. In the present study, 8 to 10 estimated parameters in the path models ideally would have 80 to 100 cases for the path analyses. However, this study only attained 66 cases for the path analyses. Thus, to better examine the interdependent relationships among social constructs, a larger sample would be helpful.

Last, the present study found some inconsistencies in the quantitative results and members' opinions gathered from the interviews. In the quantitative analysis members'

perception of effectiveness of NETwork experience did not reveal significant changes; however, members who participated in interviews did mention a change in their sense of the effectiveness of NETwork experience for their teaching. One possible explanation leading to the inconsistency between the quantitative and qualitative analyses is that some social factors might need more time to have measurable changes. To examine members' changes of perceptions with a longer time period by utilizing the data collected in the pilot study and current study, pre-service teachers/old members who both participated in these data were found to have significant in most of the social constructs. Some of the social constructs were found to be non-significant when comparing pre-service teachers/new members' perception of the first and final surveys conducted in Spring 2007. Although the NETwork community engaged students within three field experience courses, it aspired to engage teachers across levels of teacher preparation and include practicing teachers as a way to establish a fully online learning community. NETwork activities were mostly voluntary and with a few exceptions were extra curricular in content and practice. Thus, the level of intensity of engagement varied across members and over time, and certainly was less than the pressure students feel to complete course assignments or inservice teachers feel to meet school district requirements. Longer time periods than the usual semester long periods may be needed to measure changes of members' perceptions of online learning experience in a community of this sort.

Implications and Recommendations for Further Study

The findings of this study advance knowledge and improve our understanding of members' social interaction and outcomes in a teacher online learning community. The implication of this study and recommendations for further study are clustered into three

categories: 1) conceptual framework for community of practice in a teacher online learning community; 2) research and analysis methods for data collected in an online learning community; 3) practical implementation and establishment of a teacher online learning community. First of all, one implication for the conceptual framework of community of practice in a teacher online learning community is that, while Wenger's framework of community of practice is broadly confirmed by the findings of this study, this study provided more specific evidence of how members interact and participate in a teacher online learning community. Second, four implications and recommendations for research and data analysis methods include: a) new analytic methods were implemented in this study and these have value for advancing current understanding of members' levels and patterns of participation in an online community of practice; b) changes in members perceptions of social constructs were significant, but some social constructs may need to be measured over longer time periods; c) differences in relationships among social constructs from priors studies were found and suggest further examination of the relationships in different online setting (courses vs. communities); and d) relationships among sub-constructs of social ability with other primary constructs were identified and further examination is suggested to have larger sample sizes in order to examine all the social construct (sub & primary) within one model. In addition, two recommendations for practical implementation and establishment of a teacher online learning community are: a) an orientation to clarify members' roles and purposes for participation may improve participation; and b) develop activities that have value for the different member types may enhance members' participation.

I. Implications and Recommendations for Conceptual Framework of Community of Practice in a Teacher Online Learning Community

Wenger's framework of community of practice explains how a community of practice operates in general, but it does not specifically show how members interact or participate in an online teacher community of practice. The findings of the present study broadly confirm the value of using many of concepts presented in Wenger's framework of community of practice outlined in Figure 2.1 (p. 28; Laffey, 2005) for describing a COP. These constructs can be used for qualitative and quantitative examination of how different member types participate in a teacher online learning community similarly and differently and of the reciprocal influence between members' identities and participation. Differing from previous studies that also applied the framework of community of practice to examining teacher online learning communities, the findings of this study explicitly present members' actual levels and patterns of participation in a teacher online learning community via multiple indicators of participation, visualizations and statistical results of social network analysis, as well as opinions expressed in interviews. The results advance understanding of members' levels and patterns of participation across time, tools, and members types, members' perceptions of social constructs of online learning, and members' growth and perceived effectiveness of an teacher online learning community, which provides descriptions of how the teacher online learning community operated and provides insights for what needs to be considered when establishing a teacher online learning community. Additionally, the reciprocal relationship between members' identities and participation was identified in the online teacher community. However, changes of members' identities were found via members' expressions in the interviews. For further study, it may enhance the objectivity and reliability for understanding the relationship between members' identities and participation if researchers can develop a

scale to assess members' identities. It would be also interesting to include members' identities as a variable into the examination of relationships among social constructs of online learning experience.

II. Implications and Recommendations for Research and Data Analysis Methods

First of all, the findings of this study support Wenger's (1998) framework of a community of practice. Members' levels and patterns of participation via synchronous and asynchronous discussion and via shared repertoire were articulated. The visualization of members' trajectories of participation and social interaction patterns reported by social network analysis, path analysis, and content analysis, illustrate how different member types interact among each other. Although some prior studies used members' log files to examine members' participation; this study utilized multiple indicators to examine a variety of behaviors of members' participation in an online community. Through examining members' actual behaviors in the community and triangulating the results via multiple types of data rich pictures of members' levels and patterns of participation across members types and CMC tools help advance current understanding of how an online community of practice operates. Also, the different levels and patterns of participation among members and tools brings attention to instructional designers and system developers about how to design activities based on diverse characteristics of member types and how to improve CMC tools to support members' social interaction in a teacher online learning community. Thus, the analytic methods implemented in this study should be considered by future researchers of COP.

Additionally, this study found significant changes in members' perceptions of some of the social constructs (i.e. SN, S, and ET for POs; SN, PEU, PU, S for all members) via

statistical results. The interview data provided evidence of how members understood their changes and primarily supported the significant changes found in the statistical results. However, some changes expressed in the interviews were not supported as significant in the statistical results. Based on the inconsistency in the statistical and interview results, a possibility that some of the social constructs might need more time to develop is hypothesized. NETwork is a hybrid community which was integrated with three field experience courses, the activity was very intensive during the semester. In this way, the four-month examination of members' levels and patterns of participation helped to show members' patterns of interaction to a certain degree. However, the four-month time period might be too short for some changes that may be underway but require more time to develop. It is possible that members' levels and patterns of participation will be different when examining the changes over a longer time period and without activities integrated from the field experience courses. Compared to online courses, studies implemented in online learning communities may need different time perspectives to observe and wait for the changes of members' perception taking place. In an online class, students' activities are driven in date line of the learning tasks; however in an online learning community, members' participation is influenced by their daily work load and time management. Thus, when collecting data in an online learning community or a hybrid community (i.e. NETwork), the time frame for activities taking place needs to be considered.

Furthermore, the interdependent relationships among social constructs identified in the path models advanced understanding of how technologies influence members' social interaction and satisfaction in an online learning community. Differing from previous

studies of online courses, this study examined the interdependent relationships of social constructs in an online learning community. Similar to Tsai et al. (2008), this study examined the relationships among social constructs simultaneously; however, the direct relationship between social ability and satisfaction discarded in Tsai et al. (2008) was shown to be significant in this study.. Further simultaneous examination and confirmation of the direct relationship between social ability and satisfaction is needed. However, it is possible that the direct relationship between social ability and satisfaction vary between online course setting and online learning community setting. Thus, further examinations of this direct relationship in online learning community is needed.

This study examined the interdependent relationships among sub-constructs of social ability with other constructs and found significant relationships. However, because of the small sample size, this study did not examine all sub-constructs of social ability and satisfaction with other primary social constructs. There is a possibility that the relationships among the sub-constructs and other primary constructs might change after examining all the sub-constructs and primary constructs simultaneously in the same model. For further study, it would be helpful to have larger sample sizes in order to examine all the constructs simultaneously. For this last point it should be kept in mind that the results were reported using a range of alpha values to content with the risk of Type II errors. This seems like a good choice for an exploratory and broad investigation of a new practice as was studied here, but readers are cautioned in trying to generalize beyond the context and circumstances of the groups studied.

***III. Implications and Recommendations for Practical Implementation and Establishment
of a teacher online learning community***

This study found that PNs started being annoyed at having to participate in NETwork activity because they did not have clear understanding of why they needed to participate in NETwork and how the NETwork was expected to assist their learning. Although their attitude changed in a positive way through interacting with other members, it may be helpful to have a clear explanation of the purposes and members' roles in the NETwork when introducing NETwork to them. Members' participation might be different after they have a clear understanding of what they can gain from the community. Thus, a suggestion for further research is to ensure most of members understand their role and a purpose for participating in the community after the orientation activity. However, more specificity by organizers about what is expected may influence how roles and purposes evolve from the natural participation of members.

Additionally, members' participation in the teacher online learning community were different based on their roles. It is very important to consider the different member types when designing activities to promote members' participation. For example, in-service teachers did not have time to participate in discussions during the day because of their in-school work. It will help to increase their participation by arranging the synchronous chat discussion in the evening or at night. Also, members' levels of participation were influenced by their available time. It is hard to control members' time and request members' commitment for participation. However, raising the value of activities might be a good way to promote their participation. For example, inviting more in-service teachers to participate in chat room discussions might promote pre-service teachers' participation because they will have chance to gain practical feedback by talking to in-service teachers. Thus, this study suggests further study to consider

characteristics of different member types and try to raise the value of activities based on members' needs when designing activities for a teacher online learning community.

Conclusion

This study used Wenger's (1998) views of communities of practice as a framework for examining the social nature of online learning communities. Findings of this study are congruent with Wenger's framework and prior studies examining members' interaction in online teacher communities. To understand the nature of participation, social constructs, and learning in a teacher online community of practice, this study utilized multiple data sources to explore and visualize members' levels and patterns of participation, to examine the interdependent relationships among social constructs of members' NETwork learning experience, and to investigate the influence of NETwork participation on changing perceptions of social constructs and effectiveness for their teaching.

In addition to prior studies, the visualization of trajectories and social network analysis brought new insights about members' levels and patterns of participation of a teacher online learning community. The results showed some similar and some different levels and patterns of members' participation across member types and CMC tools (i.e. Discussion Board, Chat Room, and Resources). Further, the path models helped visualize and quantify the interdependent relationships among members' perceptions of social constructs (i.e. PEU, PU, SA, SPi, SPp, SN, SOC, S, and ET). Some of the relationships identified in prior studies (Tsai et al., 2008; Lin et al., 2006) were confirmed as well as some inconsistencies have been brought to attention. The inconsistencies show a need for further examination for some particular relationships, and for examining the social constructs in a similar context (i.e. online learning community).

Based on both qualitative and quantitative results, the study shows that members' perception of social constructs of online learning experience (i.e. social navigation, social presence, perceived ease of use and usefulness of Sakai tools, sense of community, satisfaction of NETowrk experience, and effectiveness of NETwork for their teaching) changed in a positive way through participation. However, the significance of the changes for some social constructs was found to need more time to develop. Overall, pre-service and in-service teachers' levels and patterns of participation in NETwork were intertwined with their identity and memberships. Also, their interaction within NETwork, including having mutual engagement, establishing shared repertoire, and developing joint enterprise, showed how members learn from each other and how their identity and participation changed in an online learning community.

To conclude, the findings from the three research questions help clarify the nature of participation in online communities, show how members are social and show the impact of participating in an online social space. The different member types learned from social interaction with each other and through CMC tools. The results show how members both act similarly and differently based on roles, context and tools to achieve their learning goals within a teacher online learning community of practice. Insights about these similarities and differences should help researchers better understand and plan further research into how a teacher online community of practice is established and how members' perceptions, levels, and patterns of participation change across time. With more understanding, researchers and teacher educators can better sustain levels of social interaction and participation in an online learning community needed to support teachers' continuumm of their professional development in teaching.

Appendix 3-A
Interface of NETwork Environment in Sakai

Login Page

The screenshot shows the Mizzou Learning Communities & ePortfolios login interface. At the top right, there are fields for 'user id:' and 'password:' with a 'Login' button. On the left, a sidebar menu includes 'Welcome', 'Acknowledgments', and 'Help'. The main content area features a 'Message of the day' section with a link to contact support. Below it, a note states that Sakai is in limited production status at MU and is not supported at the full production level. A 'Sakai Tips' section provides browser recommendations.

Homepage of NETwork

The screenshot shows the NETwork homepage. The top navigation bar includes a Mizzou logo, 'Logout', and a 'My Workspace' dropdown menu. The main content area is divided into several sections: 'About the NETwork...', 'Recent Announcements', 'Events in the NETwork for BACK TO SCHOOL!', and 'Recent Chat Messages'. The 'About the NETwork...' section contains information about the members-only web environment designed to support elementary teaching and learning. The 'Recent Announcements' section lists items like 'Countdown to back to school...', 'Congratulations to the lucky winners!', and 'Win \$50 for sharing your opinions about the NETwork!'. The 'Events in the NETwork for BACK TO SCHOOL!' section describes the Share-A-Thon and encourages users to post ideas in discussion forums. The 'Recent Chat Messages' section shows recent messages from users like 'ISI'.

Discussion Board

 [Logout](#)

My Workspace FIPSE-CANS DPSS SPo8 NETwork [- more -](#)

Home Announcements Resources Chat Room Web Resources Site Info Discussion and Private Messages Help

I-Chun Tsai

Discussion and Private Messages

[Discussion Home](#) [Search](#) [Recent Topics](#) [Member Listing](#) [Manage](#) [My Profile](#) [My Bookmark](#) [Private Messages](#) [Mark All As Read](#)

You last visited on: 03-06-2008 13:55:48
The date and time now is: 05-01-2008 13:49:15

Discussion List

Discussions	Topics	Messages	Last Message
Teachers' Lounge			
Get to Know You! Interested in knowing who's who in the NETwork? Post your profile here and say hello to others!	42	45	03-21-2007 21:50:38 Member name
Questions about NETwork Please ask questions if you have any suggestions or questions for NETwork.	0	No messages	No messages
NETwork Discussion Forums (All members)			
The First Years of Teaching Are you a beginning teacher in your first few years in the classroom? Post a message here to share with other new teachers!	13	53	04-23-2007 10:13:27 Member name
Student Teaching Are you currently student teaching? Have a question or issue you'd like to discuss with other student teachers? Share it here!	6	54	04-21-2008 10:37:01 Member name
Tips and Advice Have a teaching tip or resource? Share it here! Looking for a resource or advice? Ask away!	11	42	04-26-2007 13:17:53 Member name
What should a teacher do when... Have you experienced or observed a situation where you were at a loss as to how to respond? Share your experience here, and get responses from other NETwork members about how the situation might be handled!	10	58	05-02-2007 20:17:38 Member name
Classroom Management Share your tips and questions for effectively managing the elementary classroom.	13	77	04-25-2007 01:49:15 Member name
Teaching Elementary Science Use this forum to share your questions and comments regarding teaching science to elementary learners-- whether it's in your own classroom, or in your field experience/student teaching.	13	54	04-22-2007 21:05:23 Member name
Teaching Elementary Literacy Use this forum to share your questions and comments regarding teaching literacy to elementary learners- whether it's in your own classroom or your field experience/student teaching.	16	57	05-01-2007 10:08:48 Member name
Teaching Elementary Mathematics Use this forum to share your questions and comments regarding teaching mathematics to elementary learners- whether it's in your own classroom or your field experience/student teaching.	5	7	04-30-2007 09:42:04 Member name
Assessing Student Learning The purpose of this forum is to share questions and ideas regarding assessment of student learning.	3	9	03-11-2007 16:41:10 Member name
Effective Strategies What strategies are effective in teaching mathematics? science? special needs students? English language learners? Share your questions and comments here!	7	36	05-01-2007 10:19:31 Member name
Standardized Tests How will you prepare your students to take standardized tests? Where do you weigh in on this issue? Share your thoughts and questions here!	6	31	04-22-2007 21:03:53 Member name
Interdisciplinary Instruction How can teachers effectively build meaningful connections among math, science, and literacy? Share examples and questions here!	3	15	03-19-2007 18:01:20 Member name
Discuss What You Want. You're in charge! Discuss what you want!	33	181	04-07-2007 12:48:48 Member name
Parents How do you build successful relationships with and communicate with parents? Share your tips here!	6	26	05-07-2007 20:22:57 Member name
Field Experience (MU Students Only)			
Reflecting on Elementary Science - Case Studies Use this forum to post your responses to viewing the ROES case studies in your field seminar.	32	68	01-22-2007 19:14:12 Member name
Field Questions & Concerns Have a question or concern about field? Use this forum to share these with your field supervisor, Terri Neu.	20	154	05-01-2007 09:55:01 Member name
Professionalism & Professional Development What does it mean to be a "professional"? Share your ideas in this forum and tips for continued professional development as teachers.	2	21	05-03-2007 11:19:38 Member name
Being Proactive and Taking Initiative in Your Field Classroom What does it mean to be proactive? How can you demonstrate initiative? Share how you are making yourself a vital part of your field classroom community.	2	36	04-11-2007 14:00:59 Member name
Teaching Styles Use this forum to discuss the "teaching styles" of your own teachers, teachers you observe, and the kind of teaching style you envision for your own classroom.	5	41	05-01-2007 09:48:12 Member name

Chat Room

The screenshot shows the Mizzou Learning Communities & ePortfolios interface. The top navigation bar includes the Mizzou logo, site name, and a Logout link. The left sidebar, titled 'My Workspace', has a 'NETwork' section with a 'Chat Room' item selected. The main content area is titled 'Chat Room: "main"' and displays a message from 'I-Chun Tsai' dated March 6, 2008, at 1:57 PM CST. A message input field is present at the bottom.

Resources

The screenshot shows the 'Resources' page under the 'NETwork' section. The left sidebar shows the 'Resources' item is selected. The main content area lists various resources in a table format, including 'NETwork Resources', 'NETwork Members Share & Swap', 'New Member Information', 'A Beginner's Guide to Sakai (Video Version-Flash)', 'A Beginner's Guide to Sakai (Video Version-HTML)', 'A Beginner's Guide to Sakai.pdf', 'Get to Know You _Instruction.pdf', 'Science Resources from Dr. H's Students', and 'NETwork Archives'. The table includes columns for Title, Access, Created By, Modified, and Size.

Title	Access	Created By	Modified	Size
NETwork Resources	Add	IS1		
NETwork Members Share & Swap	Add	Actions	Entire site Deborah Hanuscin	Mar 6, 2008 1:58 pm
New Member Information	Add	Actions	Entire site I-Chun Tsai	Mar 6, 2008 1:58 pm
A Beginner's Guide to Sakai (Video Version-Flash)	Actions	Entire site I-Chun Tsai	Jan 17, 2007 12:48 am	3.6 MB
A Beginner's Guide to Sakai (Video Version-HTML)	Actions	Entire site I-Chun Tsai	Jan 17, 2007 12:53 am	0.9 KB
A Beginner's Guide to Sakai.pdf	Actions	Entire site I-Chun Tsai	Jan 16, 2007 5:22 pm	568.1 KB
Get to Know You _Instruction.pdf	Actions	Entire site I-Chun Tsai	Jan 14, 2007 4:41 pm	83.5 KB
Science Resources from Dr. H's Students	Add	Actions	Entire site I-Chun Tsai	Mar 6, 2008 1:58 pm
NETwork Archives	Add	Actions	Entire site I-Chun Tsai	Mar 6, 2008 1:58 pm

Appendix 3-B

Nurturing Elementary Teachers (NETwork): Online Experience Study

Serial Interviews Protocols

Nurturing Elementary Teachers (NETwork): Online Experience Study

Serial Interviews Protocols

First Interview

I. Instruction:

We appreciate your agreeing to participate in the series of interviews to help us investigate your learning experience with the NETwork in Sakai. Do you have any questions about the consent form or about the study before we begin?

[If yes, explain & answer his/her questions.]

During this interview I will ask you some questions about your experiences using the NETwork. Feel free to add any other thoughts about your other online learning experiences. For example if you are taking other courses in Sakai, Blackboard, MU Direct, etc. But mainly we are focused on your experiences related to NETwork. Your comments will be very helpful in providing researchers information about how teachers learn in an online community.

This session is being tape-recorded so that we can be sure we transcribe your answers and suggestions accurately. We anticipate using this information in professional presentations and publications, but nothing you say will be individually attributed to you. Your name will not be used to identify you as a participant in the research. You can end the interview at any time or skip any questions you are not comfortable answering. Your participation is completely voluntary.

II. Interview Questions

Theme: Participants' experience of learning in NETwork

1. Can you tell me about what it is like participating in this NETwork? What kind of things do you do?

[Covert categories: perception of how s/he participates; what activities s/he experience; how s/he feels about the activities; detail description of particular learning tasks; experience of interaction with others; feelings of interacting with others; sense of being a part of groups; how the feelings influence their participation; how the experience of interaction is supported by tool]

- a. What do you like most and least in this NETwork?
- b. Can you tell me about your participation in any learning tasks or activities in the NETwork?
- c. In what activity have you had the most interaction with other members or the professors?

[probe: one in which you felt like you were working in a group or interacting with others. If s/he has trouble identifying an interactive one, ask s/he to pick out one s/he remember as going well.
Try to get the interviewee to give specifics of how the members interacted]

- d. Can you tell me about a specific incident when you communicated with one of the professors or with other members? Stories & Examples [probe...can you think of a time when you got responses on postings]

e. Do you have a sense of being a part of a group or working with others? [Probe: if not much.....what kind of things usually help build a sense of being a part of a group?]
f. Can you think of things that either helped or hindered your sense of being a part of a group or having a feeling of working with others in NETwork?

- g. During these learning tasks or activities how well did the Sakai tools work to make interaction easy or natural? What were strengths and weaknesses of tools.

2. What are your goals for participating in the NETwork? [Probe: The professor, classmates, or technology & tools? Hinder or help? Some goals may be from outside the assignment, such as keeping my work manageable in the time I allotted for the class, etc....so be listening and probing to see what was important to them during participating]

[Convert categories: goals for future teaching; goal for current learning; how do they achieve the goals]

- a. How well do you feel you achieve them in NETwork?
- b. Did you do some things specifically to help achieve those goals?

3. How do you decide or choose in what learning tasks or activities you want to participate?

[Convert categories: how her/his actions are influenced by others' work or actions; how one is influenced]

- a. Do the actions of other people influence you in terms of what and how you participate in the activities/tasks online? [Probe: Instructor, classmates, or technology & tools? Hinder or help?]
- b. How have others influenced you?

4. Do you have any concerns when you communicate or interact with the professor/other members in the NETwork?

[Covert categories: concerns of sharing resources, privacy, security, showing ignorance, looking foolish, etc.]

If yes, what are those concerns?

5. Is there anything else about your participation in the NETwork that you feel is important and we haven't yet talked about?

Theme: Current Teaching Belief & Perception

1. What kind of teacher do you think you are/will be?

[Convert categories: perceptions of him/herself as a teacher currently/in the future]

2. What characteristics do you think a good teacher should have? Please give examples.

[Convert categories: perceptions of what characteristics make for a good teacher]

3. Are you satisfied with your current knowledge and skills related to teaching?

[Convert categories: satisfaction of current knowledge and skills; needs of knowledge and skills]

If yes, what make you feel satisfied?

If no, why are you not satisfied and what do you need to be satisfied?

4. Are you satisfied with the teaching supports that you have now?

[Convert categories: satisfaction of current supports; needs of supports]

If yes, what teaching supports do you have?

If no, why are you not satisfied and what do you need to be satisfied?

5. How does the NETwork provide information or resources that you use in your teaching or preparation for teaching?

[Convert categories: perceptions of information or resources for teaching; usefulness of information and resources of NETwork for current/future teaching and teacher preparation]

- a. Does the NETwork provide information or resources that you need?

If yes, please give an example of how you use (or will) the information or resources in your teaching.
If no, why?

Theme: Effectiveness of NETwork for Teaching

1. How do you think about the opportunities provided in NETwork to help you connect with other teachers around the country?

[Convert categories: perceptions of connecting to other teachers through NETwork; feelings of connecting to other teachers]

- a. Do you think NETwork provide you opportunities to connect with other teachers?

If yes, would you please give an example how you connect with other teachers through NETwork?
If no, ask question d.

- b. Is being connected to other teachers around the country important to you? If yes, why? If no, why?

- c. Do you feel a connection or sense of community with these other teachers around the country?

- If yes, please give an example. ? If no, why?
d. why don't you feel connected and what would have to happen in order for you to feel more connected with other teachers?

2. How do you feel about the change of your teaching knowledge and skills (teaching in elementary schools) through interacting with other teachers who are teaching in schools in NETwork?

- [Convert categories: feelings of how the knowledge and skills change because of participating in NETwork]
- a. Do you feel that your teaching knowledge and skills have changed because of participating in NETwork?
If yes, In what ways have they changed and what brought about the change? [Note: to find if it is improved]
If no, why?

[Note: If interviewee is teaching in school, ask Q3. If not ask Q4.]

3. How do you feel about that interacting with practicing teachers and pre-service teachers in the NETwork influences your school teaching?

- [Convert categories: influence of current teaching from NETwork; confidence of teaching established/increase because of NETwork; willingness of being a member of NETwork]
- a. Does participating in the NETwork help you know more about your students?
If yes, please give an example of how it makes you understand your potential students more.
If no, why?
- b. Does participating in the NETwork help you know more about how to provide appropriate lesson plans and materials for your students?
If yes, please give an example of how the NETwork helps you.
If no, why?
- c. Have your teaching methods or strategies changed because of participating in the NETwork?
If yes, please give an example of what has changed and how it has changed.
If no, why?
- d. Do you feel more confident about teaching in schools after participating in the NETwork?
If yes, please give an explanation of why you feel more confident.
If no, why?
- e. Do you want to continue to be a member of NETwork as long as you teach?
If yes, why?
If no, why not?

4. How do you feel about that interacting with practicing teachers and other preservice teachers in the NETwork will influence your future school teaching?

- [Convert categories: influence of future teaching from NETwork; confidence of teaching established/increase because of NETwork; willingness of being a member of NETwork]
- a. Does participating in the NETwork help you know more about your potential students?
If yes, please give an example of how it makes you understand your potential students more.
If no, why?
- b. Does participating in the NETwork help you know more about how to provide appropriate lesson plans and materials for your students?
If yes, please give an example of how the NETwork helps you.
If no, why?
- c. Do you feel more confident about teaching in schools after participating in the NETwork?
If yes, please give an explanation of why you feel more confident.
If no, why?
- e. When you start teaching will you want to continue to be a member of NETwork?
If yes, why? If no, why not?

Nurturing Elementary Teachers (NETwork): Online Experience Study
Serial Interviews Protocols
Second Interview

I. Instruction:

We appreciate your agreeing to participate in the series of interviews. Again, do you have any questions about the consent form or about the study before we begin the second interview?
[If yes, explain & answer his/her questions.]

During this interview I will ask you some questions about changes in your experiences after using the NETwork. You will answer these questions base upon your experiences in SAKAI after the first interview. This session is being tape-recorded so that we can be sure we transcribe your answers and suggestions accurately. We anticipate using this information in professional presentations and publications, but nothing you say will be individually attributed to you. Your name will not be used to identify you as a participant in the research. You can end the interview at any time or skip any questions you are not comfortable answering. Your participation is completely voluntary.

II. Interview Questions

Theme: Participants' experience of learning in NETwork (Some questions might be skipped which depends on if participants' answer in the first interview is thorough)

- Focus on asking the changes of each question.
- Compare with first interview answer and ask why it changes.

1. Can you tell me about what it is like participating in this NETwork? What kind of things do you do?

[Covert categories: perception of how s/he participates; what activities s/he experience; how s/he feels about the activities; detail description of particular learning tasks; experience of interaction with others; feelings of interacting with others; sense of being a part of groups; how the feelings influence their participation; how the experience of interaction is supported by tool]

- a. What do you like most and least in this NETwork?
- b. Can you tell me about your participation in any learning tasks or activities in the NETwork?
- c. In what activity have you had the most interaction with other members or the professors?
[probe: one in which you felt like you were working in a group or interacting with others. If s/he has trouble identifying an interactive one, ask s/he to pick out one s/he remember as going well.
Try to get the interviewee to give specifics of how the members interacted]
- d. Can you tell me about a specific incident when you communicated with one of the professors or with other members? Stories & Examples [probe...can you think of a time when you got responses on postings]
- e. Do you have a sense of being a part of a group or working with others? [Probe: if not much.....what kind of things usually help build a sense of being a part of a group?]
- f. Can you think of things that either helped or hindered your sense of being a part of a group or having a feeling of working with others in NETwork?
- g. During these learning tasks or activities how well did the Sakai tools work to make interaction easy or natural? What were strengths and weaknesses of tools.

2. What are your goals for participating in the NETwork? [Probe: The professor, classmates, or technology & tools? Hinder or help? Some goals may be from outside the assignment, such as keeping my work manageable in the time I allotted for the class, etc....so be listening and probing to see what was important to them during participating]

[Convert categories: goals for future teaching; goal for current learning; how do they achieve the goals]

- a. How well do you feel you achieve them in NETwork?
- b. Did you do some things specifically to help achieve those goals?

3. How do you decide or choose in what learning tasks or activities you want to participate?

[Convert categories: how her/his actions are influenced by others' work or actions; how one is influenced]

- a. Do the actions of other people influence you in terms of what and how you participate in the activities/tasks online? [Probe: Instructor, classmates, or technology & tools? Hinder or help?]
- b. How have others influenced you?

4. Do you have any concerns when you communicate or interact with the professor/other members in the NETwork?

[Covert categories: concerns of sharing resources, privacy, security, showing ignorance, looking foolish, etc.]

- a. If yes, what are those concerns?

5. Is there anything else about your participation in the NETwork that you feel is important and we haven't yet talked about?

Theme: Current Teaching Belief & Perception (Some questions might be skipped which depends on if participants' answer in the first interview is thorough)

- Focus on asking the changes of each question.
- Compare with answer of the first interview and ask why it changes.

1. What kind of teacher do you think you are/will be?

[Convert categories: perceptions of him/herself as a teacher currently/in the future]

2. What characteristics do you think a good teacher should have? Please give examples.

[Convert categories: perceptions of what characteristics make for a good teacher]

3. Are you satisfied with your current knowledge and skills related to teaching?

[Convert categories: satisfaction of current knowledge and skills; needs of knowledge and skills]

- a. If yes, what make you feel satisfied?
If no, why are you not satisfied and what do you need to be satisfied?

4. Are you satisfied with the teaching supports that you have now?

[Convert categories: satisfaction of current supports; needs of supports]

- a. If yes, what teaching supports do you have?
If no, why are you not satisfied and what do you need to be satisfied?

5. How does the NETwork provide information or resources that you use in your teaching or preparation for teaching?

[Convert categories: perceptions of information or resources for teaching; usefulness of information and resources of NETwork for current/future teaching and teacher preparation]

- a. Does the NETwork provide information or resources that you need?
If yes, please give an example of how you use (or will) the information or resources in your teaching.
If no, why?

Theme: Effectiveness of NETwork for Teaching (Some questions might be skipped which depends on if participants' answer in the pre-survey is thorough)

- Focus on asking the changes of each question.
- Compare with answer of the first interview and ask why it changes.

1. How do you think about the opportunities provided in NETwork to help you connect with other teachers around the country?

[Convert categories: perceptions of connecting to other teachers through NETwork; feelings of connecting to other teachers]

- a. Do you think NETwork provide you opportunities to connect with other teachers?

If yes, would you please give an example how you connect with other teachers through NETwork?

If no, ask question d.

- b. Is being connected to other teachers around the country important to you? If yes, why? If no, why?
- c. Do you feel a connection or sense of community with these other teachers around the country? If yes, please give an example. ? If no, why?
- d. why don't you feel connected and what would have to happen in order for you to feel more connected with other teachers?

2. How do you feel about the change of your teaching knowledge and skills (teaching in elementary schools) through interacting with other teachers who are teaching in schools in NETwork?

[Convert categories: feelings of how the knowledge and skills change because of participating in NETwork]

- a. Do you feel that your teaching knowledge and skills have changed because of participating in NETwork?
If yes, In what ways have they changed and what brought about the change? [Note: to find if it is improved]
If no, why?

[Note: If interviewee is teaching in school, ask Q3. If not ask Q4.]

3. How do you feel about that interacting with practicing teachers and pre-service teachers in the NETwork influences your school teaching?

[Convert categories: influence of current teaching from NETwork; confidence of teaching established/increase because of NETwork; willingness of being a member of NETwork]

- a. Does participating in the NETwork help you know more about your students?
If yes, please give an example of how it makes you understand your potential students more.
If no, why?
- b. Does participating in the NETwork help you know more about how to provide appropriate lesson plans and materials for your students?
If yes, please give an example of how the NETwork helps you.
If no, why?
- c. Have your teaching methods or strategies changed because of participating in the NETwork?
If yes, please give an example of what has changed and how it has changed.
If no, why?
- d. Do you feel more confident about teaching in schools after participating in the NETwork?
If yes, please give an explanation of why you feel more confident.
If no, why?
- e. Do you want to continue to be a member of NETwork as long as you teach?
If yes, why?
If no, why not?

4. How do you feel about that interacting with practicing teachers and other preservice teachers in the NETwork will influence your future school teaching?

[Convert categories: influence of future teaching from NETwork; confidence of teaching established/increase because of NETwork; willingness of being a member of NETwork]

- a. Does participating in the NETwork help you know more about your potential students?
If yes, please give an example of how it makes you understand your potential students more.
If no, why?
- b. Does participating in the NETwork help you know more about how to provide appropriate lesson plans and materials for your students?
If yes, please give an example of how the NETwork helps you.
If no, why?

- c. Do you feel more confident about teaching in schools after participating in the NETwork?
 - If yes, please give an explanation of why you feel more confident.
 - If no, why?
- e. When you start teaching will you want to continue to be a member of NETwork?
 - If yes, why? If no, why not?

Nurturing Elementary Teachers (NETwork): Online Experience Study Serial Interviews Protocols

Third Interview

I. Instruction:

We appreciate your agreeing to participate in the series of interviews. Again, do you have any questions about the consent form or about the study before we begin the second interview?

[If yes, explain & answer his/her questions.]

During this interview I will ask you some questions about changes in your experiences after using the **NETwork**. You will answer these questions base upon your experiences in SAKAI after the second interview. This session is being tape-recorded so that we can be sure we transcribe your answers and suggestions accurately. We anticipate using this information in professional presentations and publications, but nothing you say will be individually attributed to you. Your name will not be used to identify you as a participant in the research. You can end the interview at any time or skip any questions you are not comfortable answering. Your participation is completely voluntary.

II. Interview Questions

Theme: Participants' experience of learning in NETwork (Some questions might be skipped which depends on if participants' answer in the second interview is thorough)

- Focus on asking the changes of each question.
 - Compare with the answer of the second interview and ask why it changes.
- 1. Can you tell me about what it is like participating in this NETwork? What kind of things do you do?**
- [Covert categories: perception of how s/he participates; what activities s/he experience; how s/he feels about the activities; detail description of particular learning tasks; experience of interaction with others; feelings of interacting with others; sense of being a part of groups; how the feelings influence their participation; how the experience of interaction is supported by tool]
- a. What do you like most and least in this NETwork?
 - b. Can you tell me about your participation in any learning tasks or activities in the NETwork?
 - c. In what activity have you had the most interaction with other members or the professors?
 - [probe: one in which you felt like you were working in a group or interacting with others. If s/he has trouble identifying an interactive one, ask s/he to pick out one s/he remember as going well.
Try to get the interviewee to give specifics of how the members interacted]
 - d. Can you tell me about a specific incident when you communicated with one of the professors or with other members? Stories & Examples [probe...can you think of a time when you got responses on postings]
 - e. Do you have a sense of being a part of a group or working with others? [Probe: if not much.....what kind of things usually help build a sense of being a part of a group?]
 - f. Can you think of things that either helped or hindered your sense of being a part of a group or having a feeling of working with others in NETwork?
 - g. During these learning tasks or activities how well did the Sakai tools work to make interaction easy or natural? What were strengths and weaknesses of tools.

- 2. What are your goals for participating in the NETwork?** [Probe: The professor, classmates, or technology & tools? Hinder or help? Some goals may be from outside the assignment, such as keeping my work manageable in the time I allotted for the class, etc....so be listening and probing to see what was important to them during participating]
- [Convert categories: goals for future teaching; goal for current learning; how do they achieve the goals]
- a. How well do you feel you achieve them in NETwork?
 - b. Did you do some things specifically to help achieve those goals?

3. How do you decide or choose in what learning tasks or activities you want to participate?

[Convert categories: how her/his actions are influenced by others' work or actions; how one is influenced]

- a. Do the actions of other people influence you in terms of what and how you participate in the activities/tasks online? [Probe: Instructor, classmates, or technology & tools? Hinder or help?]
- b. How have others influenced you?

4. Do you have any concerns when you communicate or interact with the professor/other members in the NETwork?

[Covert categories: concerns of sharing resources, privacy, security, showing ignorance, looking foolish, etc.]

- a. If yes, what are those concerns?

5. Is there anything else about your participation in the NETwork that you feel is important and we haven't yet talked about?

Theme: Current Teaching Belief & Perception (Some questions might be skipped which depends on if participants' answer in the second interview is thorough)

- Focus on asking the changes of each question.
- Compare with answer of the second interview and ask why it changes.

1. What kind of teacher do you think you are/will be?

[Convert categories: perceptions of him/herself as a teacher currently/in the future]

2. What characteristics do you think a good teacher should have? Please give examples.

[Convert categories: perceptions of what characteristics make for a good teacher]

3. Are you satisfied with your current knowledge and skills related to teaching?

[Convert categories: satisfaction of current knowledge and skills; needs of knowledge and skills]

- a. If yes, what make you feel satisfied?

If no, why are you not satisfied and what do you need to be satisfied?

4. Are you satisfied with the teaching supports that you have now?

[Convert categories: satisfaction of current supports; needs of supports]

- a. If yes, what teaching supports do you have?

If no, why are you not satisfied and what do you need to be satisfied?

5. How does the NETwork provide information or resources that you use in your teaching or preparation for teaching?

[Convert categories: perceptions of information or resources for teaching; usefulness of information and resources of NETwork for current/future teaching and teacher preparation]

- a. Does the NETwork provide information or resources that you need?

If yes, please give an example of how you use (or will) the information or resources in your teaching.
If no, why?

Theme: Effectiveness of NETwork for Teaching (Some questions might be skipped which depends on if participants' answer in the second interview is thorough)

- Focus on asking the changes of each question.
- Compare with answer of the second interview and ask why it changes.

1. How do you think about the opportunities provided in NETwork to help you connect with other teachers around the country?

[Convert categories: perceptions of connecting to other teachers through NETwork; feelings of connecting to other teachers]

- a. Do you think NETwork provide you opportunities to connect with other teachers?

If yes, would you please give an example how you connect with other teachers through NETwork?

If no, ask question d.

- b. Is being connected to other teachers around the country important to you? If yes, why? If no, why?
- c. Do you feel a connection or sense of community with these other teachers around the country? If yes, please give an example. ? If no, why?
- d. why don't you feel connected and what would have to happen in order for you to feel more connected with other teachers?

2. How do you feel about the change of your teaching knowledge and skills (teaching in elementary schools) through interacting with other teachers who are teaching in schools in NETwork?

[Convert categories: feelings of how the knowledge and skills change because of participating in NETwork]

- a. Do you feel that your teaching knowledge and skills have changed because of participating in NETwork?
If yes, In what ways have they changed and what brought about the change? [Note: to find if it is improved]
If no, why?

[Note: If interviewee is teaching in school, ask Q3. If not ask Q4.]

3. How do you feel about that interacting with practicing teachers and pre-service teachers in the NETwork influences your school teaching?

[Convert categories: influence of current teaching from NETwork; confidence of teaching established/increase because of NETwork; willingness of being a member of NETwork]

- a. Does participating in the NETwork help you know more about your students?
If yes, please give an example of how it makes you understand your potential students more.
If no, why?
- b. Does participating in the NETwork help you know more about how to provide appropriate lesson plans and materials for your students?
If yes, please give an example of how the NETwork helps you.
If no, why?
- c. Have your teaching methods or strategies changed because of participating in the NETwork?
If yes, please give an example of what has changed and how it has changed.
If no, why?
- d. Do you feel more confident about teaching in schools after participating in the NETwork?
If yes, please give an explanation of why you feel more confident.
If no, why?
- e. Do you want to continue to be a member of NETwork as long as you teach?
If yes, why?
If no, why not?

4. How do you feel about that interacting with practicing teachers and other preservice teachers in the NETwork will influence your future school teaching?

[Convert categories: influence of future teaching from NETwork; confidence of teaching established/increase because of NETwork; willingness of being a member of NETwork]

- a. Does participating in the NETwork help you know more about your potential students?
If yes, please give an example of how it makes you understand your potential students more.
If no, why?
- b. Does participating in the NETwork help you know more about how to provide appropriate lesson plans and materials for your students?
If yes, please give an example of how the NETwork helps you.
If no, why?

- c. Do you feel more confident about teaching in schools after participating in the NETwork?
 - If yes, please give an explanation of why you feel more confident.
 - If no, why?
- e. When you start teaching will you want to continue to be a member of NETwork?
 - If yes, why? If no, why not?

Appendix 3-C

Nurturing Elementary Teachers (NETwork): Online Experience Study

Semester-end Interview Protocol

Nurturing Elementary Teachers (NETwork): Online Experience Study

Semester-end interview Protocol

I. Instruction:

We appreciate your agreeing to participate in the series of interviews to help us investigate your learning experience with the NETwork in Sakai. Do you have any questions about the consent form or about the study before we begin?

[If yes, explain & answer his/her questions.]

During this interview I will ask you some questions about your experiences using the NETwork. Feel free to add any other thoughts about your other online learning experiences. For example if you are taking other courses in Sakai, Blackboard, MU Direct, etc. But mainly we are focused on your experiences related to NETwork. Your comments will be very helpful in providing researchers information about how teachers learn in an online community.

This session is being tape-recorded so that we can be sure we transcribe your answers and suggestions accurately. We anticipate using this information in professional presentations and publications, but nothing you say will be individually attributed to you. Your name will not be used to identify you as a participant in the research. You can end the interview at any time or skip any questions you are not comfortable answering. Your participation is completely voluntary.

II. Interview Questions

Theme: Participants' experience of learning in NETwork

1. Can you tell me about what it is like participating in this NETwork? What kind of things do you do?

[Covert categories: perception of how s/he participates; what activities s/he experience; how s/he feels about the activities; detail description of particular learning tasks; experience of interaction with others; feelings of interacting with others; sense of being a part of groups; how the feelings influence their participation; how the experience of interaction is supported by tool]

- a. What do you like most and least in this NETwork?
- b. Can you tell me about your participation in any learning tasks or activities in the NETwork?
- c. In what activity have you had the most interaction with other members or the professors?
[probe: one in which you felt like you were working in a group or interacting with others. If s/he has trouble identifying an interactive one, ask s/he to pick out one s/he remember as going well.
Try to get the interviewee to give specifics of how the members interacted]
- d. Can you tell me about a specific incident when you communicated with one of the professors or with other members? Stories & Examples [probe...can you think of a time when you got responses on postings]
- e. Do you have a sense of being a part of a group or working with others? [Probe: if not much....what kind of things usually help build a sense of being a part of a group?]
- f. Can you think of things that either helped or hindered your sense of being a part of a group or having a feeling of working with others in NETwork?
- g. During these learning tasks or activities how well did the Sakai tools work to make interaction easy or natural? What were strengths and weaknesses of tools.

2. What are your goals for participating in the NETwork? [Probe: The professor, classmates, or technology & tools? Hinder or help? Some goals may be from outside the assignment, such as keeping my work manageable in the time I allotted for the class, etc....so be listening and probing to see what was important to them during participating]

[Convert categories: goals for future teaching; goal for current learning; how do they achieve

- the goals]
- How well do you feel you achieve them in NETwork?
 - Did you do some things specifically to help achieve those goals?
- 3. How do you decide or choose in what learning tasks or activities you want to participate?**
- [Convert categories: how her/his actions are influenced by others' work or actions; how one is influenced]
- Do the actions of other people influence you in terms of what and how you participate in the activities/tasks online? [Probe: Instructor, classmates, or technology & tools? Hinder or help?]
 - How have others influenced you?
- 4. Do you have any concerns when you communicate or interact with the professor/other members in the NETwork?**
- [Covert categories: concerns of sharing resources, privacy, security, showing ignorance, looking foolish, etc.]
- If yes, what are those concerns?
- 5. Is there anything else about your participation in the NETwork that you feel is important and we haven't yet talked about?**

Theme: Current Teaching Belief & Perception

- 1. What kind of teacher do you think you are/will be?**
[Convert categories: perceptions of him/herself as a teacher currently/in the future]
- 2. What characteristics do you think a good teacher should have?** Please give examples.
[Convert categories: perceptions of what characteristics make for a good teacher]
- 3. Are you satisfied with your current knowledge and skills related to teaching?**
[Convert categories: satisfaction of current knowledge and skills; needs of knowledge and skills]
a. If yes, what make you feel satisfied?
If no, why are you not satisfied and what do you need to be satisfied?
- 4. Are you satisfied with the teaching supports that you have now?**
[Convert categories: satisfaction of current supports; needs of supports]
a. If yes, what teaching supports do you have?
If no, why are you not satisfied and what do you need to be satisfied?

- 5. How does the NETwork provide information or resources that you use in your teaching or preparation for teaching?**
- [Convert categories: perceptions of information or resources for teaching; usefulness of information and resources of NETwork for current/future teaching and teacher preparation]
- Does the NETwork provide information or resources that you need?
If yes, please give an example of how you use (or will) the information or resources in your teaching.
If no, why?

Theme: Effectiveness of NETwork for Teaching

- 1. How do you think about the opportunities provided in NETwork to help you connect with other teachers around the country?**
[Convert categories: perceptions of connecting to other teachers through NETwork; feelings of connecting to other teachers]
a. Do you think NETwork provide you opportunities to connect with other teachers?
If yes, would you please give an example how you connect with other teachers through NETwork?

- If no, ask question d.
- b. Is being connected to other teachers around the country important to you? If yes, why? If no, why?
- c. Do you feel a connection or sense of community with these other teachers around the country?
If yes, please give an example. ?
If no, why?
- d. why don't you feel connected and what would have to happen in order for you to feel more connected with other teachers?

2. How do you feel about the change of your teaching knowledge and skills (teaching in elementary schools) through interacting with other teachers who are teaching in schools in NETwork?

- [Convert categories: feelings of how the knowledge and skills change because of participating in NETwork]
- a. Do you feel that your teaching knowledge and skills have changed because of participating in NETwork?
If yes, In what ways have they changed and what brought about the change? [Note: to find if it is improved]
If no, why?

[Note: If interviewee is teaching in school, ask Q3. If not ask Q4.]

3. How do you feel about that interacting with practicing teachers and pre-service teachers in the NETwork influences your school teaching?

- [Convert categories: influence of current teaching from NETwork; confidence of teaching established/increase because of NETwork; willingness of being a member of NETwork]
- a. Does participating in the NETwork help you know more about your students?
If yes, please give an example of how it makes you understand your potential students more.
If no, why?
 - b. Does participating in the NETwork help you know more about how to provide appropriate lesson plans and materials for your students?
If yes, please give an example of how the NETwork helps you.
If no, why?
 - c. Have your teaching methods or strategies changed because of participating in the NETwork?
If yes, please give an example of what has changed and how it has changed.
If no, why?
 - d. Do you feel more confident about teaching in schools after participating in the NETwork?
If yes, please give an explanation of why you feel more confident.
If no, why?
 - e. Do you want to continue to be a member of NETwork as long as you teach?
If yes, why?
If no, why not?

4. How do you feel about that interacting with practicing teachers and other preservice teachers in the NETwork will influence your future school teaching?

- [Convert categories: influence of future teaching from NETwork; confidence of teaching established/increase because of NETwork; willingness of being a member of NETwork]
- a. Does participating in the NETwork help you know more about your potential students?
If yes, please give an example of how it makes you understand your potential students more.
If no, why?
 - b. Does participating in the NETwork help you know more about how to provide appropriate lesson plans and materials for your students?
If yes, please give an example of how the NETwork helps you.
If no, why?
 - c. Do you feel more confident about teaching in schools after participating in the NETwork?

If yes, please give an explanation of why you feel more confident.

If no, why?

e. When you start teaching will you want to continue to be a member of NETwork?

If yes, why? If no, why not?

Appendix 3-D

Nurturing Elementary Teachers (NETwork): Online Experience Study

First Survey

Nurturing Elementary Teachers (NETwork): Online Experience Study

First Survey

Demographic Questions

1. Gender: M F
2. Age: Under 20 21-25 26-30 31-35 36-40 41-45 46-50 Over 51
3. Current Status: (check all that apply)
 Undergraduate Student
 Master's Level Student
 Specialist Degree Student
 Doctoral Student
 Teaching Fellow
 Student Teacher (specify teaching assignment/level: _____)
 Classroom teacher: (specify teaching assignment/level: _____)
 Other, please state: _____ .
4. Why did you decide to join the NETwork? (check all that apply)
 For class participation.
 Professor/instructor's recommendation
 Have a place to access good information and lessons
 Have a place to access resources and professional supports.
 Have a place to share information and personal insights.
 Have a place to go for help and ideas from those in the same situation.
 Have a place to gain insights and advices from other experienced teachers (pre and in-service teachers).
 Establish and have networking connection with other teachers
 Other, please state: _____ .
5. Please indicate the (approximate) number in which you have participated for each below:
 Sakai courses _____ .
 Blackboard or WebCT courses _____ .
 Online community/group. Please name: _____ .
6. Can you estimate how many hours you use Sakai in an average week?
 Less than 1 hour
 1-5 hours
 6-10 hours
 11-15 hours
 16-20 hours
 21-25 hours
 More than 26 hours
7. Can you estimate how many messages you post in Discussion Forums in an average week?
 Less than 2 postings
 3-5 postings
 6-8 postings
 8-10 postings
 11-15 postings
 16-20 postings
 More than 21 postings

Content of Survey

Direction: The following questions use the rating scales from “strongly disagree” to “strongly agree” as end points. Remember there are no right or wrong answers just answer as accurately as possible. For example, if you strongly agree with the statement, select 7 by circling on the number “7”; if you strongly disagree, select 1 by circling on the number “1”. If the statement is more or less true of you, find the number between 1 and 7 that best describes your opinion.

	Strongly Disagree	-----	Strongly Agree
Section I			
1. The Sakai environment is flexible to interact with	1 2 3 4 5 6 7		
2. I find it's easy to use the Sakai tools to do what I want to do	1 2 3 4 5 6 7		
3. It's easy for me to become skillful at using the Sakai tools in the NETwork	1 2 3 4 5 6 7		
4. The Sakai tools are easy to use	1 2 3 4 5 6 7		
5. Using the Sakai tools helps me learn about and accomplish my goal of being a good K-8 teacher quickly	1 2 3 4 5 6 7		
6. Using the Sakai tools makes it easy to complete tasks and activities related to NETwork	1 2 3 4 5 6 7		
7. I find Sakai tools are useful and helpful for my learning and interacting in NETwork	1 2 3 4 5 6 7		
8. Using the Sakai tools, I can master the skills and ideas that are important for K-8 teaching	1 2 3 4 5 6 7		
Section II			
When participating in the NETwork,.....	1 2 3 4 5 6 7		
1. I feel that members in the NETwork care about each other	1 2 3 4 5 6 7		
2. I feel that I am encouraged to ask questions in the NETwork	1 2 3 4 5 6 7		
3. I feel connected to others in the NETwork	1 2 3 4 5 6 7		
4. I feel that it is hard to get help when I have a question	1 2 3 4 5 6 7		
5. I do not feel a spirit of community	1 2 3 4 5 6 7		
6. I feel that I receive helpful and supportive feedback	1 2 3 4 5 6 7		
7. I feel the NETwork is like a family	1 2 3 4 5 6 7		
8. I feel uneasy exposing gaps in my understanding	1 2 3 4 5 6 7		
9. I feel isolated in the NETwork	1 2 3 4 5 6 7		
10. I feel reluctant to speak openly	1 2 3 4 5 6 7		
11. I trust others in the NETwork	1 2 3 4 5 6 7		
12. I feel that the NETwork results in only modest learning	1 2 3 4 5 6 7		
13. I feel that I can rely on others in the NETwork	1 2 3 4 5 6 7		
14. I feel that other members help me learn	1 2 3 4 5 6 7		
15. I feel that members of the NETwork depend on me	1 2 3 4 5 6 7		
16. I feel that I am given ample opportunities to learn	1 2 3 4 5 6 7		
17. I feel uncertain about others in this course	1 2 3 4 5 6 7		

18. I feel that my professional needs of teaching are not being met	1	2	3	4	5	6	7
19. I feel confident that others will support me	1	2	3	4	5	6	7
20. I feel that this NETwork does not promote a desire to learn	1	2	3	4	5	6	7

Section III

	Strongly Disagree	-----	Strongly Agree				
	1	2	3	4	5	6	7
1. My online interactions with the professor/instructor seem personal	1	2	3	4	5	6	7
2. When I log on I am usually interested in seeing what the professor/instructor is doing or has done	1	2	3	4	5	6	7
3. My interactions with the professor/instructor are sociable and friendly	1	2	3	4	5	6	7
4. The actions of the professor/instructor in the community are easily visible in our online system	1	2	3	4	5	6	7
5. I feel comfortable expressing my feelings to the professor/instructor	1	2	3	4	5	6	7
6. In my interactions with the professor/instructor, I am able to be myself and show what kind of person I really am	1	2	3	4	5	6	7
7. My online interactions with other members seem personal	1	2	3	4	5	6	7
8. When I log on I am usually interested in seeing what other members are doing or have done	1	2	3	4	5	6	7
9. My interactions with other members are sociable and friendly	1	2	3	4	5	6	7
10. The actions of other members in the NETwork are easily visible in our online system	1	2	3	4	5	6	7
11. I feel comfortable expressing my feelings to other members of the NETwork	1	2	3	4	5	6	7
12. In my interactions with other members of the NETwork I am able to be myself and show what kind of teacher I really am	1	2	3	4	5	6	7
13. Actions by the professor/instructor in the NETwork usually influence me to further participate (such as logging in more often or posting more messages)	1	2	3	4	5	6	7
14. The actions of the professor/instructor in the NETwork influence the quality of my work (such as trying to write better messages or working more thoughtfully)	1	2	3	4	5	6	7
15. Actions by other members in the NETwork usually influence me to further participate (such as logging in more often or posting more messages)	1	2	3	4	5	6	7
16. The actions of other members in the NETwork influence the quality of my work (such as trying to write better messages or working more thoughtfully)	1	2	3	4	5	6	7
17. Knowing that other members in the NETwork are aware of my work usually influences how hard I work and the quality of my work	1	2	3	4	5	6	7
18. Knowing what other members in the NETwork have done helps me know what to do	1	2	3	4	5	6	7

Section IV

	Strongly Disagree	-----	Strongly Agree				
	1	2	3	4	5	6	7
1. The objectives for participating in the NETwork were clear	1	2	3	4	5	6	7
2. I usually have a clear idea of where I am going and what is expected of me in the NETwork	1	2	3	4	5	6	7
3. I developed knowledge and competencies for teaching elementary science through the NETwork	1	2	3	4	5	6	7
4. The NETwork activities were a good fit for the way I like to learn	1	2	3	4	5	6	7

5. The NETwork activities met my expectations for what I had hoped to learn	1 2 3 4 5 6 7
6. The knowledge and competencies I gained through the NETwork are personally meaningful and important to me	1 2 3 4 5 6 7
7. I think to have the NETwork including professional support, pre-service teachers, and in-service teachers is helpful for developing my teaching skills	1 2 3 4 5 6 7
8. I'd be happy to participate in an online community similar to that one I am participating in now	1 2 3 4 5 6 7

Section V

After participating in NETwork, I feel that.....

	Strongly Disagree	-----	Strongly Agree
1. NETwork helps me develop knowledge and competencies for teaching elementary science through the NETwork	1 2 3 4 5 6 7		
2. NETwork helps me be confident in my ability to find professional supports for my teaching	1 2 3 4 5 6 7		
3. NETwork helps me be confident in my ability to use a variety of authentic assessment techniques	1 2 3 4 5 6 7		
4. NETwork helps me be confident in my ability to teach effectively in elementary schools	1 2 3 4 5 6 7		
5. NETwork helps me be confident in my ability to help the student understand concepts better when he/she has difficulty understanding	1 2 3 4 5 6 7		
6. NETwork helps me be confident in my ability to create integrated lessons and units	1 2 3 4 5 6 7		
7. NETwork helps me be connected to other teachers around the country who have similar teaching interests with me	1 2 3 4 5 6 7		
8. The NETwork activities met my expectations for what I had hoped to learn	1 2 3 4 5 6 7		

Thank you for your participation!!!

Appendix 3-E

Nurturing Elementary Teachers (NETwork): Online Experience Study

Final Survey

Nurturing Elementary Teachers (NETwork): Online Experience Study

Final survey

Demographic Survey (DS)

1. Can you estimate how many hours you use Sakai in an average week?

- Less than 1 hour
- 1-5 hours
- 6-10 hours
- 11-15 hours
- 16-20 hours
- 21-25 hours
- More than 26 hours

2. Can you estimate how many messages you post in Discussion Forums in an average week?

- Less than 2 postings
- 3-5 postings
- 6-8 postings
- 8-10 postings
- 11-15 postings
- 16-20 postings
- More than 21 postings

Content of Survey

Direction: The following questions use the rating scales from “strongly disagree” to “strongly agree” as end points. Remember there are no right or wrong answers just answer as accurately as possible. For example, if you strongly agree with the statement, select 7 by circling on the number “7”; if you strongly disagree, select 1 by circling on the number “1”. If the statement is more or less true of you, find the number between 1 and 7 that best describes your opinion.

Section I		Strongly Disagree							Strongly Agree						
		1	2	3	4	5	6	7	1	2	3	4	5	6	7
	1. The Sakai environment is flexible to interact with								1	2	3	4	5	6	7
	2. I find it's easy to use the Sakai tools to do what I want to do								1	2	3	4	5	6	7
	3. It's easy for me to become skillful at using the Sakai tools in the NETwork								1	2	3	4	5	6	7
	4. The Sakai tools are easy to use								1	2	3	4	5	6	7
	5. Using the Sakai tools helps me learn about and accomplish my goal of being a good K-8 teacher quickly								1	2	3	4	5	6	7
	6. Using the Sakai tools makes it easy to complete tasks and activities related to NETwork								1	2	3	4	5	6	7
	7. I find Sakai tools are useful and helpful for my learning and interacting in NETwork								1	2	3	4	5	6	7
	8. Using the Sakai tools, I can master the skills and ideas that are important for K-8 teaching								1	2	3	4	5	6	7

Section II

When participating in the NETwork,.....

	Strongly Disagree	-----	Strongly Agree				
	1	2	3	4	5	6	7
1. I feel that members in the NETwork care about each other	1	2	3	4	5	6	7
2. I feel that I am encouraged to ask questions in the NETwork	1	2	3	4	5	6	7
3. I feel connected to others in the NETwork	1	2	3	4	5	6	7
4. I feel that it is hard to get help when I have a question	1	2	3	4	5	6	7
5. I do not feel a spirit of community	1	2	3	4	5	6	7
6. I feel that I receive helpful and supportive feedback	1	2	3	4	5	6	7
7. I feel the NETwork is like a family	1	2	3	4	5	6	7
8. I feel uneasy exposing gaps in my understanding	1	2	3	4	5	6	7
9. I feel isolated in the NETwork	1	2	3	4	5	6	7
10. I feel reluctant to speak openly	1	2	3	4	5	6	7
11. I trust others in the NETwork	1	2	3	4	5	6	7
12. I feel that the NETwork results in only modest learning	1	2	3	4	5	6	7
13. I feel that I can rely on others in the NETwork	1	2	3	4	5	6	7
14. I feel that other members help me learn	1	2	3	4	5	6	7
15. I feel that members of the NETwork depend on me	1	2	3	4	5	6	7
16. I feel that I am given ample opportunities to learn	1	2	3	4	5	6	7
17. I feel uncertain about others in this course	1	2	3	4	5	6	7
18. I feel that my professional needs of teaching are not being met	1	2	3	4	5	6	7
19. I feel confident that others will support me	1	2	3	4	5	6	7
20. I feel that this NETwork does not promote a desire to learn	1	2	3	4	5	6	7

Section III

When participating in the NETwork,.....

	Strongly Disagree	-----	Strongly Agree				
	1	2	3	4	5	6	7
1. My online interactions with the professor/instructor seem personal	1	2	3	4	5	6	7
2. When I log on I am usually interested in seeing what the professor/instructor is doing or has done	1	2	3	4	5	6	7
3. My interactions with the professor/instructor are sociable and friendly	1	2	3	4	5	6	7
4. The actions of the professor/instructor in the community are easily visible in our online system	1	2	3	4	5	6	7
5. I feel comfortable expressing my feelings to the professor/instructor	1	2	3	4	5	6	7
6. In my interactions with the professor/instructor, I am able to be myself and show what kind of person I really am	1	2	3	4	5	6	7
7. My online interactions with other members seem personal	1	2	3	4	5	6	7
8. When I log on I am usually interested in seeing what other members are doing or have done	1	2	3	4	5	6	7
9. My interactions with other members are sociable and friendly	1	2	3	4	5	6	7

10. The actions of other members in the NETwork are easily visible in our online system	1	2	3	4	5	6	7
11. I feel comfortable expressing my feelings to other members of the NETwork	1	2	3	4	5	6	7
12. In my interactions with other members of the NETwork I am able to be myself and show what kind of teacher I really am	1	2	3	4	5	6	7
13. Actions by the professor/instructor in the NETwork usually influence me to further participate (such as logging in more often or posting more messages)	1	2	3	4	5	6	7
14. The actions of the professor/instructor in the NETwork influence the quality of my work (such as trying to write better messages or working more thoughtfully)	1	2	3	4	5	6	7
15. Actions by other members in the NETwork usually influence me to further participate (such as logging in more often or posting more messages)	1	2	3	4	5	6	7
16. The actions of other members in the NETwork influence the quality of my work (such as trying to write better messages or working more thoughtfully)	1	2	3	4	5	6	7
17. Knowing that other members in the NETwork are aware of my work usually influences how hard I work and the quality of my work	1	2	3	4	5	6	7
18. Knowing what other members in the NETwork have done helps me know what to do	1	2	3	4	5	6	7

Strongly Disagree ----- Strongly Agree

Section IV

1. The objectives for participating in the NETwork were clear	1	2	3	4	5	6	7
2. I usually have a clear idea of where I am going and what is expected of me in the NETwork	1	2	3	4	5	6	7
3. I developed knowledge and competencies for teaching elementary science through the NETwork	1	2	3	4	5	6	7
4. The NETwork activities were a good fit for the way I like to learn	1	2	3	4	5	6	7
5. The NETwork activities met my expectations for what I had hoped to learn	1	2	3	4	5	6	7
6. The knowledge and competencies I gained through the NETwork are personally meaningful and important to me	1	2	3	4	5	6	7
7. I think to have the NETwork including professional support, pre-service teachers, and in-service teachers is helpful for developing my teaching skills	1	2	3	4	5	6	7
8. I'd be happy to participate in an online community similar to that one I am participating in now	1	2	3	4	5	6	7

Strongly Disagree ----- Strongly Agree

Section V

After participating in NETwork, I feel that.....	1	2	3	4	5	6	7
1. NETwork helps me develop knowledge and competencies for teaching elementary science through the NETwork	1	2	3	4	5	6	7
2. NETwork helps me be confident in my ability to find professional supports for my teaching	1	2	3	4	5	6	7
3. NETwork helps me be confident in my ability to use a variety of authentic assessment techniques	1	2	3	4	5	6	7
4. NETwork helps me be confident in my ability to teach effectively in elementary schools	1	2	3	4	5	6	7
5. NETwork helps me be confident in my ability to help the student understand concepts better when he/she has difficulty understanding	1	2	3	4	5	6	7
6. NETwork helps me be confident in my ability to create integrated lessons and units	1	2	3	4	5	6	7

7. NETwork helps me be connected to other teachers around the country who have similar teaching interests with me 1 2 3 4 5 6 7
8. the NETwork activities met my expectations for what I had hoped to learn 1 2 3 4 5 6 7

Thank you for your participation!!!

Appendix 3-F

Content Analysis: Serial Interviews Coding Scheme

Content Analysis: Serial Interviews Coding Scheme

Coding Unit: Paragraph & Sentence Nodes	Description & Indicators
Identity	- Participants addressed their background information.
Experience of NETwork	<ul style="list-style-type: none"> - Participants talked about their experience of participating in the NETwork.
1. Login Frequency	<ul style="list-style-type: none"> - Participants mentioned how many time he/she login weekly or during a time period.
2. Interaction with others	<ul style="list-style-type: none"> - Participants described how he/she interacted with others in the NETwork.
a. Discussion Board Experience	<ul style="list-style-type: none"> - Participants shared her/his experience about participating in DB discussion.
b. Information Sharing	<ul style="list-style-type: none"> - Participants shared information or resources to others.
3. Goal of participating in NETwork	<ul style="list-style-type: none"> - Participants described their goals of participating in the NETwork.
Ways to reach the goals	<ul style="list-style-type: none"> - Participants described how they could reach the goals and what might be issues regarding to it.
4. Concerns and Suggestions	<ul style="list-style-type: none"> - Participants described what they do not like about the NETwork or anything in the NETwork that needs to be improved.
a. Time Concerns	<ul style="list-style-type: none"> - Participants expressed their time concerns about participating in the NETwork.
5. Feel about Notification	<ul style="list-style-type: none"> - Participants expressed how they felt about the notification email (Email Digest).
b. Influence of Notification Email	<ul style="list-style-type: none"> - Participants expressed how the notification email (Email Digest) influenced their action in the NETwork.
6. Changes of experiences	<ul style="list-style-type: none"> - Participants described what had changed by participating in the second month or third month.
7. Changes of Identity	<ul style="list-style-type: none"> - Participants addressed how they felt about their role or identity changed after participating in the NETwork.
Community and Belonging	<ul style="list-style-type: none"> - Participants expressed how they felt about the community and other members or being in the groups.
1. Social Presence	<ul style="list-style-type: none"> - Participants described how they felt about the presence box in the left side of the SAKAI worksite.
Practice and doing	<ul style="list-style-type: none"> - Participants addressed what he/she learned from the ideas others provided and report back with the results.
Teaching Belief and Perception	<ul style="list-style-type: none"> - Participants described what their teaching belief and perception are.
1. Characteristics of a good teacher	<ul style="list-style-type: none"> - Participants described what characteristics a good teacher should have.
2. Knowledge and Skills needed	<ul style="list-style-type: none"> - Participants described what knowledge and skills they would like to learn more for being a good teacher.
3. Satisfaction with what have learned	<ul style="list-style-type: none"> - Participants expressed their satisfaction with what they have learned.
Effectiveness of NETwork for Teaching	<ul style="list-style-type: none"> - Participants describe the effectiveness of NETwork for their teaching.
1. Sharing Resources	<ul style="list-style-type: none"> - Participants described what they liked and felt helpful of the resources shared in the NETwork.
2. Global Opportunities	<ul style="list-style-type: none"> - Participants described the global opportunities of connecting to other teachers around the country NETwork provided.
3. Teaching Knowledge and Skills	<ul style="list-style-type: none"> - Participant described how much their teaching knowledge and skills improved or increased because of participating in the NETwork.
4. Teaching confidence	<ul style="list-style-type: none"> - Participants described the changes of their teaching confidence after participating in the NETwork.
5. Teaching supports	<ul style="list-style-type: none"> - Participants described if they satisfied with the teaching supports they had and how they felt about it.

Appendix 3-G

Content Analysis: Semester-end Interview Coding Scheme

Content Analysis: Semester-end Interview Coding Scheme

Coding Unit: Paragraph & Sentence Nodes	Description & Indicators
Identity	- Participants addressed their background information.
Experience of NETwork	<ul style="list-style-type: none"> - Participants talked about their experience of participating in the NETwork.
1. Login Frequency	<ul style="list-style-type: none"> - Participants mentioned how many time he/she login weekly or during a time period.
2. Interaction with others	<ul style="list-style-type: none"> - Participants described how he/she interacted with others in the NETwork.
a. Discussion Board Experience	<ul style="list-style-type: none"> - Participants shared her/his experience about participating in DB discussion.
b. Information Sharing	<ul style="list-style-type: none"> - Participants shared information or resources to others.
3. Goal of participating in NETwork	<ul style="list-style-type: none"> - Participants described their goals of participating in the NETwork.
Ways to reach the goals	<ul style="list-style-type: none"> - Participants described how they could reach the goals and what might be issues regarding to it.
4. Concerns and Suggestions	<ul style="list-style-type: none"> - Participants described what they do not like about the NETwork or anything in the NETwork that needs to be improved.
a. Time Concerns	<ul style="list-style-type: none"> - Participants expressed their time concerns about participating in the NETwork.
5. Feel about Notification	<ul style="list-style-type: none"> - Participants expressed how they felt about the notification email (Email Digest).
b. Influence of Notification Email	<ul style="list-style-type: none"> - Participants expressed how the notification email (Email Digest) influenced their action in the NETwork.
Community and Belonging	<ul style="list-style-type: none"> - Participants expressed how they felt about the community and other members or being in the groups.
1. Social Presence	<ul style="list-style-type: none"> - Participants described how they felt about the presence box in the left side of the SAKAI worksite.
Practice and doing	<ul style="list-style-type: none"> - Participants addressed what he/she learned from the ideas others provided and report back with the results.
Teaching Belief and Perception	<ul style="list-style-type: none"> - Participants described what their teaching belief and perception are.
1. Characteristics of a good teacher	<ul style="list-style-type: none"> - Participants described what characteristics a good teacher should have.
2. Knowledge and Skills needed	<ul style="list-style-type: none"> - Participants described what knowledge and skills they would like to learn more for being a good teacher.
3. Satisfaction with what have learned	<ul style="list-style-type: none"> - Participants expressed their satisfaction with what they have learned.
Effectiveness of NETwork for Teaching	<ul style="list-style-type: none"> - Participants describe the effectiveness of NETwork for their teaching.
1. Sharing Resources	<ul style="list-style-type: none"> - Participants described what they liked and felt helpful of the resources shared in the NETwork.
2. Global Opportunities	<ul style="list-style-type: none"> - Participants described the global opportunities of connecting to other teachers around the country NETwork provided.
3. Teaching Knowledge and Skills	<ul style="list-style-type: none"> - Participant described how much their teaching knowledge and skills improved or increased because of participating in the NETwork.
4. Teaching confidence	<ul style="list-style-type: none"> - Participants described the changes of their teaching confidence after participating in the NETwork.
5. Teaching supports	<ul style="list-style-type: none"> - Participants described if they satisfied with the teaching supports they had and how they felt about it.

Appendix 3-H

Content Analysis: Coding Scheme for Discussion Content in DB

Coding Unit: Message

Nodes	Description & Indicators
Identity	<ul style="list-style-type: none"> - Participants shared information regarding to who they are. - Participants tried to social with others with greeting words or mention something not regarding to subject matter.
Socialization	<ul style="list-style-type: none"> - Participants provided emotional encourage or support to others.
1. Emotional support 2. Sharing stress	<ul style="list-style-type: none"> - Participants shared their stressed about teaching or learning process.
Community and Belonging	<ul style="list-style-type: none"> - Participants expressed their feeling about being in a group or same community. - Statement of observation or opinion - Statement of agreement from one or more other participants - Corroborating examples provided by one or more participants - Ask and answer questions to clarify details of statements - Definition, description, or identification of a problem. - The advice from people who have knowledge of the questions for discussion topics. - Participants shared their practical experience of practicing or teaching in school.
1. Advice from Knowledge Authority 2. Shared in-school experience 3. Shared NETwork experience 4. Expectation of NETwork	<ul style="list-style-type: none"> - Participants shared their previous experience in NETwork community. - Participants described what they expect to do or gain from the NETWork community. - Identifying and stating areas of disagreement - Asking and answering questions to clarify the source and extent of disagreement - Restating the participant's position, and possibly advancing arguments or considerations in its support by references to the participant's experience, literature, formal data collected, or proposal of relevant metaphor or analogy to illustrate point - Negotiation of clarification of terms - Negotiation of the relative weight to be assigned to types of argument - Identification of areas of agreement or overlap among conflicting concepts - Proposal and negotiation of new statements embodying compromise, co-construction - Proposal of integrating or accommodating metaphors or analogies - Testing the proposal synthesis against "received fact" as shared by the participants - Testing against existing cognitive schema - Testing against personal experience - Testing against formal data collected - Testing against contradictory testimony in the literature
P1 Sharing and comparing of information	<ul style="list-style-type: none"> - Participants described what they expect to do or gain from the NETWork community.
P2 Discovery and exploration of dissonance or inconsistency among ideas, concepts or statements	<ul style="list-style-type: none"> - Identifying and stating areas of disagreement - Asking and answering questions to clarify the source and extent of disagreement - Restating the participant's position, and possibly advancing arguments or considerations in its support by references to the participant's experience, literature, formal data collected, or proposal of relevant metaphor or analogy to illustrate point - Negotiation of clarification of terms - Negotiation of the relative weight to be assigned to types of argument - Identification of areas of agreement or overlap among conflicting concepts - Proposal and negotiation of new statements embodying compromise, co-construction - Proposal of integrating or accommodating metaphors or analogies - Testing the proposal synthesis against "received fact" as shared by the participants - Testing against existing cognitive schema - Testing against personal experience - Testing against formal data collected - Testing against contradictory testimony in the literature
P3 Negotiation of meaning and co-construction of knowledge	<ul style="list-style-type: none"> - Participants described what they expect to do or gain from the NETWork community.
P4 Testing and Modification of proposed synthesis or co-construction	<ul style="list-style-type: none"> - Identifying and stating areas of disagreement - Asking and answering questions to clarify the source and extent of disagreement - Restating the participant's position, and possibly advancing arguments or considerations in its support by references to the participant's experience, literature, formal data collected, or proposal of relevant metaphor or analogy to illustrate point - Negotiation of clarification of terms - Negotiation of the relative weight to be assigned to types of argument - Identification of areas of agreement or overlap among conflicting concepts - Proposal and negotiation of new statements embodying compromise, co-construction - Proposal of integrating or accommodating metaphors or analogies - Testing the proposal synthesis against "received fact" as shared by the participants - Testing against existing cognitive schema - Testing against personal experience - Testing against formal data collected - Testing against contradictory testimony in the literature
P5 agreement statement and applications of newly constructed meaning	<ul style="list-style-type: none"> - Participants described what they expect to do or gain from the NETWork community.

Appendix 3-I

Content Analysis: Coding Scheme for Messages in CR

Coding Unit: Message

Content Analysis: Coding Scheme for Messages in CR

Nodes	Description & Indicators
Identity	<ul style="list-style-type: none"> - The participants shared information regarding to who they are.
Socialization	<ul style="list-style-type: none"> - The participants tried to social with others with greeting words or mention something not regarding to subject matter.
P1 Sharing and comparing of information	<ul style="list-style-type: none"> - Statement of observation or opinion - Statement of agreement from one or more other participants - Corroborating examples provided by one or more participants - Ask and answer questions to clarify details of statements - Definition, description, or identification of a problem.
P2 Discovery and exploration of dissonance or inconsistency among ideas, concepts or statements <ol style="list-style-type: none"> 1. Advice from Knowledge Authority 2. Shared experience 3. Guidance from the instructor 	<ul style="list-style-type: none"> - The advice from people who have knowledge of the questions for discussion topics. - Participant shares his/her own story, information, or experience. - The professor facilitate and guide discussion topic.
	<ul style="list-style-type: none"> - Identifying and stating areas of disagreement - Asking and answering questions to clarify the source and extent of disagreement - Restating the participant's position, and possibly advancing arguments or considerations in its support by references to the participant's experience, literature, formal data collected, or proposal of relevant metaphor or analogy to illustrate point
P3 Negotiation of meaning and co-construction of knowledge	<ul style="list-style-type: none"> - Negotiation of clarification of the meaning of terms - Negotiation of the relative weight to be assigned to types of argument - Identification of areas of agreement or overlap among conflicting concepts - Proposal and negotiation of new statements embodying compromise, co-construction - Proposal of integrating or accommodating metaphors or analogies
P4 Testing and Modification of proposed synthesis or co-construction	<ul style="list-style-type: none"> - Testing the proposal synthesis against "received fact" as shared by the participants - Testing against existing cognitive schema - Testing against personal experience - Testing against formal data collected - Testing against contradictory testimony in the literature
P5 agreement statement and applications of newly constructed meaning	<ul style="list-style-type: none"> - Summarization of agreement - Applications of new knowledge - Meta-cognitive statements by the participants illustrating their understanding that their knowledge or ways of thinking have changed as a

Appendix 3-J
Content Analysis: Coding Book

Content Analysis: Coding Book

Nodes	Description & Indicators	Examples
Identity	<ul style="list-style-type: none"> - Participants addressed their background information. 	All year long I'm in a middle school/high school setting, so I teach 8th grade science and biology one for 8th grade and 9th grade. So I teach that all year long. I have three classes in 8th grade science and then I teach one class in biology one.
Experience of NETwork	<ul style="list-style-type: none"> - Participants talked about their experience of participating in the NETwork. 	Well, I saw the classroom management posting, and then I will probably look through that again and use it. I mean, I might use someone else's ideas to use in my classroom, like I think it talked about contacting parents and things like that, and so I'll probably reread it and see what he did to help this kid he was having problems with in class.
1. Login Frequency	<ul style="list-style-type: none"> - Participants mentioned how many time he/she login weekly or during a time period. - Participants described how he/she interacted with others in the NETwork. 	So far I've only logged in once, earlier today, and I kind of looked, and I didn't see a lot of new things as far as...
2. Interaction with Others		Yeah, even when I was saying about where to find books and stuff, like at Goodwill, just little tips that I picked up along the way that I could share. Because I've also used message boards on different sites, like different teacher sites, and so I've picked up stuff from different teachers around the country there that I could filter through into Sakai.
a. Discussion Board Experience	<ul style="list-style-type: none"> - Participants shared her/his experience about participating in DB discussion. 	I think I have my own thing, but I definitely like getting multiple points of view. You know, even something as simple as how do you handle disruption in the classroom? How do you handle teasing, or something like that? I have my own thoughts, but I like reading everyone else's thoughts, too. I think it does shape how you handle it, how you approach it the next time.
b. Information Sharing	<ul style="list-style-type: none"> - Participants shared information or resources to others. 	They had really good ideas listed, like garage sales and stuff, but that was one that I personally experienced, and so I put that out there for them.
3. Goal of participating in NETwork	<ul style="list-style-type: none"> - Participants described their goals of participating in the NETwork. 	My goals are to learn more, as much as I can. I'd like to get on here at some point and use some of the resources and really look into the resource section. And then I think that one of my

		goals is to help other people who have questions or concerns who are pre-service teachers, and other than that to just kind of read through and get ideas from the pre-service teachers and the other teachers on the site.
a. Ways to reach the goals	- Participants described how they could reach the goals and what might be issues regarding to it.	I really think that I will definitely look over it in the next coming weeks, and hopefully people will still discuss over the summer, because that is when I'd really have a chance to actually get into some depth.
4. Concerns and Suggestions	- Participants described what they do not like about the NETwork or anything in the NETwork that needs to be improved.	And we've done so many lesson plans this semester. I mean, we've all had to write them, so we might as well post them so we can all get them. We all have to do an integrated music lesson plan. If that was up there then everybody could automatically have 30 different lesson plans. You know, there are so many things that we could be sharing with each other that we're not.
a. Time Concerns	- Participants expressed their time concerns about participating in the NETwork.	I really think that I will definitely look over it in the next coming weeks, and hopefully people will still discuss over the summer, because that is when I'd really have a chance to actually get into some depth.
5. Feel about Notification	- Participants expressed how they felt about the notification email (Email Digest).	Usually I look to see if there is a topic I'm interested in or I want to see. If I don't have time then, I'll remind myself to go back and look at it later, or jot something down that I might want to look at.
a. Influence of Notification Email	- Participants expressed how the notification email (Email Digest) influenced their action in the NETwork.	I mean, just seeing other people's postings and seeing the E-mail Digest reminds me to get on there and look and see what people are saying.
6. Changes of experiences	- Participants described what had changed by participating in the second month or third month.	Yeah, definitely. Like, when I logged in, the couple of times I logged in this semester, I think because there were so many new people and I didn't know most of them, it was kind of like ... Last semester I felt like I was on the inside looking out, and this semester when I logged in it was like I was on the outside looking in. And I think it's because I know that all these people are talking are in one block together. They all know each other. They're all feeding off these really big conversations, and it's really more intimidating to jump into the

		<p>conversation when you know that all these people already have all these pre-established relationships and they're talking. They could be like, "Who is this person commenting?"</p> <p>First interview: So I don't really feel part of their group, I just feel like I'm kind of a helper.</p> <p>Second interview: Oh, I think I get something out of it, because it's useful to read different ideas and tips and just even though they're pre-service teachers it's still good to hear a discussion to see things and think about things that make you think about things and how I'm doing things in my classroom, too.</p>
7. Changes of Identity	<ul style="list-style-type: none"> - Participants addressed how they felt about their role or identity changed after participating in the NETwork. 	<p>Community and Belonging</p> <ul style="list-style-type: none"> - Participants expressed how they felt about the community and other members or being in the groups.
1. Social Presence	<ul style="list-style-type: none"> - Participants described how they felt about the presence box in the left side of the SAKAI worksite. 	<p>Practice and doing</p> <ul style="list-style-type: none"> - Participants addressed what he/she learned from the ideas others provided and report back with the results.

		<p>out. It makes it really easy, because I can have a problem today and post about it and somebody can read it tonight and respond, and I might have a suggestion by tomorrow morning where I can actually take it to my classroom and try it right there and see if it works or not.</p>
Teaching Belief and Perception	- Participants described what their teaching belief and perception are.	<p>Well, I'm hoping to learn more and get more ideas and be more hands-on. I use the book a lot now but I would like to get more hands-on as I get more ideas.</p>
1. Characteristics of a good teacher	- Participants described what characteristics a good teacher should have.	<p>I think that they should be creative and caring and knowledgeable in their subject area. And very willing to change and look at new things and be open to new lesson plans and ideas, because education is always changing.</p>
2. Knowledge and Skills needed	<ul style="list-style-type: none"> - Participants described what knowledge and skills they would like to learn more for being a good teacher. 	<p>I mean, I love art. But I can't stand the class I'm in. It's nothing beneficial. It's nothing that's relevant to me. So if there's a way for them to make it relevant. The thing is like what you said. They're viewing it from the perspective of someone who is going to be an art teacher. They're not viewing it from the perspective of "What do I need to know as a general classroom teacher? As a third, fourth or fifth grade teacher? What do I need to know?" And that's the perspective that is missing, and that is a really crucial part to their program that they're missing out on.</p>
3. Satisfaction with what have learned	<ul style="list-style-type: none"> - Participants expressed their satisfaction with what they have learned. 	<p>Mostly. Yeah, mostly. I would say this semester I'm not satisfied with what I've learned, just because several of my classes have been not helpful as a general classroom teacher whatsoever.</p>
Effectiveness of NETwork for Teaching	<ul style="list-style-type: none"> - Participants describe the effectiveness of NETwork for their teaching. 	<p>Well, I think just being exposed to multiple views on all different topics, because one thing that I've had to come to terms with is even though I already have my preconceived notions of how something would be done, there are always multiple ways to do it. And I think to hear multiple perspectives and to see them on Sakai, like all these different people responding to different ideas, I think definitely, that's contributed.</p>
1. Sharing Resources	<ul style="list-style-type: none"> - Participants described what they liked and 	Last semester it was really helpful. And in science, the

	felt helpful of the resources shared in the NETwork.	instructor posted a lot of really great resources and stuff, and of course this semester I don't have the science methods course, so right now it's sort of I know it's there, and it will be helpful, I just don't need it. But when I'm doing student teaching next year, it will be helpful, because I will be required to talk about science and things in my classroom, so I will go back and pulling those resources. But for right now it's sort of in the waiting room. Like, I know that it's there. It will be helpful, but just not quite yet
2. Global Opportunities	- Participants described the global opportunities of connecting to other teachers around the county NETwork provided.	Yeah. I think that's actually the great thing about it, is that we can connect, it's a tool to help us not only if we're in the same building at different computers typing, but we can be, I can be wherever.
3. Teaching Knowledge and Skills	- Participant described how much their teaching knowledge and skills improved or increased because of participating in the NETWork.	Well, I think that you can always learn more. I mean, nobody knows everything, so when you come together in the NETwork with other teachers, sharing their ideas with you, you're going to learn more and you're going to be able to use that in your classroom to help your teaching. And that's definitely a good thing.
4. Teaching confidence	- Participants described the changes of their teaching confidence after participating in the NETwork.	Last semester I still feel like it increased, just because all of us in Blue Block last semester, we were learning these things together and sort of figuring them out, and Sakai was a tool that we used to sort of break these pieces apart and figure them out, and so I think we were all going through it together, so I think we all increased in our knowledge and our confidence.
5. Teaching supports	- Participants described if they satisfied with the teaching supports they had and how they felt about it.	Yeah, I think so. I mean, I have my fellow teachers and the NETwork, of course, where I could go to if I have a question, or something. And I would feel comfortable e-mailing the professors if I had a question.

Reference for coding content of DB
Coding Unit: Message

Nodes	Description & Indicators	Examples
Identity	<ul style="list-style-type: none"> - Participants shared information regarding to who they are. 	<p>My name is Alice. I am currently a junior at the University, so I'm considered a pre-service teacher. This past semester I worked with 1st graders, so I will probably be working with slightly older kids this upcoming semester.</p>
Socialization	<ul style="list-style-type: none"> - Participants tried to social with others with greeting words or mention something not regarding to subject matter. - Participants provided emotional encourage or support to others. - Participants shared their stressed about teaching or learning process. 	<p>Hi guys, I am a junior at the University and I will be doing my Pre-service teaching at the Steven Elementary School.</p> <p>Don't stress and don't spend a million dollars, buy books when you absolutely can not leave the store without them.</p> <p>I know I am stressed about my classroom library also!</p>
Community and Belonging 1. Emotional support	<ul style="list-style-type: none"> - Participants expressed their feeling about being in a group or same community. 	<p>yay we are all together and not a red or orange block but a new block. I look forward to enjoying those of you I know and have yet to know. I am way excited!!!</p>
P1 Sharing and comparing of information 2. Sharing stress	<ul style="list-style-type: none"> - Statement of observation or opinion - Statement of agreement from one or more other participants - Corroborating examples provided by one or more participants - Ask and answer questions to clarify details of statements - Definition, description, or identification of a problem. 	<p>Another way to help mitigate the "out of control" behaviors that are found when a substitute is in your class is to leave very clear, very detailed lesson plans for them - that include your classroom management strategies, and a list of which students are leaders, which students will cause problems, etc. The more information the subs have gives them a better chance for keeping "control" of the class.</p>
1. Advice from Knowledge Authority	<ul style="list-style-type: none"> - The advice from people who have knowledge of the questions for discussion topics. 	<p>I also see that in classrooms where the teacher has been strict</p>
2. Shared in-school experience	<ul style="list-style-type: none"> - Participants shared their practical 	

	experience of practicing or teaching in school.	and sets high expectations for academics and behavior in the classroom, the students seem to perform better and behavior better. The teacher needs to build the classroom together so everyone understands their responsibility. Before leaving, a teacher should explain what is expected out of the students and what is acceptable behavior to have during a sub visit. If needed some teachers use a reward system for good behavior while they are gone.
3. Shared NETwork experience	- Participants shared their previous experience in NETwork community.	But anyone...this website is a really good resource to use because it can be very helpful in answering your questions!! I used it a lot last semester, and am thankful I was a part of it! I plan on using this website next year and even when I start my actual teaching because there are great web resources underneath the network page!!
4. Expectation of NETwork	- Participants described what they expect to do or gain from the NETWork community.	I expect to learn a little bit about how the daily life of a "real" teacher is! I'm also looking forward to having this network as a resource that I can turn to when I begin my teaching. Holy moly, Do I agree! I actually didn't even have the money this week to spend on the Scholastic books, but completely understand your nervousness!
P2 Discovery and exploration of dissonance or inconsistency among ideas, concepts or statements	<ul style="list-style-type: none"> - Identifying and stating areas of disagreement - Asking and answering questions to clarify the source and extent of disagreement - Restating the participant's position, and possibly advancing arguments or considerations in its support by references to the participant's experience, literature, formal data collected, or proposal of relevant metaphor or analogy to illustrate point 	<ul style="list-style-type: none"> - Negotiation of clarification of the meaning of terms - Negotiation of the relative weight to be assigned to types of argument - Identification of areas of agreement or overlap among conflicting concepts - Proposal and negotiation of new statements
P3 Negotiation of meaning and co-construction of knowledge		

	<p>embodimenting compromise, co-construction</p> <ul style="list-style-type: none"> - Proposal of integrating or accommodating metaphors or analogies
P4 Testing and Modification of proposed synthesis or co-construction	<ul style="list-style-type: none"> - Testing the proposal synthesis against "received fact" as shared by the participants - Testing against existing cognitive schema - Testing against personal experience - Testing against formal data collected - Testing against contradictory testimony in the literature
P5 agreement statement and applications of newly constructed meaning	<ul style="list-style-type: none"> - Summarization of agreement - Applications of new knowledge - Meta-cognitive statements by the participants illustrating their understanding that their knowledge or ways of thinking have changed as a result

Reference for coding content of CR
Coding Unit: Message

Nodes	Description & Indicators	Examples
Identity	<ul style="list-style-type: none"> - The participants shared information regarding to who they are. 	For those who don't know me, I was in the instructor's class last semester. Now I am student teaching in a third grade class in Chicago. Hi, Chris-- Glad you could make it!
Socialization	<ul style="list-style-type: none"> - The participants tried to social with others with greeting words or mention something not regarding to subject matter. 	
Interactivity	<ul style="list-style-type: none"> Participants provide direct or indirect responses or comments and independent statement. 	That's the same system I used-- I found it takes a lot of consistency on the part of the teacher; that is, if you go ahead and begin talking before they get fully quiet and attentive, then they learn it's OK to keep talking.
P1 Sharing and comparing of information	<ul style="list-style-type: none"> - Statement of observation or opinion - Statement of agreement from one or more other participants - Corroborating examples provided by one or more participants - Ask and answer questions to clarify details of statements - Definition, description, or identification of a problem. 	
1. Advice from Knowledge Authority	<ul style="list-style-type: none"> - The advice from people who have knowledge of the questions for discussion topics. 	My former students gave me one for those times. They called it "Don't Break The Sugar Bowl". It was a kind of competition where everyone was silent as long as possible. If you don't use it often, it works.
2. Shared experience	<ul style="list-style-type: none"> - Participant shares his/her own story, information, or experience. 	I think role playing can work well... the kids get into it, and there's an immediate platform for discussion.
3. Guidance from the instructor	<ul style="list-style-type: none"> - The professor facilitate and guide discussion topic. 	Great question, Janie! Often the root of the problem is that expectations haven't been made explicit, or that there are implicit norms that are counter to the stated expectations!
P2 Discovery and exploration of dissonance or inconsistency among ideas, concepts or	<ul style="list-style-type: none"> - Identifying and stating areas of disagreement - Asking and answering questions to clarify 	Depends... we have a clap that they'll echo if we do it. That's supposed to get their attention, but it can be lost again in a blink.

statements	<p>the source and extent of disagreement</p> <ul style="list-style-type: none"> - Restating the participant's position, and possibly advancing arguments or considerations in its support by references to the participant's experience, literature, formal data collected, or proposal of relevant metaphor or analogy to illustrate point
P3 Negotiation of meaning and co-construction of knowledge	<ul style="list-style-type: none"> - Negotiation of clarification of the meaning of terms - Negotiation of the relative weight to be assigned to types of argument - Identification of areas of agreement or overlap among conflicting concepts - Proposal and negotiation of new statements embodying compromise, co-construction - Proposal of integrating or accommodating metaphors or analogies
P4 Testing and Modification of proposed synthesis or co-construction	<ul style="list-style-type: none"> - Testing the proposal synthesis against "received fact" as shared by the participants - Testing against existing cognitive schema - Testing against personal experience - Testing against formal data collected - Testing against contradictory testimony in the literature
P5 Agreement statement and applications of newly constructed meaning	<ul style="list-style-type: none"> - Summarization of agreement - Applications of new knowledge - Meta-cognitive statements by the participants illustrating their understanding that their knowledge or ways of thinking have changed as a result

Appendix 3-K

Consent Form for Members: Serial Interviews & Surveys

**UNIVERSITY OF MISSOURI-COLUMBIA
INFORMED CONSENT FOR MEMBERS
NETWORK ONLINE EXPERIENCE STUDY: SERIAL INTERVIEWS &
SURVEYS**

This email is being sent to invite you to participate in a research study about the online environment NETwork. The primary purpose of this study is to learn about the ways members participate and interact in the NETwork and how the tools and other resources in Sakai support your learning. Your participation is greatly appreciated and has potential to benefit all teachers by helping us understand how to support your continued professional development through online environments. To thank you for your participation a \$30 check will be given to you.

PARTICIPATION

Your participation is completely voluntary, and you may withdraw from the study at any time by advising the study investigators. Participation will consist of completing the first and final surveys about your experiences in the NETwork. Each survey will take approximately 20-25 minutes to complete, and can be done with hard copy or at your convenience through an online format. You will be provided the copy of survey or URL link to this survey if you choose to participate in the research. Additionally, you will participate in a serial of interviews (3 interviews) individually during the semester to help the researchers better understand your experiences as members of the NETwork. Each interview will be approximately 30-45 minutes in length to take place in a mutually agreed upon location or via phone. You may decline to participate in the interviews or to answer any of the questions during the interviews.

CONFIDENTIALITY

All records and information collected in the surveys and interviews will be confidential. The interviews will be audio-taped and will ONLY be heard by the researchers and an interview transcriber for subsequent transcription and analyses. This interview transcriber serves as a professional transcriber for many projects of Allen institution in the Center for Technology Innovations in Education (CTIE) at the University of Missouri. All audio-tapes will be digitized as a file and stored on a computer in the CTIE at the University of Missouri.

BENEFITS

Your participation will BENEFIT YOU PROFESSIONALLY by helping research team to understand how a teacher professional community work and how it can be a supports for teachers' continuous professional development. The researchers hope the findings of this study will help the researchers design and establish a successful teacher community with resources, sharing space, and professional supports.

RISKS

This project does not involve any risks greater than those encountered in normal online course activity. To ensure that your decision to participate or decline participation in the

study does not affect your course grade if you are a student, the course instructor will not know whether or not you have agreed to participate in this study. Data will be coded by a unique identifier which will not indicate individuals' name and personal information. All names and personal information will be removed by the investigator (I-Chun Tsai). If you are a student, your instructor will only be permitted to see the data after the identifiers have been removed. Your name and personal information will not appear in any reports or publications of the study, so there is no risk of anyone associating you with the information you give us.

This project has been reviewed and approved by the University of Missouri-Columbia Human Subject Review Board. The Board believes the research procedures adequately safeguard your privacy, welfare, civil liberties, and rights. For additional information regarding human subject participation in this research, please contact the University of Missouri-Columbia IRB officer at (573) 882-9585.

Please feel free to contact me with any questions about the study and/or your participation.

I-Chun Tsai, Doctoral Student
Information Science and Learning Technologies
303 Townsend Hall
Phone: (573) 771-4282
Fax: (573) 884-5158
E-Mail: itch9@mizzou.edu

Consent to Participate in the Research Project

To give consent you must be 18 years of age or older. By entering your full name and contact information and submitting your response via email, you will provide your consent to participate in this study. You may be contacted for focus group or interview participation.

Printed Name: _____

MU Student ID (if applicable): _____

Contact Phone Number: _____

Email Address: _____

Appendix 3-L

Consent Form for Members: Semester-end Interviews & Surveys

**UNIVERSITY OF MISSOURI-COLUMBIA
INFORMED CONSENT FOR MEMBERS
NETWORK ONLINE EXPERIENCE STUDY: INTERVIEWS & SURVEYS**

This email is being sent to invite you to participate in a research study about the online environment NETwork. The primary purpose of this study is to learn about the ways members participate and interact in the NETwork and how the tools and other resources in Sakai support your learning. Your participation is greatly appreciated and has potential to benefit all teachers by helping us understand how to support your continued professional development through online environments. To thank you for your participation your name will be entered in a drawing and four individuals will be selected to receive a \$30 check.

PARTICIPATION

Your participation is completely voluntary, and you may withdraw from the study at any time by advising the study investigators. Participation will consist of completing the first and final surveys about your experiences in the NETwork. Each survey will take approximately 20-25 minutes to complete, and can be done with hard copy or at your convenience through an online format. You will be provided the copy of survey or URL link to this survey if you choose to participate in the research. Additionally, you may be randomly selected to be interviewed individually to help the researchers better understand your experiences as members of the NETwork. The interview will be approximately 30-45 minutes in length to take place in a mutually agreed upon location. You may decline to participate in the interviews or to answer any of the questions during the interview.

CONFIDENTIALITY

All records and information collected in the surveys and interviews will be confidential. The interviews will be audio-taped and will ONLY be heard by the researchers and an interview transcriber for subsequent transcription and analyses. This interview transcriber serves as a professional transcriber for many projects of Allen institution in the Center for Technology Innovations in Education (CTIE) at the University of Missouri. All audio-tapes will be digitized as a file and stored on a computer in the CTIE at the University of Missouri.

BENEFITS

Your participation will BENEFIT YOU PROFESSIONALLY by helping research team to understand how a teacher professional community work and how it can be a supports for teachers' continuous professional development. The researchers hope the findings of this study will help the researchers design and establish a successful teacher community with resources, sharing space, and professional supports.

RISKS

This project does not involve any risks greater than those encountered in normal online course activity. To ensure that your decision to participate or decline participation in the

study does not affect your course grade if you are a student, the course instructor will not know whether or not you have agreed to participate in this study. Data will be coded by a unique identifier which will not indicate individuals' name and personal information. All names and personal information will be removed by the investigator (I-Chun Tsai). If you are a student, your instructor will only be permitted to see the data after the identifiers have been removed. Your name and personal information will not appear in any reports or publications of the study, so there is no risk of anyone associating you with the information you give us.

This project has been reviewed and approved by the University of Missouri-Columbia Human Subject Review Board. The Board believes the research procedures adequately safeguard your privacy, welfare, civil liberties, and rights. For additional information regarding human subject participation in this research, please contact the University of Missouri-Columbia IRB officer at (573) 882-9585.

Please feel free to contact me with any questions about the study and/or your participation.

I-Chun Tsai, Doctoral Student
Information Science and Learning Technologies
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E-Mail: itch9@mizzou.edu

Consent to Participate in the Research Project

To give consent you must be 18 years of age or older. By entering your full name and contact information and submitting your response via email, you will provide your consent to participate in this study. You may be contacted for focus group or interview participation.

Printed Name: _____

MU Student ID (if applicable): _____

Contact Phone Number: _____

Email Address: _____

Appendix 3-M

Consent Form for Instructor

**UNIVERSITY OF MISSOURI-COLUMBIA
INFORMED CONSENT FOR THE INSTRUCTOR
NETWORK ONLINE EXPERIENCE STUDY**

This consent form requests permission to access participants' log files and artifacts in the online course environment NETwork. The primary purpose of this study is to learn about the ways members participate and interact in the NETwork and how the tools and other resources in Sakai support their learning. Your permission is greatly appreciated and has potential to benefit all teachers by helping us understand how to support their continued professional development through online environments. The data that we intend to access include:

1. NETwork members' log files which will be requested from ETMO.
2. CANS logs of activity which will be requested from CANS system administrator.
3. Members' discussion and messages of Discussion Forums and Chat Room in SAKAI.
4. Members' artifacts, including uploaded files and messages of Resources and Email Achieve in SAKAI.

This project does not involve any risks greater than those encountered in everyday online course activity. Data will be assigned a unique identifier which will not indicate individuals' name and personal information. Additionally, participants name and personal information will not appear in any reports or publications of the study, so there is no risk of anyone associating members with the information of NETwork.

This project has been reviewed and approved by the University of Missouri-Columbia Human Subject Review Board. The Board believes the research procedures adequately safeguard your privacy, welfare, civil liberties, and rights. For additional information regarding human subject participation in this research, please contact the University of Missouri-Columbia IRB officer at (573) 882-9585.

Please feel free to contact me with any questions about the study and/or your permission.

I-Chun Tsai, Doctoral Student
Information Science and Learning Technologies
303 Townsend Hall
Phone: (573) 771-4282
Fax: (573) 884-5158
E-Mail: itch9@mizzou.edu

Consent to Give Permission of Participants' Log files and Artifacts

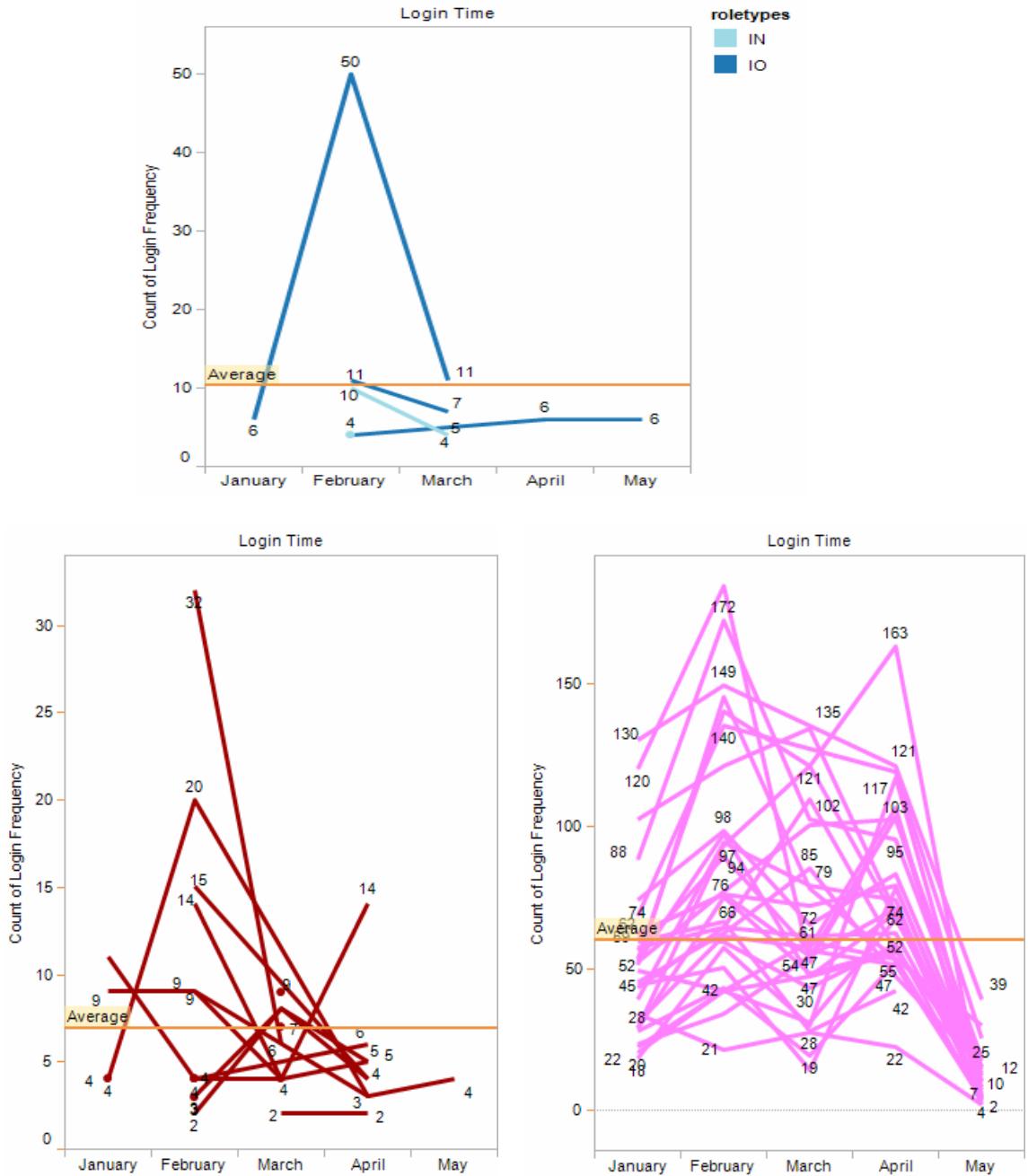
To give consent you must be 18 years of age or older. By entering your full name and contact information, you will provide your consent to access to members' data listed above. Thank you!

Printed Name: _____
Contact Phone Number: _____
Email Address: _____

Appendix 4-A

Monthly Trajectory of Login Frequency (Separate by Role Types)

Monthly Trajectory of Login Frequency (Separate by Role Types)

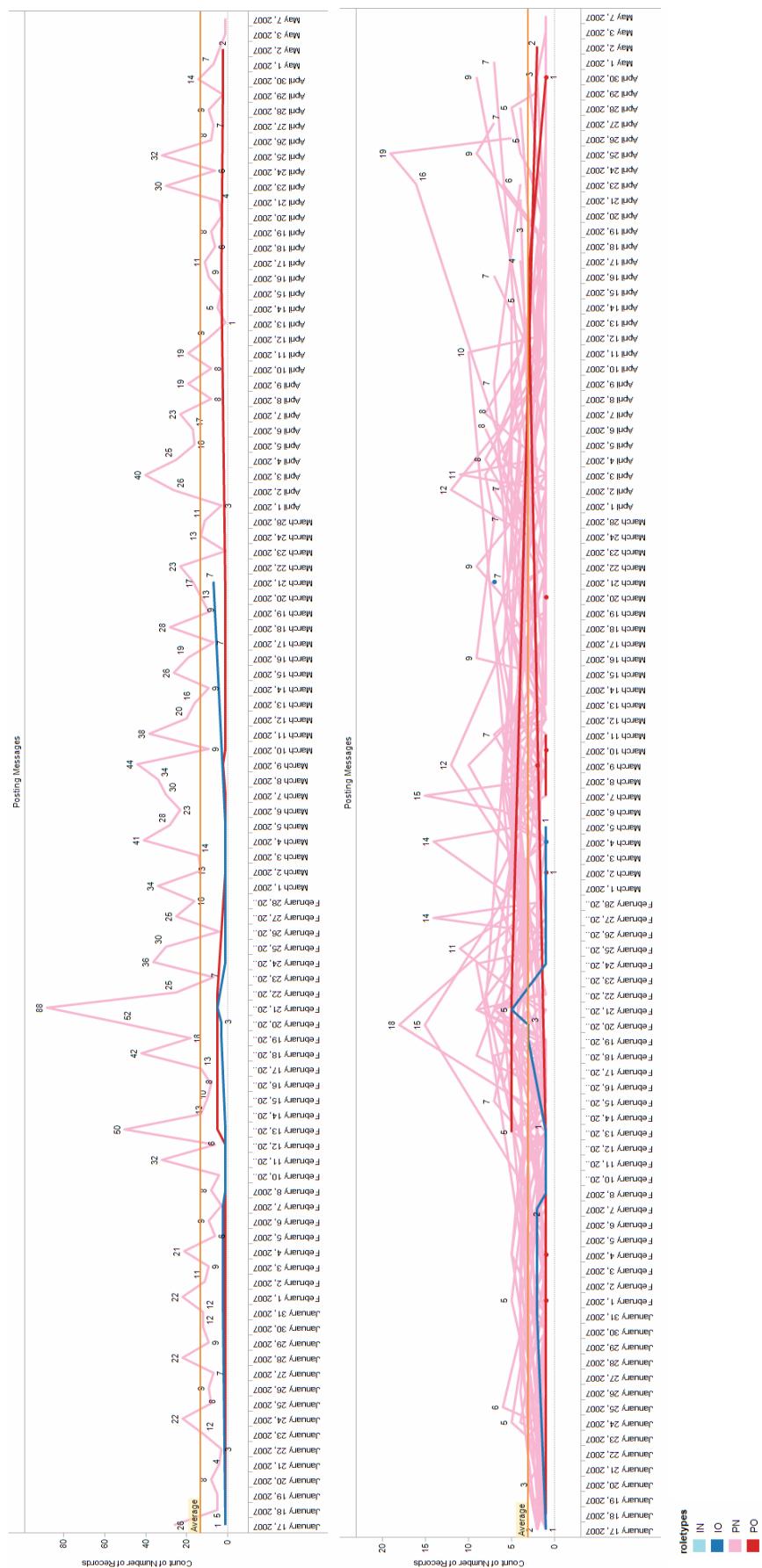


Note. Lighter blue lines represent in-service teachers who joined NETwork since Spring 2007 (IN). Darker blue lines represent in-service teachers who joined NETwork since Fall 2006 (IO). Lighter red lines represent pre-service teachers who joined NETwork since Spring 2007 (PN), as well as darker red lines are pre-service teachers joined since Fall 2006 (PO)

Appendix 4-B

Monthly and Daily Trajectories of Posting Frequency in DB (Entire DB)

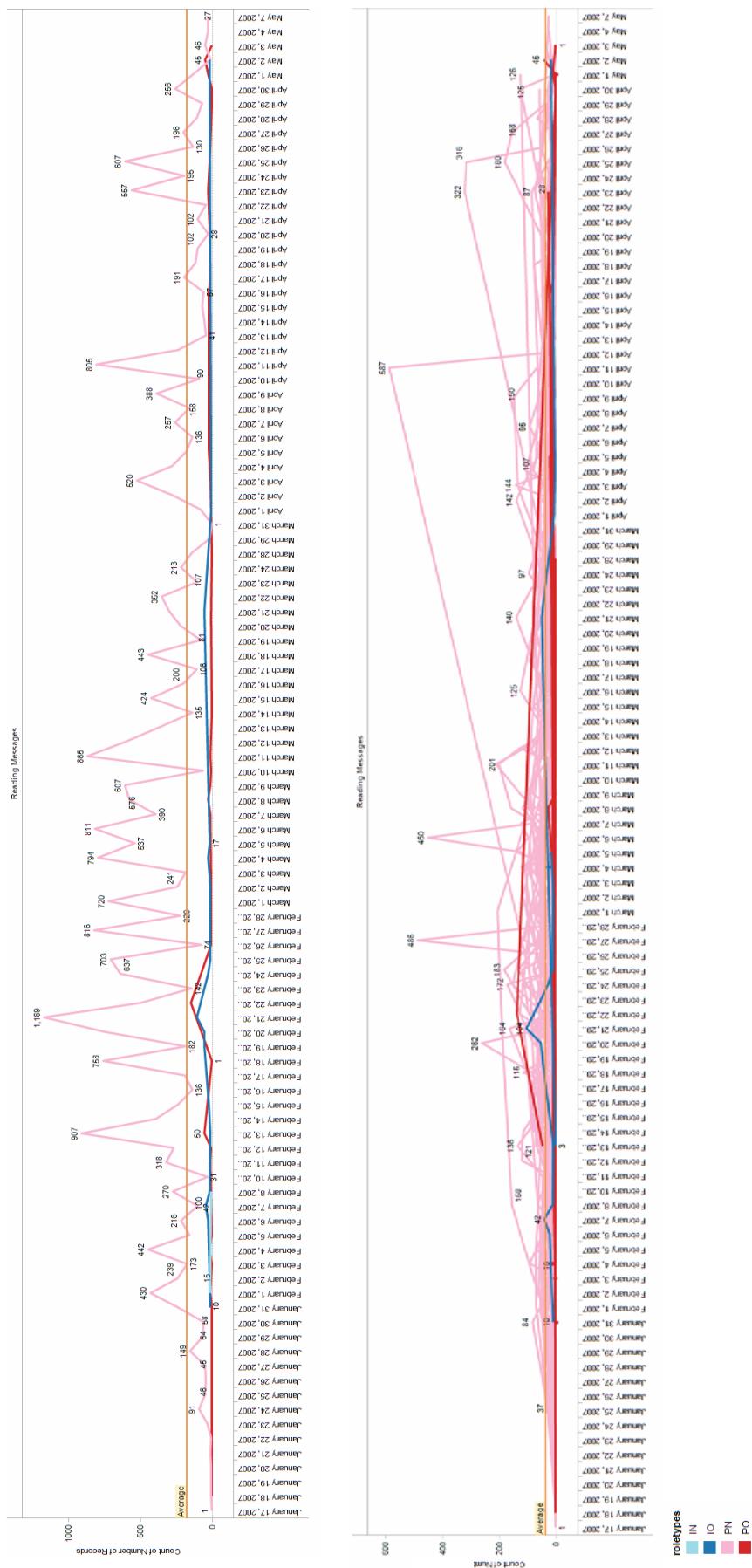
Monthly and Daily Trajectories of Posting Frequency in DB (Entire DB)



Appendix 4-C

Monthly and Daily Trajectories of Reading Frequency in DB (Entire DB)

Monthly and Daily Trajectories of Reading Frequency in DB (Entire DB)



Appendix 4-D

Participation in DB (Entire DB): Patterns of Participation

Participation in DB (Entire DB): Patterns of Participation

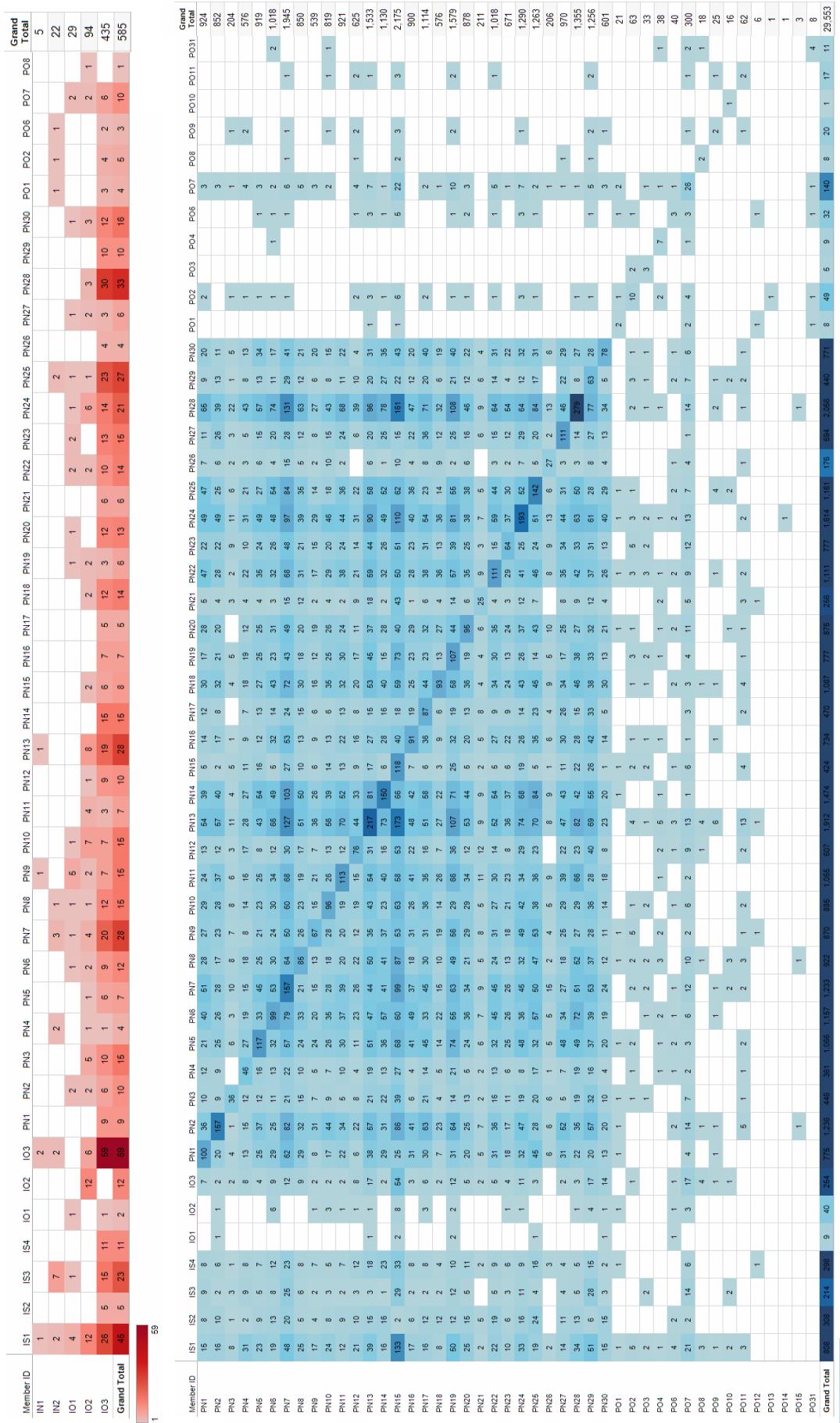
¹ Note. a. Color shows count of Frequency. Darker color represents higher frequency of interaction, and vice versa. b. The text values show the count of the frequency of interaction. c. The frequency ranges from 1 to 279.

Appendix 4-E

Participation in DB (Entire DB): Patterns of Participation

(In- v.s. Pre-service Teachers)

Participation in DB (Entire DB): Patterns of Participation (In- v.s. Pre-Service Teachers)

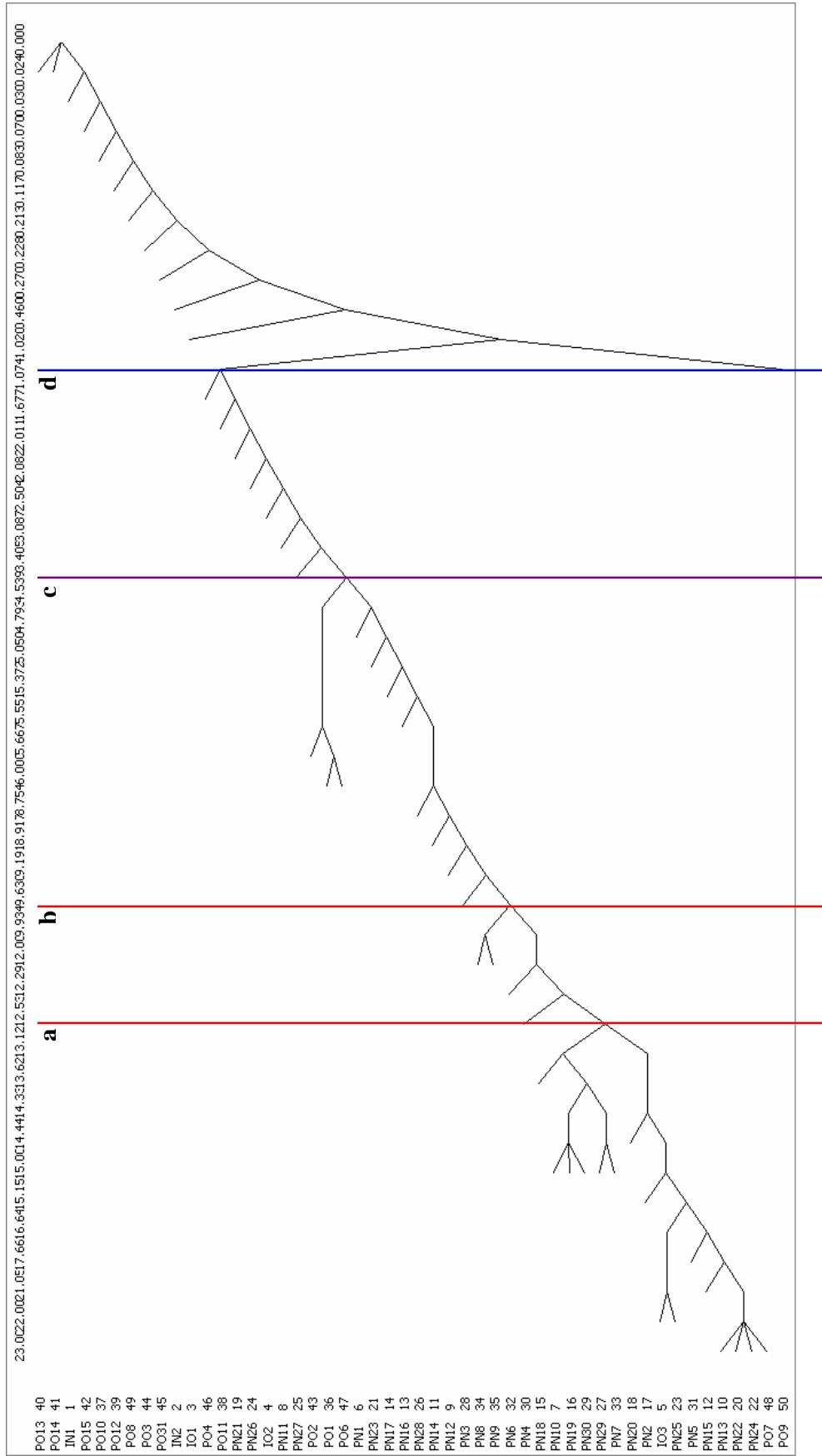


²⁷⁹ Note. a. Color shows count of Frequency. Darker color represents higher frequency of interaction, and vice versa. b. The text values show the count of the frequency of interaction. c. The frequency ranges from 1 to 59 for in-service teachers and from 1 to 279 for pre-service teachers.

Appendix 4-F

Participation in DB (Entire DB): Patterns of Participation (Subgroups)

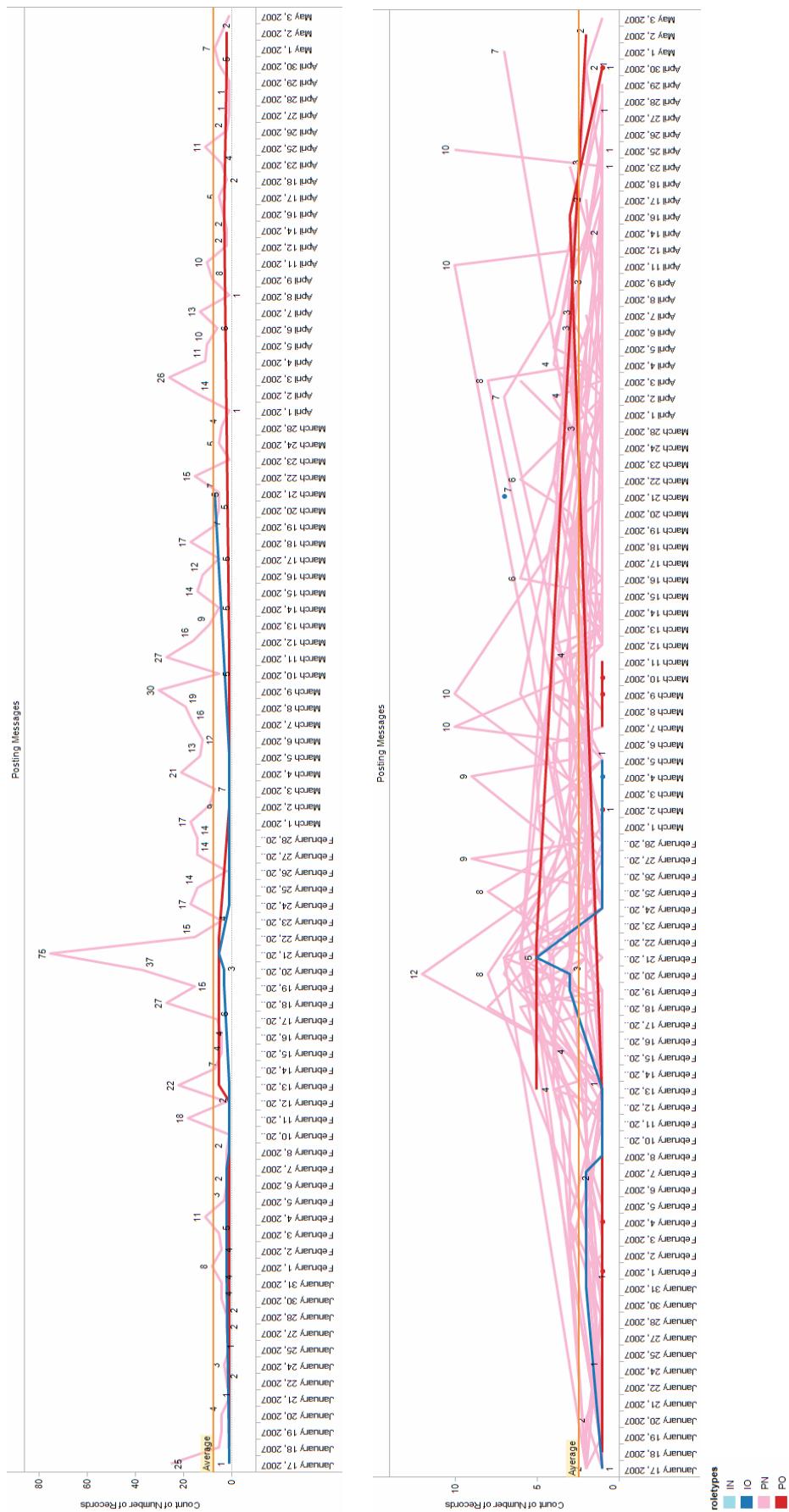
Participation in DB (Entire DB): Patterns of Participation (Subgroups)



Appendix 4-G

Monthly and Daily Trajectories of Posting Frequency in DB (FE & NETwork only)

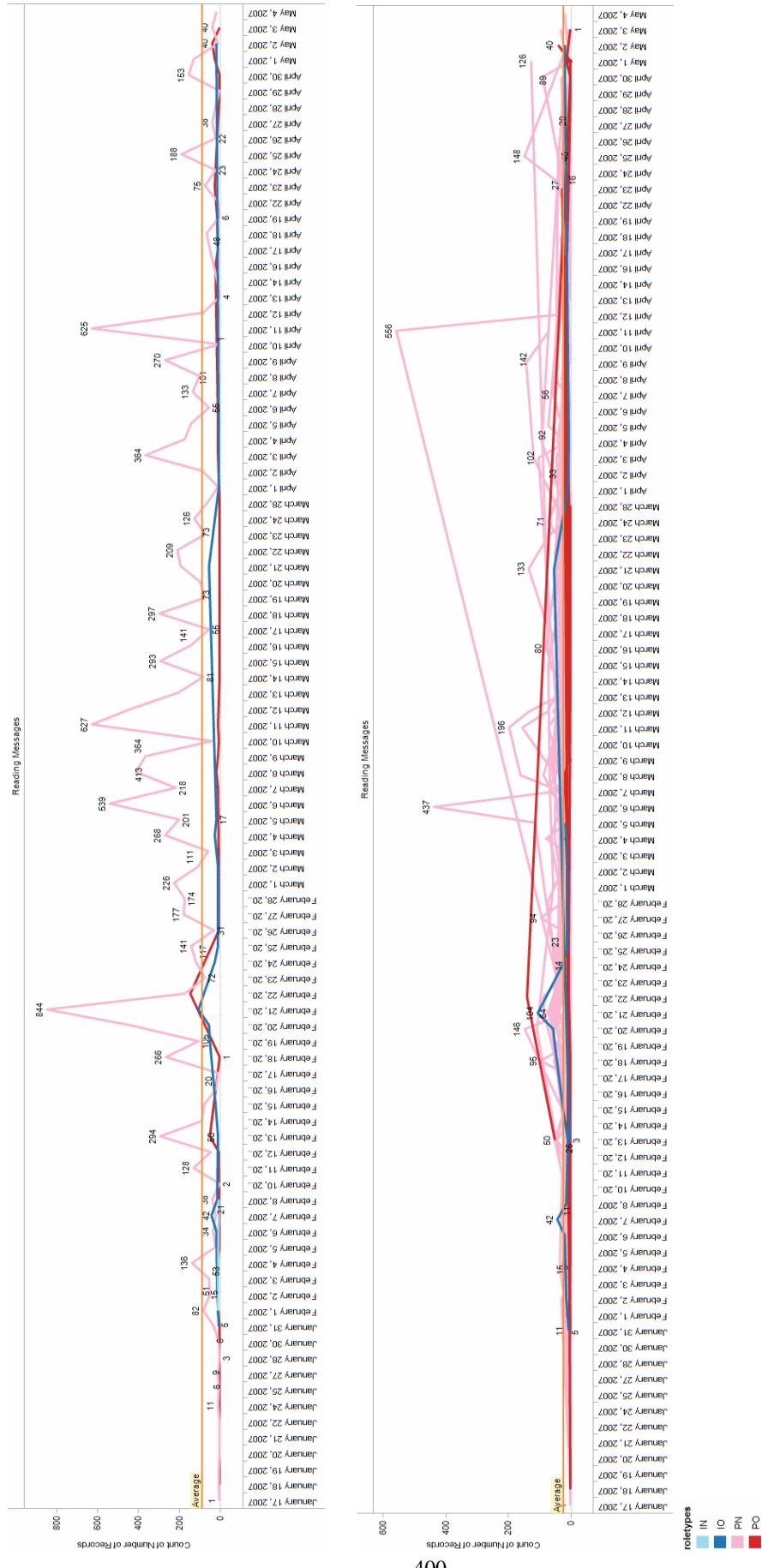
Monthly and Daily Trajectories of Posting Frequency in DB (FE & NETwork only)



Appendix 4-H

Monthly and Daily Trajectories of Reading Frequency in DB (FE & NETwork only)

Monthly and Daily Trajectories of Reading Frequency in DB (FE & NETwork only)



Appendix 4-I

Participation in DB (FE & NETwork only): Patterns of Participation

Participation in DB (FE & NETwork only): Patterns of Participation

Note. a. Color shows count of Frequency. Darker color represents higher frequency of interaction, and vice versa. b. The text values show the count of the frequency of interaction. c. The frequency ranges from 1 to 176.

Appendix 4-J

Participation in DB (FE & NETwork only):

Patterns of Participation (In- v.s. Pre-service Teachers)

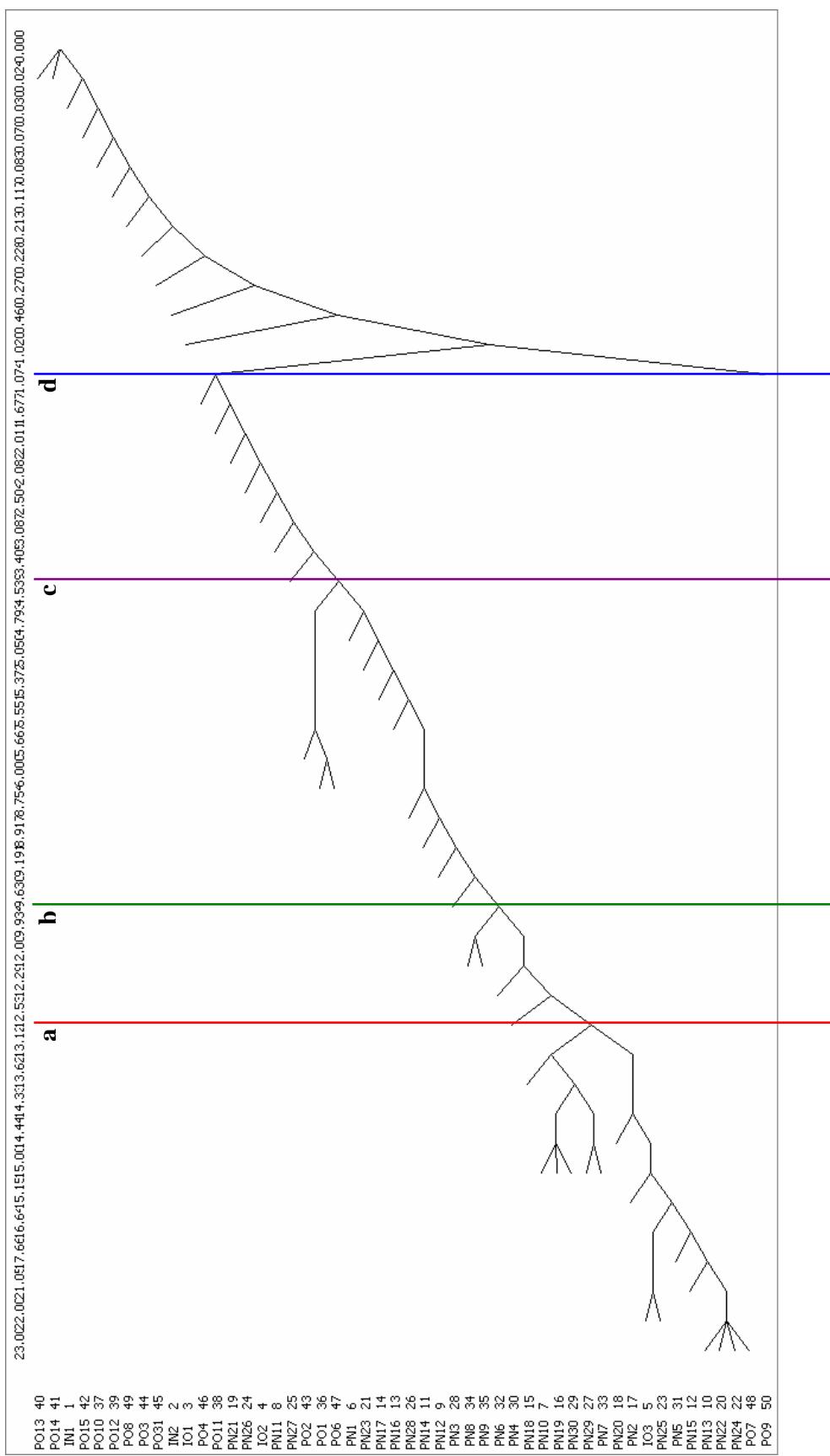
Participation in DB (FE & NETwork only): Patterns of Participation (In- v.s. Pre-service Teachers)

¹ Note. a. Color shows count of Frequency. Darker color represents higher frequency of interaction, and vice versa. b. The text values show the count of the frequency of interaction. c. The frequency ranges from 1 to 59 for in-service teachers and from 1 to 176 for pre-service teachers.

Appendix 4-K

Participation in DB (FE & NETwork only): Patterns of Participation (Subgroups)

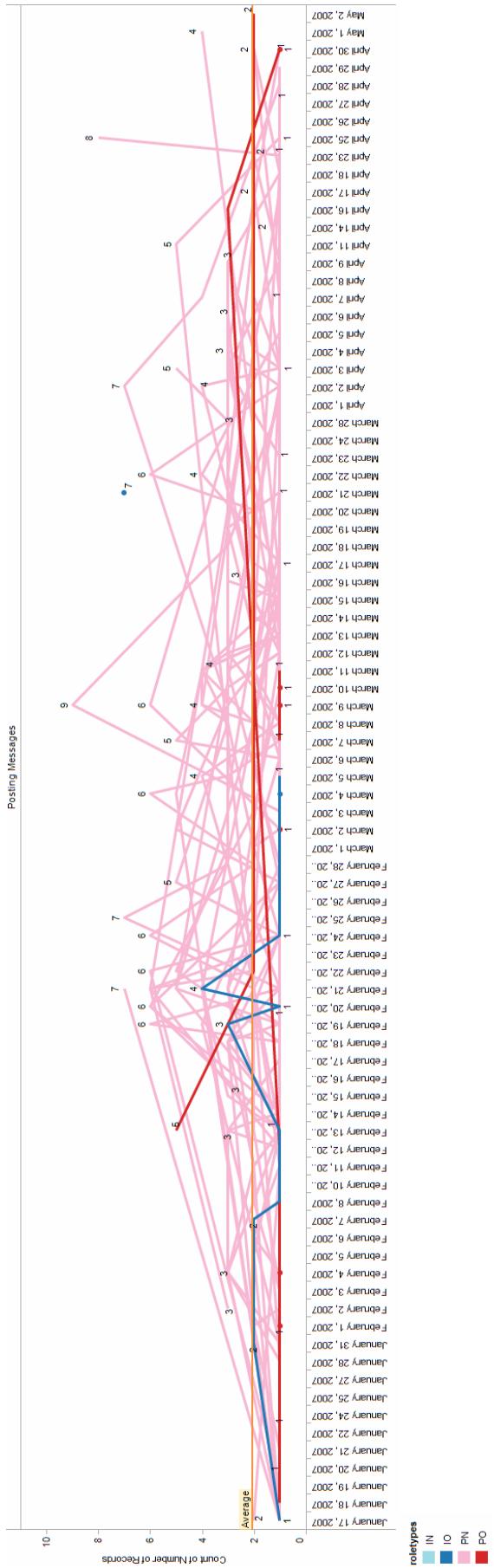
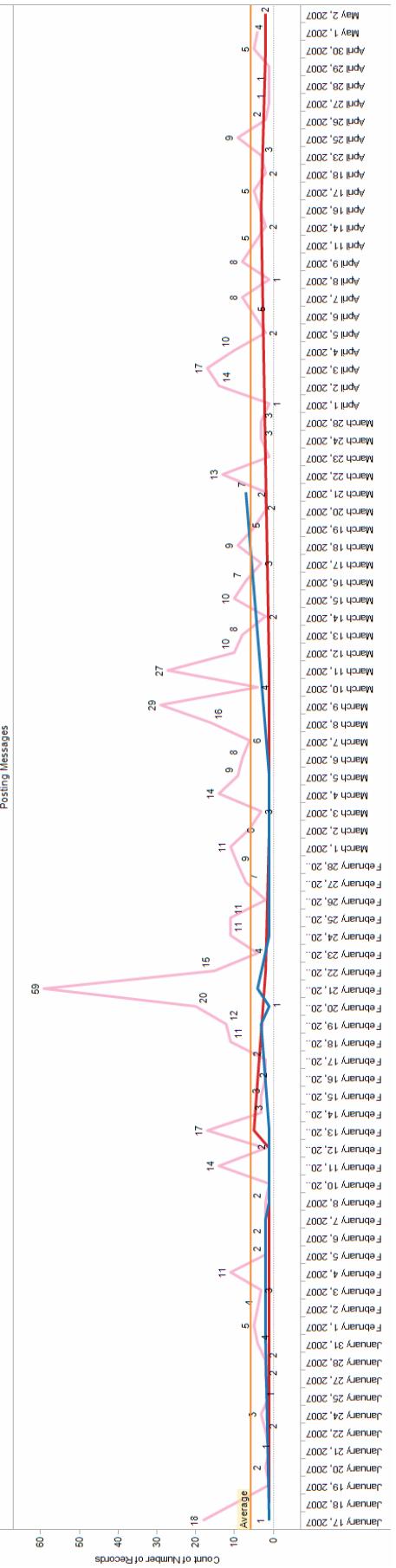
Participation in DB (FE & NETwork only): Patterns of Participation (Subgroups)



Appendix 4-L

Monthly and Daily Trajectories of Posting Frequency in DB (NETwork only)

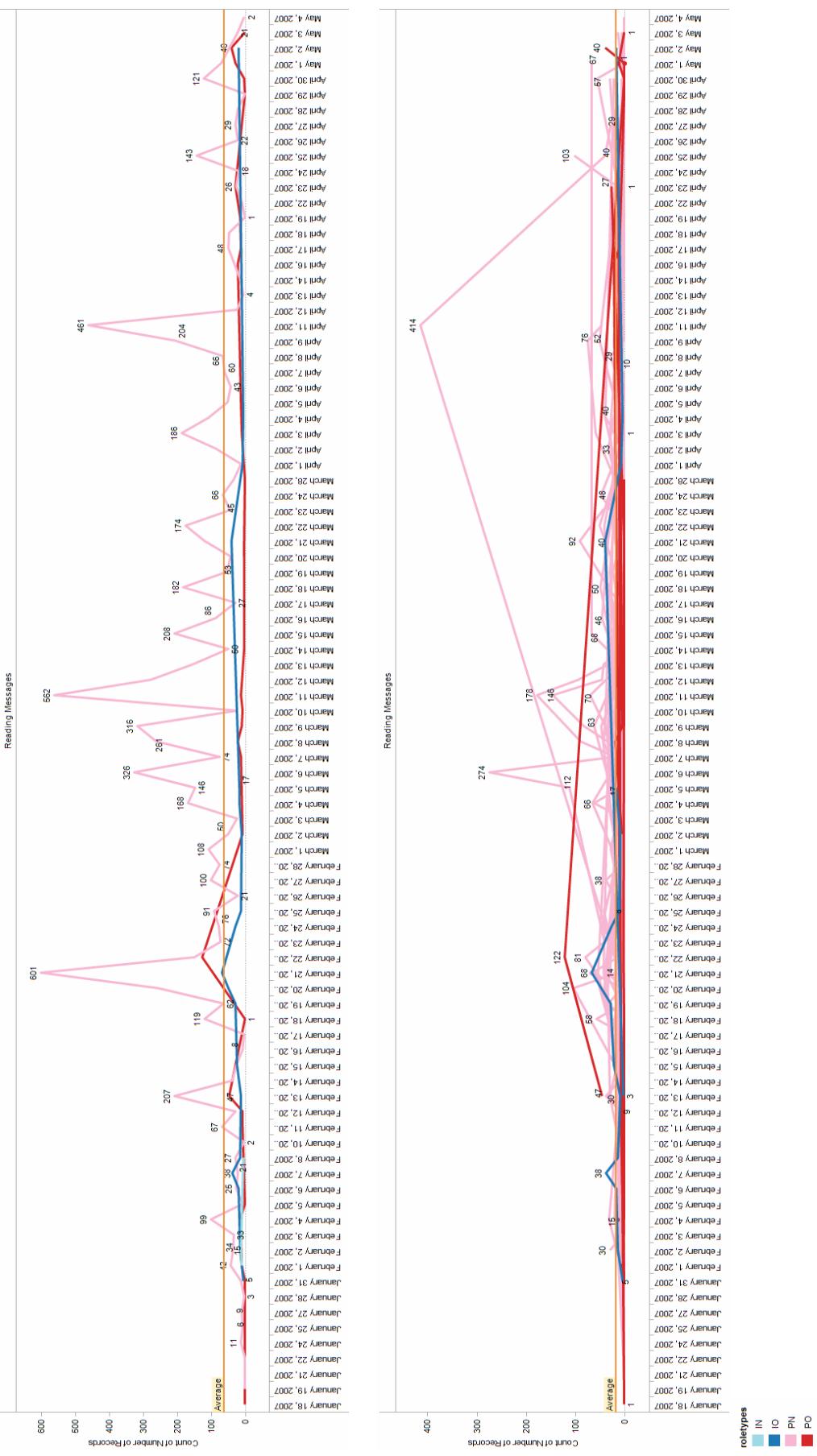
Monthly and Daily Trajectories of Posting Frequency in DB (NETwork only)



Appendix 4-M

Monthly and Daily Trajectories of Reading Frequency in DB (NETwork only)

Monthly and Daily Trajectories of Reading Frequency in DB (NETwork only)



Appendix 4-N

Participation in DB (NETwork only): Patterns of Participation

Participation in DB (NETwork only): Patterns of Participation

Note. a. Color shows count of Frequency. Darker color represents higher frequency of interaction, and vice versa. b. The text values show the count of the frequency of interaction. c. The frequency ranges from 1 to 126.

Appendix 4-O

**Participation in DB (NETwork only): Patterns of Participation
(In- v.s. Pre-service Teachers)**

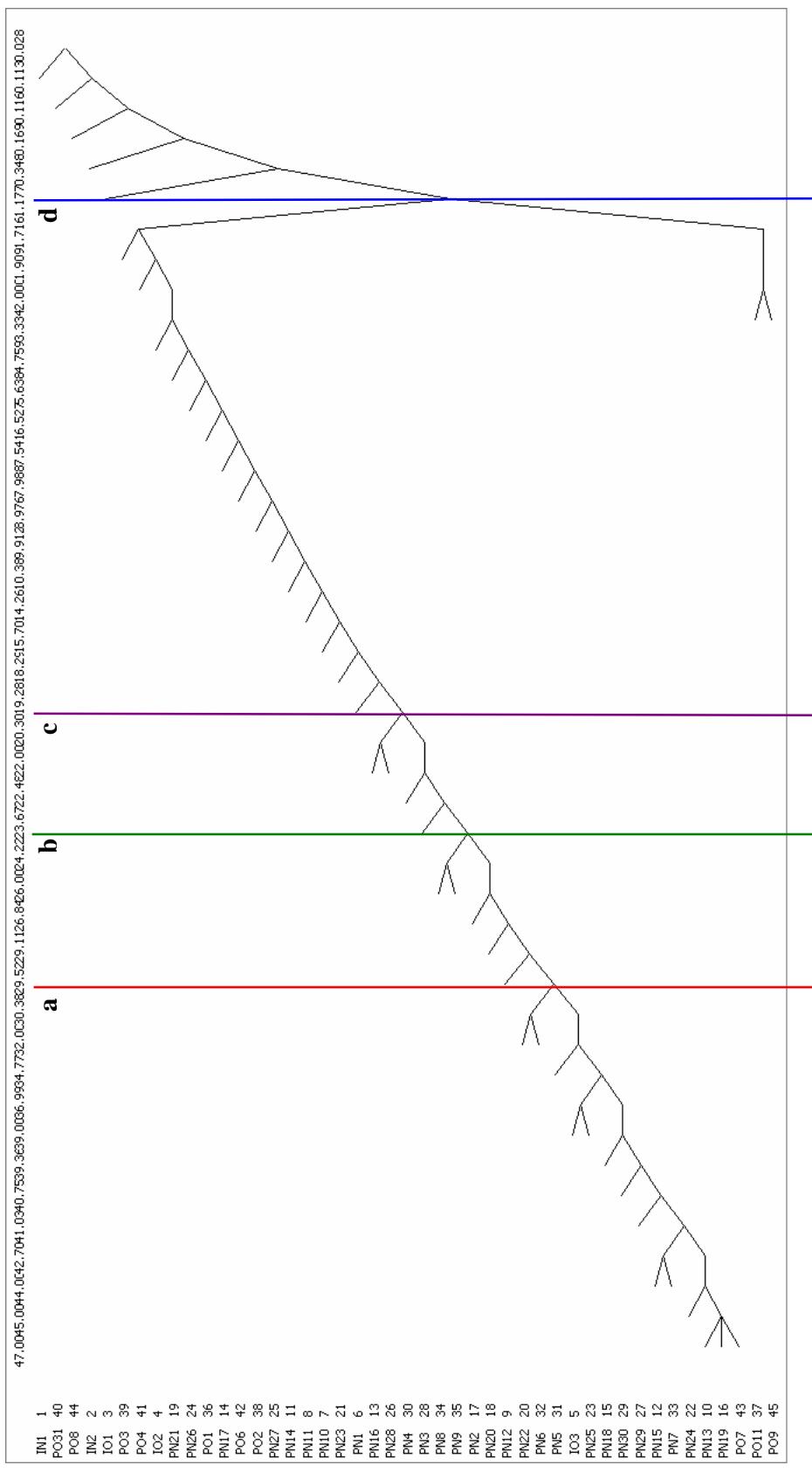
Participation in DB (NETwork only): Patterns of Participation (In- v.s. Pre-service Teachers)

Note. a. Color shows count of interaction. Darker color represents higher frequency of interaction, and vice versa. b. The text values show the count of the frequency of interaction. c. The frequency ranges from 1 to 54 for in-service teachers and from 1 to 126 for pre-service teachers.

Appendix 4-P

Interaction of DB (NETwork only): Patterns of Participation (Subgroups)

Interaction of DB (NETwork only): Patterns of Participation (Subgroups)

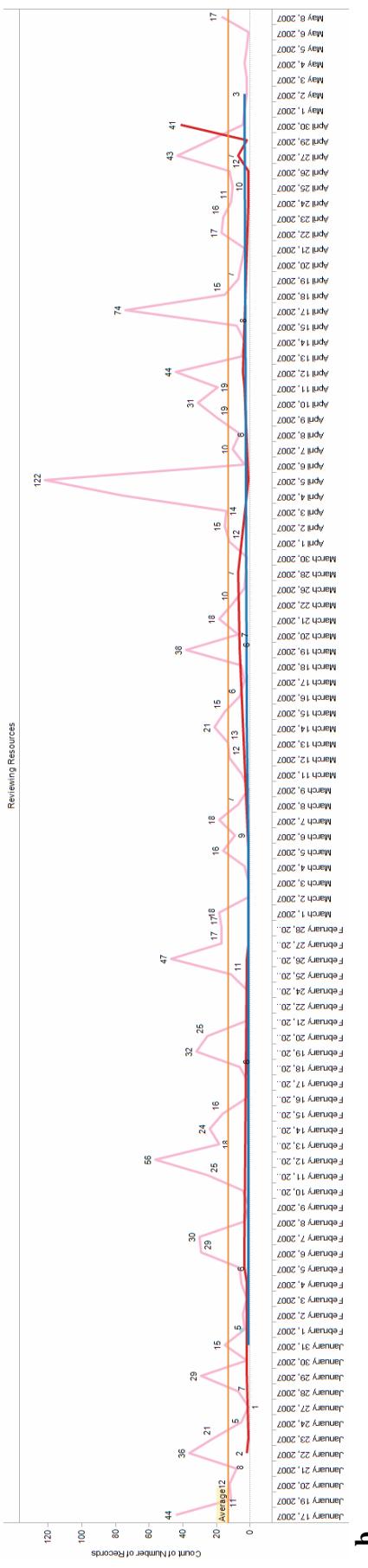


Appendix 4-Q

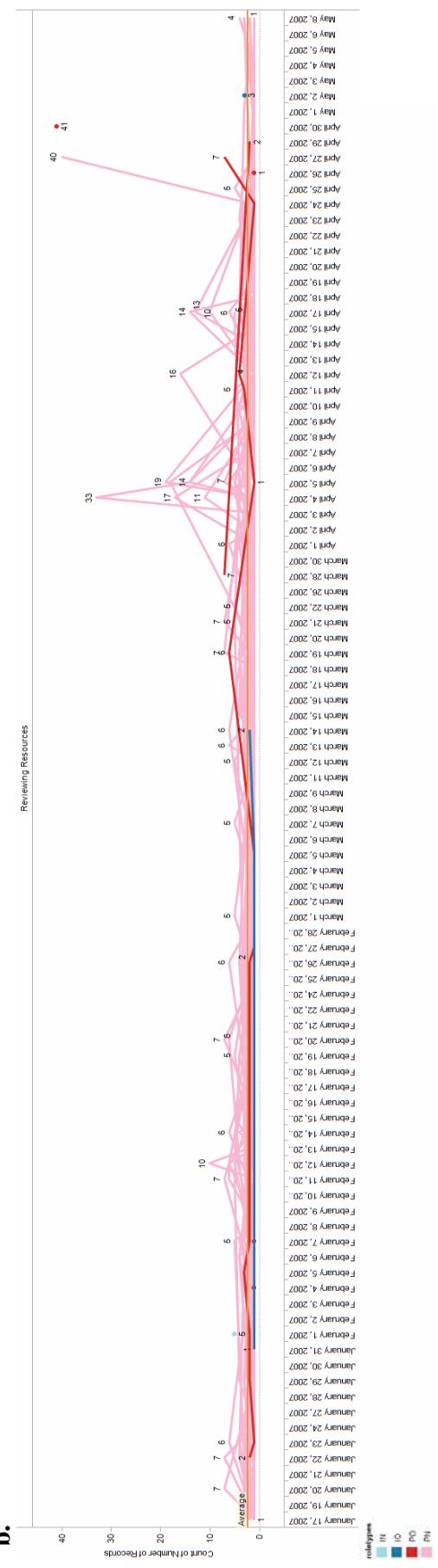
Monthly and Daily Trajectories of Reviewing Frequency in Resources

Monthly and Daily Trajectories of Reviewing Frequency in Resources

a.



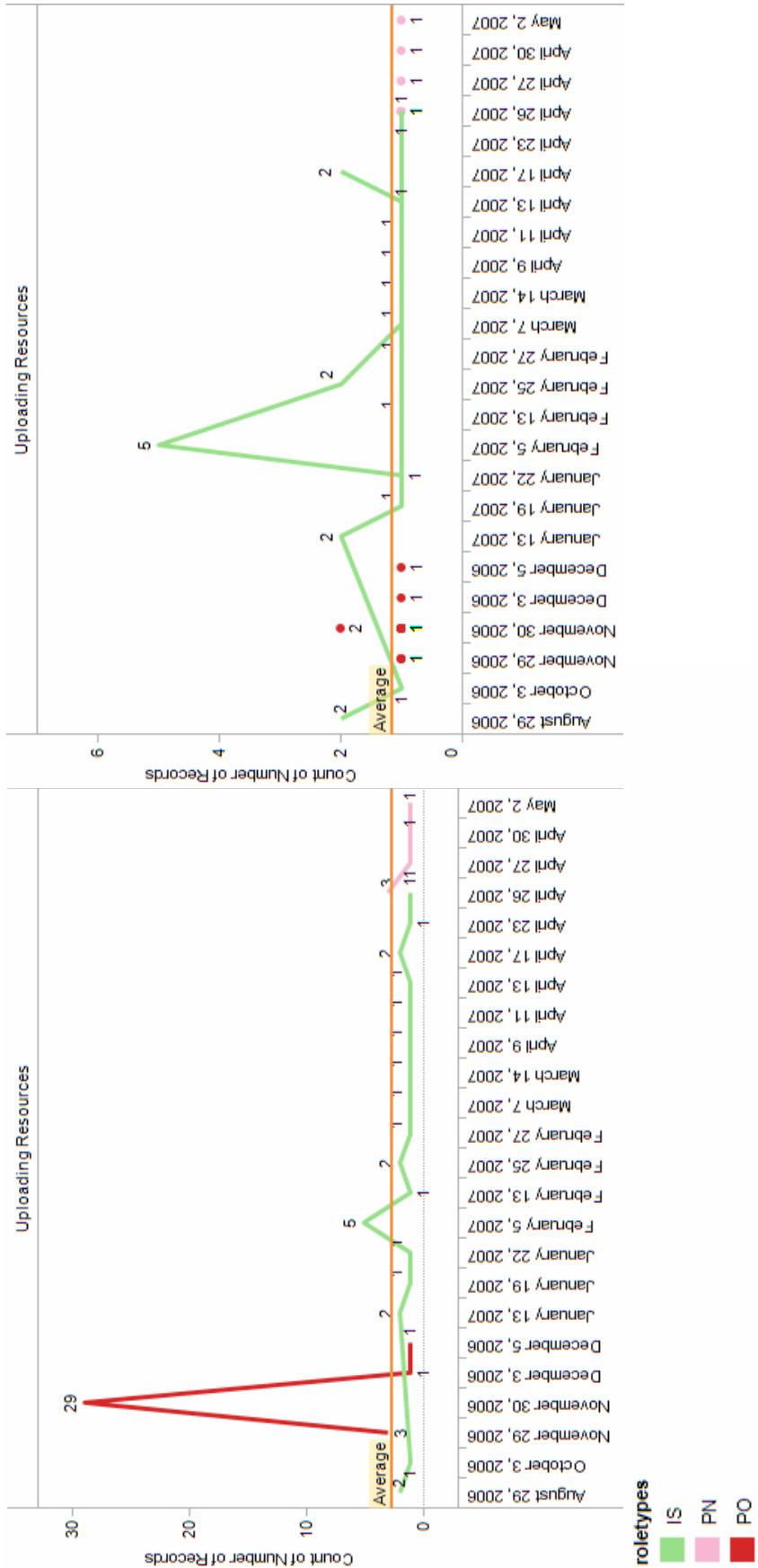
b.



Appendix 4-R

Monthly and Daily Trajectories of Uploading Frequency in Resources

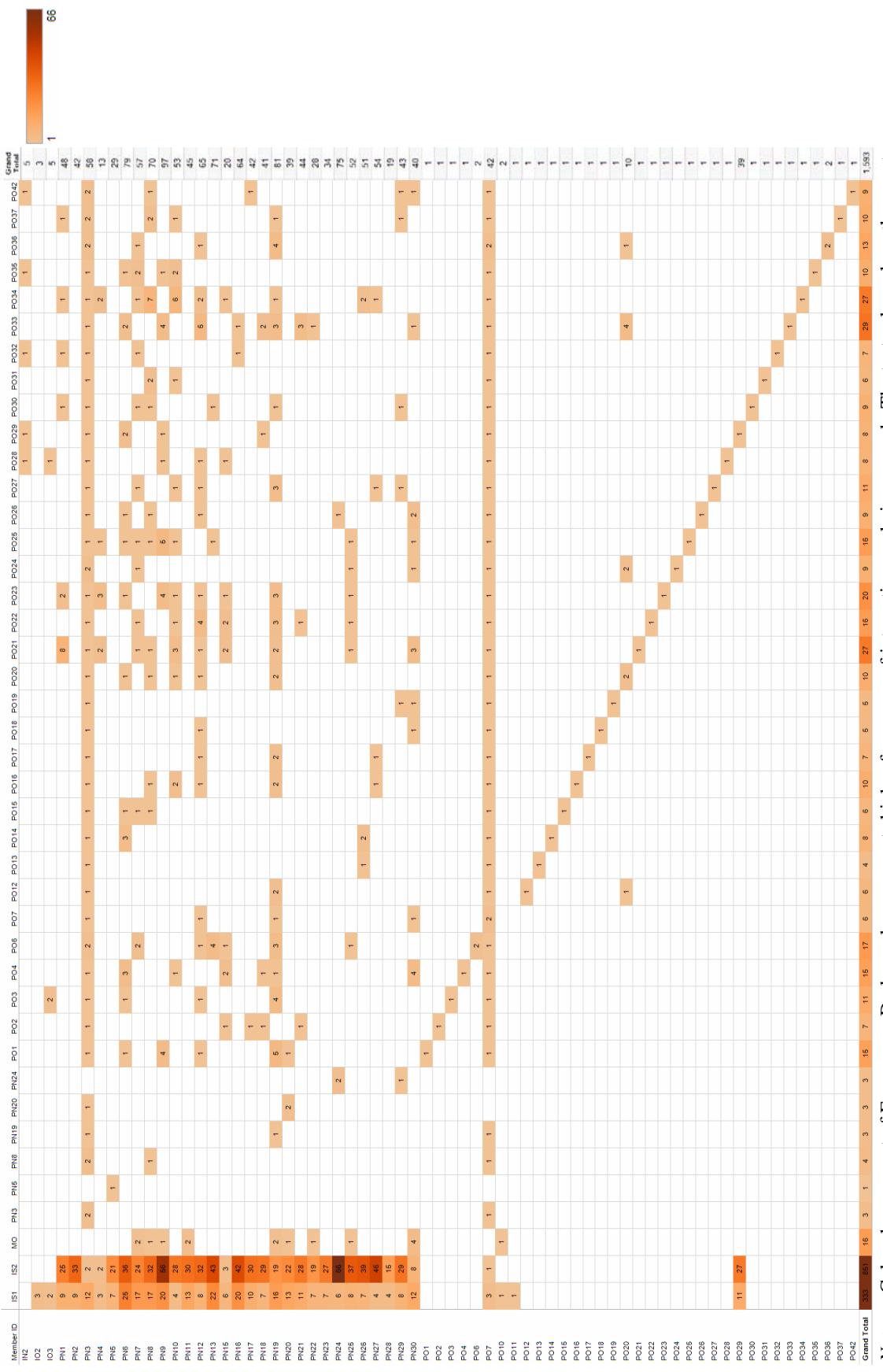
Monthly and Daily Trajectories of Uploading Frequency in Resources



Appendix 4-S

Participation in Resources: Patterns of Participation

Participation in Resources: Patterns of Participation



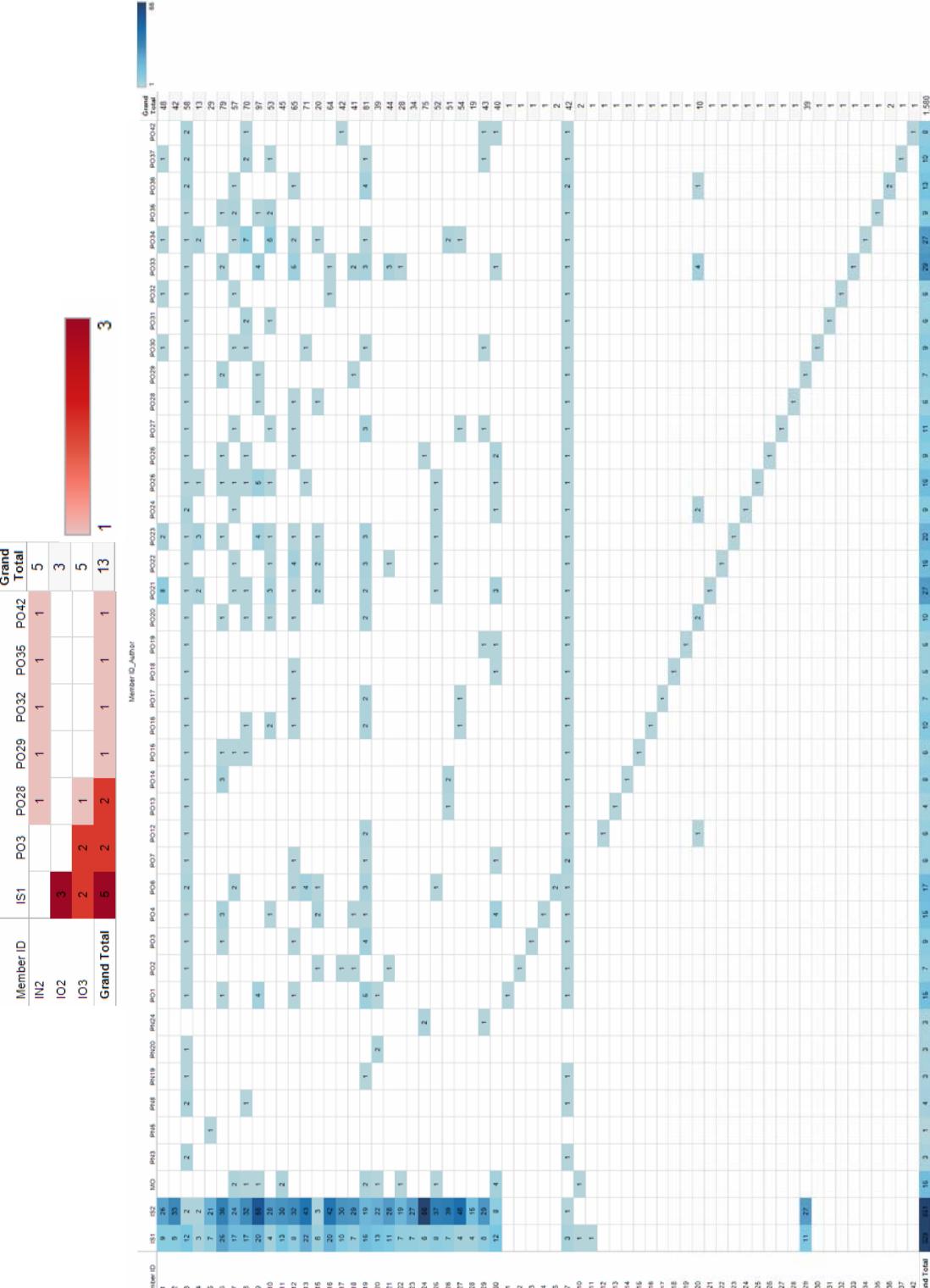
Note. a. Color shows count of Frequency. Darker color represents higher frequency of interaction, and vice versa. b. The text values show the count of the frequency of interaction. c. The frequency ranges from 1 to 66.

Appendix 4-T

Participation in Resources: Patterns of Participation

(In- v.s. Pre-service Teachers)

Participation in Resources: Patterns of Participation (In- v.s. Pre-service Teachers)

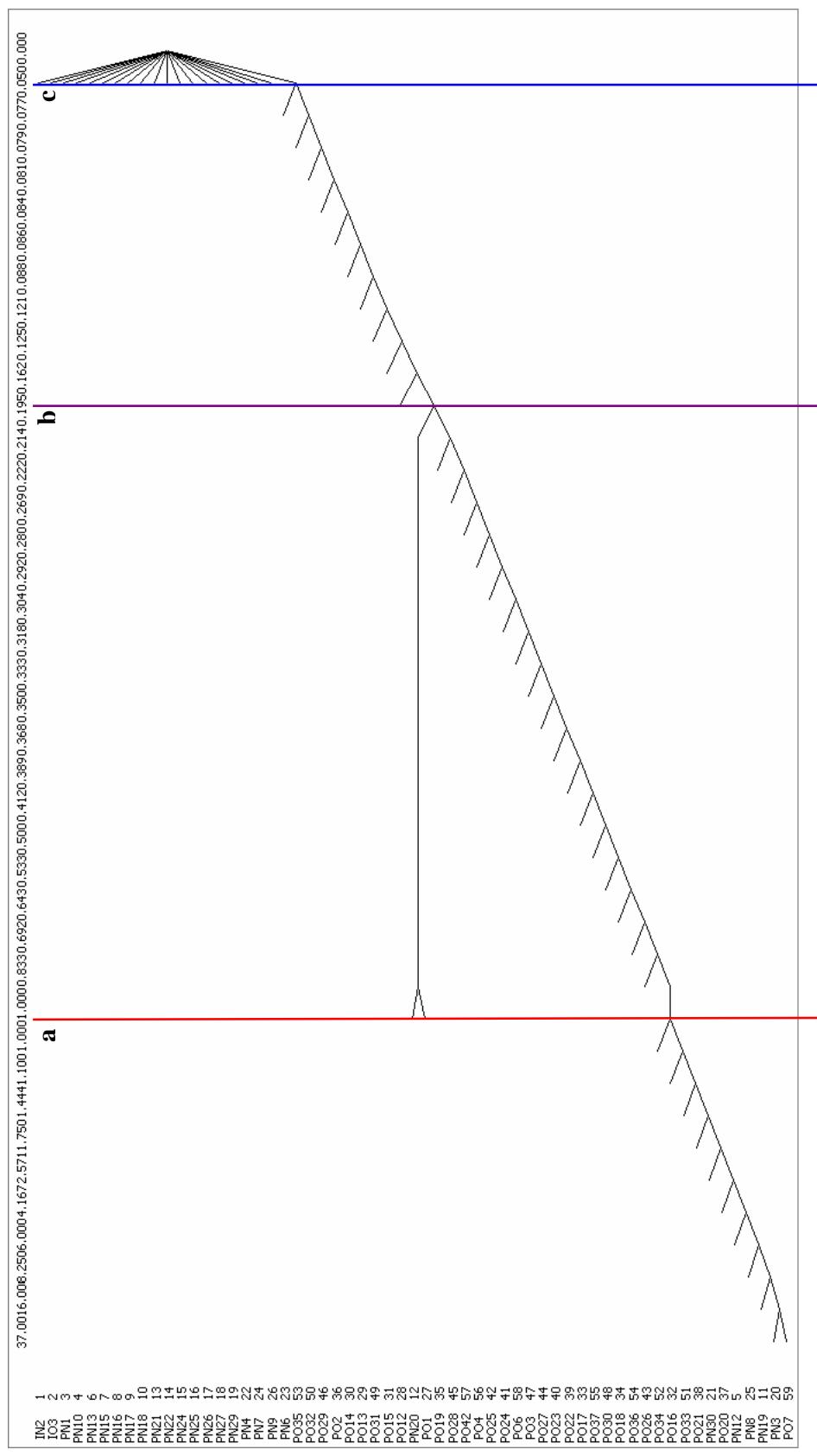


Note. a. Color shows count of Frequency. Darker color represents higher frequency of interaction, and vice versa. b. The text values show the count of the frequency of interaction. c. The frequency ranges from 1 to 54 for in-service teachers and from 1 to 126 for pre-service teachers.

Appendix 4-U

Interaction of Resources: Patterns of Participation (Subgroups)

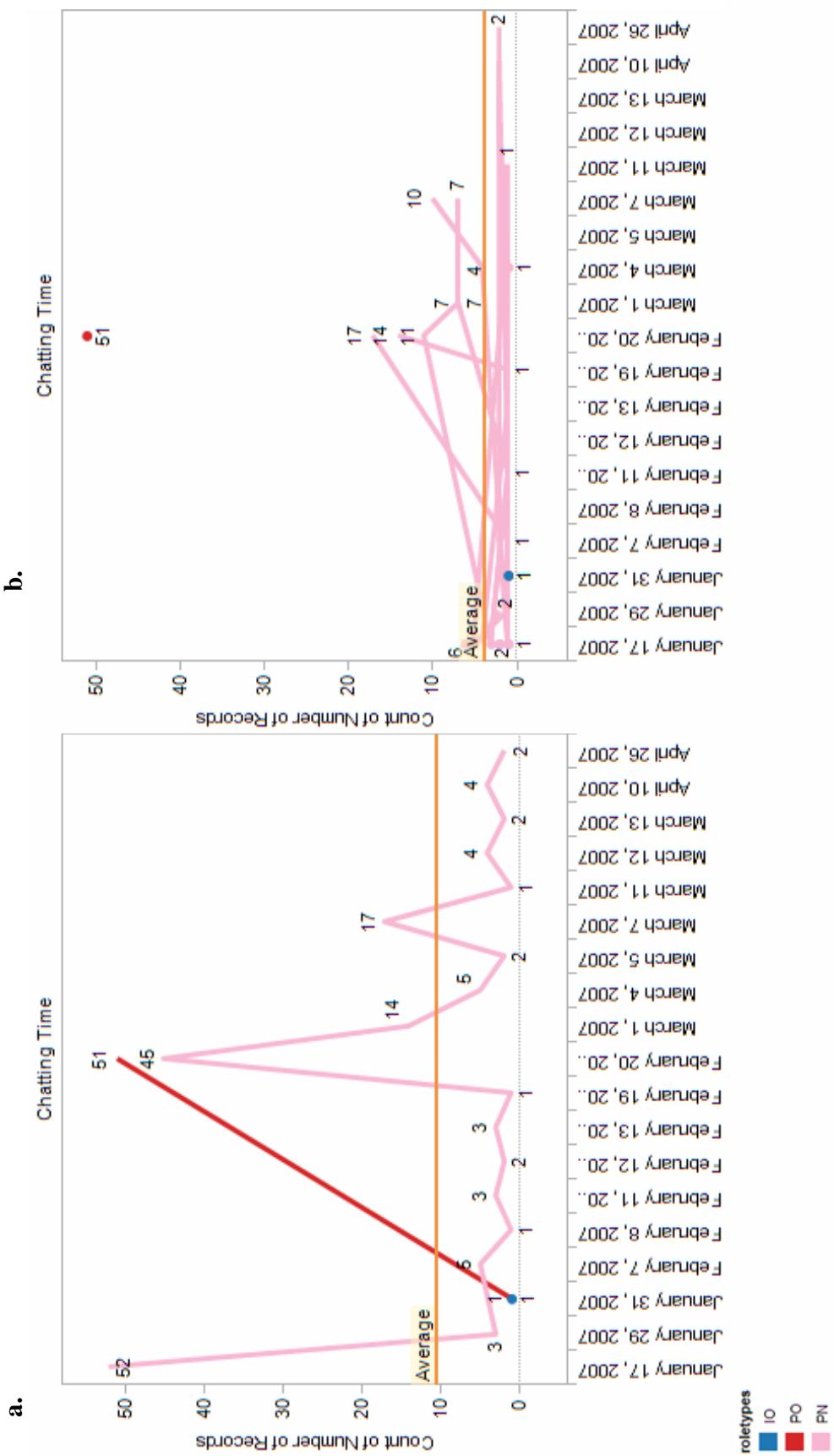
Interaction of Resources: Patterns of Participation (Subgroups)



Appendix 4-V

**Monthly and Daily Trajectories of Chatting Frequency in Chat Room
(Without Instructor)**

Monthly and Daily Trajectories of Chatting Frequency in Chat Room (Without Instructor)

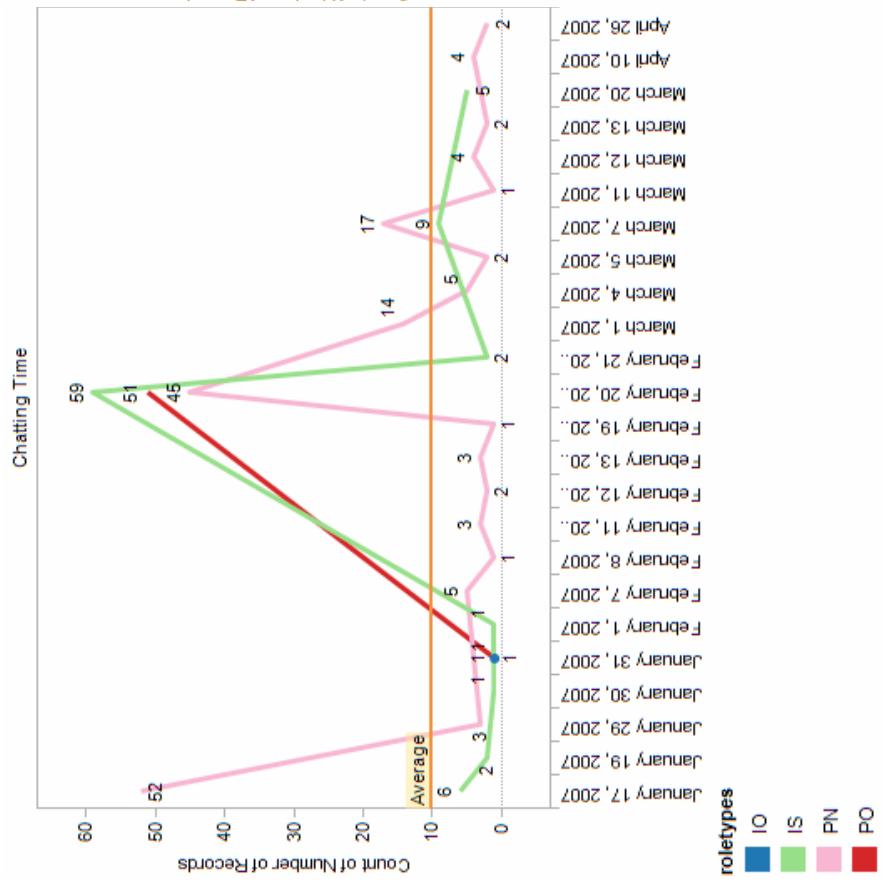


Appendix 4-W

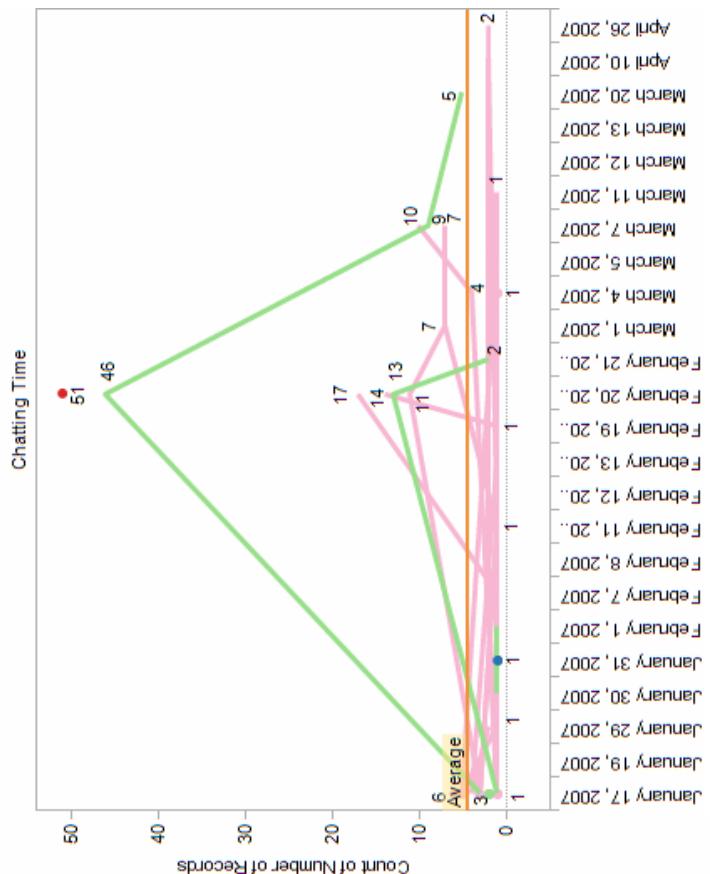
**Monthly and Daily Trajectories of Chatting Frequency in Chat Room
(With Instructor)**

Monthly and Daily Trajectories of Chatting Frequency in Chat Room (With Instructor)

a.



b.



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