

AN EXAMINATION OF FRAMEWORKS AND KNOWLEDGE
CONSTRUCTION IN ONLINE COMMUNITIES

A DISSERTATION SUBMITTED TO THE GRADUATE DIVISION OF THE
UNIVERSITY OF HAWAI'I AT MĀNOA IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY

IN

EDUCATION

AUGUST 2014

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Keywords: Communities of practice, Knowledge building, Computer mediated
discourse analysis, informal online communities, Teacher professional growth, social
learning

ACKNOWLEDGEMENTS

I would like to thank Dr. Catherine Fulford for calling me at the start of this process and encouraging me to start the long road to this dissertation. Without your encouragement, mentoring and support I would have never would have even started this journey. I am deeply thankful to Dr. Ellen Hoffman and the entire ETEC faculty for making every course and seminar in the program well designed and exciting. I would like to thank my dissertation committee of Dr. Curtis Ho, Dr. Catherine Fulford, Dr. Ellen Hoffman, Dr. Peter Leong and Dr. Jim Dator for your support and guidance. I am so thankful to Curtis for taking over the role as my dissertation chair and seeing this through to the end. Your belief in my work and encouragement to strengthen and finish it made this possible.

I am deeply thankful to Kimble McCann and Dr. Sandy Cameli for your many hours spent helping with my coding to ensure the reliability of this study. Thank you for working with me on this project and your gracious giving of precious time. The entire ETEC 'ohana has been a caring and supportive community during this process.

The team at the Hawaii Association of Independent Schools and the Hawaii Community Foundation have loving supported this work and I feel privileged to have been involved in this community of learners since 2008. In particular, Robert Witt and Joe Rice encouraged this process and allowed me to grow professionally as a result.

Lastly, my love and appreciation to my family who gave me the space, time and patience to finish this process. I love you for being there throughout.

ABSTRACT

The 21st century has been profoundly shaped by rapidly developing technologies, interdependent economies and dynamic workplace expectations. In a real sense, the new normal is constant change. Schools are being asked to transform and there has never been a more dynamic expectation of teachers as professionals to adapt and grow. New technologies provide teachers a means to grow through online communities of practice. This ethnographic case study first examined how teachers build knowledge and looked at the contribution of online communities. In order to understand the knowledge building that was occurring in these online communities, the textual records were analyzed utilizing computer mediated discourse analysis (CMDA). In this study, three instruments were applied to a community of educators with 22 conversations over 17 months. These instruments were analyzed both separately and together to see what they revealed about the community's progress. Early conversations were compared to later ones to examine the role of time. These instruments viewed the community's textual record through the three frameworks of interaction, social learning, and knowledge building. The findings indicated each of the instruments by themselves exposed different views of knowledge building that occurred, but it was when they were compared and contrasted that the deeper, nuanced story of knowledge construction was revealed. The implications from this study lead to a better understanding of how and why CMDA instrumentation illuminates the workings of a community more powerfully through multiple lenses and provides researchers with both clearly defined processes and directions for future studies.

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CHAPTER 1. INTRODUCTION

Statement of the Problem

The world that students enter from our schools is profoundly different from just a few generations ago. Schools, on the other hand, have changed very little over the past hundred years, and yet they are the institutions designed and challenged with the task of preparing learners for their future (Carroll, 2000; Christensen, Horn, & Johnson, 2008; Wagner, 2008). In order for schools to be relevant in preparing students, educators must adopt new ways of teaching, learning and assessing the skills and knowledge that students need in order to be successful participants in a globally interconnected society. There is major emphasis in education reform in preparing students for these 21st-century skills and competencies (Christensen et al., 2008; Wagner, 2008). There is little time committed in the typical school day for formal professional development, but new avenues in online learning that have made extension beyond the school day possible for professional learning (Lave & Wenger, 1991; Martin & Kragler, 1999; Thomas, Wineburg, Grossman, Myhre, & Woolworth, 1998; Vavasseur & MacGregor, 2008). The Internet and the evolution of the World Wide Web have moved from a static information repository to a rich, dynamic participatory environment that provides an opportunity for communities to share and build knowledge. This development of Web 2.0 (O'Reilly) has the potential to serve as a venue for building online communities. These online “Communities of Practice” have the potential to build a new culture of sharing and professional growth for teachers.

Significantly, these communities are not just places that live in the moment, but leave a transcript of the thinking and conversation that happened over time. As a result, these records can be accessed to analyze and understand the kind of conversations that occurred, and how those conversations developed. There are a variety of analysis techniques and tools that have been developed to aid in this kind of query.

Emergence of Online Communities of Practice

As the Internet has moved from information to conversation, a diverse number of online social sites and communities have arisen. These sites draw together people with common interests and needs, and enable an opportunity for information to be shared, posted, and archived. Most importantly, the individuals in these communities have the ability to connect, share and converse, which provides an opportunity for learning and growth. As Wenger (2011) states:

The **community** aspect refers to the development of a shared identity around a topic or set of challenges. It represents a collective intention – however tacit and distributed – to steward a domain of knowledge and to sustain learning about it. (p. 9)

These online communities, therefore, could serve an important role in reducing the typical isolation found in the teaching profession.

A Model for Examining Teacher Professional Growth Online

In efforts to move teachers from old practices into new ways of teaching and assessing, schools, districts, and researchers use what little professional time is available in a typical teacher's schedule to build useful experiences and shift their thinking about their professional practice. In order for teachers to adjust their pedagogy, professional

development efforts must include experiences that are extended over time, focused and aligned with subject area content, and involve active learning and collective group participation (Desimone, 2009). With so little time committed in the school day for professional growth, online networks and social sites provide a possible solution to help teachers build knowledge. As these networks have grown, researchers have begun investigating the kinds of learning that are happening there.

Online communities, whether formal and structured, or informal and open-ended, leave a substantial permanent record for researchers to follow and examine the kinds of interaction and learning that occurred. In many of these communities, researchers can easily access this record of communication and sharing. “The importance of discourse in the learning process can find support in theories viewing the development of thought as mediated by social discourse” (Schrire, 2006, p. 50). The research challenge, then, is twofold. First, I must determine what processes and instrumentation I will use to collect data about online conversation. Secondly, a decision must be made to view the data through a theoretical background. These are the two questions that lead to the research study in this document.

Purpose

In 2009, 20 Hawaii independent schools were awarded a 5-year \$5 million grant to support transforming their schools through professional development of their teaching staff. The purpose of this case study was to investigate how an informal online social learning community maintained for K-12 teachers interested in sharing and applying new professional practice supported their efforts to change their knowledge and behaviors. The conversations happening in this online community were analyzed (Saldaña, 2009)

and mapped them a social learning framework (E. Wenger, 1998), an interaction framework (Gunawardena, Lowe, & Anderson, 1997) and a knowledge building framework (Scardamalia & Bereiter, 2010). The methodological approach was computer mediated discourse analysis (CMDA). This approach used text transcripts from online conversations and viewed them as linguistic phenomenon that could be studied. Herring (2004) makes the case that participants interact through text primarily, and that an online conversation “typically leaves a textual trace, making the interactions more accessible to scrutiny and reflection...” (p. 338)

The analysis of the conversations in this online community was triangulated between these views to better understand the kinds of knowledge building and interaction that were happening. In prior research, analyzing online transcripts had typically been done through only one framework, or required interviewing individuals and groups about their experience.

Research Questions

1. Do current frameworks for understanding learning in social online environments provide the analytical tools through computer mediated discourse analysis (CMDA) to analyze teacher adoption of new professional practice?
2. What professional knowledge is constructed as an online professional community evolves over time and what tools can aid in understanding this question?

Relevance of the Study

Although there had been many studies that analyzed face-to-face transcripts and online conversations in a professional context, each study had only typically drawn on

one instrument or framework to analyze the conversation. In finding common threads between different frameworks, there was an opportunity to do a more in-depth analysis of online conversation, and understanding more fully the kind of interaction and learning that was happening. As a result, this study aided in the understanding of how these online professional communities supported the growth of teachers or other learners.

Online social networks provide a new means to support a teacher's involvement in a community of practice. As teachers adopt innovations to share, build, converse and reflect, online communities open up opportunities for teachers to extend the time and space they can commit to develop new skills and knowledge (Rogers, 2003). Previous studies had analyzed discourse through a variety of lenses including interaction (Gunawardena et al., 1997), presence (Osman & Herring, 2007), cognitive presence (Persico, Pozzi, & Sarti, 2010) and phases of learning (Thomson, Reeves-Lipscombe, Stuckey, & Mentis, 2009). Social learning theory provided another means to investigate the ways that online social communities of teachers can support change and growth in teachers. The application of this theory to an emerging community of learners helped develop a list of factors that best support improving professional practice in teachers. Additionally, past studies of interaction and knowledge building have had relatively short time spans. This study was unique in looking over 17 months of interaction in this community.

Conceptual Frameworks

In order to provide a more complete picture of the interaction, learning and knowledge building in an online informal community, this study viewed the online

exchanges through three complementary frameworks that allowed triangulation of the viewpoints to provide a deeper understanding of the community's behavior.

For the purpose of this investigation, knowledge building was examined through three dimensions or frameworks that drew on the past 20 years of research in discourse analysis. This approach has been applied in many studies as a means to deepen the understanding of the discourse, as well as to provide a measure of triangulation on the corpus (Garrison & Cleveland-Innes, 2005; Osman & Herring, 2007; Persico et al., 2010; Weinberger & Fischer, 2006). This project used the Interaction Analysis Model (IAM) (Gunawardena et al., 1997), which had been used in other studies, and developed two additional instruments to analyze social presence and knowledge building.

The value of interaction, and the levels therein that indicates community and individual involvement were important to analyze. The IAM (Gunawardena et al., 1997) had been applied in many studies (Garrison & Cleveland-Innes, 2005; Li-Fen Lilly & Jeng, 2006; Osman & Herring, 2007; Persico et al., 2010; Schrire, 2006). The IAM both aided in understanding the interaction occurring in the online community, and also provided an instrument that had external validity through its many past applications.

The importance of social presence in an online community provided another dimension or framework to investigate. Wenger (1999) proposed a social learning theory that described four components as a means to understand learning and knowledge building in a community. Each of these components: Identity, Community, Practice and Meaning provided a different lens or perspective to view participation in a community. Although this specific framework had not been applied to CMDA, the definitions the author gave allowed each of the selected units of analysis to be placed into one of these

four components. A challenge, therefore, was to correctly delineate characteristics of each component so that each unit for analysis was categorized reliably. This is covered in more detail in the section on measuring latent content, and is detailed in Chapter 3.

Most of the research on knowledge building in communities had looked at secondary effects that point towards it, for example interaction, role identity, or presence. Scardamalia and Bereiter (2010) proposed 12 principles that are direct indicators of knowledge building and provided a powerful means to analyze a community conversation. Much like social learning theory, the challenge was defining characteristics or indicators that could be used to map each selected unit of conversation into particular principles. Chapter 3 details the indicators that were generated for this coding and demonstrates a sample run of data to show how this was conducted. More importantly, a particular unit, even if it is only one sentence long, may well contain multiple indicators that place it into more than one principle. For example, it is entirely possible that a statement could indicate the knowledge building principles of Democratization of Knowledge, Epistemic Agency and Community Knowledge. As a result, this framework was coded to allow multiple principles to be assigned for each unit being analyzed. This allowed each conversational unit to be coded into any or all of the 12 principles, giving insight into all aspects knowledge building within that particular conversation.

Summary of Methodology

There were over three years of conversation that had occurred in the online community for the Schools of the Future grant. Purposeful sampling was used to select conversations that focused on problems of practice, issues around school change, or day-

to-day collegial advice and consensus building. Because of the long-term nature of this community, there was a rare opportunity to look at what change if any had occurred in conversation over time. This study examined multiple conversation threads, mapped them to the three frameworks detailed above and looked for commonalities and differences between the frameworks, as well as evidence of changing conversation over time. Since there was a gap in the research about how multiple frameworks can work together when analyzing conversation with discourse analysis (De Wever, Schellens, Valcke, & Van Keer, 2006), this study provided another means to broaden the techniques for making meaning from online conversation. A brief list of recent studies using some form of CMDA is given in Table 1. This list provides a partial view of the specific frameworks that are been used to study conversation as a background for this proposed study.

Table 1: A Partial List of CMDA Studies

Author, date	Framework	Participants
Koh, 2010	Knowledge Construction, Social Interaction	Graduate Students
Myllari, 2010	Knowledge Building	Undergraduate Students
Persico, 2010	Interaction	Pre-service Teachers
Philip, 2010	Interaction	Grade 5 & 6
Schrire, 2006	Cognitive Presence	Doctoral Students
Seo, 2007	Interaction	Undergraduate Students
Tan, 2006	Interaction	High School Students
Thomson, 2009	Interaction and Roles	Undergraduate

Role of the Researcher

I applied the methodology to the public and private conversations that occurred over a 17-month period and used the frameworks discussed above as a means to analyze the two research questions. In doing so, deeper insight was gained about the nature of the

frameworks and how they can be applied to CMDA, as well as a better understanding of the knowledge that existed within the network and how it had grown over time.

I had been involved with the formation, development and support of the online community that was being researched. As a result, I had intimate knowledge about the day-to-day use of the community, as well as professional relationships with some of the members of the community. That said, I was well aware of the need to remain objective about the analysis of this community. My privileged position was one that both provided an opportunity to gain greater insight, as well as a present the danger of being too close to the individuals to correctly tell their stories. This interpretive nature of qualitative research is a common characteristic that creates tension. “Researchers recognize that their own background shapes their interpretation, and they “position themselves” in the research to acknowledge how their interpretation flows from their own personal, cultural, and historical experiences” (Creswell, 2007, p. 21).

There was strength to my visible role in the community, to build trust, to hear the stories that were told on the inside, and to have a sense of the day-to-day lives and stories of those participants. “It is inevitable, however, that a researcher’s presence in a setting has implications for what takes place and how events are given meaning.” (Schram, 2006, p. 133). For this study, I had been a participant and organizer of this community since its inception. As such, I needed to be very aware of my role, and how the community perceived me as I conducted this research. Since none of the corpus that was investigated involved my initiation or response, there was a layer of detachment from the data that built in separation between the participants and myself. That said, I still needed to be very aware of analyzing communication with individuals whom I had been corresponding

with, and worked professionally with, over the course of the community's lifespan. One of the ways to address this was to be explicit in my own work and any impact that connections or participation may have caused. Creswell (2007) stated "in a qualitative study, the inquirers admit the value-laden nature of the study and actively reports their values and biases as well as the value-laden nature of information gathered from the field" (p. 18). A review of recent research studies of this same type revealed other researchers with the same positioning, and addressed their role in much the same way (Cho, Gay, Davidson, & Ingraffea, 2007; Dennen & Wieland, 2007; Garrison & Cleveland-Innes, 2005; Li-Fen Lilly & Jeng, 2006).

Definition of Key Terms

There are important terms that are used within this study and are assumed as common knowledge by the researcher and others in this field.

CMDA. Computer mediated discourse analysis is a method by which textual transcript records from online discussions are coded and analyzed to construct meaning to specific frameworks as determined by the researcher (Herring, 2004).

Social learning theory. Viewpoint developed within cognitive science that views learning as a social phenomenon (Lave & Wenger, 1991).

Knowledge building. Distinguishes information and knowledge by explaining knowledge as a construct that happens between individuals and as a negotiated meaning (Scardamalia & Bereiter, 2010).

Web 2.0. The evolution of the Internet from being a one-way source of information into a conversational space that enables two way synchronous and asynchronous communication (O'Reilly).

Explicit/Manifest Content. Easy to identify rote information that can be quickly identified through words or terms (Rourke, Anderson, Garrison, & Archer, 2000).

Tacit Knowledge. Implied, embedded knowledge that typically exists in a network and is not easily categorized or labeled (E. Wenger, Trayner, Beverley., & De Laat, Marten, 2011).

Latent Content. Hidden or implied meaning that is more common in deep conversations and requires some interpretation to analyze (Rourke et al., 2000).

Summary

It is an exciting and challenging time in education. There are more ways for teachers to interact as professionals that have ever existed before, but there is also the challenge of adapting to a world that has changed dramatically. The opportunities presented by online social networks are still being fully leveraged as teachers use these as a means to share and build knowledge together. This study was designed to add to the understanding of how teachers build knowledge in these online communities.

One of the opportunities that existed was that much of the professional conversation in education was happening in forums where the transcript was archived and available long after the initial conversation. That provided educators an opportunity to interact, assess, and continue to build knowledge long after a conversation had ended. The development of three frameworks in this study and their work in tandem provided an enhanced means to look at professional conversations, and determine if there was growth within the individuals participating in the conversation.

In Chapter 2, a more detailed analysis of how professionals build professional knowledge, factors that limit and open up opportunities for greater growth and how emerging technologies create platforms that make new ways of building and examining knowledge easier.

In Chapter 3, methods of analyzing online conversation are laid out, three frameworks are selected and developed to better understand online knowledge building. Specific examples of the frameworks are given, and examples of mapping these frameworks to an actual conversation are included.

In Chapter 4, the data collected from the methodology will be analyzed, organized and shared. This rich data set provided many ways to view and query the different representations of each set individually as well as combined.

In Chapter 5, the implications, challenges and further directions of the data will be covered. As is often the case, uncovering a story behind data leads to new questions and a need for deeper investigation. This study both shares some new ways of looking at informal communities of practice and provides opportunities to both look deeper and more broadly on this topic.

CHAPTER 2. REVIEW OF LITERATURE

There is a challenge in education. The world, and therefore the expectations of how schools should prepare students for it, has changed dramatically due to advancements in technology, globalization, and our understanding of how intellectual capacities can be leveraged to improving learning. In order to improve student learning, teachers need to improve their professional practice. Teachers require time, support, expertise and alignment with their goals to achieve better performance. It has become clear that teachers, like all professionals need to grow professionally as lifelong learners (Chalmers & Keown, 2006). To understand the context for this study, the remainder of this chapter explores some of the factors that lead to improved teaching, and therefore directly to student learning. These topics include: improving teacher capacity to change and the role that self-efficacy plays; professional development that works; the role of communities of practice to build professional knowledge; teacher professional growth through social interaction; electronic communities and how they build professional dialogue; and how Web 2.0 tools have created more powerful ways to communicate. To start, we need to understand the conditions by which professionals become more malleable to change. Studies on self-efficacy help make this clearer.

Building Internal Capacity and Self-Efficacy

It is important to understand how teachers build the internal capacity to acquire new knowledge. Professionals must believe that they have the capacity to organize and execute ideas to attain a desired performance. Bandura (1977) developed an

understanding of how individual self-efficacy arises and leads to persistence and motivation towards mastery of a specific field. He details four main sources of self-efficacy in individuals: performance accomplishments, vicarious experience, verbal persuasion, and emotional arousal. Each of these leads to a more engaged, self-confident professional.

The importance of social learning in this process is powerful. The power of group experience leads to greater self-confidence and incrementally improves feedback, action, expectation, and performance (Bandura, 1977). "People process and synthesize feedback information from sequences of events over long intervals about the situational circumstances and the patterns and rates of actions that are necessary to produce given outcomes." (Bandura, 1977, p. 192). Moreover, it is clear that learning does not start from a blank slate, as all learners start with some prior knowledge. Vygotsky's Theory of the Zone of Proximal Development (1978) establishes the idea that learning occurs in the gap between what is known and what needs to be learned or acquired. As stated by Vygotsky, this Zone is "... is the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem-solving under adult guidance or in collaboration with more capable peers" (Vygotsky, 1978, p. 86). Vygotsky recognized the social component that is inherent in this learning. He argued that although learning is an internal process, only when an individual interacts with peers do pathways become constructed between prior and new thinking. It is a highly complex and dynamic relation between learner, environment, and experience.

This is important when researchers consider how to build professional knowledge, as all teachers have prior educational experiences as teachers or learners throughout their lives. Prior knowledge can be perceived as both a negative and a positive asset. Sometimes professionals are dismissed with their prior, older knowledge with maxims like 'it is hard to teach an old dog new tricks'. However since all learning happens by connecting to prior knowledge a positive opportunity exists to build on this older knowledge. One of the goals of designing a powerful learning experience is to leverage this prior knowledge and connect it to interactions within a community. Collegial interaction allows for independent problem solving and collaboration with more capable peers with diverse experiences.

Understanding Self-Efficacy in Education

The field of education is going through a dynamic period. New ideas about how students learn and the process by which successful classrooms operate are being disseminated to schools at a rate that challenge many educators. Recent developments such as testing under No Child Left Behind, new requirements under Race to the Top and the Common Core Standards, problem based learning, differentiated instruction, multiple intelligences, and portfolios have become just some of the important topics for teachers to add to their repertoire of skills and knowledge. Studies done in the 1970s by the RAND Corporation looked at the conditions under which teachers believe they have the ability to improve student performance (Evers, Brouwers, & Tomic, 2002). This pointed to examining self-efficacy, and it was determined that a high level of teacher self-efficacy was tied to high student performance (Tschannen-Moran, Hoy, & Hoy, 1998). "Above all, teachers' sense of efficacy emerged as a powerful explanatory variable; it had major

positive effects on the percentage of the project goals achieved, improved student performance, teacher change, and the continuation of the project method and materials." (Berman, 1977).

Some studies have shown that the theories teachers bring to the classroom have an impact on both their self-efficacy and their ability to set up positive, constructive classroom environments (Leroy, Bressoux, Sarrazin, & Trouilloud, 2007). In other studies, teachers with high self-efficacy experienced less burnout, were less affected by external factors and were supported positively by collective teacher efficacy. Some researchers have examined collective teacher efficacy, which is measured as teachers work in teams (Skaalvik & Skaalvik, 2007). It is notable that teachers' perception of team effectiveness greatly influences results. This result applies to this study, as any interest in professional online communities as a means to build teacher growth has powerful implications. The importance of understanding social development of efficacy relates directly to teachers success.

This aspect of the collective effect of a social network or community has powerful implications with the emergence of 21st-century social media. Both from a theoretical framework, and from data collected in research studies, it is clear that peer support and social networks are significant and are underutilized factors in developing higher self-efficacy in teachers.

Community, Social Networks and Building Teacher Culture

Many studies (Brouwers, Evers, & Tomic, 2001; Evers et al., 2002; Kokkinos, 2007; Schwarzer & Hallum, 2008; Skaalvik & Skaalvik, 2007) examine how social learning reduces stress or improves student outcomes, but the directional asking of

whether social learning affects self-efficacy is less studied and understood. This is a potentially powerful direction to study because the reciprocal nature of self-efficacy in determining resiliency, better professional expertise and relationship building is less understood. Moreover, these characteristics are not the only determining factors. For example, a study of 447 primary school teachers in Cyprus showed that although aspects of classroom management, decision-making involvement, and relations with colleagues have an effect on self-efficacy and stress, personality traits such as neuroticism, openness and extroversion had a stronger effect on stress and burnout. The authors make the case that both external factors and personality traits need to be considered when looking at causes and mediation of stress and burnout in the teaching workplace (Kokkinos, 2007). In another study, the strongest variable that affected teacher growth was the lack of emotional support within the school system in the teachers' professional life (Brouwers et al., 2001). To understand and affect teacher growth it is important to consider that learning is a complex process with many interconnected variables.

The results from these studies on self-efficacy, like those mentioned earlier in the chapter, give strong indications about the linkage between self-efficacy, student achievement, workplace stress and burnout. Although there are some differences in the findings from these studies, there is a common connection that stems from Bandura's (1977) initial ideas and research. Much of the research conducted confirms the links between measured teacher self-efficacy and student achievement, workplace stress, institutional climate and social and collegial structures. "Schools where teachers work together to find ways to address the learning, motivation, and behavior problems of their

students are likely to enhance teachers feelings of efficacy” (Tschannen-Moran et al., 1998, p. 221).

One of the challenges facing educators is that their role is still mostly an isolated experience. Teachers spend most of their time in the classroom by themselves working with adolescents and they spend a relatively small percentage of their time interacting with colleagues planning, observing, discussing ideas of their craft (Carroll, 2000; Darling-Hammond, Wei, Andree, Richardson, & Orphanos, 2009; Glazer, Hannafin, & Song, 2005; Klein, 2005). For teaching to improve, this culturally accepted isolation must change as well. “If we are going to continue preparing educators to work as solo, stand-alone teachers in self-contained, isolated classrooms, we are going to perpetuate the schools we have today” (Carroll, 2000, p. 118). Looking at Bandura’s four sources of self-efficacy, isolation will impede professional growth most of the time. In order to create opportunities for verbal persuasion or for vicarious experience there needs to be a means for teachers to become more involved with each other professionally. A recent report, however, indicates that American teachers spend too little time in professional development sharing and building knowledge together (Darling-Hammond et al., 2009; Vavasseur & MacGregor, 2008). American teachers spend only 3 to 5 hours week planning collaboratively compared to 15 to 20 hours a week by their European counterparts. One way for this to change would be to implement and support collegial conversation, sharing of ideas and building of professional knowledge through social networks (Katz & Earl, 2010).

Online Communities Supporting Learning

Online social networks now enable synchronous and asynchronous professional conversations. These meeting areas allow posting of ideas, teaching artifacts, and even video for classroom teachers to share, learn, and build a professional conversation about their craft. The need for teachers to adopt new ways of sharing professional knowledge is as critical as their need to have students learn a new set of core 21st-century skills and competencies (Wagner, 2008). There is an opportunity to conduct research to better understand how social networks, and in particular web-based social networks can support more professional conversation for teachers to build self-efficacy (Brouwers et al., 2001; Evers et al., 2002; Tschannen-Moran et al., 1998). The importance of using communities to improve teacher self-efficacy is well documented. If a school has a greater sense of collective self-efficacy, the teachers in that school will have with higher individual self-efficacy (Tschannen-Moran et al., 1998). The opportunity of using online social networking and media is a relatively new development. There has been a great reduction in cost, greater access in and out of schools, and most importantly, higher adoption rates of social media platforms amongst adults.

There are two opposing forces at work in education. Low teacher efficacy is linked to low student performance that, in turn decreases teacher efficacy more. This effectively spirals down performance. On the other hand, the importance of effective leadership and the involvement of teachers in a learning community are extremely important in keeping the spiral moving upward (Tschannen-Moran et al., 1998). A deeper understanding of what changes teacher instructional practice is necessary to investigate possible solutions. This is explored in the next section.

Studies on Successful Models of Professional Development

Ultimately, the goal of formal education is to improve student learning. Teacher instructional practice is the means by which student learning is mediated. In a meta-analysis on studies of teacher professional development, Desimone (2009) investigated aspects of teacher professional development programs that had a focus on improving student learning. Figure 1 highlights the results of her work. In examining a variety of

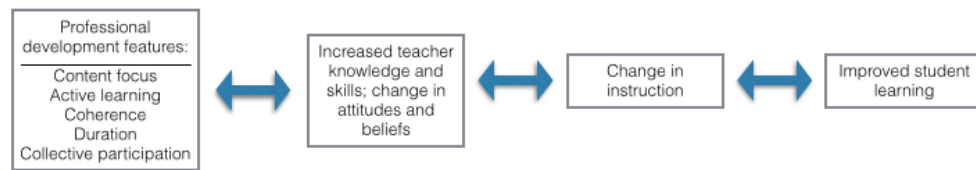


Figure 1: Desimone's Professional Development Matrix

research studies that looked at teacher professional development and student learning, she identified some specific characteristics of professional development that need to be considered in order for teaching practice to change. Although this author makes the case that there is still more research needed for a direct link between professional development and student learning, there are elements of professional development that do affect teacher practice. Most importantly, professional experiences need to center around content expertise in the domain for the teacher. It is critical that teachers understand the general central facts and concepts of their discipline. Without content mastery, real professional development cannot happen (Borko, 2004). Additionally, beyond mastery, these learning experiences need to create active engagement on the part of the teacher, and there needs to be coherence between the activities in the professional development

activities and the subject domain that the teacher is building expertise in. This implies an alignment between the teacher's knowledge and beliefs, and the experiences they are having in their professional development. Lack of teacher involvement in shaping their own learning experiences hurts ground-level commitment and therefore the growth of teachers. This importance of involving teachers gets to the main idea of coherence, since teachers know best the alignment between their needs and their expertise (Darling-Hammond et al., 2009; Kay, 2006). Although there are times when administrators believe that teachers do not understand what would best suit their needs, there is a high degree of reliability in teachers self-reporting their needs and abilities (Darling-Hammond et al., 2009; Desimone, 2009). As a result, those who plan professional development need to take into account teachers' own self-reported needs when they think about their planning, and those who design communities to build knowledge, should allow for teachers' own direction within that network.

There also needs to be a sense of collective participation, and an extended experience (Angers & Machtmes, 2005; Chalmers & Keown, 2006; Du & Wagner, 2007; Glazer et al., 2005). Studies indicate that strong communities foster learning and instructional improvement and interaction is an indication that professional knowledge is growing (Borko, 2004). Some important features include norms developed by the community as well as behaviors and shared responsibility to support teachers' growth. When researchers look at teacher growth "as in the case of student learning, situated perspectives provide a powerful research tool, enabling researchers to focus attention on individual teachers as learners and on their participation in professional learning communities" (Borko, 2004, p. 4). There is a common problem that one-time professional

development occurs in schools, and these kinds of experiences do not lead to extended thinking or change on the part of the teacher (Klein, 2005). It is important to engage teachers as learners in the community and have them discuss their experiences. A variety of studies show that important features include communities of learning, teachers being active, and opportunities for critical collegiality. These key ideas are confirmed by other researchers across different studies (Ball & Forzani, 2007; Borko, 2004; Bransford, National Research Council (U.S.). Committee on Developments in the Science of Learning., & National Research Council (U.S.). Committee on Learning Research and Educational Practice., 2000; Carneiro, 2006; Darling-Hammond et al., 2009; Kay, 2006; Vavasseur & MacGregor, 2008).

A new professional development paradigm is apparent with teacher as learner, as reflective decision-maker, and as collaborator. Conditions that would strengthen this include enabling clear leadership, allowing risk-taking, understanding individual differences, making time for collaboration, and modeling the same behavior by administrators (Martin & Kragler, 1999; Vavasseur & MacGregor, 2008). This situated nature implies the need for authentic activities as teachers build professional knowledge. Learning is partly a function of adopting the cultural practice of the community, whether it is in school or out of school, in which teachers participate (Putnam & Borko, 2000). This merging of good professional practice with technologies that support collaboration has led to a widespread adoption of online communities of practice.

Research on Communities of Practice

Wenger, McDermott, Snyder, & Net Library Inc (2002) state, “Communities of practice are groups of people who share a concern, a set of problems, or a passion about a

topic, and to deepen their knowledge and expertise in this area by interacting on an ongoing basis” (p. 4). Traditional teacher professional development has been largely based on the assumption that learning was an individual process. Moreover, research shows that in the United States there is not a sustained effort to build communities or share professional knowledge compared to other nations’ educational efforts. There is a lack of involvement of teachers shaping their professional learning experiences which hurts ground-level commitment and growth of teachers. It is uncommon for teachers within the school, alone outside of school to share and collaborate regularly with their peers (Darling-Hammond et al., 2009).

The tenets of social learning theory recognize the vital component that social participation plays in this integral activity in our daily lives. Communities of practice define themselves by the ways their members participate. Learners come together because participation in the group has meaning to its members. Their coming to together is about a specific activity or topic and this information is important to the functioning of any organization and is a key asset of communities of practice (E. Wenger, 1998, 1999). Whether the community is formal or informal is less important than the structured process of how the community works. Informal collaboration is common in the professional life of teachers, so participation in communities of practice, even when informal, provides a personal connection to the community (Stevenson, 2004). Experienced and new teachers alike “do not actually learn from experience as much as [they] learn from reflecting on experience” (Posner, 2005, p. 21). The informal spaces these online communities provide allow teachers to find the most appropriate resource, colleague or answer at the right time. Features that lead to professional growth include

active engagement, coherence with teacher's knowledge and beliefs, extended duration for opportunities, and participation in discourse that centers on content knowledge and expertise (Desimone, 2009; Nelson, Slavit, Perkins, & Hathorn, 2008). This runs counter to most of the traditions of institutional learning, which are largely based on the assumption that learning is an individual process. There is still a need to recognize and apply the tenets of social learning theory (Bandura, 1977; Lave, 1996; McLellan, 2000; E. Wenger, 1999). Within a typical community of practice participants fall into hierarchies that include passive watchers, sometimes referred to as lurkers, and individuals who actively exchange ideas. Within a community of practice, it is common for new participants to assume passive, more peripheral roles though as time goes on they take a more active stance within the community (Lambson, 2010). This evolution in their role is typical in most learning environments that involve community building and shared expertise, so learning is understood to be an evolving form of membership in the community (Lave, 1996; Lave & Wenger, 1991). The importance of community has been identified in research for many years. Tschannen-Moran et al. (1998) summarized extensive RAND research on teacher self-efficacy from the 1970s. Although there were other factors that led to higher teacher professional growth and success, the important role of community was recognized as one of the contributing factors. Their research identified that more opportunities for collaboration increase teacher's sense of self-efficacy. "Schools where teachers work together to find ways to address the learning, motivation, and behavior problems of their students are likely to enhance teachers feelings of efficacy" (Tschannen-Moran et al., 1998, p. 221).

In conclusion, teachers must have extensive experiences for growth to happen and one of the ways that this can occur is through the extended time and support that ensues in face-to-face and online communities. One of the challenges is that many new teachers only see examples around them of traditional teaching. A participatory learning community has the power of expanding visibility of a variety of teaching practice for these teachers (Bransford et al., 2000).

Web 2.0 Enables and Empowers Professional Conversation

Although online communities have existed since the middle of the 1990's, the full capabilities of social interaction has been limited. Course management software such as WebCT, Blackboard and Moodle has incorporated little of the social networking features that have become common on websites like MySpace and Facebook (Du & Wagner, 2007; Wagner, 2008). Tools like weblogs have the power to create greater interaction due to their ability to archive, create immediacy in conversation and allow many to have equal voices in professional or personal discussions (Baggetun & Wasson, 2006; Koszalka, 2001; Tapscott & Williams, 2006). These new Web 2.0 tools open up the possibility for more sharing, communicating, resourcing, and archiving. "New technologies provide opportunities for communication and online learning that can connect teachers with others who share their interests and needs" (Bransford et al., 2000, p. 194). Additionally, there is clear evidence that by using a tool, there is much greater likelihood that the teacher will understand its implications and use it more appropriately in their teaching (Koszalka, 2001; Matzen & Edmunds, 2007; Rakes, Fields, & Cox, 2006). In a 2006 national study of Finnish teachers, researchers investigated the use of electronic communication in staff development and examined how teachers that used this

online communication tool described and adopted the same technology. They were specifically interested in applying Rogers (2003) diffusion theory regarding the adoption of technology. The researchers then studied if the teachers were then more likely to use the tool. Their results showed that when teachers conversed using technology, they were more likely to consider their use of that technology in their day-to-day work (Lavonen, Lattu, Juuti, & Meisalo, 2006). The interaction that Web 2.0 applications offer for teacher communication is important. In another study by Koszalka (2001), 45 K-12 teachers from 6 US states read an article online. The control group emailed their reflection, but the treatment group was allowed to share their responses in a public forum. The treatment group had a higher affective score due to the conversational aspect of the experience. This is not surprising, since there is a clear link between collegial sharing, and teachers' sense of self-efficacy and community as discussed earlier. Chalmers (2006) makes the case that lifelong learning has become necessary and prevalent. The authors distinguish in-service sessions from professional development, which they see as more reflective, sustained, and powerful. Web 2.0 tools by their nature support this kind of extended, highly interactive conversation among individuals.

Another important aspect to consider is the depth of conversation. There is a tendency in professional conversation, whether face-to-face or online, for knowledge confirmation, which is a lower level way of knowing. Higher-level conversations involve comparing and contrasting ideas, negotiation, synthesis, re-articulation, and adoption. If conversation can be steered to a higher level, the impact is greater. To make the experience more powerful, deeper conversation needs to include negotiation, co-constructions, application and innovation (Lavonen et al., 2006). All of these aspects of

conversation are elements that are recognized constituents of real learning. Reflective opportunities are also a significant element in professional growth, as it leads to teachers changing and adopting new ideas and strategies. The nature of online communities and teacher involvement supports this behavior (Dawson, 2006).

Implications of Teacher Growth and Technology in Research Design

In a case study of transforming communication and knowledge in a research university reported by Szabo and Sobon (2003) participants “acknowledged the value of collaboration and sharing of knowledge related to the diffusion of this innovation” (p. 6). Likewise, in an interpretive case study of three novice teachers, Lambson (2010) found that a community of practice over time increases the centrality of novice teachers’ participation in the community, as well as the frequency in which they participated and built knowledge through the community. Talking and sharing builds confidence, knowledge, and positive direction in a community. This is confirmed by the research from Bransford et al. (2000): “Overall, two major themes emerged from studies of teacher collaborations: the importance of shared experiences and discourse around texts and data about student learning and the necessity for shared decisions.” (p. 198).

Designers and researchers should understand that the design of online virtual spaces determines the way teachers use them. Outside of work and home there lies a third place where individuals go to be part of a social experience. These new places for connecting to community are online virtual worlds, where individuals search for social interaction, as well as an opportunity to build personal and professional experiences (McLellan, 2000). As Bransford et al. (2000) realized:

“...action research is a constructivist process set in a social situation, teachers beliefs about learning, their students, and their conceptions of themselves as learners also have learners are explicitly examined, challenged, and supported. When action research is conducted in a collaborative mode among teachers, it fosters the growth of learning communities” (p. 199).

It is well understood that both participating in positive professional growth experiences and even observing vicariously builds confidence (Bandura, 1977; Lave & Wenger, 1991). This social persuasion through observation and conversation has a positive effect on adopting new ways of thinking and creating ownership by the participant (Ball & Forzani, 2007; Scardamalia & Bereiter, 2010). Moreover, since teachers learn from their own practice, from other teachers, and from experts, these participative experiences provide opportunities to connect teachers with others who share their interests, and therefore engage their emotional perspective (Borko, 2004; Bransford et al., 2000). Extensive experiences must occur for lasting change to happen. Therefore, it is important that encouraging conversations extend over time to build professional growth of teachers. At the same time, teachers engaged in the use of tools during their professional development gain proficiency and therefore are more likely to wrap these tools into their professional growth and instructional practice (Bransford et al., 2000; Carneiro, 2006; Dawson, 2006). In a study of 143 teachers in a graduate class in Portugal, Carneiro (2006) investigated factors that affected their success in online learning. In one question, 90% of the teachers said that technology was a natural learning environment. One of the lessons was that instant tools like email and chat are at first

preferred, while forums and therefore a tool like blogs take more time to develop an appreciation and understanding, since there is a delay in the building of knowledge (Carneiro, 2006). As teachers become more versed and immersed in online forums and communities their participation and learning will expand.

Web 2.0 specific language/resources

Online social networks provide a new means to support a teacher's involvement in a community of practice. As teachers adopt new innovations to share, build, converse and reflect, online communities open up opportunities for teachers to extend the time and space they can commit to develop new skills and knowledge (Chalmers & Keown, 2006; Rogers, 2003). Online social tools align well with professional development that allows learners time to reflect, interact with other teachers and examine issues in their fields (Chalmers & Keown, 2006; Glazer et al., 2005). The design of online communities allows distributed cognition so tacit knowledge is shared within the community and by its nature is powerfully situated for and with the learners (Gunawardena et al., 2006; Jonassen, 2004). Powerful informal communities require cooperation, spontaneity and informality. This kind of informality allows teachers time for risk-taking and adoption of new ideas (Angers & Machtmes, 2005).

“Helping teachers become comfortable with the role of learner is very important. Providing them with access to subject matter expertise is also extremely important. New developments in technology provide avenues for helping teachers and their students gain wider access to expertise”
(Bransford et al., 2000, p. 195).

Online tools like weblogs are superior to paper-based learning logs in how they create immediacy and knowledge sharing in conversation, their ability for collaboration and group work, their permanence in creating an archive of ideas to be reviewed and the feedback that is quicker and more timely. For example, a research study by Du and Wagner (2007) showed that weblogs were the single best predictor of student achievement when used for enhancing knowledge construction. This kind of learning opportunity supports teacher learning as much as students. One of the outcomes of this is that teachers build knowledge using these tools in the way that they interact professionally, and then these tools become part of their professional practice over time (Margerum-Leys & Marx, 2004). The more teachers use these tools the more they see them as a means to improve their practice. There is both an inherent trust in the community and a power in showcasing and talking about your professional work. As Borko (2007) stated “One way researchers in this genre ensure quality and rigor is by considering their work to be community property and therefore available to others for review and critique” (p. 6).

One of the strengths of the participatory evolution of the web is to provide access to expertise real-time, all the time. The emerging ability for teachers to access expertise and collegiality through online communities greatly enhances opportunities for professional growth and reflection (Bransford et al., 2000; Putnam & Borko, 2000). Online communities are more capable of working with ill-structured problems that dynamically evolve over time. In these environments knowing is not rewarded as much as using information to solve problems (Jonassen, 2002).

Challenges of Community Development

The development of a community of practice is not easy. It is time-consuming and difficult due to the inherent tension in maintaining respect in the community. Group norms need to allow members to challenge and critique issues the community forms around. The role of leadership and facilitation is an important factor in professional development (Borko, 2004). The rewards of teacher participation must be consistent with their perceived value of the community, as their involvement in shaping their own learning experiences is a pivotal feature of successful professional development (Darling-Hammond et al., 2009). There is an inherent challenge in creating communities from which learners go back to traditional workplaces and struggle against institutional inertia (Thomas et al., 1998). Some of the features that mitigate this challenge are the development of norms and behaviors, as well as shared responsibility for supporting each other. As learners are drawn in, there needs to be worthwhile learning experiences that build presence and higher engagement (Garrison & Cleveland-Innes, 2005). It is an interesting dilemma that good design is invisible and makes the community easy to run, but poor design is highly visible, and can make participation difficult enough in the community to ruin it (E. Wenger, White, Smith, & Rowe, 2005). There is also a danger in everyone doing their own individual work, and not listening to and supporting each other (Skinner, 2007). Another challenge in computer-mediated conversation is the role of turn taking. In spoken conversation, there is an economy which flows naturally where speakers alternate turns seamlessly. In online environments this natural turn taking is stilted, and the community design as well as its members need to adjust to this challenge (Herring, 1999). In a community of practice, learners do not have to be continuously

present together, but their norms for behavior as a part of the community can support shared understanding in these gaps (Jonassen, 2004).

Research Methods Using Qualitative Methodology

There has been extensive research on learning and interaction in face-to-face and online communities that occur due to structured events and specific learning groups like conferences, classes and workplace training. In these formal situations, the community is lead by a strong central voice, often a teacher or program facilitator. These communities typically have a closed time period in which participants exchange information and ideas and often have requirements or expectations that members must contribute during certain windows of time. For example, in a study by Garrison, Cleveland-Innes, Koole & Kappelman (2006), four online courses were examined to look at how learning happens in forums that were required as a part of the students' course grade. The researchers examined participation levels and examined how well enrolled students met the course learning requirements. Cho (2007) studied social networks and how they supported learning an aerospace class. In this study, two remote classes shared a common design problem. These networks were part of the class design, and the author found that those who were more committed to the community performed better.

There is a second class of online communities that is more informal, where there is still a strong sense of identity and core mission about the reason for existence, but the centrality of the community is more based on participation and generalized community agreement, not due to a central authority figure that is accountable to and for the community. In these cases, membership rises and falls as topics and relevance ebb and flow. These online informal learning communities have become more prevalent and

provide a rich area for study as professionals have increased their participation as a means to converse, share ideas and passions, and build knowledge. Although there has been research on learning in these communities, there is still much to be understood and developed to support questions about their nature and how they support community conversation, value creation and knowledge building (E. Wenger, Trayner, Beverley., & De Laat, Marten, 2011).

In both formal and informal communities, there are common approaches to examining the exchanges, interactions and transactions that occur. One of the ways which qualitative research strengthens understanding from research is by viewing the data through different viewpoints, or lenses. It is common practice when examining a group of individuals to view their exchanges through the textual transcript record, through interviews, and by using some group means of conversations such as focus groups (Angers & Machtmes, 2005; Borko, 2004; Somekh & Lewin, 2005; Yin, 2009). Table 2 lists a few of the studies that have used a multi-lens approach to approaching the research question from multiple perspectives (Angers & Machtmes, 2005; Du & Wagner, 2007; Gunawardena et al., 2006; Koszalka, 2001; Lavonen et al., 2006; Stevenson, 2004).

The qualitative paradigm is suited to multiple lenses to broaden and deepen the narrative being examined. The challenge is the necessity of reaching out to and interacting with the study participants. This study is tailored to examine three different lenses that do not require interaction with participants but instead view their dialogical processes through different lenses to broaden and deepen the understanding of their interaction.

Table 2: Teacher Growth Studies Using Multiple Lenses for Triangulation

Authors	Year	Lens 1	Lens 2	Lens 3
Stevenson	2004	Questionnaire	Interview	Focus Group
Angers & Machtmes	2005	Researcher Observation	Participant Observation	Interview
Du & Wagner	2007	Learning Outcome	Learning Process	Weblog use
Gunawardena et al.	2006	CMDA	Surveys	Concept Maps of Learning
Koszalka	2001	Interviews	Attitude Survey	
Lavonen	2006	Questionnaire	Field Notes	Self-Evaluation

Defining Knowledge Building

The distinction between learning and knowledge building is a relatively new occurrence. Whereas learning had been seen as an individual's cognitive activity, knowledge building has its origins in understanding how groups build common understanding. The idea of a social component to learning was championed by Vygotsky (1978), who explored the underlying importance of interaction in learning. His theory of the Zone of Proximal Development expanded thinking about the role of interaction and shared meaning in learning. Since knowledge building can be viewed as a situated activity, the learning process in the community can be viewed through the shared experiences and communications that occur therein. Learning occurs socially as the collaborative construction of knowledge. Of course, individual members are involved in

this group activity, but these activities that they engage in are not individual learning activities, but group interactions such as negotiation and sharing. The participants may have gone off to do things individually, but returned and engaged with a shared task that was constructed and maintained by and for the group (Sawyer, 2002). This understanding of group construction of knowledge allows a variety of venues through which to view the knowledge building process.

For example, the ways in which teachers build knowledge can be viewed through many of the activities that occur for them professionally. “For teachers, learning occurs in many different aspects of practice, including their classrooms, their school communities, and professional development courses or workshops” (Borko, 2004, p. 4). Early studies in online computer environments showed promise in investigating knowledge construction online (Sawyer, 2002). Scardamalia and Bereiter (2010) distinguish knowledge building from general constructivism in two ways:

“Intentionality: most learning happens naturally/unconscious, but knowledge building implies a purposeful effort on the part of the learner.

Community knowledge: whereas learning is personal, knowledge building is something that a community actively engages in” (p. 2).

With this in mind, a variety of tools had been developed to analyze these aspects of knowledge building in face-to-face and online communities. Henri (1991) developed some of the early techniques in examining cognitive dimensions in transcripts. In particular, this investigation of cognitive dimension and interaction has been replicated and built upon since the original research was published.

Studies that have applied CMDA over the past 20 years have used, developed and expanded a variety of constructs to view knowledge building in communities. Some of these studies grouped by their CMDA constructs are listed in Table 3.

Table 3: Past Computer Mediated Discourse Analysis Studies

Construct/Framework	Author(s)
Interaction	D. Randy Garrison & Cleveland-Innes, 2005 C. N. Gunawardena et al., 1997 Henri, 1991 Li-Fen Lilly & Jeng, 2006 Osman & Herring, 2007 Persico, Pozzi, & Sarti, 2010 Schrire, 2006
Participation	Dennen & Wieland, 2007 Jamaludin, Chee, & Ho, 2009 Persico, Pozzi, & Sarti, 2010 Weinberger & Fischer, 2006
Functional Moves	Osman & Herring, 2007
Community of Inquiry	D. Randy Garrison & Cleveland-Innes, 2005 Li-Fen Lilly & Jeng, 2006
Argumentative Dimension	Jamaludin, Chee, & Ho, 2009
Teaching Presence	Osman & Herring, 2007 Persico, Pozzi, & Sarti, 2010 Vavasseur & MacGregor, 2008
Cognitive	D. Randy Garrison & Cleveland-Innes, 2005 Henri, 1991 Persico, Pozzi, & Sarti, 2010
Knowledge Construction	C. Gunawardena et al., 2006 Jamaludin, Chee, & Ho, 2009 Tan & Tan, 2006

Each of these frameworks was applied to view transactions in a community through a particular lens based on the research questions from each researcher. Each researcher makes clear their rationale for using specific frameworks and whether they have been used before, or if they are newly developed to fit the frame of their research question.

Summary

In the world of education, the pressure has been mounting for schools and teachers therein to adjust to the new realities of what we understand about learning and preparing learners for their future, which is remarkably different than our past. The ways by which teachers change their practice are complex, and many forces are at work to keep the status quo. Yet, there are clear proven ways to support the professional change in teachers that are needed. Most notably, technology, and particularly the World Wide Web and its development of tools that support communication and collaboration have provided a venue that aligns with best practice models of professional change and leverages a fundamental human instinct for social interaction.

The use of communities of practice existed long before online tools made asynchronous and far-flung individuals connected in powerful ways. The power of Web 2.0 tools to enable new supportive communities provides an opportunity, but more needs to be understood about how information and more particularly knowledge is built in these communities and networks. In the next chapter, social participation, online social communities and teacher professional growth are connected to the research design and methodology for this study.

CHAPTER 3. METHODOLOGY

This chapter will address the methodological choices that were made to conduct the study. This chapter is organized to first review the purpose and rationale for this study. A qualitative approach was utilized in this study and the basis for that choice will be explained. Next, I will detail the population and community chosen as well as the demographic information from which this study was drawn. There will be a discussion of the rationale for the information that was selected to study. Choices on instrumentation, sample size and classification schema will be explained. These choices led to the particular research design that was developed and applied. The data analysis and process for synthesis will be discussed, including supporting documents that were used to make an audit trail of this study more accessible. The issue of trustworthiness will be addressed at the end of this section.

Introduction and Overview

The purpose of this study was to develop, implement and analyze tools that could provide evidence of knowledge building in informal online communities. The approach taken in this study was driven by the need to best shed light on the community in question. For the purpose and research questions of this study, a qualitative approach was an ideal fit. Qualitative research by its nature is best suited to complex social phenomena with multiple views in multiple sources of data. Qualitative research provides a view at the personal, micro-level that suits itself to understand individuals “with the intent of reporting multiple realities” (Creswell, 2007, p. 18). One of the strengths in this method

is that it "...is a situated activity that locates the observer in the world... At this level, qualitative research involves an interpretive, naturalistic approach to the world" (Creswell, 2007, p. 36). In qualitative research there is an understanding that there might be multiple truths, and as result there is a need for holistic, contextual descriptions (Schram, 2006). Since the purpose of this study was to investigate how an informal online social learning community supported efforts to change knowledge and behaviors, the interpretive nature and multiple possibilities within the qualitative approach were suited to this activity.

One of the hallmarks that distinguishes qualitative research from quantitative is the extent to which the researcher has control over events and outcomes during the research (Yin, 2009). The inherent nature of the qualitative approach allows a more holistic view of the area being studied, and allows it to unfold naturally. Moreover, the research does not just report summary of data, but adds meaning and tells a more personal, detailed story. In much the same way that a baseball umpire makes a decision whether a pitch is a strike or a ball, this study involved shaping decisions and making meaning from the data and highlighting their relevance to bring it to life (Patton & Patton, 2002). In qualitative studies, researchers may have been looking at small events and experiences, but with proper perspective and analysis they help support an understanding of larger issues. Qualitative research in this study was not just about searching for ways to understand knowledge building, but gleaning the connection from that understanding and what it revealed about the human condition. The researcher's perspective mattered: "This means building upon a stance that positions you to view the world a certain way and deciding

upon a lens through which you will be filtering your ideas and perceptions.” (Schram, 2006, p. 40).

Research Design

Restating the research questions from Chapter 1:

1. Do current frameworks for understanding learning in social online environments provide the analytical tools through computer mediated discourse analysis (CMDA) to analyze teacher adoption of new professional practice?
2. What professional knowledge is constructed as an online professional community evolves over time and what tools can aid in understanding this question?

It was important to fit these questions within the historical approach taken in online learning environments, and to apply tools and instruments, as well as approaches that were already within the literature. In order to understand the process by which teachers undergo professional growth and change, it was necessary to gain an interim understanding of the thinking and conversations that transpired as teachers shared and built their knowledge in the community.

The methodology utilized in this study was computer mediated discourse analysis (CMDA) as detailed by Gunawardena, Lowe and Anderson (1997), Herring (2004), and Saldana (2009). One of the strengths of analyzing online communities was that they leave a textual trace that could be accessed and viewed over time. Herring (2004) stated that participants interact through text primarily, in fact “constituted through in by means of discourse: Language is doing, in the truest performative sense, on the Internet” (p. 339). In prior studies, the analysis of conversation in CMDA ranged from the linguistic

aspects of words and sentences to large-scale structures examining identity, community and meaning-making.

Knowledge was not taken as a static object, but constructed through social interaction and exchanges. As the community conversed over time, there was both value in the immediate, explicit nature of the information and knowledge being exchanged, as well as the tacit, aggregated layered knowledge that the community accrued over time. Both of these types of knowledge built value in the community (E. Wenger et al., 2002; E. Wenger, Trayner, Beverley., & De Laat, Marten, 2011). Although research on interaction in learning networks had been ongoing, there was still a need to better understand how the structure of online communities supported and accrued the learning of its members through the knowledge constructed in the network (Cho et al., 2007).

The Qualitative Paradigm

This study was designed as a case study. In case study research, the questions that were answered deal with “how” and “why” (Yin, 2009). In this particular study, the online community formed a single case from which the research questions could be addressed. The value of researching this case was the opportunity to open up the voices within that community. Creswell (2007) argued that the “strongest and most scholarly rationale for study, I believe, comes from the scholarly literature: a need exists to add or fill a gap in the literature or to provide a voice for individuals not heard in literature.” (p. 102). Chapter 2 included a set of qualitative case studies that examined variety of different formal and informal learning communities. These formed the historical research record upon which this study was based.

One of the opportunities that existed, and was addressed in this study, was comparing different instruments that measure aspects of community conversation. As stated in Chapter 2, there are not many examples in CMDA research that compare and contrast instruments of this sort. It is more common to find research studies that use a single instrument to examine one particular aspect of a community conversation, with other lenses to triangulate such as interviews or focus groups (Schrire, 2006). There are many examples of a single instrument used to view an online community reported in a meta-study by De Wever et al. (2006).

Past Approaches in Computer Mediation Discourse Analysis

Historically, the field of content analysis in electronic communication was initiated by a paper published by Henri (1991). He proposed an analytical framework to categorize five dimensions of the learning process evident in electronic messages: student participation, interaction patterns, social cues, cognitive skills and depth of processing, and metacognitive skills and knowledge. This framework allowed the deepening of the investigation on the nature of communication between participants in online discussions. Henri (1991) stated “The method we propose has three main components: a framework defining the dimensions of the analysis; an analytical model corresponding to each of these dimensions; and the techniques for the analysis of the message content.” (p. 123).

Over the past 20 years, researchers have expanded these dimensions, and developed additional frameworks, models and dimensions to analyze conversations both for transcribed records from face-to-face interviews, as well as online conversations. Table 4 has a summary of some of the many studies that of been done with particular

theoretical backgrounds and their associated instrumentation as analyzed by De Wever and Schellens (2006).

Table 4: Content Analysis Studies and their Instruments

Instrument	Year	Theoretical Background
Henri	1992	Cognitive and Metacognitive knowledge
Newman et al.	1995	Critical thinking
Zu	1996	Theories of cognitive and Constructive learning - Knowledge construction
Gunawardena et al.		Social constructivism
	1997	Knowledge construction Critical thinking
Bullen		Critical thinking
	1997	
Fahy et al.		Social network theory
	2000	Interactional exchange patterns
Veerman and Veldhuis-		Social constructivism
Diermanse	2001	Knowledge construction
Rourke et al.		Community of inquiry
	1999	Social presence
Garrison et al.		Community of inquiry
	2001	Cognitive presence
Anderson et al.	2001	Community of inquiry Teaching presence

Järvelä and Häkkinen	2002	Social constructivism Perspective taking
Veldhuis-Diermanse	2002	Social constructivism Knowledge construction
Lockhorst et al.	2003	Social constructivism Learning strategies
Pena-Shaff and Nicholls	2004	Social constructivism Knowledge construction
Weinberg and Fischer	2005	Social constructivism Argumentative knowledge construction

Once the theoretical background and instrument were selected, the consideration of unit size for large online conversations needed to be settled. There was an inherent tension between fixed unit size and open-ended unit length. These can vary from single words, to sentence length, to entire paragraphs of text. Henri (1991) addressed the issue of unit length as follows: “our proposal is to divide messages into statements corresponding to units of meaning, and to use these, rather than the messages proper, as the counted units measuring active participation” (p. 126).

One can also set unit length by determining and grouping the separate ideas expressed by the author. Rourke, Anderson, Garrison & Archer (2000) examined the historical use of unit size and recognized that there are strengths and challenges to any approach. Although selection of an entire posted message would eliminate issues around subjectivity (Gunawardena et al., 1997; Osman & Herring, 2007; Thomas et al., 1998), Henri (1991) rejected fixed unit length, and instead used units of meaning that focused on

a single idea to determine the unit length. The challenge of this idea is that different coders may decide on different unit lengths as they dissect the conversation (Strijbos, Martens, Prins, & Jochems, 2006). As much as there is no agreed upon process to determine unit length in CMDA studies of this type, unit length for this study was defined as an entire entry by a participant. This approach allowed multiple raters easier access to coding segments so they could focus attention to the ways they coded long entries by participants.

Participants and Context

The participants in this study were members of an online community of learners of 20 schools connected by a grant initiative in Hawaii named “Schools of the Future”. The community had a membership of over 600, but a much smaller subset were involved in conversations around changes in their school, questioning and sharing ideas and strategies as well as resources. These participants had a variety of roles in their professional lives. There were teachers, administrators, parents and university researchers who had participated in the community. Some of the members had been part of the community since 2009; others joined later and became part of conversations that happened at later dates. Although the vast majority was from the major five islands of Hawaii, there were community members who were from the continental United States, Alaska, and countries around the world. Given the nature of these conversations, location was not as important as adding diverse views to these discussions, and often, differing perspectives added to the depth and negotiation of the conversation. Membership in this community was restricted to facilitate conversation and common purpose. The manager of this community restricted membership access to only those directly involved with

education. Additionally, smaller semi-private groups were formed within the community for individuals who had like-minded interests, whether it was members of the same school, or individuals interested in questions on a specific pressing topic like sustainability.

In this study, conversations were selected from September 2009 to January 2011 in both public and private forums. Additionally, specific conversations were purposefully selected that made ideal candidates for the research questions in this study. For the purpose of this study, I selected discussions that involved more than 4 participants, were focused on a problem of practice in education, took place of over more than 7 days and involved back-and-forth exchange of ideas. There were 52 participants that were involved with the 22 selected conversations. This selection process allowed the CMDA methodological approach to be utilized. Three frameworks were identified, clarified and detailed. A list of criteria were constructed for each framework so that the units could be studied consistently and organized clearly.

Human Studies Program Approval

In November 30, 2012, an application of exempt status was submitted to the University of Hawaii Committee on Human Studies for this study. On December 12, 2012 the Human Studies Program approved the study as exempt. This letter is included as Appendix A. Additionally, the researcher clarified with the Human Studies Program about the need to attain consent forms from the participants in the study. Since the data for this study was already in existence before the study began, consent was not necessary. All participant information in this study has been replaced by pseudonyms to protect privacy and this list is password protected in a spreadsheet by the researcher only. The

researcher will destroy this link between participant names and their pseudonyms one year after the study's publication. Appendix B contains the conversation with the Human Studies Program on this particular issue.

Groups within the Community

To facilitate more intimate and powerful conversations, three groups were established in the fall of 2009. Each group contained 6 of the 18 projects that were part of the Schools of the Future grant. The grant leadership team created the groupings with feedback from the schools themselves. Group A contained the larger schools that were mostly grades K-12 comprehensive. Group B contained either middle or high schools, and Group C contained elementary schools. Schools were encouraged to invite and include as many school members as they wanted to be involved in these community conversations. The breakdown of participants by groups and whether they contributed to the conversations is shown in in Table 5.

Table 5: Groups and Participation Numbers

Group	A	B	C
Total Members	50	45	120
Participating Members	15	14	23

Although it is not directly a part of this study, it is worth noting that of the 215 members of these three groups only 52, or 24% contributed to the conversations that were analyzed. Lave and Wenger (1991) explore the role of legitimate peripheral participation, which is sometimes referred to “lurking”. This researcher understood that participants

that do not contribute still have the opportunity to gain from the knowledge being accrued in the networked communication.

The conversations selected for this study occurred within these smaller groups and were only visible to that community. The gender makeup of the groups was Group A 73% female, Group B 57% female, and Group C 82% female. These percentages are reasonable given the larger female presence in schools, especially in elementary schools. Since the research questions for this study did not explore a more specific need to examine other demographic data, that information was not collected. The community conversations span a timeframe that began in September 2009 and ended January 2011. Although public conversations were possible as a part of the data set, the researcher found that the 22 conversations in Groups A, B and C were an ideal fit for the research questions. The general description and characteristics of the grant and the community are covered in more detail in Chapter 1.

Conceptual Framework

The methodology chosen for this study was to use three frameworks to analyze interaction and knowledge building in this community. In particular, some studies (Osman & Herring, 2007; Persico et al., 2010; Thomas et al., 1998) have investigated discourse by using multiple frameworks to better analyze specified characteristics of online communities and to provide a measure of triangulation of the data. This approach developed a better understanding of the trends in communication content. The three selected frameworks that were used for analysis in this study were the Interaction Analysis Model (IAM) (Gunawardena et al., 1997), Social Learning Theory (E. Wenger,

1999) and Knowledge Building Principles (Scardamalia & Bereiter, 2010). These were explored in Chapter 2 and are explained in their research context more clearly below.

Each of the frameworks had specified phases, components or principles that the conversational units were mapped onto. One of the ways to ensure a high level of reliability in coded units was to detail specific characteristics of each aspect of a framework so that the rationale for coding into that particular aspect was explicit (Rourke et al., 2000).

A pilot test of this approach was implemented in Spring 2012. In this exploratory test run of the data, distinguishing characteristics of each framework were identified and defined and then delineated on a guide sheet. These guide sheets were utilized to code a single conversation from the community. In the full research study it was expected that the characteristics would be both emergent and agreed upon by the raters, and therefore would be more dynamic. For example, as rating was being done for components of social learning, it helped clarify certain characteristics by adding more descriptors to them. The component on Practice (learning as doing) had a specified characteristic “professional statement” from the original article. The researcher added clarification that this was statement about prior knowledge. This needed to be distinguished from a proposed idea or solution that implied accumulated or assimilated knowledge. That depth of development fit under the component Meaning (learning as experiences). It was clear from prior research that any kind of coding needed to be tested between raters so that reliability could be more thoroughly addressed. Past research demonstrated the development of characteristics of coding is an iterative process that needs to be agreed upon by the raters (Garrison et al., 2006; Li-Fen Lilly & Jeng, 2006; Osman & Herring,

2007; Persico et al., 2010; Schrire, 2006). The next sections detail the three frameworks more explicitly and identify the particular characteristics that make each an interesting perspective to view the conversations.

Interaction Analysis Model (IAM)

Developed by Gunawardena (1997), this framework had been used in many studies to analyze interaction in communities (De Wever et al., 2006; Garrison et al., 2006; Gunawardena, 1999; Thomson et al., 2009). The author designed it to specifically analyze knowledge construction in networks communities. Since it had been utilized in many studies, it was used as the standard bearer for looking at new ways of uncovering knowledge construction by comparing the results from this method to the others in this study. In this framework, there are five phases of interaction that are hierarchical. Each of these phases is broken down into sub-levels so it is easier to identify the level of the conversation. As is common practice with frameworks in CMDA, each sub-level is assigned elaborate descriptors to make coding easier. The original authors developed these sub-levels and their descriptors. This full framework can be found in Appendix C. Additional statements were added to a guide sheet for this study and are included in Appendix E.

Social Learning Theory

Communities of Practice and online communities in general align well for Social Learning Theory analysis. Wenger (1999) developed an articulation of Social Learning Theory that centered around the different identities and roles individuals take when they participate in a community. Wenger's social participation framework had four components that are shown in Table 6.

Table 6: Wenger's Social Learning Framework

Component	Descriptor
Practice	Learning as Doing
Community	Learning as Belonging
Identity	Learning as Becoming
Meaning	Learning as Experience

Since each of these identities represented a different aspect of community involvement, they provide an interesting lens into the ways that the community was interacting. These four components were given descriptors and conversational units were coded to these different components of social learning. These are addressed in the Chapter 3 section on instrumentation and the coding guide sheet is included in Appendix F.

Knowledge Building

Scardamalia and Bereiter (2010) detailed the difference between learning, which was an individual internal construction, and knowledge building that required a community exchanging and building ideas. They defined 12 principles that characterized different facets of knowledge building. These 12 principles are listed in Table 7.

This pointed to an inherent challenge in past research on discourse analysis. Most researchers looked at secondary aspects of knowledge building, such as the level of interaction. Scardamalia and Bereiter's (2010) knowledge building framework provided a more direct way to view learning in online discussions. In their knowledge building framework, they laid out 12 characteristics of knowledge building. For this study,

conversation units were mapped against these 12 characteristics to see how many of them existed in any given conversational unit.

Table 7: Twelve Knowledge Building Principles

Real ideas, authentic problems	Improvable ideas	Idea diversity	Rise above
Epistemic agency	Community knowledge	Constructed uses of authoritative sources	Concurrent, embedded, in transformative assessment
Democratizing knowledge	Pervasive knowledge building	Knowledge building discourse	Symmetric knowledge advancement

Although these knowledge building principles were not hierarchical, they did identify different types of behaviors and transactional exchanges. To utilize this framework fully, each conversational unit was analyzed to determine if it contained elements of each of the individual principles. The descriptors and characteristics will be discussed in the next section. The coding guide sheet is included in Appendix G.

Instrumentation

Chapter 2 discussed the rationale for and the general information about the three frameworks that form the backbone for investigation in this study. Each of the three frameworks has aspects that indicate different types of interaction or knowledge building. For the three frameworks a set of criteria for each of the phases, components and principles needed to be explicitly developed and made available to help in the analyzing, coding and to aid in inter-rater support.

Interaction Analysis Model (IAM)

The IAM developed by Gunawardena et al. (1997) is included Appendix C. In order to clarify this document more fully, more detailed narrative guidance and examples were added to aid in consistent coding and to help inter-raters. For example, in the IAM, Phase I: Sharing/Comparing of Information has a sub-level A described as “a statement of observation or opinion”. If a unit of analysis only had a participant stating an opinion or stating an observation, it was scored Phase IA. These descriptors aided the researcher’s explicit efforts to make reliability higher. An example of the guidance is given in Table 8.

Table 8: Coding Guidance for the Interaction Analysis Model

Gunawardena Phase	Statement Examples	Comments
Phase IB: Statement of agreement from one or more participants	Thanks ladies! Great discussion regarding the selling of food. I know children and adults get excited about food. I had the privilege of attending the SAS primary garden party. What a great time	Here the participant is agreeing with and validating the statement.

This full document with more guidance can be found in Appendix E. A sample that demonstrated this process for all 3 frameworks is included later in this section to make the process more explicit and clearer.

Social Learning Framework

Wenger’s Social Learning Theory (E. Wenger, 1999) considers participation in a social community through one of four unique components: Practice, Community, Identity, and Meaning. For example, community, which the author defined as “learning

as belonging” implied participants’ language should have included references to being connected and valuing collaboration. Therefore, one criterion would be a proposed collaboration, which would reinforce the belonging to the community. All of these developed criteria are outlined in Table 9.

Table 9: Social Learning Framework

Component	Definition	Criteria
Community	Learning as Belonging	proposed collaboration supportive statement
Identity	Learning as Becoming	engagement group affirmation professional reflection (focus on group, not info) shared observation (I agree...with you)
Practice	Learning as Doing	clarifying question prior experience prior knowledge probing question professional input professional statement (prior knowledge) recommended resource restating question
Meaning	Learning as Experiences	new knowledge (accumulated) professional request proposed idea/solution (new knowledge) stated challenge

Although it was possible to find examples in some conversational units of evidence of more than one social learning component, the researcher made the decision to code each conversational unit with only one. In cases where there were more than one component identified, the stronger implied intent of the message was coded only. The challenge of this process is detailed more in the section regarding inter-rater reliability.

Knowledge Building Framework

In the earlier description of the knowledge building framework developed by Scardamalia and Bereiter (2010), the 12 principles of knowledge building were listed. To develop the criteria for these principles, the authors' own descriptions of these principles were used. After an initial sample coding criteria were refined and defined more fully. These are listed in Table 10.

Something that makes these characteristics and criteria different than the IAM and the social learning framework is that these principles are neither hierarchical nor mutually exclusive. For instance, a participant statement could both talk about solutions in new ways (Idea Diversity) and cite authoritative resources as its background (Constructive Uses of Authoritative Resources). That would mean that a single conversation unit could have more than one principle at play. As a result, each conversational unit was coded for as many of the principles that matched.

Data Collection

The most appropriate and meaningful conversations in the record were selected through purposeful sampling. Although researchers cannot generalize from specific examples, choosing specific ones can shed light on unique or compelling stories that indicate traits for the research in question. These information-rich cases highlight and give depth to the study (Patton & Patton, 2002).

These conversation threads were first broken into the decided unit length, and then coded against the three frameworks: Interaction Analysis Model of Gunawardena, Social

Table 10: Knowledge Building Principles and Criteria

Principle	Definition	Criteria
1. Real ideas, authentic problems	problems arise from the need to understand something in the world—need to feel real—this causes momentum and back and forth exchanges	problem or question comes from real practice
2. Improvable ideas	any idea should have at its core the need to advance the idea, or create higher-quality in the process of building knowledge around	the problem or question has a place to grow as a solution
3. Idea diversity	allows comparison and combination in new ways to view forms of the problem	not a simple yes/no - has different approaches for solution/resolution
4. Rise above	out of the messiness comes a higher level synthesis and knowledge building transcends to this	the solution/resolution creates better clarity - transcendence?
5. Epistemic agency:	participants have collective responsibility for the success of the endeavor they work collectively and are motivated to reach new ways of understanding the problem	participants play active role in acting on problem - give advice, exchange ideas
6. Community knowledge	this is not an internal solution for one member, but has value to others	members engage and articulate the value to them
7. Democratizing knowledge (only judged at end)	all participants have legitimacy and take pride in moving the knowledge forward	participants language indicates active role
8. Symmetric knowledge advancement (only judged at end)	even though there may be different perspectives and different levels of internal knowledge, both/all groups involved in the endeavor gain in the process	participants gain value through their words and involvement
9. Pervasive knowledge building (only judged at end)	all of the activity involves building knowledge at some level	conversation focuses on the problem/situation
10. Constructive uses of authoritative sources	authoritative sources are used, and understood for what they bring with requisite critical awareness of its limitations	during exchange authoritative sources are included as reference or for perspective
11. Knowledge building discourse (only at end)	just as important as the knowledge itself, the way in which it is shared and refining through conversation/discursive practices of the community matters	the conversation centers on the problem and views it continuously through each members words
12. Concurrent, embedded, and transformative assessment	the community is involved in gauging its own learning and assessing progress—communities work should meet a high threshold of agreement internally and externally	there are moments of reflective assessment about the process and the knowledge required

Learning of Wenger and Knowledge Building of Scardamalia and Bereiter. Each of the three frameworks spotlights a different view of the conversation. It is worthwhile to note that each of these frameworks represent a codified way to test and apply a particular theory or framework. The Interaction Analysis Model from Gunawardena looks at primarily the ways that participants interact. It is based on Henri's (1991) pivotal work on analyzing conversation by gauging interaction in the early days of online conferencing. The social learning framework from Wenger looks at how individuals position themselves in and within the community. Wenger recognized the importance of social behaviors in building knowledge and value in a community of practice. The knowledge building framework from Scardamalia looks at 12 specific principles that represent aspects of knowledge building. These twelve principles recognize the behaviors and words that must be present in order to determine if the community built knowledge.

Data Analysis

To conduct the analysis, I acted as a catalyst on the data. My role was an active part of the meaning-making. Patton (2002) stressed the importance of synthesis, as the researcher works with and organizes the data into emergent themes. It was not enough just to report on the factual information, there needed to be a keen eye to tie together important ideas and themes and for meaning-making. All of this should arise from the research question (Garrison et al., 2006).

Piloting a Conversation for Coding Strategies and Analysis

In order to test out the ideas of instrumentation and analysis detailed above, an initial pilot run of data from one conversation thread was coded and analyzed. A

discussion thread that occurred from August 2010 to February 2011 was selected as the sample corpus to apply the frameworks in this proof of study. It consisted of an initial question regarding curriculum mapping, and involved seven participants and a total of 17 postings. Most of the postings were one paragraph long, so the unit of analysis was selected to be each individual posting. The full text with identifying names and schools removed is located in Appendix B. The coding is noted at the end of each unit. A key to explain the coding abbreviation is included as well. For the pilot, the coding was done with paper and pencil and the results were tabulated in a simple word processing table.

Refining the Coding Guides

After this initial pilot coding, it was apparent that more explicit guidance was needed to clarify and distinguish coding decisions. The language in the three framework criteria was refined and more explicit examples were added to aid in clearer approach to the coding process. For example, in the social learning framework, one of the components was Identity. The author had stated “Identity - a way of talking about how learning changes who we are and creates personal histories in the context of our communities.” (E. Wenger, 1999, p. 31) In order to deepen and clarify this language, I listed additional criteria for coding, summarized a coding strategy and gave samples of conversations units with their coding. These guide sheets for all three frameworks are located in Appendix E, F and G.

Coding and Inter-Rater Involvement.

Once the instruments were finished, the researcher began the process of coding the 22 conversations for the three frameworks. In all, these 22 conversations had 383 conversation units. In order to more purposefully organize and access the data set, NVivo

10 for Windows 6 was used. NVivo was a qualitative coding tool that was well suited for this study. It allowed each conversation to be imported as a separate source. It allowed the creation and delineation of the three frameworks as separate nodes with multiple sub-levels. During the coding process, it allowed multiple nodes or even different sub-branches within a node or between the same nodes to be coded to any selected text. An image of the interface is shown in Figure 2.

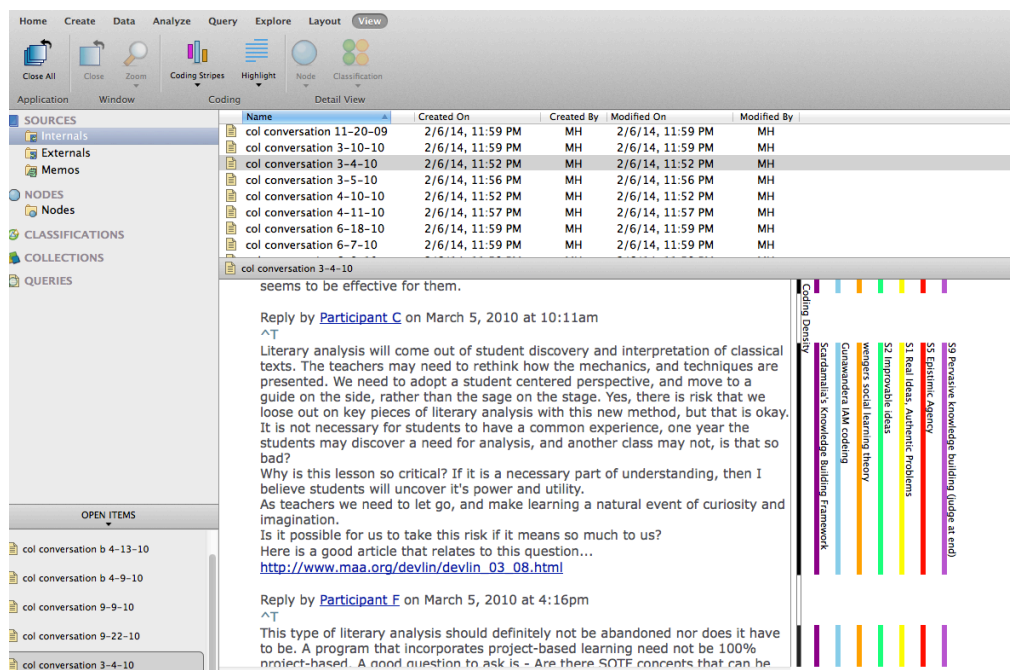


Figure 2: The NVivo Interface

The real power of NVivo lay in the analysis phase of this study. NVivo had an easy interface that allowed data sets to be viewed and exported in both tabular form as well as graphical charts. To allow a wider range of analysis, the data sets were exported from NVivo and imported into MS Excel in 2011 for Mac. This allowed easier totaling, sorting, charting and multiple representations within a single worksheet. Figure 3 shows

an example of the knowledge building data and some of the associated charts in MS Excel.

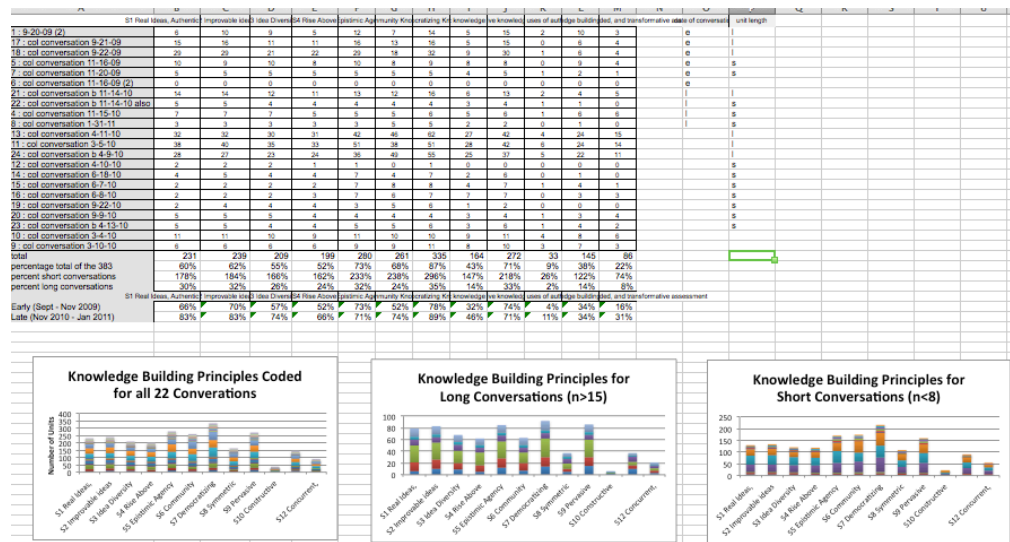


Figure 3: Knowledge Building Tables and Charts in MS Excel

Once the data sets were coded, 2 additional raters were brought in to investigate reliability between raters. One rater recently completed their doctorate in education in 2013 and the other was in the last semester of finishing theirs. As mentioned earlier in the chapter, less than half of previous studies had used additional raters to ensure reliability in the instruments and their use in coding (De Wever et al., 2006). Each of these raters spent over one hour with the researcher to review the instruments and to discuss and ask questions about the coding guide sheets that had been created in addition to the instrument itself. After reviewing the guide sheets, the researcher and the additional raters went through an online conversation together, coding and discussing together. Once the additional raters felt comfortable with the instruments, they were given one of the 22 conversations to code on their own.

Rourke (2000) and Lucas, Gunawardena and Moreira (2014) state that inter-rater reliability in CMDA will increase as the list of indicators is well-rounded. Although there

needs to be clear, extended training of the raters, there is inherently some challenge around the subjective and interpretive nature of latent content analysis (Garrison et al., 2006; Rourke et al., 2000; Schrire, 2006). When the additional raters were finished their scoring was compared to the researcher's scoring. In order to gauge whether an acceptable level of agreement was reached, Cohen's kappa was selected, since it was determined to be one of the more common methods used in many CDMA studies. Cohen's kappa is useful because it does more than count the number of agreements per coding decisions. In order to get more meaningful data, Cohen's kappa factors in the possibility of scoring agreements due to chance as well. As such, it is a more reliable process to determine acceptable rater agreement. The formula for calculating kappa is:

$$k=(F_o -F_c)/(N-F_c)$$

Where: N = the total number of judgments made by each coder

F_o = the number of judgments on which the coders agree

F_c = the number of judgments for which agreement is expected by chance (Rourke et al., 2000) p 5.

Previous studies have stated that if the results for Cohen's kappa are .75 or greater, they are considered excellent agreement. If the results are between .40 and .75 they indicate fair to good agreement. If the results are below .40 they indicate poor agreement (Koh, Herring, & Hew, 2010; Rourke et al., 2000; Yap & Chia, 2010). It is worth noting that although the IAM had been used in multiple studies before, the social learning framework and the knowledge building principles had not been implanted until this study. I understood that scores for latent analysis can be difficult to agree on.

Agreement Level of Inter-rater Coding

The results for Cohen's kappa for the 2 additional raters are shown in Table 11.

Table 11: Cohen's kappa Score for Inter-rater Reliability

	Rater 1	Rater 2
Interaction Analysis Model	.01	.61
Social Learning Framework	.06	.22
Knowledge Building Principles	.50	.66

Although the results for knowledge building for both raters (.50, .66) and IAM for Rater 2 (.61) were determined to be adequate by the researcher, there was clearly a low level of initial success by both raters in the social learning framework as well as by Rater 1 in the IAM. More surprising was the scoring between the two raters on the social learning framework. Measured against each other, they attained a Cohen's kappa of .84! There was a possible reason this may have occurred. The additional raters both decided that only scoring one social learning component was too difficult, as most conversational units exhibited more than one component of social learning. As a result they scored more than one component to the majority of the conversational units. This had the impact of increasing their agreements between each other, and decreasing the Cohen's kappa score for the researcher.

In order to increase the agreements and therefore raise the Cohen's kappa score, I applied the technique of negotiated meaning as detailed by Garrison et al. (2006). In negotiated meaning, the researcher and the additional rater code a conversation first

separately, then compare the conversational units. In cases where the scoring is different, the coders discuss their rationale and negotiate to reach agreement.

Each of the additional raters was contacted and another meeting was scheduled. When the negotiated meaning approach was used with the additional raters, the Cohen's Alpha Score on the social learning framework increased from .06 to .73 for Rater 1 and from .22 to .67 for Rater 2. Garrison et al. (Garrison et al., 2006) reported substantial gain increases utilizing a similar approach. This technique required more joint effort on the part of the raters and the researcher, but the added benefit is a more powerful conversation about the coding that is going on.

Additionally, the impact on the additional raters was profound. Both additional raters stated that the process of negotiated coding was powerful since it meant deeper thinking about the conversational units. Rater 1 stated, "Working together on negotiating coding provides a learning opportunity for both to really explore what they see and understand about the text". Rater 2 added, "The complexity of inferring intent and meaning is much easier when done conversationally than in isolation. It builds confidence that we have reached a common understanding of the text." Most importantly it paves a pathway for the inherent challenge of coding for latent content that is by its very nature contextual and open to judgments on the part of a rater.

Creating Subsets for Investigation

In order to fully explore the conversations, I created smaller subsets of conversations to help in the analysis of the instruments. It was particularly insightful to not just examine all of the conversations as an aggregate, but to create smaller categories within them that explored conversation size and historical sequence.

To investigate the effect of the length of the conversation, all conversations having less than 8 units were identified as *short* conversations. There were 11 of this type. Any conversations longer than 15 units were identified as *long* conversations. There were 7 of these. In the analysis described later in this chapter, these *short* and *long* conversations provided an excellent opportunity to investigate the utility of the three frameworks in answering questions about characteristics of the community's conversations.

To investigate the effect of the community's evolution over time, *early* conversations were flagged as those that took place from September to November 2009. There were 6 conversations in this date range. *Later* conversations were flagged as those that took place from November 2010 to January 2011. There were 4 in this category. This subset was specifically helpful in answering Research Question 2 that explored the impact of time in how communities adopt new ideas.

The next section will explore each of the frameworks and their tools separately as well as cross comparison of the data set to see what can be gleaned from that process.

Organizing the Data for Later Analysis

For each of the three frameworks, the data sets were brought into Microsoft Excel 2011. All 22 conversations had in total 383 units or postings by community individuals. These were totaled so that an accumulated view of the community conversation could be viewed through each framework lens and each of their corresponding levels. After totaling, it was easier and more powerful to convert total counts into percentages so that comparisons across each of the levels for interaction, components for social learning, and principles for knowledge building could be more easily discerned. This was done by taking the total instances of coding and dividing it into the specific level, component or

principle total to create a percentage. The full data set for each of the three frameworks and counts are included in Appendix H.

Verification

Measuring Latent Content

An important methodological decision of past studies has been the determination of the units to be studied. Previous researchers agree that selective and purposeful sampling is a powerful way to analyze specific aspects of the community conversation.

Particularly, there is a need to distinguish between manifest content which looks at surface level issues like the number of times a particular person responded, and latent content, which is more of a covert process to determine meaning behind messages.

“Researchers...are more interested in struggling with important (though hidden) facets of individual and social cognition rather than assessing that which is most easily measured” (Rourke et al., 2000, p. 8). Since the vast majority of past studies focus on latent content, researchers should be concerned about the issues of subjectivity when purposeful decisions are made about which aspects of conversation are selected (Rourke et al., 2000; Schrire, 2006). To address this, the researcher must be very explicit in detailing both how they address issues of reliability, internal validity and external validity.

Validity and Reliability

In this study, a qualitative case approach was determined to be the most desirable method because of the need to place the study in its natural setting. Denzen and Lincoln (2007) state, “Qualitative research is a situated activity that locates the observer in the world...at this level, qualitative research involves an interpretive, naturalistic approach to

the world. This means that qualitative researchers study things in their natural settings” (as cited in Creswell, 2007, p. 36). This investigation was of a contemporary phenomena over which I had little or no control (Yin, 2009). Moreover, Yin (2009) elaborates “Case study designs need to maximize their quality through four critical conditions related to design quality: (a) construct validity, (b) internal validity, (c) external validity and (d) reliability” (p. 40).

Construct Validity

Construct validity has already been addressed in the previous section regarding measuring latent content in the ways which purposeful sampling and mapping characteristics will be accomplished. Borko (2004) argues

“Consistent in distinguishing features of interpretive research include privileging of “insiders” perspectives and a focus on understanding sociocultural processes in natural settings in which individuals learn to teach. Participant’s voice and discourse are critical to capture, so researcher’s record interactions in naturalistic settings, conduct interviews, and review written artifacts” (p. 5).

I recognize the need to be explicit in both how units were selected and coded to the specific frameworks and will both give examples and clear guidance in how participants’ interactions were analyzed as proposed by Borko (2004).

Internal Validity

The most common way to ensure internal validity is by collecting multiple views of the data to ensure measurements check against each other. In CMDA research, it is possible to use multiple frameworks to triangulate what is being analyzed in a

conversation through different lenses (Osman & Herring, 2007). For this proposed research, frameworks that view the community through three perspectives (interaction, social learning, and knowledge building) will allow a view that will give perspective to the community over time. Past studies of teachers' reflections and self-reports indicate that these type of artifacts portray an accurate measure of teacher professional growth and behaviors (Desimone, 2009). Additionally, the need to be explicit in the methodology is paramount to allow an external audit to understand this process as well as to allow its replicability. This study utilizes triangulation through three frameworks as explained by Schrire (2006), but also opens up the possibility of wider usefulness since the three lenses can all be accessed and manipulated without needing to conduct interviews or other means of personal contact. This creates an opportunity to examine any community conversation in the textual record over the past 30 years in online discussions.

External Validity

For external validity to be possible, it is important for the researcher to take the results from the study and use analytic generalization so that it can be tied to a broader theory (Yin, 2009). In this study I will be explicit in how the methods of the three frameworks have been applied, as well as demonstrate how the constructs that are used are generalizable. For instance, in the knowledge building framework, the characteristics that are used to match conversational units to particular principles of knowledge building should be clear enough that it can be applied to other CMDA studies. It is common practice to make the research clear and transparent enough so that another researcher can repeat it.

Reliability

One of the main outcomes of good reliability in a study is that the data can be analyzed a second time and come out with the same result. For this study it is necessary to involve additional raters to work with the researcher so that the coding process is consistent internally and repeatable externally. Surprisingly, many of the studies that have been done using CMDA have not used or explicitly stated the process by which coding was tested for reliability (Rourke et al., 2000). There were a considerable number of studies that did not explicitly articulate coding for reliability (Dennen & Wieland, 2007; Gunawardena et al., 1997; Jamaludin, Chee, & Ho, 2009; Leech & Onwuegbuzie, 2008; Myllari, Ahlberg, & Dillon, 2010; Philip, 2010; Tan & Tan, 2006). However, there were enough case studies that did detail the process by which reliability was obtained through multiple raters, that there is more than enough variety to select a process that will be explicit and standard practice (Garrison et al., 2006; Li-Fen Lilly & Jeng, 2006; Osman & Herring, 2007; Persico et al., 2010; Schrire, 2006; Strijbos et al., 2006; Thomson et al., 2009; Vavasseur & MacGregor, 2008; Weinberger & Fischer, 2006). Additionally, there are several methods that have been documented for measuring inter-rater reliability in meta-study analysis (Garrison et al., 2006; Rourke et al., 2000; Schrire, 2006).

In Summary

In any qualitative study there is a challenge in recognizing the value-laden nature of the investigation. The real challenge for my research is to build in as much transparency and explicit recognition of possible biases to make the process and results clear and reproducible (Creswell, 2007). For this research, there must be a recognition and clear

explanation of possible bias from my position as well as my personal culture and experiences. In bringing this to light, it will bring a complex, detailed understanding of the issue that will allow it to be used as a possible model to investigate other phenomena.

CHAPTER 4. FINDINGS

This section will explore and explain the results from coding the online discussions and detail the summary results of the three frameworks, first separately, then compared and contrasted against each other in a matrix. The intent of this study was to develop and analyze tools that could uncover knowledge building in online communities of practice. By exploring these tools, a better understanding of teacher adoption of new professional ideas could be more thoroughly explored and understood. There were two research questions for this study. The first question proposed examining three different frameworks to better understand if they uncover the evolution of the new ideas and thinking on the part of the community members. The second question proposed using these tools to examine notable changes that happened to the community's conversation over time. An existing online community of practice was chosen and 22 conversations from that community were purposefully selected to provide a body of text that was extensive enough to apply the methodology of computer mediated discourse analysis (CMDA). Each of the conversational transaction units was coded to each of the three frameworks, as described in detail in Chapter 3.

The purpose of this chapter is to report the results from the coding process, and to analyze the rich data set so as to be able to identify patterns in the data set. These patterns will be compared to the existing literature, and in Chapter 5 will lead to a discussion of the implications of these results.

Introduction

To facilitate the investigation of the conversations, three frameworks were selected that provided three different analytical views of these conversations that occurred in the community. Three complementary frameworks were chosen that could be analyzed separately, but more importantly compared and contrasted to provide insight and a means of triangulation to closely investigate knowledge building that occurred in the community. This approach has been used in previous studies by Osman and Herring (2007), Persico et al. (2010), and Thomas et al. (1998).

Chapter 3 discussed the methodological choices in detail. In this chapter the research moved from the frameworks and their coding to findings. This process required three major steps that are described in the sections that follow. The first step involved examining the data for each framework individually. This allowed each framework to be examined closely to see if the findings were coherent and aligned with the selected instrument. The second step involved exploring patterns and themes that occurred when the three frameworks were compared and contrasted against each other with a matrix. Lastly, each of the frameworks was applied to conversations that happened early during the community formation and more than a year later. These two sets of conversations were explored to examine whether the nature of the conversation had changed over the ensuing time. The data was examined to explore shifts, if any, in interaction, social learning and knowledge building.

Interaction Analysis Model (IAM)

As detailed in Chapter 3, the IAM was developed by Gunawardena, Lowe and Anderson (1997) to examine knowledge construction by analyzing the interactions that

occurred in an online collaborative learning environment (Lucas et al., 2014). The IAM uses an ordinal coding schema that has five major Phases (I – V) that have 21 granular levels to more closely examine and categorize interaction. As interaction rises from Phase I to Phase V, it moves from sharing and comparing to exploration of dissonance to negotiation to testing and modification to the highest level of agreement. This framework with its coding guide sheet is included in Appendix E. Each of the 383 units in the 22 conversations used in this research project was coded to one of the 21 levels of the IAM.

Consolidating the Data into Phases. One of the analysis decisions for this rich data set was to either keep the granular view of all 21 levels or to consolidate the levels into their corresponding higher Phases I through V. Although there was a possibility of losing some fidelity in the data, I made the decision that consolidation would make identifying patterns easier, and therefore more meaningful. The coding score for each level was totaled up and combined into each of the five Phases. An example of this is explained below.

One of the conversations in the data set started on March 5, 2010. There were a total of 59 conversational units of which 22 were coded into one of the 5 Levels of Phase I. There were 7 units coded level A, 8 units coded level B, 4 units coded level C, 3 units coded level D, and 0 units coded level E. The data representations shown later in the section utilized these consolidated data sets. All the other levels in the data set were done similarly for the analysis below. As the findings and interpretation showed, there was powerful meaning to be made even with this more general organization of the data set.

Comparing Percentages and Counts In collecting and analyzing the data, the specific coded counts in each level were converted to percentages to make the values

comparable. In doing so, comparisons between each level were easier, but it does have the effect of making small responses (for example 8 out of 10 for 80%) look comparable to large responses (90 out of 100 for 90%). Appendix H contains the full data sets where counts and percentages can be compared. This aligns with the earlier discussion of construct validity and making the data and its analysis visible. Analyzing changes in percentages, therefore are indicators of data trends and not an argument of statistical significance.

Table 12 presents the connection between the conversations and their interaction phases. Although most of the coding did not score at either Phase IV: Testing and Modification (3%) or Phase V: Agreement (1%), it was striking that there was roughly equal occurrences of Phases I (29%), II (34%) and III (33%). This indicates that the community spent as much time agreeing and disagreeing as they did negotiating meaning and comparing and contrasting ideas. For this study the IAM was the only framework that had been used in prior studies of CMDA. It is notable that in most prior studies, most of the conversation stayed in Phases I and II, whether the communities were formal or informal (De Wever et al., 2006; Garrison et al., 2006; Gunawardena, 1999; Thomson et al., 2009). Since this was a community that had some face-to-face familiarity, general agreement on topics, and a sustained conversation, the depth of interaction makes visible this community's focus and purpose.

Another finding worth noting was that regardless of whether the conversation contained less than 8 conversational units or more than 15, the level of interaction was still equally distributed between Phases I - III. There was a higher use of Phase III in the

Table 12: Interaction Scoring for All, Small and Large Conversations

	Phase I: Share/Compare	Phase II: Explore Dissonance	Phase III: Negotiation	Phase IV: Test/Modify	Phase V: New Agreements
All Conversations	29%	34%	33%	3%	1%
Small (n<8) Conversations	37%	37%	25%	1%	0%
Large (n>15) Conversations	29%	33%	33%	3%	1%

longer conversations (33% vs. 25%) and this is not surprising since the longer a community talks about an issue the more likely deeper negotiation and even testing and modifying should happen. The implications of this finding are explored more below and in Chapter 5.

Social Learning Framework

Communities of practice and online communities in general, lend themselves well to being analyzed by Social Learning Theory. Wenger (1999) has developed an articulation of Social Learning Theory that centers around the different identities and roles individuals take when they participate in a community. For the social learning framework, each of the 383 units for all 22 conversations was coded to a single component of social learning from Wenger.

As stated earlier in Chapter 3, it was decided that each unit should be coded to a single component. In cases where there was evidence of multiple components in a single unit of conversation, the stronger, higher or more implied meaning was coded solely.

This scoring was a judgment decision made by the rater, but as mentioned in Chapter 2, the nature and challenge of qualitative research often requires researchers to assign meaning in order to dive deeply into a case.

When the social learning components were tallied, it was clear there were more aligned with Practice (47%) and Meaning (26%) which were indicators of focus on the question. This is detailed in Table 13. The lower numbers for Community (20%) and Identity (6%) are as much about the focus of the conversation than a lack of community or self-awareness. For example when Participant PC9 said:

Thanks ladies! Great discussion regarding the selling of food. I know children and adults get excited about food. I had the privilege of attending the (...) primary garden party. What a great time! I was able to check out their gardens, hear about their harvesting, and enjoy the fruits of their labor. We had pizza, pasta, salad, and soup. The children were very excited to share their goods. I can visualize this as an entrepreneurial opportunity with options to sell to the broader school community and/or wider community at the farmers' market. Students could sell vegetables, prepared dishes, and recipes. (PC9)

This conversational unit showed elements that clearly drew on a strong sense of the community when they mentioned how the discussion affected their thinking. There was also an element of identity, as PC9 refers to themselves multiple times. They also offered a potential future scenario when talking about visualizing, but the main thrust of their communication was their “Learning as Doing”; what they have done. This conversational unit was coded as Practice as a result.

The summary percentage results of coding are shown in Table 13. In fact, as mentioned above there were challenges expressed by the raters that a better approach may well have been to allow either multiple codings for individual units this framework,

or break the units into smaller pieces since there are times when more than one of the components of social learning were clearly evident.

Table 13: Social Learning Scoring for All, Small and Large Conversations

	Community	Identity	Practice	Meaning
All	20%	6%	47%	26%
Conversations				
Small (n<8)	12%	12%	55%	22%
Conversations				
Large (n>15)	25%	5%	44%	26%
Conversations				

One of the striking results was comparison of short conversations (less than 8 conversational units) and longer conversions (more than 15 conversational units). As can be seen in Table 13, the longer conversations had a much higher percentage of Community component (25%) than the shorter conversations (12%). The shorter conversations had a higher Identity component (12% vs. 5%). This seemed to indicate that in longer, focused conversations, even though there was a higher level of contribution about asking questions and stating prior experiences and knowledge, the community began to look at itself and spent more time expressing the value of the community in reaching agreement. This seemed to make sense, as the larger participation and more voices involved allowed for more reflection and input. Short conversations may address an issue quicker and may affirm and state the value the conversation offers to an individual and therefore a higher Identity component occurs.

The implications for this kind of analysis are powerful, and give insight as to why these instruments used individually and more importantly, in combination, can answer some deep meaningful questions about the nature of knowledge building in a community of practice. This is elaborated more in Chapter 5.

The Knowledge Building Framework

For this framework, each of the 383 units were assigned as many of the 12 knowledge building principles that were judged to exist in the conversational unit. Table 14 shows the percentages for each. For example, a fairly simple statement from Participant PC2 said “Perhaps you could make this into a collaborative project to get what you want. Pick a specific topic for students to discuss, then exchange videos about it. Reflect, give feedback, make comparisons, etc.” (PC2). This statement fell into a category of conversation I identified as “*Have you tried this?*” This statement was coded for 10 of the 12 knowledge building principles (all but Authoritative Sources and Transformative Assessment) because it indicated active involvement, provided alternative thinking and served to advance the idea.

It is notable that for the overall knowledge building coding of conversations, most of the units were assigned to more than half of the 12 principles, regardless of whether they were offering ideas, asking questions, comparing and contrasting strategies, or just supporting each other. This is likely the outcome of the purposeful selection of the conversations, as well as the nature of a fully engaged community that is talking about and trying to advance solutions to problems.

Table 14: Knowledge Building Percentages for All, Small and Large Conversations

	All Conversations	Small (n<8) Conversations	Large (n>15) Conversations
Real Ideas	60%	71%	62%
Improvable Ideas	62%	74%	64%
Idea Diversity	55%	71%	54%
Rise Above	52%	64%	52%
Epistemic Agency	73%	84%	76%
Community Knowledge	68%	81%	70%
Democratize Knowledge	87%	93%	94%
Symmetric Advancement	43%	58%	40%
Pervasive Building	71%	78%	74%
Use of Authority	9%	8%	8%
Knowledge Discourse	38%	47%	37%
Transformative Assessment	22%	29%	21%

Looking at the long and short conversations, there were small differences in the distribution of the principles, but it is clear that whether the conversation was long or short there was still pervasive knowledge building activity that was taking place.

Overall, regardless of the conversation length, the four principles that were least identified were Symmetric Knowledge Advancement (43%), Authoritative Sources (9%), Knowledge Building Discourse (38%), and Transformative Assessment (22%). It is interesting that in this community, authoritative sources were not called on often, and instead the community relied on their collective expertise and experiences to share, build and agree on common language and solutions. For the other three principles, they are

more prone to needing more direct evidence that the conversation has reflected, agreed and transformed their thinking. Although there is ample evidence of individual shifts in thinking and great negotiation around ideas, consensus and advancement are still difficult elements of knowledge building to observe and identify.

Connecting the Frameworks for More Detail

Diving deeper into the question of whether the frameworks provide the tools to examine and explore teacher adoption of new practice, the frameworks were analyzed against each other to see if there were emergent patterns that told a deeper story of both the coherence of the frameworks, as well as to provide insight into ways their intersection brought new perspectives to light. To accomplish this, each of the frameworks was paired successively with another to see where their overlapping results might show interesting patterns. These three pairings are detailed in the next section.

Interaction Analysis Model and Social Learning

For both of these frameworks, the percentage of each level or component of the framework was plotted against the other. Looking at the results in Table 15, when community conversations were coded at interaction Phase I, there was a strong connection primarily to the social learning components for Practice (61%) and Community (26%). As the levels of the conversation were coded to higher levels of Interaction, Meaning increased from 4% (Level I) to 26% (Level II) to 54% (Level III). Although Practice actually increased in Level II (69%) there is a connection between increasing interaction levels and increasing focus on the Meaning component.

Table 15: Examining Social Learning and Interaction

	Community	Identity	Practice	Meaning
Phase I: Share/Compare	26%	9%	61%	4%
Phase II: Explore Dissonance	22%	6%	69%	26%
Phase III: Negotiation	24%	8%	36%	54%
Phase IV: Test/Modify	1%	0%	3%	7%
Phase V: New Agreements	0%	0%	0%	3%

This indicates that as levels of interaction go up from sharing to dissonance to negotiation, there is a movement in the social aspect of the conversation from community, identity and practice to an emphasis on the aspects of meaning. These results are also represented graphically in Figure 4, since this data lends itself easier to visual comparisons.

The pattern that is most striking is the increase in meaning as the level of interaction moved from Phase I to Phase III. There is a corresponding decrease in the level of the Practice component as this happens. This is a good example of the coherence of these two instruments. When there are higher levels of interaction, it should be no surprise to see increased meaning-making, which involves higher-order thinking. At the same time there is less practice, which indicates lower order thinking of recall and questioning.

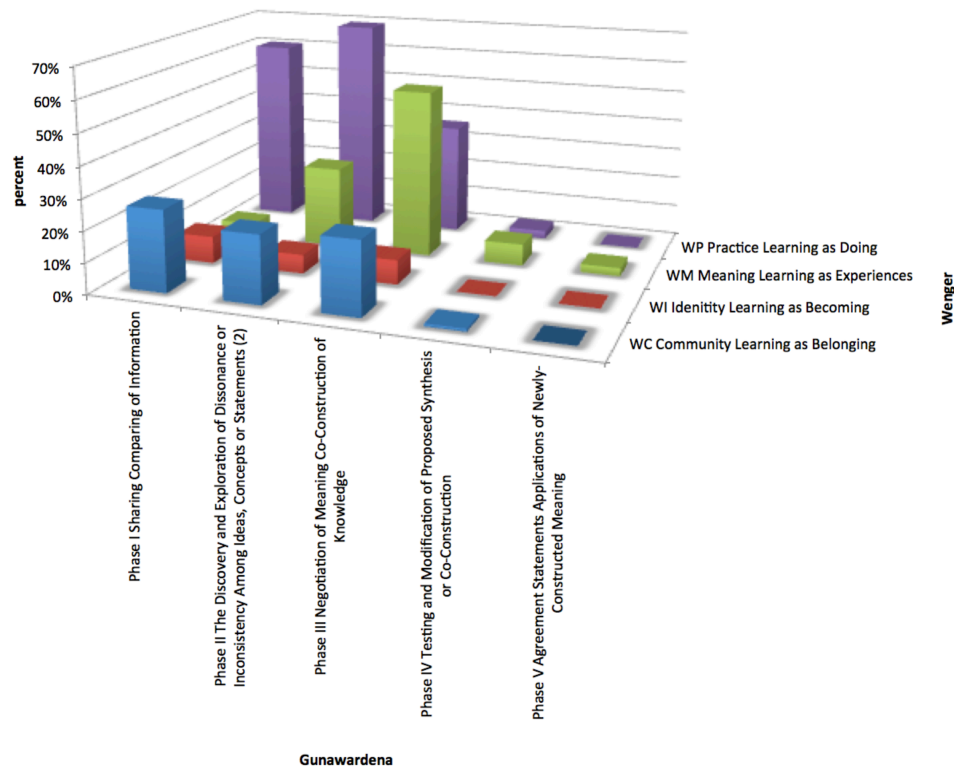


Figure 4: Examining Social Learning and Interaction

Is also interesting to note that the level of the Community and Identity component stayed about the same as the conversation moved from Interaction Level I to Level III. Perhaps this implies that moving to higher order thinking skills involves reflection about the community and one's own identity in the process of learning. These instruments provide both the exposure and the opportunity to investigate questions like this more fully.

Social Learning and Knowledge Building

When the social learning and knowledge building framework are intersected, there is a lot to unpack in the data. The data is graphically represented in Figure 5. A few salient points stick out that reinforce each of the frameworks, however.

It is worth noting that the two highest knowledge building principles that corresponded to the Community component were S6 Community Knowledge (25%) and S7 Democratizing Knowledge (22%). Both of these principles focused on the importance of community and therefore there was good reason for this matching to occur.

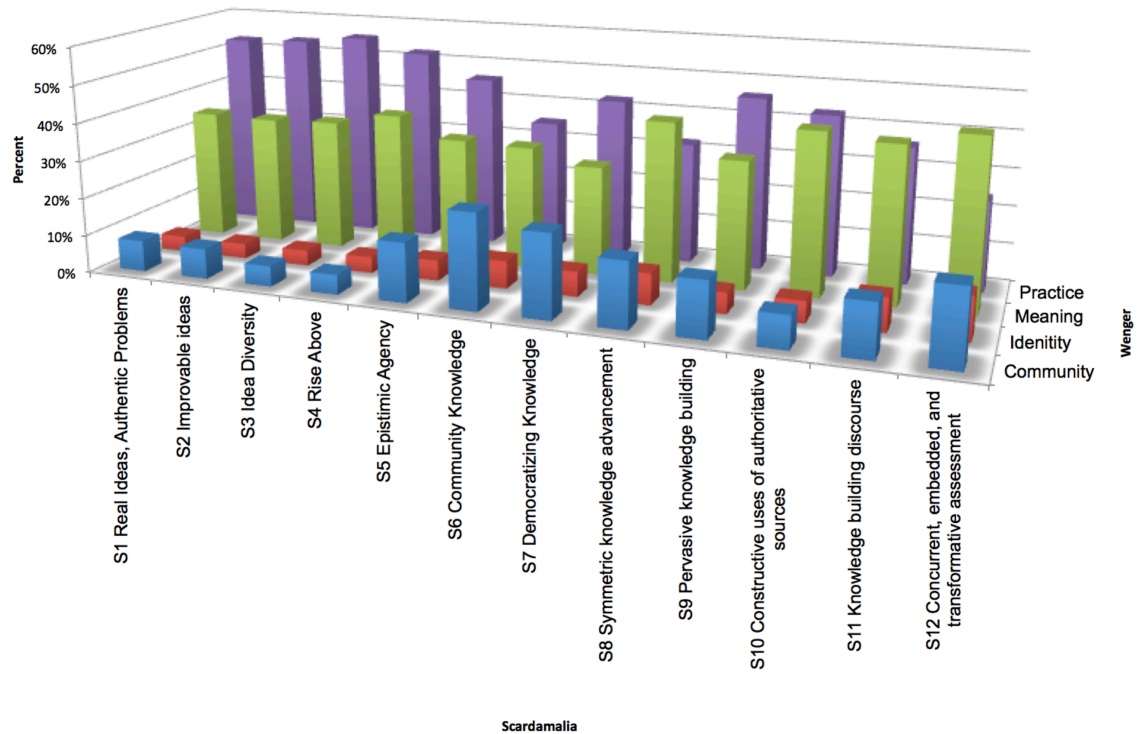


Figure 5: Examining Social Learning and Knowledge Building

The knowledge building principles with the highest correspondence to the Identity component were S11 Knowledge Building (9%) and S12 Transformative Assessment (9%). Although this is a small percentage compared to the other components, it makes sense that this would be stronger, because those two principles do describe a more personal “take away” for participants than the other principles in the framework.

The Meaning component had the highest percentages for S8 Symmetric Knowledge (42%), S10 Authoritative Sources (43%), S11 Knowledge Discourse (41%) and S12 Transformative Assessment (45%). Each of these has a deeper reflective or meaning-

making feature that would align well with the findings here. The language in these descriptions include phrases like “authoritative sources are used, and understood for what they bring”, “just as important as the knowledge itself, the way in which is shared and refined”, and “community work should meet a high threshold of agreement”.

The Practice component was highest in the first four principles: S1 Real Ideas (53%), S2 Improvable Ideas (54%), S3 Idea Diversity (55%) and S4 Rise Above (52%). Since these are focused on identifying and sharing the problem they match up well with the Practice component. Although the knowledge building framework is not designed to be hierarchical, these first principles indicate a primary function around knowledge building. Before higher levels of exchange and adoption can occur, problems and offerings must be real and improvable and allow higher order synthesis in order for the community to advance their knowledge.

Interaction and Knowledge Building

Since the interaction framework was ordinal and the knowledge building framework was nominal with possible multiple codings, interpreting this set revealed some interesting patterns.

When the conversation was scored at interaction Phase I, the exchanges focused more on the principles of knowledge building that focused on the problem and participation. This is shown in Figure 6. The top five included S7 Democratizing Knowledge (24%), S6 Community Knowledge (24%), S2 Improvable ideas (21%), S1 Real Ideas (20%), S4 Rise Above (20%). These particular knowledge principles are more tied to the entry level of a problem or the participation of the community member.

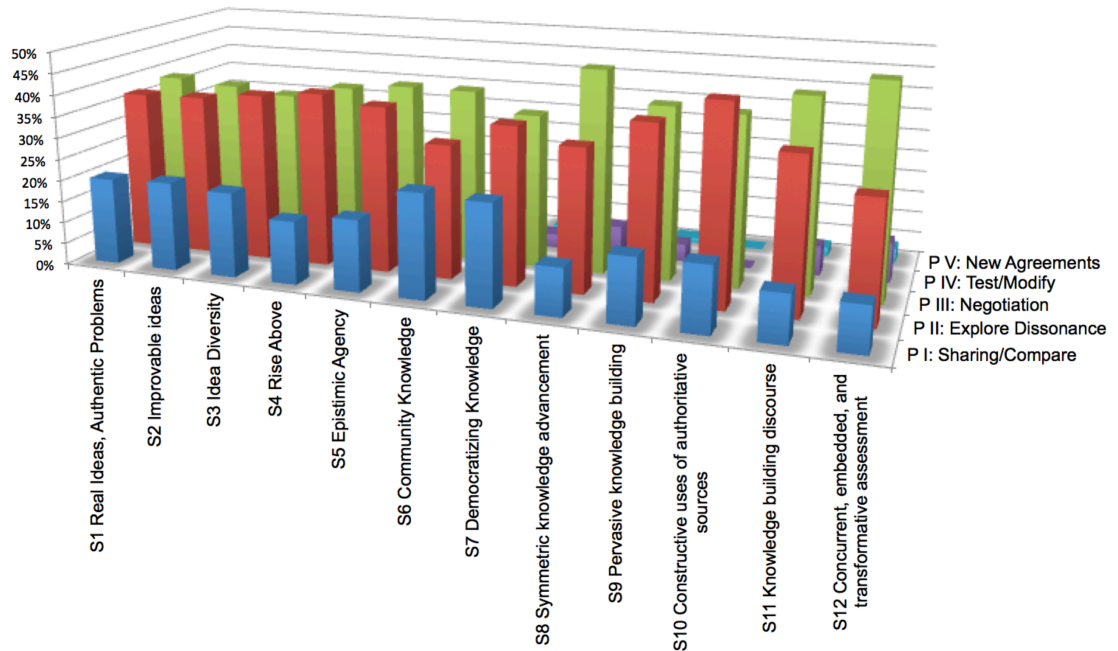


Figure 6: Examining Knowledge Building and Interaction

When the conversation was scored at the third interaction level (Phase III), there was deeper knowledge building happening. In these examples, principles that stood out were S12 Transformative Assessment (49%), S8 Symmetric Knowledge Advancement (47%) and S11 Knowledge Building Discourse (44%). In accordance with the idea of higher interaction, these principles tend to reflect a deeper and more meaningful level of knowledge building such as group affirmation, common agreement, and reflection of the learning by the whole.

Although it is true that the knowledge building framework is not hierarchical, there are certainly principles that are more indicative of higher order processes occurring in a conversation, and as a result, it is not just a matter of how many knowledge building principles are mapped, it is also particularly important to where they are more strongly coded. Told together, it does appear that there is strength in viewing conversation through

both interaction and knowledge building, as they indicate a different lens about depth of conversation between them both.

Some Findings on the Usefulness of the Frameworks

In looking at the results from each individual framework, as well as where they overlap and reinforce each other, there is certainly ample evidence that each framework by itself highlights specific, consistent views of knowledge building. Whether they are used individually to ask questions about the nature of teacher adoption, or considered as a group in how they portray the different frameworks as supporting lenses, there is powerful, coherent meaning that can be made from these representations.

Plotted together, they are complimentary and provide deeper views of knowledge making in the community. It is of note that the three pairings that were charted against each other each gave interesting and somewhat different views of the conversations and the subsequent knowledge building that happened as a result. This certainly strengthens the arguments that multiple frameworks can provide a deeper, more interesting view into what is happening in these communities. The overall utility of this will be summarized in Chapter 5.

The Effect of Time on Teacher Adoption of New Ideas

The second research question specifically addressed whether there was a shift in community knowledge building over time. In order to address this question, the first six conversations dating from September to November 2009 and last four conversations from November 2010 to January 2011 were selected and their coding was compared. These early and late conversations were examined with each of the three frameworks to see

what differences, if any, were detected. Since each framework provides a different lens, comparing these lenses allowed examining patterns or differences that became visible.

Interaction Analysis Model Framework

The comparison data for the interaction framework is shown in Table 16. This data set appears to indicate slightly more Phase III Negotiation in the early (35%) conversations than the late (26%) ones.

Table 16: Comparing Interaction in Early and Late Conversations

	Early Conversations: Sept. – Nov. 2009	Late Conversations: Nov. 2010 – January 2011	Percent Difference
Phase I: Share/Compare	27%	34%	+7%
Phase II: Explore Dissonance	34%	37%	+3%
Phase III: Negotiation	35%	26%	-9%
Phase IV: Test/Modify	4%	3%	-1%
Phase V: New Agreements	1%	0%	-1%

This seems surprising since it implies there was deeper consideration of ideas with more negotiation in the earlier conversations. A possible explanation of this could be that

by later conversations there was already agreement in some ideas and therefore there was less language of negotiation and agreement and more just weighing of ideas.

Certainly, when findings indicate a different result than anticipated, it forces a researcher to rethink what each framework is really telling about the community. Although the intent of this paper is to compare and develop these instruments, there is certainly evidence of opportunities for continued research here. The implications of this will be discussed later in this paper.

Social Learning Framework

In the social learning framework there is a stronger occurrence of the Practice component in the late conversations (41%) than the early ones (23%). This data is shown in Table 17.

Table 17: Comparing Social Learning for Early and Late Conversations

	Early Conversations: Sept. – Nov. 2009	Late Conversations: Nov. 2010 – January 2011	Percent Difference
Community	10%	14%	+4%
Identity	3%	8%	+5%
Practice	23%	41%	+18%
Meaning	64%	38%	-26%

This is surprising given the results of the interaction framework mentioned earlier, but it shows why more than one framework casts new light on a common conversation.

When data is coded to the Meaning component it implies a higher level of adoption of ideas, or at least a deeper level of exploration of them. One of the values of triangulation is that it allows and encourages a researcher to utilize all the research methods at their disposal to make meaning (Patton & Patton, 2002). A researcher needs to be attentive not just to anticipated outcomes, but pay attention to places in the data where the result challenges their ideas on the research question.

Knowledge Building Framework

For the knowledge building principles, late conversations exhibited higher percentages of the 12 principles. For example, Symmetric Knowledge Advancement was scored on 46% of the late conversations units compared to 32% on the early ones. This data is shown in Table 18.

Transformative Assessment was scored for 31% of later units compared to 16% of the early ones. This indicates more aspects of knowledge building occurring in the later conversations, which seems to support the meaning making that was brought out in the social learning coding, but still is contradictory to the finding in the interaction framework. This result is result compelling, since it leads to deeper questions about what is happening in the conversation. Indeed, some elements of these frameworks point in one direction and yet others point in an other direction.

The nature of inference during the process of latent coding certainly is one of the factors at work here. As Herring (2004) stated earlier, language is doing. This CMDA approach can only be successful if the researcher *correctly* infers the meaning from the words of participants in an online community. The exploration of these implications will be covered more in Chapter 5.

Table 18: Comparing Knowledge Building for Early and Late Conversations

	Early	Late	Percent Difference
	Conversations:	Conversations:	
	Sept. – Nov. 2009	Nov. 2010 –	
		January 2011	
Real Ideas	66%	83%	+17%
Improvable Ideas	70%	83%	+13%
Idea Diversity	57%	74%	+17%
Rise Above	52%	66%	+14%
Epistemic Agency	73%	71%	-2%
Community	52%	74%	+22%
Knowledge			
Democratize	78%	89%	+11%
Knowledge			
Symmetric	32%	46%	+14%
Advancement			
Pervasive Building	74%	71%	-3%
Use of Authority	4%	11%	+7%
Knowledge	34%	34%	0%
Discourse			
Transformative	16%	31%	+15%
Assessment			

Summary of Findings

The findings presented here provide a multitude of possibilities for researchers to be able to apply these frameworks to a variety of conversational texts and transcripts to dig deeper into the spiraling nature of knowledge building in the exchange between participants. Certainly, the instruments by themselves provide an interesting glimpse into what is happening to and through the participants. Each one by itself exposes one element of learning and adoption of ideas that are an instrumental element of growth of professionals and the knowledge that is accruing in the network. When the three frameworks are used together, they tell at times a coherent story of social learning, interaction and knowledge building. Perhaps it is when there are surprises that the real opportunities arise to understand better what is happening in these online conversations.

It is when these instruments are compared and contrasted to each other that deeper and more nuanced views of learning become visible. As previous authors have encouraged, it certainly appears that all three tools woven together shed more light on the nuances of exchange than any single one might give, which fits within the ideas of triangulation (De Wever et al., 2006; Garrison et al., 2006; Herring, 2004). This validates at some level this study's question about the way that these tools can better shed light on interactions in online communities. Certainly there are moments in this methodology that lead to more questions and not always answers. These implications and the need for more research are part of the context for Chapter 5. These successes and challenges will be looked at again through the research design and the proposed rationale for the

methodologies that were put into place in order to determine the success in answering the research questions posed.

CHAPTER 5: IMPLICATIONS AND CONCLUSIONS

This study has two distinct areas from which to draw implications, conclusions and limitations. The methodological choices of the study involve advancing new frameworks and strategies and these will be discussed below. The analysis of the selected conversations and the implications from the analysis bring their own set of questions, synthesis and possibility. Exploration of these results will be discussed as well.

Introduction

As a researcher looks back at his work it is helpful to ask three common questions to support his reflection and consideration of the meaning and breadth of it all: What? So What? Now What? The first question leads the researcher to look back at their work: the purpose, the questions, the background review, and the methodology that was selected. This question will guide the opening of this chapter.

This part of the final chapter is a review of the purpose of the study, an integration of the key pieces of the reviewed literature, and a revisiting of the methodology that was chosen. The findings discussed in Chapter 4 will set the context for the implications and the suggestions and limitations brought forth from closer examination. Each of the research questions will be addressed in light of both the history of research in the literature, and the added perspective that the methodological design revealed. This chapter will end with suggestions for future research.

A Brief Research Perspective on Teacher Growth

The driving question throughout this research centered on an examination of how teachers build professional knowledge. Restating the purpose from Chapter 1, the purpose of this case study was to investigate how an informal online social learning community maintained for K-12 teachers interested in sharing and applying new professional practice supported their efforts to change their knowledge and behaviors. Currently at all levels of education there are many pressures on schools to address the ways that they are preparing students for their future. One of the strongest ways to improve professional practice is through coherent, sustained and engaged professional knowledge building (Desimone, 2009). For this paper, a case study approach was ideal, since case studies are an empirical inquiry that examines real life phenomena. This allowed a study of complex social interactions, which this online community possessed (Yin, 2009).

In order to build the capacity within teachers to learn as professionals and adapt their professional practice, it is important to understand and improve teacher's self-efficacy through active, engaging relevant professional development (Bandura, 1977; Desimone, 2009; Martin & Kragler, 1999).

Communities of practice provide a means for professionals to share, compare, reflect, negotiate and agree on ways to improve their professionalism both inside and outside the school day (Bransford et al., 2000; Lambson, 2010; Lavonen et al., 2006; Szabo & Sobon, 2003). They emphasize sharing and negotiation over knowing and telling. These aspects of online communities align best with the ways that support teacher growth and development (Jonassen, 2002; Putnam & Borko, 2000). A secondary,

but important aspect of online communities is that they leave a textual trace of the conversation that occurred. As a result, this text record provides a means to study what happened in the online communities utilizing CMDA (Gunawardena et al., 1997; Herring, 2004; Saldaña, 2009). This methodological approach is discussed more in the next section.

A Means to Investigate Communities of Practice

From the review of research literature, two research questions were offered to investigate and build on the knowledge and theory around building professional capacity in teachers in online communities. As detailed earlier, these two questions explored the *means* by which conversations could be analyzed and applied these mean to examine a community's conversation.

To that end, three complementary frameworks were selected as a way to study the communities. Each offered a different view of the exchanges in the community: interaction (Gunawardena et al., 1997), social learning (E. Wenger, 1999) and knowledge building (Scardamalia & Bereiter, 2010). Taken in total, they provided a means of triangulation to ensure that a complete and cohesive story was being revealed in the community. Past studies have identified these aspects as a critical element in learning and knowledge building (Ball & Forzani, 2007; Borko, 2004; Bransford et al., 2000; Carneiro, 2006; Darling-Hammond et al., 2009; Kay, 2006; Vavasseur & MacGregor, 2008) .

Analysis of the Frameworks

Analysis of the coding for each of the three frameworks revealed pertinent findings that lead to the implications explored in this section. There was evidence of high

interaction that increased over time, the majority of the conversations clearly focused on social aspects of practice and meaning which indicate a high degree of community energy around sharing, negotiating and there were high levels of knowledge building principles evident.

It was also notable that regardless of whether the conversation was shorter or longer, the frequency and diversity of knowledge building principles in the communication was fairly similar. If conversations have more exchanges, one might expect to see more knowledge building in the community's words and actions. There is certainly more research to be done in this regard.

Combining together different frameworks in a matrix revealed a different level of interplay between knowledge building and the different frameworks. When social learning and interaction were combined, it became clear that higher levels of interaction did not change community or identity, but greatly increased the meaning-making happening in the community. When the social learning framework and knowledge building framework were analyzed together, it was clear that different types of social learning behaviors drove different kinds of knowledge building. In particular, it was notable that the Meaning component in the social learning framework had a stronger connection with transformative and reflective language in the community.

Early and Late Conversations

The second research question for this study examined one application of these new tools. Since the conversations in this community occurred over a span of 17 months, it was possible to look at earlier and later conversations in the community to see what differences might exist when viewed through the lenses of the three different

frameworks. Surprisingly, earlier conversations had a higher incidence of meaning-making in the social learning framework, and a slightly higher level of interaction from the IAM. There is definitely a place here to analyze why later conversations did not have higher interaction levels. The early adoption of internal capacity to solve problems and therefore not needing to reach agreements as time went on could have been one reason for this result. The knowledge building principles in the later conversations indicated more reflective and transformative language, and so it did paint a more complex picture of negotiation, meaning-making, and consensus building. These kinds of nuanced questions will be explored in the implications section.

Study Implications

The previous section addressed the first question: *What?* In this next section, the implications of this study fall under the probing question *So What?* From the different representations and analysis of the data in Chapter 4, there were interesting observations and questions that arose. These were both aligned with and at times challenged some of the prevailing understandings that underpin the three key frameworks and how they shed a light on the research questions and the purpose of this study. These implications are listed and detailed below. The implications center around two key ideas from this study: the lessons learned from this methodological approach and what that method revealed about learning in the selected community.

Implications from the Methodology

As discussed at the start of this chapter, exploring the methodology and the frameworks selected are one area to explicate conclusions. This section explores the implications of the methodological choices.

The power of the three frameworks is clear and their cross comparisons expose interwoven stories. This study developed and implemented two new frameworks for coding that would allow different lenses into a community's conversation, thus allowing triangulation. The findings reported in Chapter 4 clearly show that the tools are internally consistent, have a means to be reliable and offer complementary views of what is happening in the conversations. In particular, the knowledge building framework provided powerful information about what was happening within the conversations and between the conversations that occurred over time. For a researcher, it is powerful to have a set of tools that can be used to analyze particular research questions. Both the social learning framework and the knowledge building framework require a researcher to look deep into the latent meaning in conversations. This is much more aligned with the traditions of qualitative research, and could be used in a variety of ways to investigate how and why communities succeed in moving their common conversation forward instead of staying in place.

Although it was difficult to examine all three frameworks simultaneously, complementary pairs were evaluated and made a higher level of understanding possible. This highlighted the profound meaning-making that occurred when each framework was viewed against each other. For example, when social learning was cross plotted with interaction levels, the Community and Identity components stayed the same, but the Learning as Experience component became much more pronounced, and the Learning as Doing decreased. This data was shown earlier in Figure 4. This is a coherent view of knowledge building, and supports the idea that higher levels of interaction that include negotiation can also be recognized as a focus on Learning as Experience.

By the use of different frameworks, a richer more meaningful picture of conversation was exposed. Clearly, viewing the data in isolation did not reveal the same information as viewing the intersection in a matrix. For example, the value of triangulating between the frameworks became exposed when looking at the community Identity component in small and large conversations. In larger conversations there is more opportunity for members to not just talk about their problem or idea, but also look back at the group and position themselves within the group as an active member of a community of practice. As stated earlier, conversion of coding counts to percentages allowed cross comparison to be done, but each count size differs and therefore indicates trends and not statistical significance.

The principles of knowledge building and the process of coding for meaning are well aligned. In much the same way that knowledge building is an exchange between participants, the coding process in latent content is an exchange that transpires powerfully when done together between the researcher and the text. The knowledge building framework's 12 principles outlined very specific aspects of transactional exchanges between participants. One of the outcomes of this study is clarity that the knowledge building framework does reveal a powerful view into the conversation of a community of practice. The specificity of language in the instrument enables a high degree of inter-rater reliability and acted as a powerful tool in analyzing the conversation. As Rourke et al. state, start by "identifying your perspective... And then select a transcript analysis instrument that views communicative behavior in terms of active, collaborative, construction of knowledge" (2000, p. 6)

Future uses of this process open up a variety of possibilities for exploring a human/machine interface to strengthen data collection and encourage deeper investigations. The extensive cognitive effort and challenges with reliability lead me to wonder about other approaches to make the process easier and more replicable. There are already a number of examples of machine scoring for complex human writing. One of the challenges in this research process was the variability in interpreting latent content. Standardized writing prompts like those in the Graduate Record Exam are scored with machines. This scoring of essays by computers has started to be used in tandem with human scoring to more efficiently and accurately check consistency and reliability (Valenti, Neri, & Cucchiarelli, 2003). Over the next 5 to 10 years, there will certainly be an improvement in these capabilities in computers, and the potential impact on this kind of research will be profound. For the three frameworks that were part of this study, or for others that could be used, reliability issues will become less and less a factor and much time and energy will be saved by the incorporation of computer-based analysis in extracting meaning from human conversations in textual form. This will not remove the researcher from the process, but make their work more powerful by the additional speed and accuracy offered by computer analysis.

This study confirmed that negotiating meaning is a process that greatly improves coding reliability. The development of computer-based scoring will not take away the role of the researcher, but in a sense will become part of the negotiated meaning process. This will make qualitative coding work more powerful and easier to manage.

Latent content presents both challenge and promise. The nature of qualitative research is that it situates the researcher in the participant's natural setting (Creswell,

2007). This placement and positionality allow the voice and meaning of participants to be analyzed. Since their story becomes deep and personal there are often questions regarding the scalability of findings. Qualitative studies are like a mosaic. They scale to larger phenomena not by replicating results, but by connecting to and elaborating the story being told over larger social phenomena.

Schrire (2006) distinguished between manifest content and latent content. Manifest content is obvious and can be identified through specific words or statements in the textual record. Identifying latent content implies participation and interaction, and they lie below the surface where cognition and metacognition are defined. The value of the personal side of qualitative research is that it can bring access both manifest and latent content. There is an important distinction between basic interaction and participation, which implies deeper cognitive involvement. For example, there is an important place for counter arguments in communities, as they require viewing the problem from multiple perspectives and challenges. This causes the learner to develop a higher level of thinking around their topic (Weinberger & Fischer, 2006). The challenge is that the judgment of whether there is an argument and corresponding counter argument is ultimately judged by the experience of the coder, it is not something that would be in the manifest language of the conversation.

It is important to distinguish the difference between a network, which is directed at the connections between people and resources, and the community, which centers around the identity those members have around topics, challenges and ideas. Tacit knowledge, like latent meaning occurs as the value of the community increases and is not as easily identified as manifest content or explicit knowledge (E. Wenger, Trayner, Beverley., &

De Laat, Marten, 2011). This challenge is inherent in the nature of qualitative studies, As Barab, Kling and Gray (2004) state:

“In fact, CMDA is most useful for comparing discourse features within independently established technical, social or psychological phenomena. Plus there are limits on what kinds of phenomena can be investigated via online discourse behaviors. However, this is also the case for self-report studies, ethnographic observation, social network analysis, and indeed are any other methodological approach to analyzing human behavior” (p. 238).

Although the challenge of working with latent meaning requires a set of complex tools that require detailed and complex explanations, this mirrors the complexity in the social phenomena itself. Case studies are an empirical inquiry, which the focus on contemporary phenomenon within its real-life context and boundaries between phenomenon and its context are not clearly evident. This is suitable for studying complex social phenomena (Yin, 2009).

Implications for the Knowledge Building in the Community

This section addresses the second key area from the study centered on the analysis of the conversations and what they reveal about knowledge construction in the community.

Time does matter and the instruments are able to capture and analyze this.

There are subtle but discernible differences as conversation takes place over time. In this particular study, there were really two different time frames. Each conversation took place over time, usually about a month. In total, the 22 conversations that comprised the corpus of this study took place over 17 months. Salmon (2002) argues that one of the

strengths of online discussions is the time for reflection before responding, unlike face-to-face conversation where often a participant is forming their response while another is in conversation.

Since a response to an asynchronous discussion typically requires the participant to compose after reflecting on the subject, it tends to allow time for deeper meaning-making out of the discussion for the participant. There was evidence of this within the words of the participants themselves. After 10 days of an ongoing conversation thread, participant PC14 stated: “Reading through some of these responses, and tagging on to what you said at the end about not getting too locked into a specific structure, I think one of the things we might be missing at this point...”[PC14]. This statement is powerful because it indicates the time and effort PC14 took to look back at earlier statements and add their thoughts. One of the interesting findings from Chapter 4 was the higher occurrence of the Community component of social learning framework in later conversations. This may have played into the idea that extended time allows a better sense of community and manifests itself in the language of the participants. One of the research questions proposed investigating the effect of knowledge building over longer units of time. The implications of this approach using three frameworks allow a deeper investigation into questions like this. It allows the researcher to consider questions like: Does community change? Does the amount of knowledge building activity change? What levels of interaction correspond to what levels of community activity?

As the community evolves over time, new members will come to the community. If these new members find an engaged intellectual community, it will support the ability of these new teachers to access the expertise that resides within the community and the

knowledge network they have built. This greatly enhances opportunities for professional growth and reflection (Putnam & Borko, 2000).

Centrality of voice in online communities is not always necessary and authority is in the hands of the community. One of the more interesting aspects of the online community in this study was the lack of centrality in leadership. Whether it is the nature of a well-established community of practice or the size and focus of the community, the depth of knowledge building indicated a deep collegial sense of mission and the data bore that out. Conversations indicated a high value placed on the community, even though these were scored secondary to knowledge building in many of the conversational units. For example, participant PA3 stated “It's a long process and very difficult at times. Having the larger "community of learners" is a huge element that makes this necessary transition possible. I am thankful to everyone at HCF, HAIS and within our SotF group for all the support.”[PA3]. In response, PA2 stated, “I agree with [PA3] that it is wonderful to have colleagues who are like minded that we can encourage one another to keep on keeping on ...”[PA2]. Statements like this do more than just affirm individuals; they act as ways to share the success of the community, and make the work that is done more relevant and meaningful for the community members. As learners become involved in an activity, their commitment to the group and the learning goals are attained through the actual practice or participation in the group (Jonassen, 2004).

Dennen and Wieland (2007) examined structured and unstructured student conversations and found there was more diversity in the work when the teacher did not take such a central directive voice. The implications for this study's instruments were that they show the interactions that support community. High levels of interaction do not

necessarily mean that there is cognitive engagement. It is possible that quality of discourse and quantity of discourse do not necessarily overlap. One of the strengths of this methodological approach is that the three frameworks allow the researcher to distinguish interaction and presence. Studies that show that peer interaction builds social presence, but focused group conversation is what builds cognitive interaction and pushes higher order thinking (Garrison & Cleveland-Innes, 2005; Nielsen, 2006).

There is still considerable work to be done about the importance of a central voice, or higher levels of authority in informal communities in particular. This study indicates that authority or a central voice were not critical elements for this community to build knowledge. Since this was a single case study, many more communities would need to be analyzed to compare and contrast the characteristics of the group, the depth of their conversation, and what other factors may build or inhibit knowledge building in a network. One of the knowledge building principles is defined as Idea Diversity. Clearly in this network, there was enough commitment and internal capacity to create Idea Diversity amongst the members without a central authority or external authority being called upon.

Limitations

As in all case studies, there are limitations to the ability to generalize findings beyond the specific realities of the case that was examined. Researchers recognize this limitation and reflect on the conditions they impose and the possibilities they still may allow in looking at the broader reality of the research question as applied across a wider circle of potential participants. In this research project, there were limitations caused by the nature of this independent school community, their contexts from their culture and

place that they were located, and the other forces that were at work shaping their knowledge and conversations including their ongoing relationships with each other outside of the online community. Additionally, the research methodology applied new instrumentation that will benefit from a broader set of studies to look at its reliability across different communities and different researchers. Since this study examined conversation for a little more than a year into the change process for these schools, it represents a snapshot more than a longitudinal view as most of these change efforts were many years in the making.

Since the group for this study was formed from independent schools in Hawaii, this was a smaller community that had a closer face-to-face relationship than is the norm for many online communities. This may have allowed participants to share ideas in multiple contexts beyond the online community, although there was little mention of this additional interaction in their conversations that were analyzed. Any results about shared negotiation of ideas and knowledge building needed to take this into account.

Additionally, these schools have a cooperative and competitive relationship since they service more than not the same population of students. Many students apply to these different schools and more than not the schools themselves see this competitive nature as a positive for student choice. Still, it was not the normal behavior of these teachers and leaders to talk in such depth about their professional work and challenges. Broader studies of informal communities will rarely have such a closely-knit set of schools exhibiting these behaviors.

One of the challenges in this study was the nature of designing new instruments to apply the social learning framework of Wenger and the knowledge building framework

of Scardamalia and Berier. Although it was insightful to compare these frameworks against the well-established IAM of Gunawardena, larger scale conclusions about knowledge building need to be augmented by continued research.

“In fact, CMDA is most useful for comparing discourse features within independently established technical, social or psychological phenomena. Plus there are limits on what kinds of phenomena can be investigated via online discourse behaviors. However, this is also the case for self-report studies, ethnographic observation, social network analysis, and indeed are any other methodological approach to analyzing human behavior” (S. C. Herring, 2004, p. 368).

This inherent tension between the personal nature of revealing stories in qualitative studies and the hopeful extension of these ideas to a broader educational community opens up the possibility of more studies piecing together a jigsaw of how the lessons learned can be connected together.

Challenges and Possibilities

Challenges exist at the boundaries between conversational units and with the descriptions of the phases, components and principles of the frameworks. One of the debates that still continues in the field of CMDA is the decision-making to determine unit size (Gunawardena et al., 1997; Henri, 1991; Osman & Herring, 2007; Rourke et al., 2000; Thomas et al., 1998). Although the decision to break conversations into unit sizes that constitute a single post was as much a choice of convenience as it was common practice in CMDA, the inherent subjective nature of coding latent content meant that some of the conversational units had multiple coding possibilities, but needed to be restricted to one. This was most exposed with the social learning framework, since the

four components although discrete, often existed in multiple representations in single conversational units, particularly those that were long. Both of the inter-raters for this study reported struggling with coding a single social learning component to some of the conversational units. Not surprising, of the three frameworks, social learning had the lowest reliability between raters until negotiating of the coding was implemented. In both cases of the co-raters, initial Cohen Alpha values on social learning were below 0.10, but increased to greater than 0.70 when approached as a negotiated meaning. This occurred as a result of specific, lengthy conversations on units that the raters had not agreed on initially. In a sense, the dialogue between raters allowed a self-check, and a deep conversation about the latent meaning. Raters reported the challenges with interpreting meaning, versus reading responses literally. This interpretive distinction was nuanced and continually shifted the conversation between the joint raters. As Herring (2004) stated earlier in this chapter, all methodologies that study human behavior need to recognize the limits of inference and meaning that can be drawn. Like all qualitative studies, this is a challenge, but is also strength.

The possibilities and affordances offered by a more closely matched human/machine interface will make this kind of qualitative research more powerful. The challenge for the researcher will still be to continue to tell the story that comes out of the case being examined.

Is the very nature of the changes in online communication presenting new challenges for the instruments being implemented? The online landscape is evolving rapidly in response to ubiquitous access and mobile devices. There have been shifts in the ways that people communicate online and as a result the way online transcript and

text appear. Although it seems likely that online discussion forums with their lengthy back-and-forth exchanges will exist into the future, informal learning environments have been influenced by micro-blogging platforms like Twitter. The positive side of this development is that the threshold for being part of a conversation has been lowered substantially. Mobile technologies are the first technology to see equal and widespread use across all socioeconomic levels. Moreover, there is clear evidence that the nature of communication online is changing for the greatest adopters of these technologies: teenagers and young adults (Lenhart, Purcell, Smith, & Zickuhr, 2010). The implications for analyzing informal communities in general and utilizing the methodologies in CMDA will require a rethinking of the instruments used. One of the strengths of using latent content in conversation is the deeper rich text that is part of lengthy conversation online. With limitations of 140 characters, or a tendency towards shorter factual answers, latent meaning will be a more challenging approach. Livingstone and Ontario Institute for Studies in Education (2001) detail some of the research in which informal learning environments are becoming more and more prevalent. The author also distinguishes the research done in tacit learning versus more intentional learning. "Informal learning never ends. But much of it occurs in irregular time and space patterns" (p. 21). Additionally wider access to broadband connectivity has created communities that exist in the moment and do not leave a textual record. Studying these communities will require new means to capture the record of their conversations. The changing nature of learning and online environments lends itself handily to questions of what areas researchers might address in the future, which is covered in the next section.

Further Research

The final question that needs to be addressed is *What Now?* In exploring both the methodology and the evidence of knowledge construction there are notable findings and ramifications. Both these implications and questions discussed above lead to directions for future research.

There is an opportunity to apply these ideas to past, present and future environments and examine the trending that is happening there.

This study, as a qualitative case study, examined a single community in depth to explore the ways it grew and built knowledge together. As much, like most qualitative studies, it paints a deep and personal tale about the participants that were selected. Further research needs to be done to broaden the types of communities examined and place them on a portrait that explores the size of the community, the centrality of the leadership, the length of time for individual conversations in the community as a whole, the shifting role of peripheral or central voice within the community, the technologic structures of the community and many more variables. One of the strengths of this approach is the ability to identify and act on communities that have already existed as they are numerous and varied. In connecting the dots between past design, current design and behaviors, and future trends it is possible that a better understanding will take place. This will help deepen the understanding of the kinds of learning that are going on in these communities and how to best approach their design and implementation.

Adaptive and responsive online environments are still undergoing change and will be able to be assessed more fully. One of the capabilities that this research design allows is the opportunity to look at current and past successes and challenges and

examine those online networks for locations and moments that define design considerations. Researchers like Herrington et al. (2006) have applied the research on what works to look at particular aspects of design. These instruments can more powerfully view the success or failure of these designs.

Schrire (2006) details a very precise manner by which forums were analyzed for content in higher-order thinking. This included visual mapping of the messages and how they were interconnected, giving a more global view of the conversation. The results section goes into detail on how the codings shaped into the data analysis. Approaches like this provide excellent ways to expand on understanding the relationships between the data.

Summary

This study began with a question of how to best support teachers in their professional development so as to prepare students for a world that is dynamic and requires a new set of skills and knowledge. Online communities of practice provide one powerful way to help professionals build their knowledge. An online community of Hawaii teachers was selected as a means to conduct a case study exploring ways to measure knowledge building within their community. The research questions of this study, therefore, were designed to contribute to the field of computer mediated discourse analysis (CMDA) as a methodological approach to help researchers better understand and apply those findings to improve online community design.

The two research questions explored both the methodological structure to analyze the conversation and the detailed analysis of these professional communications. These

two questions provide both an underlying architecture for research design and a road map to apply to that design.

The first question explored some current frameworks that could be used to examine conversation occurring in online communities. The findings and their implications of those findings indicate strong coherence between these frameworks. These findings provide insight into the research questions about these communities from the viewpoints of interaction, social learning, and knowledge building. One of the interesting findings was the stewardship that the community put into maintaining the conversation supplanted any need for central authority within those communities. This supports the idea that a community of practice can be engendered through authentic membership in the community (E. Wenger et al., 2002). Although one community does not in and of itself provide the *breadth* of clarity on this research question, it did provide the *depth* necessary to examine these frameworks and how they work individually and together.

The second question examined the community over time. This allowed an opportunity for the instruments to be used comparatively, and also allowed a deeper understanding of what growth occurred within this case study group over the course of the 17 months of their participation. The findings indicated changes in the social dynamic within the community as members moved from their own identity to the value of the community. There was also a shift in the types of knowledge building that were happening as the group moved from questions and idea exchanges to symmetric advancement of ideas and a higher level of negotiated meaning. Although interaction was not substantially different, this actually showed why the triangulation of data matters, because not all interaction advances knowledge forward.

The findings do more than align with prior research, but provide new insight into both the ways by which researchers can apply tools to analyze conversation as well as shed light on specific area of communities and their conversations. This study has implications for future online community design, and exposes a particular need for the nuanced interpretation that happens with latent meaning within conversations online. Moreover, as technology continues to change what communities are and how they behave, there are challenges for researchers in using these tools and the need to see them applied across a wider range of informal learning environments.

Appendix A: Human Studies Exemption Letter



UNIVERSITY
of HAWAII*
MĀNOA

Office of Research Compliance
Human Studies Program

December 12, 2012

TO: Mark Hines
Principal Investigator
Educational Technology

FROM: Denise A. Lin-DeShetler, MPH, MA
Director

A handwritten signature in black ink, appearing to read "Denise A. Lin-DeShetler".

Re: CHS #20870- "An Examination of Frameworks and Knowledge Construction in Online Communities"

This letter is your record of the Human Studies Program approval of this study as exempt.

On December 12, 2012, the University of Hawai'i (UH) Human Studies Program approved this study as exempt from federal regulations pertaining to the protection of human research participants. The authority for the exemption applicable to your study is documented in the Code of Federal Regulations at 45 CFR 46.101(b) (4).

Exempt studies are subject to the ethical principles articulated in The Belmont Report, found at <http://www.hawaii.edu/irb/html/manual/appendices/A/belmont.html>

Exempt studies do not require regular continuing review by the Human Studies Program. However, if you propose to modify your study, you must receive approval from the Human Studies Program prior to implementing any changes. You can submit your proposed changes via email at uhirb@hawaii.edu. (The subject line should read: Exempt Study Modification.) The Human Studies Program may review the exempt status at that time and request an application for approval as non-exempt research.

In order to protect the confidentiality of research participants, we encourage you to destroy private information which can be linked to the identities of individuals as soon as it is reasonable to do so. Signed consent forms, as applicable to your study, should be maintained for at least the duration of your project.

This approval does not expire. However, please notify the Human Studies Program when your study is complete. Upon notification, we will close our files pertaining to your study.

If you have any questions relating to the protection of human research participants, please contact the Human Studies Program at 956-5007 or uhirb@hawaii.edu. We wish you success in carrying out your research project.

1960 East-West Road
Biomedical Sciences Building B104
Honolulu, Hawai'i 96822
Telephone: (808) 956-5007
Fax: (808) 956-8683

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Appendix B: Human Studies Program Communication on Consent

Aloha Mark,

O.K.

Thank you for letting me know that you have decided to proceed without contacting people. This is the way existing data studys are typically conducted.

Best wishes for a successful study.

Aloha,

XXX

On Tue, Dec 11, 2012 at 11:59 PM, Mark Hines <mehines@hawaii.edu> wrote:

Aloha XXX

Although I am checking with my chair, the easiest path to getting started would be to go ahead without sending anything to participants. Since this is within the exempt guidelines, I am fine with going forward with the study without gaining permission. I will make sure there are no identifiers.

mark hines

On Dec 11, 2012, at 7:02 PM, Human Studies Program wrote:

> Dear Mark Hines,

> The UH IRB has received your application. Thank you for sending it in.

> A point of clarification - if your study is an existing data study, then you would not send anything out to participants such as you describe in your application.

> Existing data studies under the exempt review and approval process are described as data that already exists at the time of application submission and when the data is recorded for the study there are no identifiers.

- > If you do wish to gain permission from the people who created the existing data, then you must submit that communication to the UH IRB for review and approval prior to sending it out.
- > Please write me back and let me know what you decide to do.
- > Thank you!
- > Let me know if you have any questions.
- > Aloha,
- > XXX

Appendix C: Gunawardena's Interaction Analysis Model

Phase I: Sharing/Comparing of Information. Stage I operations include:

- A. A statement of observation or opinion
- B. A statement of agreement from one or more other participants
- C. Corroborating examples provided by one or more participants
- D. Asking and answering questions to clarify details of statements
- E. Definition, description or identification of a problem

Phase II: The Discovery and Exploration of Dissonance or Inconsistency Among Ideas, Concepts or Statements

- A. Identifying and stating areas of disagreement
- B. Asking and answering questions to clarify the source and extent of disagreement
- C. Restating the participants position, and possibly advancing arguments or considerations in its support by references to the participants 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

- A. Negotiation or clarification of the meaning of terms
- B. Negotiation of the relative weight to be assigned to types of argument
- C. Identification of areas of agreement or overlap among conflicting concepts
- D. Proposal in negotiation of new statements embodying compromise, co-construction
- E. Proposal of integrating or accommodating metaphors or analogies

Phase IV: Testing and Modification of Proposed Synthesis or Co-Construction

- A. Testing the proposed synthesis against "received fact" as shared by the participants and/or their culture
- B. Testing against existing cognitive schema
- C. Testing against personal experience
- D. Testing against formal data collected
- E. Testing against contradictory testimony in the literature

Phase V: Agreement Statement(s)/Applications of Newly-Constructed Meaning

- A. Summarization of agreements
- B. Applications of new knowledge
- C. Metacognitive statements by the participants demonstrating their understanding that their knowledge or ways of thinking (cognitive schema) have changed as a result of the conference interaction

Appendix D: Transcript of Analyzed Community Discourse

Coding Abbreviations examples:

Interaction Analysis Model from Gunawardena Phase I Level 2 is abbreviated **GI2**

Social Learning Components from Wenger are coded **WC** for Community, **WI** for Identity, **WP** for Practice and **WM** for Meaning.

Knowledge Building Principles from Scardamalia are abbreviated **S1** for Principle 1:

Real Ideas, authentic problems

Participant A : We are reinvigorating curriculum mapping at my school this school year. The program we are using is Rubicon and I think it is an awesome program, but I need some help. If you map your curriculum, what are some successful practices that have helped your teachers find time and stay motivated to map? GIA WP (prof statement) s1,2,34,6

Participant B: {{our}} School has been using curriculum mapping for a number of years. I have only been here for two years, but I know that our lead will respond to your question. One of the challenges I see is finding time for teachers to share their revised maps with each other. Time is always an issue. GIC WP (prof input) S3,5, 6

Participant A: Thank you. Time is a big part of success. We will embed time in our staff meetings and hopefully also tackle the apprehension of some of our teachers who are still a little shy with computers. GIIC WM (prop idea) S2, 3, 4, 5, 6, 12

Participant C: Hi,

I spent some time as a consultant and trainer for CurriculumMapper a few years back and

I have attempted mapping at two different schools. I think successful practices include:

1. Embedding time to map together into teacher meetings at the beginning to ensure everyone gets the hang of mapping. As {B} says, time is a huge factor!!
2. Having a monthly deadline seems to work at many schools. Like have your maps for previous month completed by the 5th of the next month (ie. September maps done by October 5th) and then provide specific feedback on the maps so teachers know that someone is actually looking at them and trying to support them.
3. Creating really interesting and important discussions that required deep examination of sharing maps together so that there is a purpose for having a completed or work in progress map. For example, are we using the maps to review assessment practices in the context of using more authentic types of assessment? Are we looking to see what types of projects are being used in particular grades/across the grades? Are we trying to find opportunities for collaboration across disciplines and/or grades? Are we trying to find evidence of 21st century skills embedded into the curriculum? Are we reviewing standardized assessment results and going back to the maps to see if certain skills need to be integrated more to improve in a particular area?

I think having a manageable and focused purpose is really important. To me the maps just provide data and information for important conversations about teaching and learning.

People tend to get too caught up in the idea of "perfect" map and it sort of inhibits deeper dialogue.

Just some food for thought. GIIA WM (prop idea) S1, 2, 3, 4, 5, 6, 10, 12

Participant A :Thank you! You've got some great ideas for us to consider. Fortunately Atlas Rubicon has also provided us a rubric for teachers so that we can see the

differences between exemplary and beginning stages. That will be a nice tool to guide us through the process of mapping. GIIIA WI (prof relect) S1, 2, 3, 4, 5, 6, 12

Participant D: One way to make time is to use our faculty meeting time for curriculum mapping. Time is a real issue and when the administration can set some time aside in this way and not require us to do it on our time it really helps. Also, people who are newer to mapping can get help from others since we are all doing it at the same time. GIIC WP (prof input) S1, 2, 3, 4, 5

Participant A: Aloha and thanks {D}! The plan is to embed time to map the curriculum during faculty meetings. I've also been advised to create a road map of goals for this school year so that teachers can have an idea of expectations by "such and such date". And especially, be transparent about the maps' goals and purpose so teachers will be motivated to map. GIIC WP (prof statement) S1, 2, 3, 4, 5, 12

Participant E: I suppose the best practice is to be honest with teachers and discuss the time consuming nature of mapping when beginning an initial map; however, with a good year's map being completed, it is very easy (yes, easy!) to update the map in subsequent years. Once a map is complete and archived (usually done over summer months), the teacher can make small changes to the map as needed while doing unit planning each weekend/month. In this way, the map is kept current yet the task of keeping current is not as overwhelming. I hope this helps! God bless your efforts! GIIC WM (prop idea) S1, 2, 3, 4, 5, 6

Participant A: HI {E}!

Yes, mapping is a true committment of time as we are now carving time into the faculty

meetings. With so many other project and program goals, I am advising teachers to "attack" one map at a time, don't fret about all the other curricular maps on the horizon, just be okay with one attempt at a time. We will also enlist a critical friend to view each teacher's map and give some feedback so teachers will be helping each other. GIIC WM (prop idea) S1, 2, 3, 4, 5, 12

Thanks for your reply!

Participant F: Hi {A},

We have been mapping our curriculum for the past five years. Setting aside time to map is one way to assure that it will be done and is a good first step. Even with that in place it is wise to set deadlines as far as how much you expect to be completed in a given time period. Also, teachers need to be aware that maps are rough drafts, or a work in progress, they are never really completed so change becomes part of the process. It is important to see that there is flow and a connection between Content, Skills, and Assessment. There is a need understand the difference between a "Skill" and an "Activity." When it is time for teachers to share maps, good communication and flexibility is something that really needs to be in place especially if there are gaps or overlaps. I have always found Bloom's Taxonomy to be particularly helpful with different types of Assessment. GIIC WP (prof statement) S1, 2, 3, 4, 5, 10, 12

Participant A: Aloha {F}!

I believe we have to examine those terms more deeply. Some teachers are taking off like a rocket and some are needing more support...but even those "rockets" need feedback to be sure content, skills, etc are being articulated well. GIIC WI (shared statement) S1, 2, 3, 4, 5, 6, 12

Thanks for your comment!

Participant G: I am impressed with the professional collaboration and the helpful feedback and advice coming from the various teachers and administrators. It's obvious that {A} is gaining confidence as she negotiates the path of Curriculum Mapping. Time is often not on our side. Being creative and making the time for the mapping to take place without overwhelming the mappers is essential. Good luck to all and especially to you, {A}. God's Peace! GIIC WC (support statement) S1, 2, 3, 4, 5, 6, 12

Participant A: Thank you {G}! It is a PROCESS, for sure, and I am happy with the gains we've been having as we learn to map together. Good luck and blessings to you, too!

GIIC WI (shared obs) S1, 2, 3, 4, 5, 6

Participant H: We have been involved in curriculum mapping for the last three years. We are now in the process of making our mapping public to all. There are pros and cons to this by faculty. It was only up until last week, when I attended Sir Ken Robinson's presentation did I realize that I did not like the term "curriculum mapping." The term mapping sounds very rigid, with no room for creativity. One of the negative comments I've been hearing from our faculty is the difficulty they are having because of our shift in promoting 21st Century Learning skills. Our curriculum mapping program is set up for basic criteria, relationship to standards, and specified units, skills and activities. To allow for "creativity in education," it becomes difficult to stick to the plan and thus, our mapping is not always accurate. Making it public may cause concern as our mapping is a constant "work in progress." GIVD WP (prob q) S1, 2, 3, 5, 6, 10

Participant A: This is HUGE issue for us too. There seems to be two camps among the teachers in my school. One camp wants to do right by the mandate of our principal and

diocese and just do the maps, the other camp questions why set ourselves for inflexibility? Why map when we're going forward with being more flexible and letting the students drive project ideas and experiments? To this camp, curriculum mapping goes against the SOTF movement.

I see both sides, and sometimes it is a struggle to bring the camps together. No easy solutions are apparent except for, maybe, the idea that curriculum maps are ideally supposed to be flexible, alive, changing when change is needed. A suggestion our trainer gave us was to document our map as we progress through the year instead of losing tons of sleep in the planning. We can revisit the maps and make changes then. Thankfully we've got a very user friendly program that enables changes easily. GIVE WI (shared obs) S1, 2, 3, 4, 5, 6, 10, 12

Participant {E}: {A},

Heidi Jacobs who is given credit for the idea of mapping states that maps are first drafts, meaning they are always works in progress and flexible.

I agree that maps may not fit with 21st century teaching but the skelton would be of help to a new teacher who may need direction. GVA WP (Restate Q) S1, 2 3, 4, 5, 6, 10, 12

Participant H: For us, it was mandated by our administrators. We were also given a stipend for every subject completed. Requirements were set as to what was to be included for our classes, and if we met the requirements we were awarded. This process was successful in getting our mapping done, but the issue we have now is to find the time to keep our maps updated. GIIC WP (Prof input) S1, 3, 5

Appendix E: Interaction Analysis Model Coding Guide Sheet

Gunawardena's Interaction Analysis Model

Phase 1: Sharing/comparing of information. Stage I operations include:

- A. a statement of observation or opinion
- B. a statement of agreement from one or more other participants
- C. corroborating examples provided by one or more participants
- D. asking and answering questions to clarify details of statements
- E. definition, description, or identification of a problem

Phase 2: the discovery and exploration of dissonance or inconsistency among ideas, concepts or statements. (This is the operation at the group level of what Festinger calls cognitive dissonance, defined as inconsistency between a new observation and the learners existing framework of knowledge and thinking skills.) Operations which occur at this stage include:

- A. identifying and stating areas of disagreement
- B. asking and answering questions to clarify the source and extent of disagreement
- C. restating the participants position, and possibly advancing arguments or considerations in its support by references to the participants experience, literature, formal data collected, or proposal of relevant metaphor or analogy to illustrate point of view

phase 3: negotiation of meaning/Cole construction of knowledge

- A. negotiation or clarification of the meaning of terms
- B. negotiation of the relative weight to be assigned to the types of argument
- C. identification of areas of agreement or overlap among conflicting concepts
- D. proposal and negotiation of new statements embodying compromise, Co-construction
- E. proposal of integrating or accommodating metaphors or analogies

phase 4: testing and modification of proposed synthesis or co-construction

- A. testing the proposed synthesis against "received fact" as shared by the participants and/or their culture
- B. testing against existing cognitive schema
- C. testing against personal experience
- D. testing against formal data collected
- E. testing against contradictory testimony in the literature

Phase 5: agreement statement(s)/applications of newly constructed meaning

- A. summarization of agreement(s)
- B. applications of new knowledge
- C. 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

phase 1 is typically clarifying – statements like “I’ve done this” or “can you tell me more about what you mean” or “I agree with what you’ve done we’ve done something like this as well”

phase 2 is typically probing – statements like “by comparison, we’ve done something like this” or “is the reason that this isn’t working because of...” or “According to expert A, this is the way it should have gone”

phase 3 is typically reaching agreements or negotiating – statements like “it sounds like we agree that this process should work” or “I like what you said and I think it would work under these conditions – shall we try it?”

phase 4 is typically checking the proposal against fact or history – statements like “When we tried this idea last year, this is what happened” or “the plan we are proposing has limitations because...”

phase 5 Typically indicates adoptance – statements like “in trying this I learned the following” or “we will be implementing this idea next week...”

Gunawadena Phase	Statement (s)	comments	
Phase 1B: A statement of agreement from one or more participants	Thanks ladies! Great discussion regarding the selling of food. I know children and adults get excited about food. I had the privilege of attending the SAS primary garden party. What a great time!	here the participant is agreeing with And validating the statement	
Phase 1D: asking and answering questions to clarify details of statements	May I ask for your assistance in responding to the following clarifying questions to enable me to more clearly understand your school's problem/issue: 1) Who are the identified leaders of the grant? Why are they considered to be the leaders of the grant?	here, the participant is asking for clarification	
phase 2A: Identifying and stating areas of disagreement	We have struggled with this very issue from day one too. In fact, while we have loosely discussed how this would look from day one, and while we had even thought about bringing someone in to train us on Total Quality Education (a spin off of TQM), we just have sort of been patch working our system, without any formal descriptions or protocols.	here, the participant is identifying where they agree, and where the elaborate on the issue – not so much disagreement, but probing or exploring the issue more deeply	

<p>phase 2C: restating the participants position, and possibly advancing arguments or considerations in its support by references to the participants experience, literature, formal data collected, or proposal of relevant metaphor or analogy to illustrate the point of view</p>	<p>I can share what we did for the Kailihi No Ka Oi project, knowing that you will need to pick and choose whatever will work in your school.</p> <p>1) Student and teacher representatives joined the administrators from both schools and the Chaminade University staff to develop a common vision - what they wanted their students to know, do and care about. Please note: This Project Leadership Team is comprised of representatives from both schools and the monthly meetings are hosted by each school on alternate meeting dates.</p>	<p>here, the participant is advancing arguments by saying here's something we did, and you might want to try it. This borders on three a – but the difference here is that she's not negotiating her point – she's offering it. If the response detail the consideration or questions about it, that would move this up to phase 3</p>	
<p>phase 3A: negotiation or clarification of the meanings of terms</p>	<p>I'm also interested in the community involvement, but I feel this would stem up from the team responsible for consistent implementation. Maybe there could be more parent and community involvement directly on the grant team itself? That in of itself presents an odd conundrum in that the middle school parents are most involved right now since the lab program at the middle school started it all, but those parents are only with us for two years max, and the ones already invested are parents of last-year students. Do we choose a parent of a student simply because they will be most impacted for the full duration of the grant, or choose from those that can have the most immediate impact? Both?</p>	<p>here, the participant is offering some questions to clarify you negotiate how they might move forward</p>	

Appendix F: Social Learning Framework Guide Sheet

Social Learning Framework with Additional Guidance

Component	Definition	Criteria	
Community	Learning as Belonging	proposed collaboration supportive statement	<p>Community: Emphasizes the group as the catalyst. Includes group confirmation, focuses on the group for help, "Would anyone like to..."</p> <p>Identity: Includes affirmation to the group. Focus on self-directed language like "I agree, I feel, I think, at my school I..."</p> <p>"How has this exchange met my ideas?"</p> <p>Practice: Focus is more lower order thinking and doing, recall. Language like "What I did, What I know or understand, Here are 5 things we have done, etc."</p> <p>"What I thought, knew or did"</p> <p>Meaning: Focus is on more higher order thinking and advancing the argument together, application. Implying assimilation of new information, builds on the conversation - more than just a back and forth. "What I thought, knew or did".</p>
Identity	Learning as Becoming	engagement group affirmation professional reflection (focus on group, not info) shared observation (I agree...with you)	
Practice	Learning as Doing	clarifying question prior experience prior knowledge probing question professional input professional statement (prior knowledge) recommended resource restating question	
Meaning	Learning as Experiences	new knowledge (accumulated) professional request proposed idea/solution (new knowledge) stated challenge	

Social Learning Component	Statement (s)	comments
Community Component	Can you share examples of venues used to share teachers works? Great idea!	Here the participant is Posing a question to the community and affirming the community at the same time.
Identity Component	That is an interesting idea. Something to consider... Thanks.	The participant has given an affirmation to the group, but the emphasis is more about the impact it is had on them
Practice Component	One of the focuses of this year and the coming years is for our school to look at how students present their work and talk who they are as learners. We brainstormed ideas during orientation before school along these lines... In recent years, seniors have led their final conference...	Although there is a brief mention of coming years, this unit primarily focuses on what was done and therefore is a practice component.
Meaning Component	I am hoping that we can follow High Tech High's example and have regularly scheduled PoLs that include formal presentations, questioning, and celebration. I also really like the idea of having a year-ed opportunity for each student present their most impactful learnings of the year.	Although there are elements here that draw on the community and the identity component, the main thrust of this unit was the making meaning of the information. when they say "I really like the idea of having" or "I am hoping we can follow..."

Appendix G: Knowledge Building Framework Guide Sheet

Knowledge Building Principles Coding Guide Sheet

Principle	Definition	Criteria	Additional Guidance
1. Real ideas, authentic problems	Problems arise from the need to understand something in the world—need to feel real—this causes momentum and back and forth exchanges	Problem or question comes from real practice	Not just the original problem, but any brought up in the discussion
2. Improvable ideas	Any idea should have at its core the need to advance the idea, or create higher-quality in the process of building knowledge around	The problem or question has a place to grow as a solution	Does the unit either advance the idea or create an opportunity for it to?
3. Idea diversity	Allows comparison and combination in new ways to view forms of the problem	Not a simple yes/no - has different approaches for solution/resolution	Something is offered that isn't just confirming what is already said. a different opinion or a complementary idea
4. Rise above	Out of the messiness comes a higher level synthesis and knowledge building transcends to this	The solution/resolution creates better clarity - transcendence?	does the unit cause the conversation to spiral up?
5. Epistemic agency:	Participants have collective responsibility for the success of the endeavor They work collectively and are motivated to reach new ways of understanding the problem	Participants play active role in acting on problem - give advice, exchange ideas	Is it clear that the participant is engaged in the conversation that is happening?
6. Community knowledge	This is not an internal solution for one member, but has value to others	Members engage and articulate the value to them	More than someone saying what they did, there is evidence of a proposal or adoption of other ideas
7. Democratizing knowledge	All participants have legitimacy and take pride in moving the knowledge forward	Participant's language indicates active role	There is clear evidence that the participant is part of the exchange of information and ideas
8. Symmetric knowledge advancement	Even though there may be different perspectives and different levels of internal knowledge, both/all groups involved in the endeavor gain in the process	Participants gain value through their words and involvement	There is evidence of participants gaining or widening their thinking aligned with the conversation – not just sharing
9. Pervasive knowledge building	All of the activity involves building knowledge at some level	Conversation focuses on the problem/situation	Does the participants stay on track?
10. Constructive uses of authoritative sources	Authoritative sources are used, and understood for what they bring with requisite critical awareness of its limitations	During exchange authoritative sources are included as reference or for perspective	Authoritative sources here should be from outside the group itself
11. Knowledge building discourse	Just as important as the knowledge itself, the way in which it is shared and refining through conversation/discursive practices of the community matters	The conversation centers on the problem and views it continuously through each members words	Does the repost connect to other participants work? Is there sharing in refining?
12. Concurrent, embedded, and transformative assessment	The community is involved in gauging its own learning and assessing progress—communities work should meet a high threshold of agreement internally and externally	There are moments of reflective assessment about the process and the knowledge required	Is there a focus of reflection on the process and what it did to build knowledge? Do they reference the group?

Appendix H: Full Data Sets

A	B	C	D	E
	WC Community Learning as Belongin	WI Identity Learning as Becoming	WM Meaning Learning as Experience	WP Practice Learning as Doing
7 : col conversation 11-20-09	1	0	2	3
18 : col conversation 9-22-09	3	1	6	25
17 : col conversation 9-21-09	2	1	7	8
1 : 9-20-09 (2)	1	0	1	15
5 : col conversation 11-16-09	0	1	3	10
6 : col conversation 11-16-09 (2)	4	0	5	7
21 : col conversation b 11-14-10	5	0	8	4
8 : col conversation 1-31-11	0	0	1	4
4 : col conversation 11-15-10	0	3	2	5
22 : col conversation b 11-14-10 also	0	0	4	1
24 : col conversation b 4-9-10	17	2	22	15
11 : col conversation 3-5-10	14	9	11	33
13 : col conversation 4-11-10	25	1	17	20
23 : col conversation b 4-13-10	1	0	2	4
19 : col conversation 9-22-10	3	0	0	4
12 : col conversation 4-10-10	0	0	0	6
14 : col conversation 6-18-10	0	1	2	5
20 : col conversation 9-9-10	0	4	0	3
15 : col conversation 6-7-10	1	0	2	6
16 : col conversation 6-8-10	3	1	2	2
10 : col conversation 3-4-10	0	0	4	8
9 : col conversation 3-10-10	3	2	6	2
total	83	26	107	190
percent	20%	6%	26%	47%
long percent	6%	1%	12%	26%
short percent	77%	26%	78%	128%
	WC Community Learning as Belongin	WI Identity Learning as Becoming	WM Meaning Learning as Experience	WP Practice Learning as Doing
early (Sept - Nov 2009)	10%	3%	23%	64%
late (November 2010 - January 2011)	14%	8%	41%	38%

Figure 7: Full Social Learning Coding

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
	C : Phase 1A Statement of Observation or Opinion	D : Phase 1B A statement of agreement from one or more other participants	E : Phase 1C Corroborating examples provided by one or more other participants	F : Phase 1D Asking and answering questions to clarify details of statements	G : Phase 1E Definition or description or identification of a problem	H : Phase 2A Asking and answering questions to clarify the source and extent of	I : Phase 2B Asking and answering questions to clarify the participants position and possibly advancing	J : Phase 3A Negotiation or clarification of the meaning of terms	K : Phase 3B Negotiation of the relative weight to be assigned to types of	L : Phase 3C Identification of areas of agreement or overlap among conflicting	M : Phase 3D Proposal in negotiation of new statements embodying compromise & co-	N : Phase 3E Proposal of integrating or accommodating solving metaphors or shared by	O : Phase 3F Testing the proposed synthesis against received fact as shared by	P : Phase 4A Testing the proposed synthesis against existing cognitive schema	Q : Phase 4B Testing against existing cognitive schema	R : Phase 4C Testing against formal data collected	S : Phase 4D Testing against contradictory testimony in the literature	T : Phase 4E Testing against contradictory testimony in the literature	U : Phase 5A Summarization of agreements	V : Phase 5B Application of new knowledge	AA : Phase 5C Metacognitive statements by the participants demonstrating their
1 : 9-20-09 (2)	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2 : col conversation 11-12-09	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3 : col conversation 11-12-10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4 : col conversation 11-15-10	1	0	0	0	1	0	0	0	2	1	0	1	0	1	0	0	0	0	0	0	0
5 : col conversation 11-16-09	3	3	1	1	0	0	2	2	0	1	1	1	0	1	0	0	0	0	0	0	0
6 : col conversation 11-16-09 (2)	1	0	0	1	0	0	3	3	4	1	1	1	0	0	0	0	0	0	0	0	0
7 : col conversation 11-20-09	1	0	0	0	0	1	0	1	0	1	1	1	0	0	0	0	0	0	0	0	0
8 : col conversation 1-31-11	1	2	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9 : col conversation 3-10-10	1	0	0	0	0	1	0	2	0	0	3	1	1	0	0	0	0	0	0	0	0
10 : col conversation 3-4-10	0	1	0	0	1	0	1	2	1	0	0	2	2	0	2	0	0	0	0	0	0
11 : col conversation 3-5-10	7	8	3	3	0	1	1	20	7	2	4	2	0	0	0	0	0	0	0	0	0
12 : col conversation 4-10-10	1	0	1	1	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0
13 : col conversation 4-11-10	3	4	3	5	5	5	7	10	8	2	7	5	2	0	0	0	0	0	0	0	0
14 : col conversation 6-18-10	1	0	0	1	0	1	0	1	2	2	0	0	0	0	0	0	0	0	0	0	0
15 : col conversation 6-7-10	1	1	0	2	0	1	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0
16 : col conversation 6-8-10	1	0	0	0	0	1	0	1	1	0	2	2	0	0	0	0	0	0	0	0	0
17 : col conversation 9-21-09	1	1	0	1	0	1	1	1	2	3	0	3	0	1	1	1	0	0	1	0	0
18 : col conversation 9-22-09	2	0	1	1	1	0	4	9	7	4	0	1	0	0	0	0	0	0	0	0	0
19 : col conversation 9-22-10	1	1	1	2	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20 : col conversation 9-9-10	1	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0
21 : col conversation b 11-14-10	2	1	0	2	0	1	2	4	2	2	1	0	0	0	0	0	0	0	0	0	0
22 : col conversation b 11-14-10 also	1	0	0	0	0	0	0	2	0	1	1	0	0	0	0	0	0	0	0	0	0
23 : col conversation b 4-13-10	1	0	0	0	0	1	3	1	1	0	0	0	0	0	0	0	0	0	0	0	0
24 : col conversation b 4-9-10	0	5	2	5	1	2	4	9	5	2	6	6	2	3	0	0	0	1	2	0	0
total	93356	25	14	29	11	18	36	78	44	22	30	24	7	6	3	1	0	1	3	0	0
	2.93356	2.15703	1.20794	2.50216	0.94909	1.55306	3.10613	6.72994	3.79638	1.89819	2.58844	2.07075	0.60397	0.51769	0.25884	0.08628	0	0.08628	0.25884	0	0

Figure 8: Full IAM Coding

	S1 Real Ideas, Authentic Problems	S2 Improvable Ideas	S3 Idea Diversity	S4 Rise Above	S5 Epistemic Agency	S6 Community Knowledge	S7 Democratizing Knowledge	S8 Symmetric knowledge advancement	S9 Pervasive knowledge building	S10 Constructive uses of authoritative sources	S11 Knowledge building discourse	S12 Concurrent, embedded, and transformed
1 : 9-20-09 (2)	6	10	9	5	12	7	14	5	15	2	10	3
17 : col conversation 9-21-09	15	16	11	11	16	13	16	5	15	0	6	4
18 : col conversation 9-22-09	29	29	21	22	29	18	32	9	30	1	6	4
5 : col conversation 11-16-09	10	9	10	8	10	8	9	8	8	0	9	4
7 : col conversation 11-20-09	5	5	5	5	5	5	5	4	5	1	2	1
6 : col conversation 11-16-09 (2)	0	0	0	0	0	0	0	0	0	0	0	0
21 : col conversation b 11-14-10	14	14	12	11	13	12	16	6	13	2	4	5
22 : col conversation b 11-14-10 also	5	5	4	4	4	4	4	3	4	1	1	0
4 : col conversation 11-15-10	7	7	7	5	5	5	6	5	6	1	6	6
8 : col conversation 1-31-11	3	3	3	3	3	5	5	2	2	0	1	0
13 : col conversation 4-11-10	32	32	30	31	42	46	62	27	42	4	24	15
11 : col conversation 3-5-10	38	40	35	33	51	38	51	28	42	6	24	14
24 : col conversation b 4-9-10	28	27	23	24	36	49	55	25	37	5	22	11
12 : col conversation 4-10-10	2	2	2	1	1	0	1	0	0	0	0	0
14 : col conversation 6-18-10	4	5	4	4	7	4	7	2	6	0	1	0
15 : col conversation 6-7-10	2	2	2	2	7	8	8	4	7	1	4	1
16 : col conversation 6-8-10	2	2	2	3	7	6	7	7	7	0	3	3
19 : col conversation 9-22-10	2	4	4	4	3	5	6	1	2	0	0	0
20 : col conversation 9-9-10	5	5	5	4	4	4	4	3	4	1	3	4
23 : col conversation b 4-13-10	5	5	4	4	5	5	6	3	6	1	4	2
10 : col conversation 3-4-10	11	11	10	9	11	10	10	9	11	4	8	6
9 : col conversation 3-10-10	6	6	6	6	9	9	11	8	10	3	7	3
total	231	239	209	199	280	261	335	164	272	33	145	86
percentage total of the 383	60%	62%	55%	52%	73%	68%	87%	43%	71%	9%	38%	22%
percent short conversations	178%	184%	166%	162%	233%	238%	296%	147%	218%	26%	122%	74%
percent long conversations	30%	32%	26%	24%	32%	24%	35%	14%	33%	2%	14%	8%
S1 Real Ideas, Authentic Problems												
Early (Sept - Nov 2009)	66%	70%	57%	52%	73%	52%	78%	32%	74%	4%	34%	16%
Late (Nov 2010 - Jan 2011)	83%	83%	74%	66%	71%	74%	89%	46%	71%	11%	34%	31%

Figure 9: Full Knowledge Building Coding

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