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Schools of the future in Hawai'i: networked learning communities and teaching innovation

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DEDICATION

This dissertation is dedicated to two important people:

James A. Mains (1952-2003), an inspiring educator and mentor who encouraged me to pursue a doctorate and to live my life as an educational leader by asking myself just one simple question, “What is best for the kids?”

Fred M. Villanueva (1935-2011), an exemplary father, role model and human who encouraged me to live a life of service, to take myself less seriously and to utilize every single gift I have been given to make the world a better place.

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Many wonderful people supported me along this challenging journey.

Special mahalo to:

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Dr. Paul Sparks for being supportive, accessible and patient.

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ABSTRACT

Networked learning communities have the potential to improve teacher practice more effectively than traditional professional development models by expanding the pool of ideas to draw upon and engaging participants in mutual problem solving (Little, 2005). The intent of this descriptive, quantitative study was to better understand how network factors and benefits relate to teaching innovation in a networked learning community, part of the Hawai'i Schools of the Future Initiative in Hawai'i.

Forty-one teachers from 10 schools took a customized 50 item Levels of Teaching Innovation Digital Age Survey to generate ratings in three key areas, Personal Computer Use, Current Instructional Practices, and Levels of Teaching Innovation. Existing data regarding type of professional learning community and intensity of professional development was also utilized. Results were analyzed descriptively and inferentially in order to better understand the nature of participation in the networked learning community as it relates to digital age teaching practices. The researcher concluded that:

- Teachers with higher levels of network participation demonstrate higher fluency with digital tools and learner-based methodologies.
- Teachers who collaborated more often with higher quality collaboration and established more new professional relationships demonstrate higher fluency with digital tools.
- The type of professional learning community in place at the school level does not bear a relationship to levels of teaching innovation.
- The intensity of professional development offerings in place at the school level does not bear a relationship to levels of teaching innovation.

- Teachers with higher levels of teaching innovation place greater value on learning from experts outside the network and collaboration at individual schools in transforming their practice.

This study was limited as it studied only one network, it had a lower than expected response rate, and relied on a snapshot versus intervention lens. Recommendations for future studies include replicating the study in subsequent years of the project or in a similar network, further exploring the nature of professional relationships formed in the network, and focusing on the online Ning tool.

Chapter 1

Introduction

The intent of this quantitative, descriptive study is to build understanding about teacher participation in a networked learning community as it relates to innovative teacher practice. The changing nature of professional development from reliance on the traditional workshop based approach to a more customized teacher-designed type of learning utilizing tools including Nings, blogs, wikis, e-conferences, Twitter and Skype warrants examination. Teachers seem to be creating their own, more relevant, personal learning networks. At the same time, schools are continuing to experiment with different ways to build and strengthen professional learning communities. In an effort to capitalize on these two trends, the Hawai'i Association of Independent Schools and the Hawai'i Community Foundation joined forces and responded by providing a structure, forum and support for teachers from twenty independent schools across the state for professional knowledge creation and sharing via a networked learning community. The hope is that teachers in project schools experience significant pedagogical shifts by participating in a networked learning community that intentionally strengthens the professional learning community at each school.

Background of Problem

Koper, Rusman, and Sloep (2005) define a learning network as "an ensemble of actors, institutions and learning resources which are mutually connected through and supported by information and communication technologies in such a way that the network self-organizes and thus gives rise to effective lifelong learning" (p. 8). The explosion in the use of social media has allowed teachers to develop their own personal learning networks or PLN's as vehicles for more individualized professional

development. Teachers have always been able to create their own networks transcending school walls by attending district meetings and/or conferences. However, these interactions are limited for most. With more interactive and readily available social media, there are many new learning opportunities for teachers when they connect with each other through the use of Web 2.0 tools such as Twitter, blogging, RSS readers or by joining one of the many education related Nings that have sprung up over the past few years (Lieberman & Mace, 2010). Personal learning networks are marked by their individual, personalized nature, a flat rather than hierarchical structure where anyone can be an expert, and the ability for members to contribute and receive resources anytime, anywhere one has an internet connection.

Professional learning communities or PLC's are another form of professional development marked by emphasis on student learning, a shared sense of accountability and a collaborative school culture (DuFour, R., 2004b; Wood, 2007a). Professional learning communities have been implemented for several years in schools as a vehicle for school reform since the literature indicates that well-designed professional learning communities allow for the type of sustained teacher learning that leads to instructional improvement (Borko, 2004; Darling-Hammond & Richardson, 2009; DuFour, R., 2007; Sergiovanni, 2000; Vescio, Ross, & Adams, 2008).

Networked learning communities or NLC's intentionally work across schools to strengthen professional learning communities by creating new opportunities for knowledge sharing and creation (Katz, Earl, & Jaffar, 2009). Networked learning communities can offer more intense levels of learning by providing more diverse opportunities for ongoing, social and contextual learning through the development of

relationships amongst the individuals across the schools in the network. Ideally, schools in the network work together to create higher quality professional learning experiences and build greater capacity for reform as they collaborate to improve student learning (Katz et al., 2009). Schools can contribute to the strength of the network by sharing expertise with a broader audience while at the same time finding a more diverse set of responses within the larger network when they share their own problems of practice (Katz et al., 2009). Newer technologies can facilitate a more dynamic and interactive level of collaboration and sharing across the networked learning community (Lock, 2006; Trinkle, 2009; D. Wiley, 2010). Through the use of face-to-face meetings and web-based, social media tools, networked learning communities can potentially meld together the best features of both personal learning networks and professional learning communities.

Metcalfe's law states that the "value of a network is proportional to the square of the number of connected users in the system" ("Metcalfe's Law," 1995, p. 53). The value of ten members in the network can potentially become worth that of one hundred teachers since teachers now have the chance to perhaps connect with the individuals comprising each of the ten extended networks. Thus, teachers who participate in networked learning communities have the potential to connect with an exponentially larger and more diverse pool of educators who can expand their learning which can possibly change both their thinking and classroom practice (Hargreaves, 2003). Networked learning community theory rests on the assumption that "significant changes in student learning depend on major changes in the practices and structures of schools, and these changes will emerge from the professional knowledge creation and sharing that occurs through interaction within and across schools in networks" (Katz et al., 2009, p. 9). Figure 1, designed by the

researcher, demonstrates how participation in a network, relationships formed in the network and knowledge transfer can occur not only between the networked learning community (NLC) and each individual professional learning community (PLC) but also between professional learning communities. A scenario follows elucidating how networked learning theory might unfold in practice.

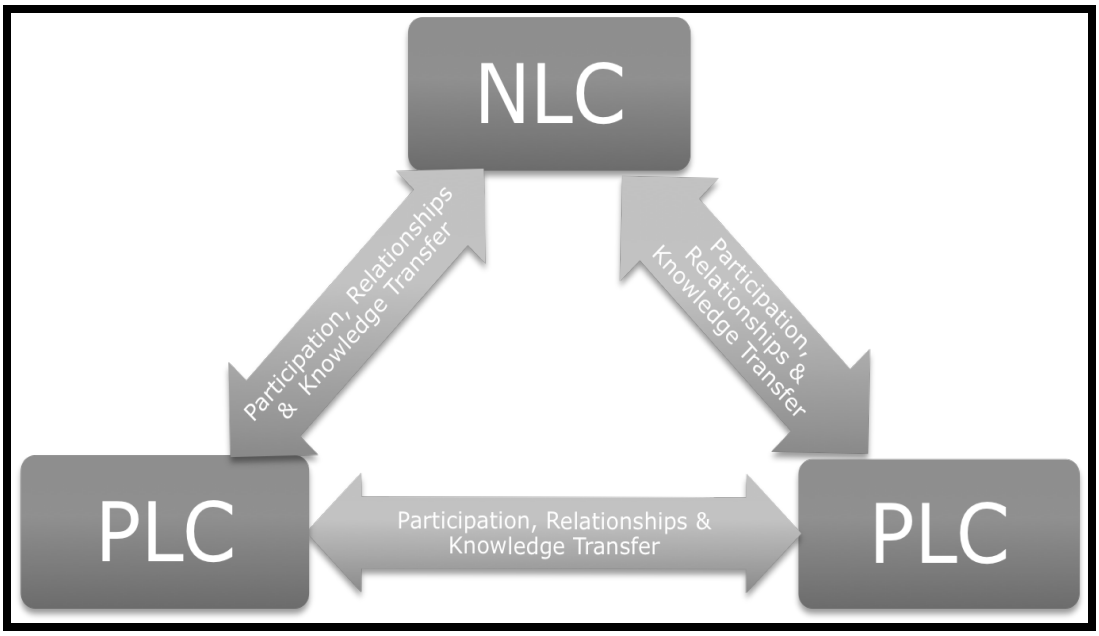

Figure 1. The dynamic between a networked learning community and its professional learning communities (designed by the researcher).

A Networked Learning Community Scenario

Maile has taught fourth grade for over 15 years at one of the best and largest independent schools in the country. Maile is well respected by students, parents and her peers and considers herself to be very up to speed with technology and the current research on best practices in teaching. She is not so sure about the other teachers on staff. The primary mode of professional development is for the school to hire experts and big-name speakers to come in and present to the staff through a traditional workshop model. These sessions are often offered during the summer or over breaks. Teachers who teach

the same grade level meet weekly to discuss ideas and go over administrative items such as upcoming events and the schedule. Learning coordinators, who report to the division principal, facilitate these meetings. The teachers have a great time together and many of them enjoy deep friendships outside of school. However, the conversations rarely turn to teaching and learning.

Recently, the principal invited Maile to be part of the leadership team for a large, multi-year grant the school had just received to become a model "School of the Future." As part of the grant, project leaders at each school would both lead the initiative at their own school and participate in a larger, networked group comprised of project leaders from all twenty schools who received the grant. This networked group would be called a community of learners. The community of learners would meet four times a year for one day face to face. Additionally, they would attend one weeklong study tour per year together. Finally, they would participate in a shared online space called a Ning by sharing resources, facilitating and contributing to discussions. All project leaders would be expected to strengthen the professional learning community back at their own schools by sharing their learning with teachers and school leaders.

Maile's head was spinning. What was a Ning? What did a School of the Future look like? Who would cover her class for the meetings? Did her school even have a real professional learning community? Would she have time to take on this additional responsibility? Although open to trying new things in her classroom, Maile had to admit that she had become a bit complacent in her teaching. After all, the school was clearly working as evidenced by the long waiting lists and the college admissions acceptances of graduating seniors. However, she had recently been hearing more and more about 21st

Century skills and the concepts associated with this were still fuzzy. She had heard from her colleagues at other schools about tools such as protocols, blogs, wikis, and Twitter that she thought might be good for her students. Maybe this would give her a chance to learn more about these practices and help the other teachers at her school learn about them as well. After a great deal of reflection, she decided to accept the invitation. Maybe it would be the boost she needed to go beyond her classroom to try to learn with and from other teachers who were also anxious about how they could move from more traditional, teacher-centered practices to more innovative, student-centered strategies.

One year later, Maile feels invigorated and reenergized. She has started a classroom blog, set up a twitter account and has participated in several project tuning protocols. She has several new e-mentors outside of her school. She follows several blogs and starts each day with a fifteen-minute review of new resources shared with her by her personal learning network. This year when she began planning her curriculum over the summer, she redesigned many of her old lessons and integrated them into units of discovery with essential questions and essential understandings. Each of her four main units now has a project associated with it that gets students working together, out in the community and using their creative abilities to share their learning with a wider audience. Most importantly, she feels confident talking to parents, her colleagues and school administrators about why these changes were made and how they will improve student engagement. She is certain that her students will soar and become better and more creative readers, writers, problem solvers, critical thinkers, and collaborators. For the first time in years, she can't wait for school to start and is assured that she will be able to address any challenges that she faces with the help of her ever expanding personal

learning network of colleagues, some of whom are members of the School of the Future networked learning community and some of whom are members of her even larger personal learning network which now spans the globe.

A Networked Learning Community

The Hawai'i Association of Independent Schools and the Hawai'i Community Foundation are supporting an innovative venture attempting to transform several schools at once by creating an intentional networked learning community of schools demonstrating solid plans to become model Schools of the Future aligned with the 21st century teaching and learning movement. Independent schools from across the state were invited to apply for multiyear grants ranging from $25,000 - $75,000 per year for five years. Schools were required to assess their readiness to change and to submit plans embracing a clear commitment to transformation. School leaders were encouraged to read *Disrupting Class* by Clayton Christensen and *The Global Achievement Gap* by Tony Wagner. A conference featuring Tony Wagner was held in October 2008 and interested schools were required to bring teams comprised of a school administrator, teacher, board member, parent and student. Approximately 50 schools submitted proposals and 18 projects were funded. Two of the projects are partnerships between one or more schools so in all, 20 independent schools across Hawai'i are now participating. The first cohort of schools received funding in January 2009 and the second group received funding in June 2009. Although each project is unique, all demonstrate willingness and a clear plan to transform their learning environment.

As part of the grant, all schools are required to have at least two staff members, including the project leader at each school, participate in the community of learners

(COL). The COL meets four to five times a year for one-day face-to-face meetings to learn together and to discuss problems of practice. Additionally, the COL participates in a one-week study tour each year of the project. In October 2009, the group visited the cluster of High Tech High charter schools in San Diego and in June 2010, the group attended the International Society of Technology in Education (ISTE) Conference in Denver. One further requirement is that project leaders and teachers from each project school participate in an online space called the School of the Future Ning. The Ning currently has over 540 members including project teachers, administrators and outside educators and consultants with an interest in the project. Formal discussions revolving around problems of practice are held in the Ning and led by different participating schools during the months that the group does not have face-to-face meetings.

Grant progress is monitored through quarterly reports submitted by project coordinators to both the Hawai'i Community Foundation and the Hawai'i Association of Independent Schools. Each year, schools are required to submit their completed project budget, a summary of actual versus intended accomplishments and reapply for funding. A cross-agency team reviews reports and proposals to determine annual funding and, if necessary to provide feedback to schools on their revised grant goals and objectives as they relate to the overall project goals of infusing 21st Century teaching and learning into each school's curriculum.

Statement of The Problem

Society has faced a cataclysmic shift in how people interact, learn and acquire information (Schlechty, 2001). According to Andreas Weigend (2009) former chief scientist at Amazon.com, humans generated more data in 2009 than all of history's prior

years combined. Historically, knowledge was held in the hands of the educated. Children learned to read, write & do math in school from their teachers, who could pretty much rest secure in the knowledge that they knew more than their students. Most official learning took place in schools. Good students were those who could regurgitate the teacher's lecture, the textbooks and other information available to them at school. This perception of teaching and learning is no longer adequate within a rapidly evolving global landscape. Students can learn about almost anything with a few keystrokes wherever there is a reliable Internet connection. We are also beginning to understand that the digital generation processes information differently than previous generations (Jukes, McCain, & Crockett, 2010) and that today's students will spend much of their lives learning online contributing to a variety of different virtual networks based on their passions and interests (W. Richardson, 2009).

It is no secret that American students are consistently outperformed on international measures of achievement and that other countries are making great strides in areas of innovation and creativity (Gonzales et al., 2008b; Pink, 2006; Statistics, 2009; Wagner, 2008; Zhao, 2009). More than the passive recipients of yesteryear, American students today must become network literate, self-directed and self-motivated requiring exposure to a different, more interactive and participatory educational model (W. Richardson, 2009). As the global economy shifts, workplace demands are shifting alongside. The knowledge economy requires that ALL of our students learn to actively access, evaluate, manage, integrate and create knowledge (Hayes - Jacobs, 2010; Wagner, 2008; Zhao, 2009). Students will need to be able to synthesize and create knowledge in a

way that no previous generation has experienced. Our education system must evolve accordingly.

Despite the reality that we have access to solid research on how students learn best and how the brain functions, most of this has not been integrated into classroom practice (Jukes et al., 2010). Twenty-first century students need twenty-first century teachers who are comfortable with the strategies, tools and pedagogy necessary to prepare their students for a world where information is everywhere but knowledge is fleeting. Today's teachers must learn how to redesign learning experiences in order to ensure that students are exposed to the type of critical thinking, rigor, problem solving, creativity and collaboration required to succeed in today's economy (Darling-Hammond, 1998). To learn how to do this, twenty-first century teachers need twenty-first century professional development models that clearly define and emphasize the importance of integrating 21st Century skills and tools by tapping into teachers expertise within and across schools (21st century skills, 2007; DuFour, R., 2007).

Unfortunately, most teachers continue to be exposed to traditional, drive-by professional development workshops emphasizing traditional teaching methods (Borko, 2004; Darling-Hammond, Wei, Andree, Richardson, & Orphanos, 2009a). This type of professional development has largely proven to be ineffective with regards to changing classroom practice or improving student achievement (Borko, 2004; Little, 1993) yet districts and conference organizers continue to rely on them as avenues for school reform (Darling-Hammond et al., 2009a). Educational systems are continuously trying out different professional development models and frameworks to improve how they meet their objectives (Schlechty, 2001). Educators have grown accustomed to learning about

new trends, many of which are actually repackaged earlier trends. This has created a frustration and cynicism on the part of many educators who tend to sit passively in the room as educational experts describe another new/old way to improve instruction.

In some of the more progressive schools and districts, there have been various attempts to integrate the professional learning community model as a mechanism to help schools improve their ability to achieve their objectives. Professional learning communities provide structures for teachers to collaborate and share practical examples of practice. Enhancing and connecting professional learning environments via interactive social media tools that allow participants to construct their own learning and expand their teaching repertoire is essential if we are to begin to prepare our students more adequately for their futures (21st century skills, 2007; Darling-Hammond, 1998; Lieberman & Mace, 2010; Wood, 2007a).

The idea of a networked learning community as a model for professional development in education emerged in the literature as far back as the 1970s with a significant resurgence of literature in the early 1990s. More recently, networked learning communities (NLC's) are garnering renewed attention. NLC's take the professional learning community model one step further by providing a structure for professional knowledge sharing and creation using interactive web-based tools to connect teachers and administrators across school, district, state and national boundaries. This will hopefully facilitate the use of various social media tools to codify knowledge and scale up reform in a way that was not possible before (Lieberman & Mace, 2010). As more and more educators search for meaningful connection with their colleagues around the world for professional growth options that are more customized, relevant and personal, there is a

need to explore new models more deeply. Examining the role networked learning communities can play in promoting innovative teaching practice will better help us meet the unique learning needs of both teachers and the digital generation (Jukes et al., 2010; Katz et al., 2009; Lieberman, 2000).

Conceptual Framework

The theory underlying the rationale for networked learning communities integrates the knowledge base from a variety of disciplines including community of practice theory, knowledge management theory, professional learning community theory, network theory, and capacity-building theory, with each providing different perspectives from which to view and understand networked learning theory in action (Noden & Bruce, 2006).

This study begins by exploring the current discourse regarding the need for our students to be exposed to a different type of pedagogy in order to be more successful in a rapidly changing global economy. Current student achievement and the impact of teachers on student achievement will be examined as a means of justifying the need to consider alternative and more meaningful ways to improve teacher practice in order to address our nation's current achievement woes. This will lead into a review of the literature related to effective professional development and professional learning communities. Deeper understanding of both areas of study will inform us as to how knowledge sharing and creation within networked learning communities can support deeper and more sustained teaching innovation.

Networked learning community theory rests on the assumption that professional learning communities and networked learning communities strengthen each other if three

enablers are in place and functioning effectively: the development of formal and informal leaders; collaborative inquiry that challenges thinking and practice; and a specific and clear learning foci for students, teachers and leaders (Katz et al., 2009). With all of these elements in place, professional knowledge sharing and creation occurs. In an ideal scenario, this sharing and creation results in the type of changes in both thinking and practice on the part of teachers and leaders that are necessary to improve student learning, engagement, and success (Katz et al., 2009). This thinking raises many new questions worthy of investigation. What types of teachers seem to engage in and benefit most from participating in networked learning communities? How does knowledge travel across the network? What if the changes in thinking and practice have a negative impact on student learning? To what degree are participants establishing new professional relationships? Is there a relationship between the level of teacher participation in a networked learning community and level of teaching innovation? How do we know?

Purpose of the Study

The intent of this descriptive, quantitative study is to build understanding about teacher participation in a networked learning community established for knowledge creation and sharing as it relates to the development of innovative 21st century teacher learning and practice. The focus will be on factors that contribute to the building of collaborative inquiry that changes thinking and practice (Figure 2). Learning more about how related network factors such as levels of participation in networks, collegial relationships, and school-based factors related to the strength of the school's professional learning community and the intensity of professional development, interact to shape

levels of teaching innovation can provide important insight as we search for new ways to enhance teacher learning.

Research Questions

This study will address the following research questions as measured by teacher self-report about the nature of network participation and the level of innovative teaching practices as rated by the Levels of Teaching Innovation (LoTi) Digital Age Survey.

1. Do teachers who participate more frequently in networked learning community activities utilize more innovative teaching strategies as measured by the LoTi Digital Age Survey?
2. Do teachers who develop new professional relationships in networked learning communities utilize more innovative teaching strategies as measured by the LoTi Digital Age Survey?
3. Does the type of professional learning community in the school bear a relationship to levels of teaching innovation as measured by the LoTi Digital Age Survey?
4. Does the intensity of professional development in a school bear a relationship to levels of teaching innovation as measured by the LoTi Digital Age Survey?
5. What factors do the teachers with higher levels of teaching innovation as measured by the LoTi Digital Age Survey report as being significant in influencing changes in their practice?

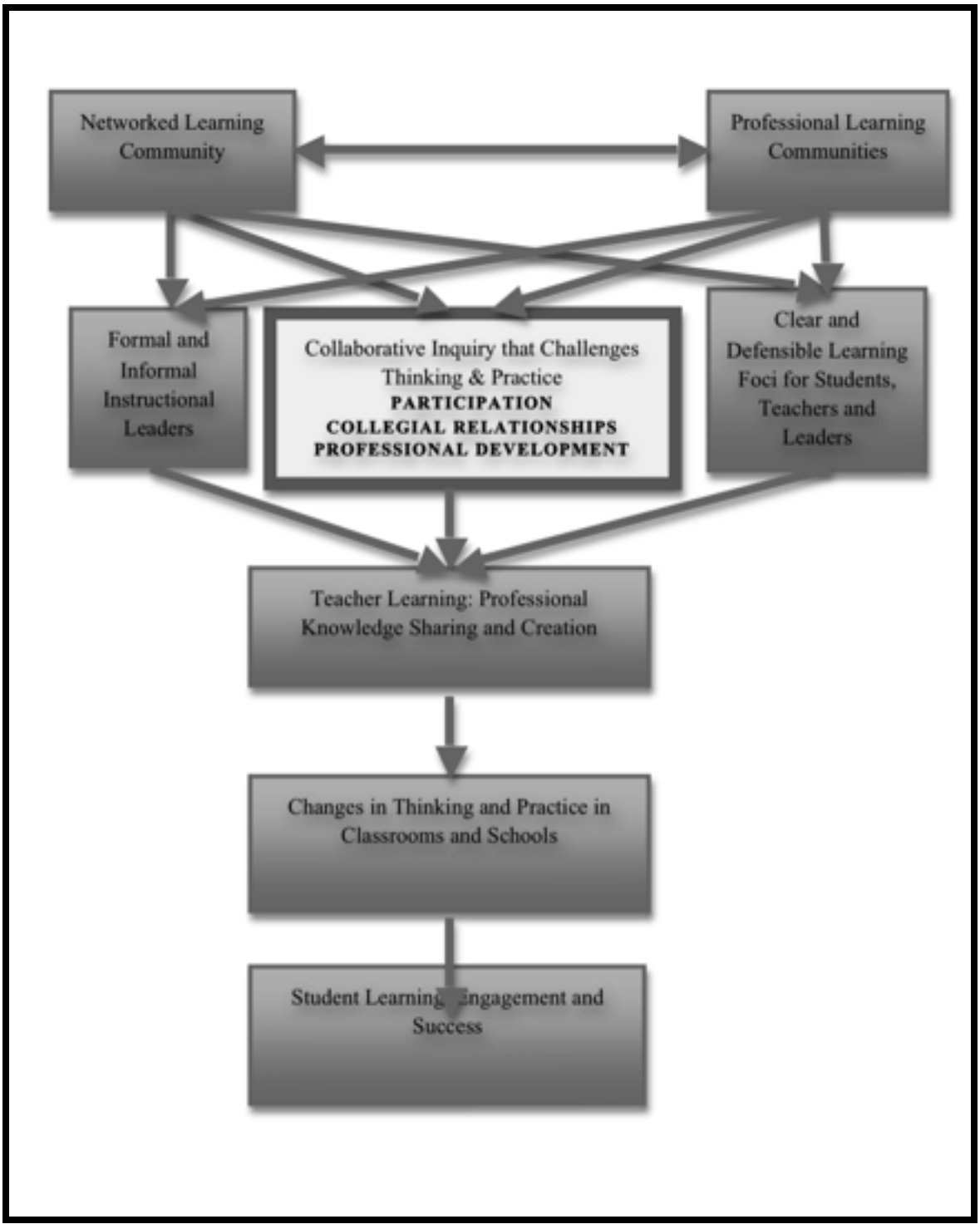

Figure 2. Networked Learning Community Theory (Katz, Earl & Jaffar, 2009 p.10) elucidating the key factors of participation, relationships and professional development as keys to changing thinking and practice. In this study, these factors are to be explored as they relate to teaching innovation.

Research Design

The primary strategy of inquiry for this quantitative study is a cross-sectional, non-experimental survey design (Creswell, 2003). Data from the Levels of Teaching Innovation (LoTi) Digital Age Survey instrument, customized with additional questions related to teacher perception about their participation in the networked learning community will be utilized to analyze subsets of teacher perception and performance data. Descriptive and inferential statistics, such as Pearson's r, and ANOVA will be used to study independent variables related to participation in a networked professional learning community as they relate to the dependent variable, levels of teaching innovation (LoTi). Additionally, a correlational matrix will be produced to test for significance and for potential associations between study variables.

Study participants are independent-school teachers from the twenty project schools who are part of the Schools of the Future networked learning community in Hawai'i. Some study participants are also members of the School of the Future Ning, an online space for social networking and sharing of resources. The School of the Future Ning has a discussion forum, resource center, and space for blogs. All schools involved in the project were invited to allow their teachers to take the LoTi Digital Age Survey during a one-month time frame during the second year of the project. The survey was customized to include ten additional questions validated by experts in the field related to the survey participants experience in the networked learning community. The custom questions specifically addressed frequency and quality of participation in network activities, along with frequency and quality of collaboration with colleagues at the school site and within the network. One final question asked participants to identify perceived

network benefits. Additional data related to type of professional learning community and intensity of professional development experienced during Year 1 was utilized. The data from both the custom questions and Year 1 data were analyzed in relation to LoTi results.

Definition of Terms

Personal Learning Network – "a group of people who can guide your learning, point you to learning opportunities, answer your questions, and give you the benefit of their own knowledge and experience" (Tobin, 1998, para. 1).

Professional Learning Community – A model for school improvement and reform at the school-level characterized by "shared mission, vision and values; collective inquiry; collaborative teams; an orientation toward action and a willingness to experiment; commitment to continuous improvement; and a focus on results" (DuFour, R., & Eaker, 1998, p. 45).

Networked Learning Community – "Groups of schools working together in intentional ways to enhance the quality of professional learning and to strengthen capacity for continuous improvement in the service of enhanced student learning" (Katz et al., 2009, p. 9).

Levels of Teaching Innovation - The Levels of Teaching Innovation (LoTi) Digital Age Survey is a tool measuring teacher integration of digital-age literacy aligned with the National Educational Technology Standards for Teachers (NETS-T) and Administrators (NETS-A) ("LoTi ", 2010).

Web 2.0 - Dynamic internet-based social networking applications allowing for contributions and collaboration such as blogs, wikis, Ning, RSS and social bookmarking.

Limitations of the Study

The data set used in the study was collected from teachers working in independent schools in Hawai'i that were chosen to participate in a competitive, statewide, multi-year Schools of the Future grant initiative. Only teachers from independent schools involved in the Schools of the Future initiative are included in the study. Since this project is not intended to treat the network as an intervention, pre and post data is not being considered. Rather the study is more descriptive in an attempt to better understand the nature of network participation as it relates to teaching innovation. Recognizing that not all networks have a positive focus or potentially positive impact, this study assumes that the learning focus of the network under study is a positive one with the intended outcome being the improvement of student learning and engagement.

Significance of the Study

This study is significant because it can provide insight into how we can support teachers as they transform their teaching and learning environments to better serve today's students. It is significant because it may help us better understand how teachers perceive their learning as it relates to participation in networked learning communities. It is significant because it will likely provide clues into how we can design more meaningful, authentic and sustainable teacher learning opportunities (Lieberman, 2000). Finally it can help us better understand how to support teachers so they can design learning experiences for our 21st century students that are in alignment with the digital world in which students live, work and play. Hopefully, the reader gains deeper insight into how networked learning communities can impact professional knowledge sharing and creation which in turn, can result in changes in thinking and practice in schools (Katz

et al., 2009). Ultimately, this study will hopefully provide useful information to professionals who are considering the establishment of networked learning communities as a catalyst to transform teacher practice and improve student learning.

Organization of the Study

This study is organized into five chapters. Chapter one provides an overview of the problem and grounds the work in a conceptual framework. Chapter two reviews the literature pertaining to teacher versus student centered approaches to teaching and learning as it relates to 21st century skills, how teachers learn, and professional development including professional learning communities and networked learning communities. The third chapter of this study outlines the research methodology used to conduct the study. The results of the study can be found in chapter four with an analysis and discussion of those results in chapter five.

Chapter 2

> Learning for a child of the 21st century is much more complex than ever before. Modern technology has been seamlessly infused into the lives of children and their interactions with their surroundings. (Leh, Kouba, & Davis, 2005, p. 242)

Overview

The traditional way teachers in schools gain new knowledge and ideas has been via formal professional development efforts such as workshops, in-services, school-based teams, district curriculum committees and conferences. With the advent of the Internet and more recently, the proliferation of social media and other interactive digital tools, a new way of accessing ideas and knowledge has emerged. School networks have sprung up as a vehicle to accelerate school reform efforts (Veugelers & O'Hair, 2005). The most recent iteration of the learning community model, the networked learning community, capitalizes on the increasing use of interactive social media tools to help teachers share resources, challenges and stories of practice in the service of enhanced teaching and learning (Lieberman & Mace, 2010). These networks extend the professional learning community model by connecting practitioners across schools, districts, regional associations and even globally. Although school learning networks come in many shapes and forms, networked professional learning communities typically allow for the convergence of the knowledge, experience and expertise of practitioners within and across schools, fostering innovation in classroom teaching and school-based practices (Hargreaves, 2003).

By examining the literature base in several key areas such as teacher versus student centered 21st century learning environments, professional development, professional and networked learning communities, this chapter builds the case for more

research regarding the potential for networked learning communities to transform teaching practices. Considering the dismal state of education in our country today as evidenced by our inadequate performance on international measures of achievement, our extremely high drop-out rate, the inequity in funding and performance across our 50 states and the high rate of teacher turnover, it is imperative that we learn more about how the networked learning community model can help us create sustainable, dynamic and organic models of teacher learning to transform our schools into the 21st century learning environments our children deserve.

The Case for 21st Century Teaching and Learning

It is no secret that other nations consistently outperform American students on international measures of achievement. In 2007, only 10% of U.S. fourth graders and 6% of U.S. eighth graders scored at or above the advanced international benchmark in mathematics on the TIMSS or Trends in International Mathematics and Science Study (Gonzales et al., 2008a). Overall, we ranked only 13th in math amongst fourth graders and 11th amongst eighth graders. Fourth graders ranked 11th while eighth graders ranked 13th in science (Gonzales et al., 2008b). On our nation's 2009 reading report card, only 33% of fourth graders scored at the proficient level in reading while only 8% scored at the advanced level (NCES, 2009b). Among eighth graders, 33% scored at the proficient level while only 3% scored at the advanced level (NCES, 2009b). Although one could argue the validity of utilizing standardized tests as the measure to assess how effective our educational system is working in comparison to other nations, examination of other indicators demonstrates that the overall design of our educational system needs rethinking.

In 2007, 16 % of persons between 16 and 24 years of age (nearly 6.2 million people) were high school dropouts (CLMS, 2009). According to the National Center for Education Statistics, only 44% of public high school graduates in 2003 (most recent year available) attended four-year universities. For private schools, that figure was much higher at 79.5%. Only 20.5% of our nation's ninth graders go straight to college and finish within six years (NCES, 2009a). In terms of college degrees amongst 25-34 year olds, the United States has plummeted in the rankings from 1st to 12th amongst 36 developed nations (Lewin, 2010). Our public educational system is clearly not working well enough to prepare students for today's knowledge economy (Miller-Sadker & Zittleman, 2007; Ravitz, Becker, & Wong, 2000b; Zhao, 2009).

Many researchers, speakers and educational leaders argue that the entire system needs rethinking and that our nation's schools need to move away from the current emphasis on traditional, discipline specific skills and instead focus on a much broader skill set that is more aligned with the changes taking place in the global economy. Several books published over the last five years including, *The Global Achievement Gap* (Wagner, 2008*)*, *Catching Up or Leading the Way* (Zhao, 2009*), A Whole New Mind* (Pink, 2006)*,* and *Curriculum 21: Essential Education for a Changing World* (Hayes - Jacobs, 2010), amongst others, argue that in order for today's students to be successful in our rapidly changing and flattening world, they must develop an expanded set of literacies and a skill set integrating critical thinking, problem-solving, collaboration, adaptability, initiative, analysis, oral and written communication, curiosity and imagination.

Defining Twenty-first Century Teaching and Learning. The terms 21st century skills, 21st century literacy or fluency, and 21st century learning are used regularly and interchangeably in the media and in education literature. The advent of more advanced technologies and the continued permeation of computers into our nation's educational environments over the past several years means that we must reconsider how advanced technologies create the need to expand our previous notions of literacy before we can truly transform learning environments (Leh et al., 2005).

Different than the back to basics movements that resurfaced several times after Sputnik in the late 1950s, the publication of "A Nation at Risk" in 1983 and the SCANS report in 1991, the 21st century skills and literacy movement urges educators to see beyond traditional academic disciplines and to integrate content and skills in a manner more relevant for students who live in a world connected in ways we could only imagine as recently as 20 years ago (Armstrong & Warlick, 2004; A Nation at risk, 1983; SCANS, 1991). To start with, today's students need to be able to read and interpret the texts of today's world (Armstrong & Warlick, 2004; Kellner, 2001). This means becoming familiar and accomplished not only with traditional forms of print literacy that transcend each discipline but also with e-mail, texting, chat room, blog, Ning and other current forms of communication (Kellner, 2001; O'Brien & Scharber, 2008). Visual literacy is becoming much more critical (O'Brien & Scharber, 2008) in an era dominated by media collage, mixed media and mash-ups. These and other new skills, literacies and fluencies have been identified by a variety of individuals and organizations.

As an example, in 2002, the Carnegie Corporation issued an in-depth update of a 1989 report called *Turning Points 2000: Educating Adolescents in the 21st Century* (A.

Jackson & Davis, 2000). The report called for teachers to inspire middle level students to become caring global citizens by designing engagements that promote creative thinking, raise awareness of strengths and areas for improvement, foster the identification and finding of solutions to complex, authentic problems, integrate different forms of communication and promote effective collaboration (A. Jackson & Davis, 2000). The North Central Regional Educational Laboratory (NCREL) and the Metiri group released the *enGauge 21st Century Skills for 21st Century Learners* document breaking down 21st century skills into digital literacies, inventive thinking, effective communication and high productivity (enGauge, 2003).

The Partnership for 21st Century Skills, formed in 2002, espouses a similar skill set. The Partnership's founding coalition included the United States Department of Education and organizations such as AOL Time Warner, Apple, Microsoft, the NEA, Cisco and Dell. The mission of the Partnership is to "serve as a catalyst to position 21st century skills at the center of US K-12 education by building collaborative partnerships among education, business, community and government leaders" (Partnership, 2011, p. para 1). In May 2009, the Partnership completed a Framework for 21st Century Learning articulating the skills, knowledge and expertise students need for future success. Specific outcomes are broken down into information and communication skills, thinking and problem-solving, interpersonal and self-direction skills, global awareness, financial, economic and business literacy, developing entrepreneurial skills to enhance workplace productivity and career options, and civic literacy (Bellanca & Brandt, 2010).

The International Society of Technology in Education (ISTE) publishes standards in this area for students, teachers and administrators. ISTE is a membership organization

bringing together educators committed to advancing technology use to improve teaching and learning (ISTE, 2010). The ISTE standards for students are worded differently from those laid out by the Partnership for 21st Century Skills, yet both groups call for emphasis on a similar set of core skills including creativity and information, communication and collaboration, research and information fluency, critical thinking, problem solving, and decision making, digital citizenship, and technology operations and concepts (ISTE, 2007a).

It thus appears as if leading educators, government agencies, business and practitioner organizations seem to recognize the reality that those working in today's schools are perhaps just beginning to understand – the first decade of the 21st century has been marked by a continued rapid emergence of new and innovative technologies profoundly impacting how we work, play and communicate with one another (J. S. Brown, 2000). American education and teacher learning must evolve accordingly. The advent and continued, rapid development of social media tools along with the looming reality of Web 3.0 mean that technology users will play even more active & collaborative roles in content and knowledge creation via progressively more dynamic and interactive interfaces. Implications of these interactive technologies on teaching and learning are potentially enormous (J. S. Brown, 2000) yet most schools have yet to fully integrate the pedagogy that the newer modes of inventive, collaborative, participatory learning offered by the Internet and mobile technologies will require (Davidson & Goldberg, 2009; Kellner, 2001).

Although there are many complex layers to explore when discussing educational philosophy, psychology and pedagogy, for purposes of this research, we will consider

pedagogy through two primary lenses: teacher-centered and student-centered. The teacher-centered approach is considered more direct-instruction and transmission oriented while the student-centered approach is considered to be more creative and construction oriented. Traditional transmission pedagogy is still the norm over constructivist compatible pedagogy, the latter seeming to better align with the strategies, practices and tools that will help our students develop a set of 21st century literacies and skills (Ravitz et al., 2000b). To be fair, there are classrooms across the country that look more 21st century than not. However, these classrooms are exceptions rather than the norm (Wagner, 2008).

> We are at a tipping point that compels us to abandon schools that were designed to meet the needs of the last century. At the end of the 19th Century, the factory model of teaching and learning emerged in response to: the demands of an industrial economy; the prevalence of behaviorist learning theory; and the dominance of scientific management principles in the workplace. The convergence of these forces produced "Teaching 1.0", which enshrined the delivery of standardized content, by stand-alone teachers, who were expected to do uniform work in self-contained classrooms. In Teaching 1.0 the role of the teacher was to transmit a fixed body of knowledge and skills to students who would use it to engage in predictable careers and pursuits. (Carroll, 2007, p. 48)

Teacher Centered Approaches to Teaching and Learning. The traditional, transmission oriented, teacher-centered or back-to-basics approach that lies beneath the foundation of the No Child Left Behind Act currently drives instruction in the majority of our nation's schools making it quite difficult for many teachers to move beyond the Teaching 1.0 model as described above by Carroll (Schoen & Fusarelli, 2008). The ideals of the excellence movement remain embedded in the collective educational psyche with many schools continuing to adhere to a model in which a teacher transmits information to students (Carroll, 2000). Thus most teachers teach as they always have.

They plan lessons using traditional textbooks and scripted teacher guides. They design using strategies learned early in their teaching careers. Walk through most schools across our country today and you will see a teacher-centered paradigm in action with most students engaged in one or more of the following: listening to a teacher lecture; reading from textbooks, answering publisher designed questions; copying notes off of a board or overhead or sometimes a PowerPoint slide; writing paragraphs or traditional essays; engaged in class discussions with one or two students dominating the conversation; sitting in computer labs doing drill and practice type programs; and completing worksheets (Schools, 2008; Wagner, 2008).

In transmission-oriented learning theory, teachers plan their lessons so that all of the students experience the same subject content in the same way (Miller - Sadker & Zittleman, 2007). The goal is to reduce errors and confusion by outlining very clear procedures that are easily comprehensible (Ravitz et al., 2000b). Competition and rewards are viewed as important for motivating learners. Schools that subscribe to this approach focus on developing disciplined minds and respectful citizens (Miller - Sadker & Zittleman, 2007). According to Rogoff (1994), in a teacher-centered paradigm, students are passive knowledge receptacles and adults are responsible for filling up the receptacles.

Cuban (1983) painted a broader and more vivid description of teacher-centered classrooms while investigating curriculum change and stability over time for the National Institute of Education. Cuban (1983) found that teacher-centered classrooms had more rather than less teacher talk, focus on facts, whole group instruction, reliance on textbooks as a primary source, desks arranged in rows, questions posed by the teacher

and little, if any technology usage. The teacher-centered approach has enjoyed a long history of support and advocacy by many leading educational experts. However, there is considerable dialogue in the literature regarding the limits to its efficacy in our rapidly changing knowledge landscape. As the nature of access to knowledge changes, more progressive educators and reformers argue that pedagogy should change alongside (Armstrong & Warlick, 2004; Kellner, 2001; Papert, 1994; Reynard, 2008; Wagner, 2008; Zhao, 2009). The traditional approach seemed logical in an era when knowledge was more fixed and when it took years rather than seconds for information and new knowledge to be transferred to the populace. Here is what we know about how the world works. Learn it, master it, apply it and you are educated. Is this enough in today's world when the amount of new knowledge that a child is exposed to in 24 hours might be more than his grandparents encountered in their entire lifetime?

> Teaching 2.0," is emerging in response to a 21st Century convergence of forces that includes: a knowledge-based global workforce; a new understanding of how people learn; and a widespread adoption of collaborative teamwork in the workplace. Teaching 2.0 is customized to individual learning needs. In Teaching 2.0, teachers and students co-create coherence and meaning out of the wide range of learning experiences they can pursue in an open learning economy that is enriched by smart networking and user generated content. (Carroll, 2007, p. 48)

Student Centered Approaches to Teaching and Learning. Leh, Kouba and Davis suggest that 21st century learning involves five types of interactions: "(a) learner–content, (b) learner–teacher, (c) learner–learner, (d) learner–interface and (e) learner–community" (Leh et al., 2005, p. 237). Their paradigm expands the strictly teacher-centered model to reflect the learning that takes place between two learners, between learners and social media and between learners and the communities they are a part of

(Leh et al., 2005). They argue that modern technology provides learners with a wider variety of learning options (Leh et al., 2005). More progressive or student-centered educators would agree that new media and technologies warrant a shift in how we approach teaching and learning (Armstrong & Warlick, 2004; Carroll, 2000; Kellner, 2001; Papert, 1993). Student-centered approaches are less authoritarian, less concerned with the past and more concerned with ensuring individual learning needs are met, that learning is relevant and that students will thrive in a future that is difficult to visualize (Miller - Sadker & Zittleman, 2007).

Students and teachers are viewed as co-learners who together make meaningful and well-informed choices about what to study and how to best design learning experiences accordingly (Carroll, 2000). School is organized around the interests, concerns, curiosities and real world experience of the learners. Teachers facilitate rather than direct learning although students can facilitate as well. In true co-learning settings, teachers encourage students to work cooperatively. Progressives believe that genuine and long-lasting learning originates within the learner and that education is a vital and organic part of society. Fostering a sense of meaning and development of intrinsic motivation are favored. Progressives believe that this approach best reflects (Carroll, 2000) and prepares students for the information age (Miller - Sadker & Zittleman, 2007).

Student centered approaches have their roots in constructivism, a teaching method based on the works of Jean Jacques Rousseau, John Dewey, Jean Piaget, Les Vgotsky and others (J. K. Brown, 2008). Constructivism asserts that knowledge cannot be handed from one person to another; rather each learner must construct it as they interpret and reinterpret a constant flow of information (Darling, 1993). In 1762, Rousseau published

Emile which some feel started the student-centered educational movement (Darling, 1993). Rousseau believed that children should discover the world around them and that teachers should plan lessons correlated to the child's natural development and desires (Masters & Holifield, 1996). Rousseau emphasized learning by doing and felt that the teacher should present problems that would stimulate curiosity (Duffy & Cunningham, 1996).

John Dewey, an educational reformer in the late 1800s and early 1900s also promoted situated learning or learning by doing (Duffy & Cunningham, 1996). Dewey focused on an inquiry-based approach and felt that learning should be organized around the individual rather than around subject matter topics. Dewey eschewed memorization and recitation and instead advocated that education was life, not a preparation for life. Similar to Rousseau, Dewey felt that an issue or problem should arouse student interest, and that learning should be organized around learner efforts to resolve the issue or problem. Problem-solving skills and reasoning would naturally develop with this type of approach (Duffy & Cunningham, 1996).

Constructivist teachers typically take more time to determine a student's prior knowledge and understanding; include cues, integrate penetrating questions and instructional activities that challenge and extend a student's insight; utilize scaffolding including questions, clues, and suggestions that help a student link prior knowledge to new information; and create new ways to handle problems. Constructivist learning environments are more "self-directed, personally-responsive, and socially-mediated" (Becker & Ravitz, 1999, p. 53) mirroring almost exactly the type of skills called for by organizations such as ISTE and the Partnership for 21st century skills.

Student-centered classrooms tend to involve five types of activities including projects requiring students to practice different skills and to participate in a wide variety of tasks to develop their subject matter competence; group work emphasizing interdependence and facilitated dialogue with other students; problem-based tasks that require deep thinking, evaluation, decision-making and planning; reflective writing that integrates development of reasoned arguments; and tasks that encourage students to consider and integrate prior knowledge alongside new information discovered during the learning process (Ravitz, Becker, & Wong, 2000a). Constructivist classrooms are designed so that students can have ownership with regards to the selection of problems and issues to explore (Ravitz et al., 2000a). They are also designed so that students can generate their own questions and figure out on their own what steps to take to answer questions independently (Ravitz et al., 2000a). Students learn how to interact with their peers and learn to articulate their solutions to an audience with the purpose of receiving feedback for reflection and refinement (Ravitz et al., 2000a). All of this aligns nicely with the type of authentic learning, critical thinking, individualized instruction and project based learning advocated by supporters of the 21st century skills movement (Miller - Sadker & Zittleman, 2007).

Cuban's description of student-centered classrooms closely mirrors the type of pedagogy called for by 21st century learning experts. He describes these learning environments as being characterized by more student talk; more student questions; individual and small or large group instruction; students determining the class structure and class rules; varied instructional materials available for student use; learning stations

or centers set up around the room; with physical arrangement of the class varying depending on instructional needs (Cuban, 1983).

Since information is more widely available than ever, the role of the teacher needs to shift from one of information transmitter to one of knowledge facilitator. Although the historical frameworks, definitions and examples presented thus far are somewhat simplified due to the limited nature of this literature review, the underlying assumption of how knowledge is acquired is perhaps the biggest distinction between traditional or teacher centered approaches and progressive or student centered approaches. Traditionalists believe that instruction is the key. Progressives believe that construction is the key. Papert perhaps put it best by stating that:

> Traditional Education codifies what it thinks citizens need to know and sets out to feed children this "fish." Constructionism is built on the assumption that children will do best by finding ("fishing") for themselves the specific knowledge they need; organized or informal education can help most by making sure they are supported morally, psychologically, materially, and intellectually in their efforts. (Papert, 1993, p. 139)

A review of the two approaches demonstrates that 21st century teaching and learning skills and fluencies as described in this literature review are probably better learned in and aligned with environments emphasizing a more student-centered, constructivist type approach.

Teachers: Key to Transforming Learning Environments. Teachers hold the key to the quality of learning environments. Although the teacher impact on their students can be influenced by school-level factors such as curriculum and faculty morale, the individual teacher ultimately sets both the affective and the instructional tone. Teachers design their curriculum, decide how to manage their classroom and determine which

instructional strategies will be utilized. We are thus faced with two immediate challenges to improve student learning. We must help teachers better understand how to integrate new technologies while at the same time expand their notion of literacy so they can create more innovative educational environments that support 21st century teaching and learning.

Interestingly, Cuban (1983) discovered that teacher centered classrooms continue to reassert themselves in spite of continual reform efforts to transform teaching and learning. Traditional approaches may lie dormant for a period of time but educators often fall back on these practices despite being exposed to different types of teacher training and professional development. This creates a huge dilemma since it is very clear from the research that teacher decisions and actions greatly impact student achievement (Darling-Hammond, 1999; Marzano, 2003; Mendro, 1998). Educational reform efforts that seek to integrate more 21st century teaching and learning practices should therefore, concentrate on teachers.

The National Commission on Teaching and America's Future states that "...we have achieved a national consensus that what teachers know and can do is the most important influence on what students learn" (Hunt & Carroll, 2003, p. 6). A large-scale Tennessee study published in 1997 concluded that teacher effects are the more dominant factors over other variables such as heterogeneity of students and class size in terms of student academic growth (Sanders, Wright, & Horn, 1997). A similar study conducted by Jordan, Mendro, & Weerashinge (1997) in Dallas confirms that teachers affect a student's achievement level and that the effects are cumulative and additive. In a random-effects, meta-analysis study, it was determined that large differences in teacher quality exist

within schools and that an important key to improving student achievement is to work on improving teacher efficacy (Rockoff, 2004). Yet another study found that the more effective teachers in terms of student achievement ask more and deeper questions, provide more complex instruction and use a wider variety of methods when delivering instruction (Stronge, Ward, Tucker, & Hindman, 2007). Wood (2007a) iterates and expands upon these findings by asserting that great teachers understand that ongoing professional learning is critical to student success, and that they design more interesting and effective learning experiences regardless of class composition.

Although there is plenty of discourse about 21st century teaching and learning in the blogosphere, the Twitterverse, in educational journals and at educational technology conferences, the reality is that many teachers still seem to have trouble conceptualizing and/or articulating what we mean by 21st century teaching and learning. The International Society of Technology in Education (ISTE) developed standards & performance indicators in 2000 for teachers that were updated in 2007. According to ISTE, teachers should "facilitate and inspire student learning and creativity; design and develop digital-age learning experiences and assessments, model digital-age work and learning; promote and model digital citizenship and responsibility; and engage in professional growth and leadership" (ISTE, 2007b, p. 1).

This section of the literature review explored the 21st century skills movement, teacher and student centered approaches to teaching and learning and the impact that teachers have on students. What emerged from this part of the review is the understanding that in order to improve our educational system by fully integrating twenty-first century skills and pedagogy, teachers will need help shifting their practice.

How do we train, develop and support teachers to become the type of lifelong learners we need our students to be? How do we help them learn how to develop 21st century skills, literacies and fluencies utilizing a more constructivist approach? Our best bet might be to provide new forms of professional learning to teachers & instructional leaders so that they can visualize and experience exemplars of good practice with regards to 21st century pedagogy. The next section of the literature review examines the definitions, characteristics and benefits of effective professional development in order to help us better understand the types of professional learning that might be more aligned with 21st century teaching and learning.

Professional Development

> There is widening consensus that the quality of students' educational experiences depends most of all on the quality of teachers. People may differ about how to ensure "quality," but most would agree that quality teachers know how to craft engaging and effective learning experiences, despite constant changes in student populations. They need to be knowledgeable and they need to know how to use their knowledge. Ongoing professional learning simply must be integral to their work. (Wood, 2007a, p. 281)

Educators face a myriad of challenges when attempting to transform their classrooms into 21st century learning environments integrating more of a constructivist or student-centered approach. One challenge is bridging the disconnect prevailing between print culture, traditional learning and new types of learning afforded by the cyber culture permeating student experiences and interests (Kellner, 2001). Alongside this challenge is the one arising as educators try to figure out how to help students effectively navigate and contribute to the individualized learning networks exploding on the internet without fully understanding them themselves (W. Richardson, 2009). Many teachers were educated

during a time when traditional pedagogy and print based literacy were emphasized, rendering them less comfortable using new technologies in innovative ways (McGrail, 2005). Additionally, most teacher education programs have yet to adequately address 21st century skills and literacy (Littrell, Zagummy, & Zagummy, 2005).

As the nature of what students need to be able to know and do changes, so then changes what the teacher should know and do. More than ever, teachers must learn how to integrate content-based instruction, digital tools and 21st century skills that require higher order thinking and collaboration skills. For this to happen, effective professional learning must become more widely available to all of our nation's teachers (Darling-Hammond & Richardson, 2009). The National Commission on Teaching and American's Future states that highly qualified beginning teachers must "possess a deep understanding of subject matter and how students learn, demonstrate teaching skills that help ALL students achieve high standards, create positive learning environments, use a variety of assessment strategies to diagnose and respond to individual learning needs, integrate modern technology into curricula, collaborate with colleagues, parents, community members and other educators, reflect on their practice to improve future teaching and student achievement, pursue professional growth in both content and pedagogy and instill a passion for learning in their students" (Hunt & Carroll, 2003, p. 73).

Since several studies demonstrate that experience plays a key role in teacher effectiveness (Wayne & Youngs, 2003) and teacher education programs vary in quality and approach (Darling-Hammond, 2006), both new and experienced teachers need ongoing mentoring, training and support. Teachers entering the profession in non-traditional ways or those who have been in the profession longer may have learned to

teach at a time when technology, collaboration and reflection were less emphasized. Effective professional development can and should bridge both the experience and teacher preparation gaps. There are a myriad of options for ongoing teacher learning and in fact, most states require that teachers pursue continuing education in order to maintain licensure (Nieto, 2009). Teachers can refine their practice by attending conferences and/or workshops, taking face to face or online college courses, participating in school based peer or mentoring programs, joining professional organizations, and by reading journals. This list is by no means exhaustive and leaves out arguably the most relevant learning, the learning that takes place from daily experience with students and from dialogue with colleagues about those experiences. How do teachers know which professional development activities will give them the most bang for the buck? How do we ensure quality and ongoing professional learning experiences? What is quality or effective professional development?

Defining Professional Development. Professional Development is a "comprehensive, sustained, and intensive approach to improving teachers' and principals' effectiveness in raising student achievement" (Hirsh, 2009, p. 12). Educational organizations devoted to professional development and experts who have done extensive research in this area are quite clear and consistent in what effective professional development should look like (Borko, 2004; Darling-Hammond, Wei, Andree, Richardson, & Orphanos, 2009b; Diaz-Maggioli, 2004; Nieto, 2009). According to the National Staff Development Council, professional development should:

> Align with student academic standards and school improvement goals; be conducted among educators at the school and facilitated by well-prepared school principals and/or school-based professional development coaches, mentors, master teachers, or other teacher leaders; occur several times per

> week among established teams of teachers, principals, and other instructional staff members where the teams of educators engage in a continuous cycle of improvement; evaluate student, teacher, and school learning needs through a thorough review of data on teacher and student performance; define a clear set of educator learning goals based on the rigorous analysis of the data; implement coherent, sustained, and evidenced-based learning strategies, such as lesson study and the development of formative assessments, that improve instructional effectiveness and student achievement; provide job-embedded coaching or other forms of assistance to support the transfer of new knowledge and skills to the classroom; regularly assesses the effectiveness of the professional development in achieving identified learning goals, improving teaching, and assisting all students in meeting challenging state academic achievement standards; inform ongoing improvements in teaching and student learning; and be supported by external assistance (Hirsh, 2009, pp. 11-13).

While the National Council for Staff Development list is comprehensive, clearly reflecting the latest research and thinking in professional development, it might not be specific enough for teachers, administrators and staff developers who are trying to create 21st century learning environments. The characteristics put forth by the Partnership for 21st Century Skills and the International Society for Technology in Education build upon the NCSD recommendations while providing a much more detailed and descriptive approach for how to train teachers to address 21st century teaching and learning. According to the Partnership for 21st Century Skills, professional development should:

> Highlight ways teachers can seize opportunities for integrating 21st century skills, tools and teaching strategies into their classroom practice; help teachers identify what activities they can replace/de-emphasize; balance direct instruction with project-oriented teaching methods; illustrate how a deeper understanding of subject matter can actually enhance problem-solving, critical thinking, and other 21st century skills; enable 21st century professional learning communities for teachers that model the kinds of classroom learning that best promotes 21st century skills for students; cultivate teachers' ability to identify students' particular learning styles, intelligences, strengths and weaknesses; help teachers develop their abilities to use various strategies (such as formative assessments) to reach diverse students and create environments that support differentiated teaching and learning; support the continuous

> evaluation of students' 21st century skills development; encourage knowledge sharing among communities of practitioners, using face-to-face, virtual and blended communications; and finally, use a scaleable and sustainable model of professional development ("21st century professional development," 2011, p. para 1).

The International Society for Technology in Education standards call for teachers to:

> Continuously improve their professional practice, model lifelong learning, and exhibit leadership in their school and professional community by promoting and demonstrating the effective use of digital tools and resources. Teachers should also participate in local and global learning communities to explore creative applications of technology to improve student learning; exhibit leadership by demonstrating a vision of technology infusion, participating in shared decision making and community-building, and developing the leadership and technology skills of others; evaluate and reflect on current research and professional practice on a regular basis to make effective use of existing and emerging digital tools and resources in support of student learning; and contribute to the effectiveness, vitality, and self-renewal of the teaching profession and of their school and community (ISTE, 2007b, p. 1).

Both lists are comprehensive, offering specific details about how to structure professional learning. Additionally, they emphasize the need for teachers to learn in environments integrating digital tools seamlessly in order to become fluent enough in digital skills to redesign lessons automatically when planning instruction.

Inadequacy of Traditional Professional Development. Despite fairly clear and research based guidelines on what professional development should look like in the 21st century, most teachers continue to report that professional development is inadequate, irrelevant and not consistent with what the research base has demonstrated (Borko, 2004; Darling-Hammond et al., 2009b; Diaz-Maggioli, 2004; Nieto, 2009). Much like the teacher-centered approach explained earlier, traditional professional development views teachers as passive recipients with no motivators that inspire them to reflect on how what they are learning can be embedded into classroom practice (Little, 1993).

Traditional one size fits all professional development tends to ignore teacher experience and student needs (Lieberman & Mace, 2008). More than 90% of US teachers participate in professional learning that consists primarily of short-term conferences or workshops (Darling-Hammond et al., 2009b). In fact, on the 2003-2004 National Schools and Staffing Survey, 57% of teachers said they had received fewer than 16 hours of professional development over the previous 12 months in the subjects they taught (Darling-Hammond et al., 2009b). Research clearly shows that drive-by workshop models do not result in lasting change in teacher practice (Darling-Hammond et al., 2009a; V. Richardson, 2003) yet most professional development opportunities are still presented in this manner.

Interestingly, nations outperforming the United States on international assessments have a very different view of professional learning structuring teacher work schedules so that time for regular teacher learning and collaboration is integrated seamlessly (Lieberman & Mace, 2010). In many Asian and European countries, less than 50% of a teacher's working time is devoted to actual classroom instruction with the rest devoted to collegial planning time, lesson preparation and working with students and parents (Lieberman & Mace, 2010). By contrast, American teachers are directly teaching for more than 80% of their day. This translates to about 200 more hours per year of instructional time than their Asian and European counterparts (Development, 2009). American teachers also report that the majority of their planning occurs in isolation (Darling-Hammond et al., 2009b) despite growing evidence that social context can account for variability in teacher expertise (Lieberman & Mace, 2008).

Further compounding the dilemma is that although research outlines the characteristics of effective professional development, there is little demonstrating that traditional forms of professional development have any long lasting impact on practice (Mouza, 2009). Traditional professional development shortcomings have been well-documented in the literature (Little, 1993). The extensive research carried out by the NSDC published in February 2009, found very few studies demonstrating a direct relationship between traditional professional development and either sustained changes in teacher practice or a positive impact on student achievement (Darling-Hammond et al., 2009b).

Why is traditional professional development not working to change classroom practice and/or to improve student achievement? Why is there such a large chasm between what we know works and what actually happens in schools? Reasons ranging from lack of ownership in the planning process, inaccessibility of professional development opportunities, universal application of classroom practice regardless of subject or individual student needs, and undifferentiated delivery modes that fail to recognize learning characteristics of adult learners are discussed in the literature (Diaz-Maggioli, 2004). Initiatives may also fail because they do not address school capacity in a comprehensive enough manner (Newmann, King, & Youngs, 2000). Lack of time is mentioned often (V. Richardson, 2003; Yoon, Duncan, Lee, Scarloss, & Shapley, 2007; Zimmerman & May, 2003). Additionally, there is usually little if any follow-up or support to help teachers practice new ideas and strategies (V. Richardson, 2003). Finally, school leaders cite the lack of qualified presenters and teacher resistance when pressed

about obstacles to effective staff development (V. Richardson, 2003; Zimmerman & May, 2003).

Most challenging is that teachers are being asked to integrate 21st century skills at the same time that they are being pressured to prepare students for standardized testing emphasizing the more traditional literacy required by the No Child Left Behind act (Carroll, 2007). Professional development offerings do not enable teachers to practice or visualize how integrating new literacies and technologies can strengthen and refresh their curricula to make it more appealing to students. Teachers receive mixed messages and some seem to have actually shifted further away from utilizing the type of creative, project-based, constructivist teaching practices needed to prepare our children for the future (Zhao, 2009).

The Promise of 21st Century Professional Development. Many teachers struggle to integrate technology and constructivist, student-centered 21st century practices. Some of this can be attributed to teacher's fear of technology, their actual lack of technical expertise and fear of change in general. However, teacher knowledge and practice can also change through intensive, well-designed professional development programs that specifically address subject matter (Borko, 2004).

Interestingly, teachers who participate more deeply in professional development are also more likely to have constructivist compatible 21st century teaching philosophies, utilize computers more often in exemplary ways and integrate teaching strategies aligned with the constructivist philosophy espoused by 21st century skill advocates more often (Becker & Riel, 2000). Teachers who have higher levels of personal computer use tend to use constructivist instructional practices more often (Rakes, Fields, & Cox, 2006) thus

implying that embedding relevant digital tool training into professional development could also lead to changes in practice. Participation in research-based professional development can result in long lasting change in teacher's abilities to design learning experiences that integrate digital tools for students and their overall educational technology knowledge (Mouza, 2009).

Teachers are most likely to change their teaching and practice if they are provided with adequate time for collaborative types of professional development in which they are able to be involved in the planning and share their concerns and triumphs with their colleagues. Another key factor is if the training simultaneously teaches digital skills and methods of integrating digital tools into subject matter curriculum (Heine, 2002; W. Richardson, 2009; Wood, 2007a). Several studies have found that both the intensity and duration of professional development has a direct correlation to changes in teacher practice (Desimone, Porter, Garet, Yoon, & Birman, 2002). Longer and more sustained (49 hours per year) professional development activities have a statistically significant impact (21%) on student achievement (Yoon et al., 2007). Not surprisingly, participating in fewer than 14 hours per year does not appear to have any statistical impact on student achievement (ISTE, 2007b; Yoon et al., 2007).

The National K-12 Foreign Language Resource Center (NFLRC) at Iowa State University began offering summer institutes in 1994. Over the years, the NFLRC has offered 36 professional development institutes to more than 680 teachers from all 50 states. The NFLRC findings on effective technology based professional development support the ideas that it should be relevant, led by experts who are also learning with participants, promote a collaborative and empowering environment and that it allow for

continued learning that is supported beyond the event itself (Kendall, Montgomery, & Rosenbusch, 2008).

In 2009, The National Staff Development Council published a status report on teacher development in the United States and abroad. In this report, researchers made the case that strong working relationships among teachers should be nurtured through intensive, ongoing focus on student learning and specific content directly related to practice (Darling-Hammond et al., 2009b). Richardson (2003) reviewed several studies on effective professional development and concluded that it should be include vested school-wide stakeholders; be well-funded, appropriately staffed and supported by administration; recognize and honor current beliefs and practices, foster strong collegial relationships and be long term. Clearly, lasting changes in classroom practice can only occur if professional development is job-embedded, on-site, centered on active learning and focused on content and student outcomes (Chappius, Chappius, & Stiggins, 2009; Desimone et al., 2002; Garet, et al., 2001).

In summary, this section of the literature review exploring the definitions, characteristics of and benefits of effective professional development, highlighted that in order to support teacher integration of more innovative teaching practices, effective professional development for the 21st century should integrate 21st century strategies, literacies, fluencies and tools. Teachers should also be able to learn about, practice and reflect on new practices while being supported by others who can share their individual knowledge and expertise (Darling-Hammond & Richardson, 2009; Salpeter, 2008). Newmann, King et al. (2000) add that professional development is more likely to improve student outcomes if it addresses all aspects of school capacity rather than just

individual teacher skill. A different approach to professional development could have longer lasting results and create deeper understanding of the conditions needed to improve teacher practice (Lieberman & Mace, 2008). The next section of the literature review explores such a model, the professional learning community.

Professional Learning Communities

> To meet the needs of 21st Century students, there is a pressing national need for today's teachers to create a collaboratively built, widely shared professional knowledge base. This calls for the creation of school cultures in which teachers, principals, students and parents hold themselves collectively accountable for improving student achievement. (Carroll, 2007, p. 55)

The research summarized in the previous section demonstrated that environments supporting ongoing, embedded adult learning are essential in order to better guarantee that teachers will integrate more progressive instructional strategies. Traditional workshops, outside consultants and conference type modes of professional development tend to view teachers as passive recipients of information (Little, 1993), ignoring the reality that professional learning works because humans need to feel part of and that they are contributing to communities where they connect with others and create new understandings together (Lieberman & Mace, 2008). If teachers are to infuse more 21st century constructivist type practices, then teachers should participate in professional development that is more learner centered. The need for schools to become "learning organizations" has been emphasized in the literature (Carroll, 2007; Senge, 2000; Wehling & Schneider, 2007; Wood, 2007a) yet it seems that we have yet to harness this potential (Leonard & Leonard, 2005). Schools that do embody characteristics of learning organizations encourage collaborative reflection resulting in the creation of new

knowledge and sharing of common goals such as improved practice and outcomes for students (DuFour, R., 2004b; Schlechty, 2001; Wehling & Schneider, 2007).

Professional learning communities (PLC's) provide an alternative model for professional development, viewing teachers as learners and schools as learning organizations. Although there is not one universal definition, Bolam, McMahon, Stoll, Thomas and Wallace (2005, p. iii) conducted an extensive review and subsequently defined PLC's as having "the capacity to promote and sustain the learning of all professionals in the school community with the collective purpose of enhancing pupil learning." Richard DuFour's (2004b) work extends this thinking by offering a set of three core principles essential to PLC's including a collaborative culture, accountability for student learning, and examining student results to focus professional learning endeavors. The PLC model supports deep, collaborative discussion about teacher practice grounded in actual classroom activities. The Partnership for 21st Century Skills specifically recommends the professional learning community model as the structure best suited to ensure integration of 21st century skills into the curriculum since PLC's model teaching strategies that encourage the development of these skills (DuFour, R. & DuFour, R.B., 2010).

In professional learning communities, teachers work together to find solutions to professional problems of practice (Wood, 2007a). Focused professional conversations revolve around teaching and learning, stimulating ongoing innovation and inquiry (DuFour, R., 2004b; Wehling & Schneider, 2007; Wood, 2007a). Teachers are encouraged to share their expertise in order to create and share knowledge based on their own classroom experiences. Professional learning communities empower teachers to

focus on changing practice to improve student results (DuFour, R. & Eaker, 1998) taking advantage of the social context that can contribute to building teacher expertise (Lieberman & Mace, 2008). Traditional professional development experiences such as isolated workshops are replaced with ongoing activities that are embedded into the school's daily organizational structures and expectations (DuFour, R., 2004a; Graham, 2007). These structures then become the primary agents for teacher growth and reflective practice.

Since quality professional development requires a focus on instructional strategies emphasizing student learning and needs via sustained and collegial learning (Salpeter, 2008), well-designed professional learning communities seem to fit the bill. Strong professional learning communities are thus worth exploring as a mechanism for promoting school and system reform as they embody many of the criteria for effective professional development (Bolam et al., 2005; Borko, 2004; Darling-Hammond & Richardson, 2009; DuFour, R., 2004b; Newmann et al., 2000).

Characteristics of Professional Learning Communities. The idea of professional learning communities is not entirely new. Dewey (2007) envisioned a school where teachers would engage in collective inquiry and dialogue through focused professional conversations among colleagues based on the premise that we learn more about the science of teaching from actually practicing and reflecting upon it rather than just reading about and observing it. Teachers should be reflective practitioners and creators of pedagogical knowledge in order to add to the knowledge base of teaching (Wood, 2007a). There appears to be consensus that effective professional learning communities place student learning at the forefront of all professional conversation,

promote a culture of collaboration, and focus on results (Bolam et al., 2005; DuFour, R., 2004b; Smith, Wilson, & Corbett, 2009; Vescio et al., 2008).

In a large scale literature review and study of professional learning communities carried out in 2005 in the United Kingdom, researchers concluded that effective professional learning communities had eight key characteristics: shared values and vision; collective responsibility for pupil learning; collaboration focused on learning; individual and collective professional learning; reflective professional inquiry; openness, networks and partnerships; inclusive membership; mutual trust, respect and support (Bolam et al., 2005). Other researchers have found that professional learning communities, although implemented differently at different school sites, have a common purpose and shared beliefs, values and vision amongst the staff, shared and supportive leadership, collective learning at the core and structural systems in place to support the collaboration efforts including extended time during the school day, resources and a culture of trust and openness amongst faculty members (Hord & Sommers, 2008; Smith et al., 2009; Stoll, Bolam, McMahon, Wallace, & Thomas, 2006).

Schools that characterize themselves as professional learning communities clearly recognize that the entire school is a learning community placing a high priority on ongoing adult learning (Hord & Sommers, 2008; Nathan, 2008). Barth (2006) argues that in addition to talking about their practice on a regular basis, teachers in professional learning communities should be observing one another, sharing craft knowledge and supporting one another. Teachers continually share their knowledge and expertise in this model. The actual practice of professional learning communities should integrate rotating facilitation within small groups, teacher learning on teacher terms, authentic and willing

participation, balanced use of protocols and raising questions and problems that are of common interest (Smith et al., 2009; Wood, 2007a). Much like cooperative learning versus group work, professional learning versus collaboration means that teacher dialogue and work must be structured and facilitated effectively ideally by the teachers themselves. The professional learning community model thus rests on much more structure than just asking teachers to work together.

The challenge of integrating professional learning communities into our schools is obvious – most schools are still bastions of isolation (Wood, 2007b). Teachers are masters of their own domains and what goes on behind classroom doors is primarily left up to them (DuFour, R., 2004b). Many schools do not have open, safe or supportive climates and many teachers are anxious about sharing their problems of practice for fear of being judged or evaluated in a negative way. However, with effective and supportive leadership that builds trust and collegial relations amongst the staff, schools have and can embark on a path of continual self-improvement via the professional learning community model described above (DuFour, R., 2004a; Stoll et al., 2006).

Professional Learning Communities as Communities of Practice. Professional Learning Communities are grounded theoretically in the assumption that knowledge is situated in the daily experiences of teachers and that teachers need to spend time actively reflecting with other teachers in order to improve their practice (Buysse, Sparkman, & Wesley, 2003). This community of practice approach is in turn grounded in social learning theory and described extensively in the literature (Buysse et al., 2003; Lave & Wenger, 1991; Wenger, 1998; Wertsch, 1991). The theory, perhaps best described by Wenger (1998) supposes that in groups organized around a practice, learning takes place

in relationship with others within the framework of the practice (Laksova, Mannb, & Dahlgrena, 2008). In other words, learning is social. As members of the community become more experienced in the practice, they take on the mentor and teacher roles while at the same time improving the nature of the practice for everyone in the community. Thus practice evolves in a sort of apprenticeship model. The mentors teach the newcomers the norms of the group but as the newer members become more expert, they help to reshape the norms and practices of the group (Lave & Wenger, 1991).

Lave and Wenger (1991) studied groups of professionals to try to uncover how meanings, beliefs and knowledge were transmitted. What they discovered was that learners enter communities on the periphery and move closer to full, legitimate participation through their interactions with other, more experienced members of the community (Lave & Wenger, 1991). At the same time, the learners change their view of themselves and become confident enough to impact the evolving practice of the community (Buysse et al., 2003; Lave & Wenger, 1991). What is significant about this theory is the notion that cognition occurs within a participatory framework and that meaning must be negotiated and refined through interactions with others. Learning in our "heads" is the traditional & still relatively widely accepted view of learning but learning theory has recently expanded with the notion that knowledge creation is a process stemming from the intersection of sharing practices that reflect the culture of the group, joint learning experiences and individual knowledge formation (Earl, Katz, Elgie, Ben Jaafar, & Foster, 2006). Learning thus occurs as "people participate in shared endeavors with others, with all playing active but often asymmetrical roles in socio-cultural activity" (Rogoff, 1994, p. 294).

If a community of practice around teaching and learning, or a professional learning community has been established, three things happen. Participants become mutually engaged in the teaching and learning of students meaning they support each other both formally and informally in their practice; a new joint enterprise is developed, meaning, for example, that they might develop a shared understanding of authentic assessment and the use of rubrics; and, participants build a shared repertoire around teaching and learning through the development of tools and methods for the support of learning (Wenger, 1998). For example, they might make those individual and common rubrics freely accessible to all the teachers in the community (Laksova et al., 2008; 1998).

In Noden and Bruce's (2006), *Cracking the Concrete*, David Jackson and Madeline Church offer a similar perspective based on three fields of knowledge that explains foundationally how professional learning communities work to expand knowledge. The first is described as what is known, referring to the integration of the knowledge from theory and research. The second field is what we know, recognizing the expertise of the practitioners involved in the learning community. The third field is referred to as the new knowledge field or the knowledge created by the learning community together through their collaborative work (Noden & Bruce, 2006). This perspective resonates with community of practice theorists who recognize that learning is both social and individual and that it happens through experience and practice. People who learn with and from each other tend to refine practice, negotiate meaning, strengthen the learning community and eventually experience a shift in identity as learning changes

the essence of each individual by expanding and broadening their perceptions and practice (Lieberman & Mace, 2008).

The Impact of Professional Learning Communities on Teacher Practice. The premise of professional learning communities is that they improve student learning by improving teacher practice. Teachers who participate in well-designed professional learning communities will increase professional knowledge, and enhance student learning (Vescio et al., 2008). Establishing a structure for positive relationships amongst the teachers anchored in a shared sense of purpose and responsibility for student learning is essential in order for the professional learning community to have an impact on actual teacher practice (Bezzina, 2006; Stoll & Fink, 1996). Schools that become successful learning communities, meaning that they demonstrate improvement and the capacity to sustain that improvement, all seem to provide space and time for collaboration and the generation of shared meaning (Newmann et al., 2000; Sergiovanni, 2000). Stoll and Fink (1996) argue that collegial relations and collective learning are at the core of building capacity for school improvement. Barth (2006) agrees by stating that "the nature of relationships among the adults within a school has a greater influence on the character and quality of that school and on student accomplishment than anything else" (Barth, 2006, p. 8). Several other researchers also suggest that powerful collaboration occurring within the framework of true professional learning communities can change and improve teacher practice (Bezzina, 2006; Darling-Hammond & Richardson, 2009; DuFour, R., 2004b; Graham, 2007).

In order for changes in practice and pedagogy benefiting teachers and students to happen, strong professional learning communities are essential (McLaughlin, 1993). In a

summary of three years of research conducted at the Center for Research on the Context of Secondary School Teaching, McLaughlin (1993) noted that every teacher in the study who implemented sustainable, alternative and active pedagogical practices was a member of a strong collegial learning community. In a mixed-methods case study exploring the relationship between teacher improvement and professional learning community activities, Graham (2007) found that these activities had the potential to positively influence teaching effectiveness depending on several key factors including positive leadership, organizational structures that supported learning, and the richness of meetings, conversations and community. Vescio, et al (2008) reviewed eleven research articles and concluded that participation in a professional learning community leads to changes in teaching practice. In summary, professional learning communities appear to impact practice.

The Impact of Professional Learning Communities on Achievement. Effective professional development can also impact and raise student achievement (Yoon et al., 2007). In a review of studies designed to investigate the impact of Collaborative, Continuing Professional Development (CPD), reviewers found that there was increased student motivation to learn and improvements in student achievement in schools that had internalized core features of professional learning communities such as peer support, opportunities for teachers to design their own focus for their professional growth and processes to encourage professional dialogue (Cordingley, Bell, Rundell, & Evans, 2003). When teachers move beyond storytelling, sharing and helping each other to true joint work that focuses on shared responsibility for student learning and reflective practice in the form that effective professional communities support, students benefit

(Cordingley et al., 2003; Little, 1990, 2003). Newmann et al. (2000) present a model showing how effective professional development that builds school capacity in terms of principal leadership, teacher's knowledge, skills and dispositions, technical resources, program coherence and professional community improves instructional quality and student achievement. Stoll et al. (2006) concluded that improving student learning depends on the link between school capacity and teacher's individual and collective capacity purporting that professional learning communities have strong potential for improving student achievement.

Additionally, in an evaluation of high school restructuring efforts, Lee and Smith (1995) found that schools organized under an "organic" model characterized by the reduced hierarchy and increased collaboration that exists within the professional learning community framework, demonstrated higher overall achievement and smaller achievement gaps than schools with traditional types of organization. A study of twenty-four exemplary elementary, middle and high schools, found that schools with the strongest professional learning communities had significantly higher levels of authentic pedagogy and student achievement (Louis & Marks, 1998). Another study found empirical evidence of a positive impact on student achievement in mathematics in professional learning communities that experienced transformational leadership (S. Wiley, 2001). Bolam, et al. (2005) found a positive correlation between the level of staff involvement in professional learning and subsequent student outcomes and that the higher the level of internal support for pupil learning, the higher the level of student progress. An analysis of the impact of a well-designed literacy multi-year framework based on a professional learning community model at a low-performing elementary

school found that reading and math scores increased significantly (Fisher & Frey, 2007). In a recent review of eleven studies exploring professional learning communities and their link to student achievement, Vescio, et al. (2008) found that schools with the strongest professional learning communities demonstrated the greatest student gains. The evidence is fairly clear that a positive link exists between professional learning communities and student learning.

This section of the literature review examined the definitions, characteristics and impacts of professional learning communities. This model of professional development, when implemented effectively, can change teacher thinking and practice and subsequently impact student achievement. The next section of the literature review explores how another form of professional development, networked learning communities, can extend the potential and expand the reach of professional learning communities.

Networked Learning Communities

> It is now possible for more people than ever to collaborate and compete in real time with more people on more different kinds of work from more different corners of the planet and on a more equal footing, than at any previous time in the history of the world—using computers, e-mail, networks, teleconferencing, and dynamic new software (Friedman, 2005, p. 8).

Clearly we need to reform our current perception of professional development to one that is more effectively based in the needs of teacher-learners, more inclusive of individuals who share interest and expertise across different regions, and more readily and authentically integrated into teacher's professional routines and practice (Lock, 2006). As our world becomes more networked, the professional learning community model will inevitably morph in that direction (Carroll, 2000). Teachers intuitively

understand this and have started to create their own informal and formal networked learning communities on the internet (Ferriter, 2009). The earliest sites were primarily information hubs with links to resources and lesson plans for other teachers in more of a Web 1.0 model. Over the past several years, Web 2.0 tools began to be utilized as a vehicle for more interactive collaboration. Wikis, Nings and blogs sprung up, giving teachers the opportunity to become contributors and collaborators. On the most dynamic sites, teachers have formed their own professional learning communities where they can contribute resources, blog about particular topics, learn about online, professional development events and trends, and dialogue with others in discussion forums about common topics of interest (Ferriter, 2009). They can do this anywhere, anytime. Best of all, teachers can decide if they want to lurk on the outside, become heavily immersed or land somewhere in between with regards to these online learning communities (Nielsen, 2010).

As more and more teachers voluntarily become participants in these types of professional learning communities, and as schools and other educational organizations formally create these types of communities to transform schools, there is a need to research the impact that participation in networked learning communities can have on teaching practice (Borko, 2004; B. J. Caldwell, 2005; Church et al., 2002; Lieberman, 1999). Informal networks have been the basis of family, community, and politics for centuries, but as technology reshapes traditional networks and it becomes more of a central modern organizational form, it is important to begin to make meaning of the linked work that occurs in networks (Church et al., 2002). Strong networked learning communities bring together the knowledge and skills of teachers across schools to

promote shared learning (Hargreaves, 2003). The networks create conditions necessary for radical innovations and large-scale reform (Black, 2008; Hargreaves, 2003).

Although serious attention to the use of networks as an alternative form of professional development began in the early 1990's (Lieberman, 1999; Little, 1993), technology is reshaping traditional networks, allowing for enhanced capacity to challenge and change ingrained hierarchies and to connect stakeholders across different levels (Black, 2008; Church et al., 2002; D. Wiley, 2010). Several authors have iterated the role new technologies play in creating networked learning communities that can reshape knowledge sharing by offering closer cooperation between schools, provide solid pathways to radical innovation and invoke pressure on teachers to redesign learning (Chen, 2003; Hargreaves, 2003; Lock, 2006; Stoll et al., 2006; Trinkle, 2009; D. Wiley, 2010). Wiley (2010) argues that technology changes the game of knowledge sharing completely in that knowledge expressions are now available to everyone all at once for each to interpret. Collaborative technology also now allows for teaching professionals to communicate and collaborate, regardless of geography in real-time, and in a manner where they can co-create new knowledge, promote new forms of collegiality and offer sustained learning far exceeding what single schools or districts can support (Hunt & Carroll, 2003; Salpeter, 2008).

Networked learning communities are well suited to integrate new technologies since they are inherently borderless and innovative, allowing for the creation of focused, collaborative environments (Lieberman, 2000) with much flatter hierarchies (Veugelers & O'Hair, 2005). More interactive digital tools and social media allow teachers, schools and professional learning organizations to go public with their work in a professional

learning community 2.0 type of model. We are beginning to see more and more examples of blogs, ePortfolios and podcasts integrated into professional learning with networked learning communities facilitating this new type of sharing (Lieberman & Mace, 2010) .

Defining Networked Learning Communities. Professional learning communities are typically site-specific, focusing on the improvement of student learning at one school. In contrast, Goodyear, Banks, Hodgson & McConnell (2004) define networked learning as "learning in which information and communications technology is used to promote connections; between learners…and between a learning community and its learning resources" (Goodyear et al., 2004, p.252). Networked learning communities extend both of these concepts by attempting to build bridges between schools to further learning in common areas of interest. Although education has always had it's fair share of partnerships, networked learning communities are different since they extend the professional learning community model with the specific goals of changing teacher practice and improving student outcomes across schools (Black, 2008).

More than just network learning or just a professional learning community, networked learning communities (NLC's) emphasize accelerated learning, innovation, and transformation by encouraging schools to learn from one another utilizing the possibilities afforded by technologies (Chen, 2003; D. Jackson, 2006; Veugelers & O'Hair, 2005). In NLC's, members of the community develop new knowledge and skills in partnership as they develop solutions for common problems of practice (Carroll, 2000). In this model, learning is not limited to the physical classrooms in typical school settings. Rather, these settings become important network nodes (Carroll, 2000; Little, 2005) connecting with other nodes to create exponentially greater opportunities for learning.

Connecting school-based professional learning communities and expanding cross-school learning is at the heart of the networked learning community model (D. Jackson, 2006).

Networked learning communities manifest in a variety of forms (Black, 2008). They can be informal or formal, focused on short term or long term goals, be varied in their composition of members and can serve a variety of purposes including everything from knowledge sharing to complete system transformation (Black, 2008; Black-Hawkins, 2004). For purposes of this study, the working definition of a networked learning community will be the one put forth by Katz et al. (2009) as "groups of schools working together in intentional ways to enhance the quality of professional learning, and to strengthen capacity for continuous improvement in the service of enhanced student learning"(p. 9). Deeper understanding can come from examining the characteristics of networked learning communities that have been put forth over time in the literature.

Characteristics of Networked Learning Communities. In the late 1970s, the National Institute of Education drafted key scholars to create a deeper understanding of the nature of networks. From that work studying sixty school improvement networks, five key characteristics emerged. These characteristics included a strong sense of commitment to the ideals of the network, shared purpose, information sharing and moral support, voluntary participation and a sense of egalitarianism (Lieberman, 2000). Lieberman and Grolnick (1996) extended this work, offering a more precise set of characteristics including purpose and direction, building collaboration and commitment, adequate resources, relationships and activities, and a view of network leadership as cross-cultural resource brokering.

Church et al. (2002) added a new dimension to the thinking on networked learning communities by acknowledging the heavy role that technology has played in reshaping the unique role of networks. Her threads, knots and nets perspective purports that while networks need to be voluntary and autonomous, network participants must also pay close attention to the quality of participation in the shared network space and the "linked nature of the work" in the network (Earl & Katz, 2007, p. 240). The tighter the threads (relationships) built on trust and communication are spun and the stronger the knots (joint activities) of the participants, the more solid the structure and dynamism of the net (Church et al., 2002). Chen (2003) concurs that networks must effectively and intentionally nurture strong social and pedagogical interactions but adds that networks which integrate digital tools to enhance communication and knowledge creation should take great care to ensure adequate training and support in the use of these tools to help the network reach its full potential. Lock (2006) emphasizes the importance of thoughtful and appropriate digital tool selection in effective networks.

In a review of five international networks, Hopkins (2000) laid out a framework integrating previous thinking about networked learning communities quite similar to the characteristics present in effective professional learning communities: consistency of values and focus; clarity of structure; knowledge creation, utilization and transfer; rewards related to learning; dispersed leadership and empowerment; and adequate resources including time, technology and financing (Hopkins, 2000). Other researchers have iterated the need for a common and shared purpose that revolves around improving student outcomes (Bell, Cordingley, & Mitchell, 2006; Bezzina, 2006; Black, 2008; Black-Hawkins, 2004) while many also stress the importance of relationship building in

order to transcend the inadequacy of soft collegiality towards the type of rigorous collaboration that can result in meaningful knowledge creation and sharing in the service of improved student learning (Black, 2008; Black-Hawkins, 2004; Hargreaves, 2003; D. Jackson, 2006; Veugelers & O'Hair, 2005).

The idea of networks as breeding grounds for risk-taking and innovation is another primary reason cited in the literature for supporting networked learning communities as a vehicle for wide-scale school reform (Bentley, 2006; Hopkins, 2006; D. Jackson, 2006). Lieberman (1999) points out that networks are increasingly popular for this purpose since they encourage many of the ideas inherent in the school reform movement including opportunities for teachers to both consume and create knowledge across traditional boundaries; provision of a variety of collaborative structures that can be attached to but independent from schools; flexibility; promotion of ideas that challenge rather than prescribe; discussion of ideas with no agreed upon solutions; a vision of reform that promotes risk-taking; and all in a manner that respects and encourages both inside teacher knowledge and outside knowledge from research and reform. Hopkins (2003) adds that networks play such a key role in innovation because they can overcome the traditional isolation and hierarchical models that currently permeate many educational institutions through collaborative professional development and the exchange of practice and expertise. In other words, they amplify many of the best elements of the professional learning community model, by adding a dimension of expanded synergy.

However, Black (2008) cautions that networks are not always so rosy. Over-networking, lack of resources and top-down structures limit the potential of networked learning communities. Little (2005) cautions against generalizing about knowledge

transfer as the primary benefit of a network. The true power of networks is in the transactions that underpin the relationships between participants. Little (2005) outlines a three-pillar framework to deepen our understanding of this key network dimension. The first pillar is that networks are *reciprocal* in that both the school and the network give and take ideas, energy and resources. Secondly, the *reflexive* nature of the relationships and interactions within the network results in changes at both the school and network level. Finally, the school professional learning community becomes stronger as the network does due to the *synergistic* nature of network function (Little, 2005).

Veugelers and O'Hare (2005) offer a synthesis of how networks aligning with many of the goals of the 21st century skills movement can become an important mechanism to enhance school reform efforts and increase student achievement by offering a forum for broad yet personalized learning, reflective practitioner research, peer learning, shared ownership, partnerships and empowerment of teachers and school leaders. In their view, networked learning communities must be based on the belief expressed by Fullan (1993) that we must improve teacher learning in order to improve student learning and teachers learn best when they can share their ideas and experience in professional communities of practice (Veugelers & O'Hair, 2005).

Networked Learning Communities as Communities of Practice. The traditional situation of schools within a hierarchical framework is evolving into a newer type of structure where schools are situated within potentially a multitude of horizontal networks depending on needs, interests and purpose (B. Caldwell, 2008). The notion of communities of practice becoming more formal within such frameworks is central to school transformation providing new opportunities for shared and dispersed leadership

along with new approaches to the sharing of professional knowledge. Caldwell (2008) believes that the shift will encourage education related communities of practice to integrate more student-centered teaching and that the success of tomorrow's schools will rest upon both their understanding that they can no longer act in isolation and their capacity to join networks for knowledge-sharing, solving problems of practice and pooling of resources. Interactions across schools is inevitable and will require new approaches to resource allocation, partnership building and knowledge management (B. Caldwell, 2008; Veugelers & O'Hair, 2005) resulting in potentially enormous benefits in terms of school transformation (Stoll et al., 2006).

Much like professional learning communities, underpinning the rationale for networked learning communities is the belief that in groups organized around a practice, learning takes place in relationship with others within the framework of the practice (Laksova et al., 2008; Toole & Louis, 2002; Wenger, 1998). Community of practice advocates recognize that learning is an act of participation and thus, very social (Kimble, Hildreth, & Bourdon, 2008). With regards to the practice of teaching as it aligns with communities of practice, Toole and Louis (2002) lay out several assumptions about teaching as a practice including the reality that teaching is non-routine and complex, that much untapped knowledge exists in schools, that many teachers challenges are at the local level and should thus be handled at that same level, and perhaps most relevant, that teachers can refine their practice by working together to experiment, analyze, evaluate and reflect.

Echoing these sentiments, Kimble, Hildreth and Bourdon (2008) purport that "teaching is very personal and individual yet teachers benefit greatly from links with

colleagues in their own school and in the wider community" (p. x). Effective networks invariably increase the pool of ideas and as individual members internalize these new ideas, practice is transferred, refined and cycled back into the network for other members to draw upon (Hargreaves, 2003). In this manner, networks can strengthen school based professional learning communities while simultaneously being strengthened themselves through an upload and download model. Professional learning communities upload new ideas to the network while at the same time downloading ideas that others put forth or that are created within the network collaboratively (Katz et al., 2009). By building capacity in this manner, networks also strengthen a school's capacity to respond creatively to challenges of practice at their own school (Black, 2008). Networks thus provide a focal point for the creation and spread of innovation by sustaining the discourse around teaching and learning, strengthening the ability of members to become change agents through the mentor/newbie aspect inherent in a community of practice and by building and supporting professional learning communities in schools (Hopkins, 2003)

The notion of social capital as people learning from one another in networks, is expanded upon by Jackson (Noden & Bruce, 2006) rather extensively. Intellectual or social capital comes from the intersection that occurs when people learn from one another. In order to create meaningful *new knowledge* we must honor *what is known* from theory and research alongside *what we know* from the perspective of the practitioners working in the schools (Noden & Bruce, 2006). These three fields of knowledge coalesce in a community of practice to increase social capital and cohesion. This work must begin with the building of opportunities for teachers to share what they know with their peers while at the same time allowing for the integration of outside knowledge. Further

supporting this idea, in a study of over fourteen networks involving 4,500 titles and abstracts including 383 full studies, Bell, et al. (2006) found that both peer to peer collaboration and expert input were widely used to support the transfer of knowledge and practice. The extension and enlargement of communities of practice afforded by networks can potentially completely alter the educational reform landscape (Hargreaves, 2003; Moore & Kelly, 2009; Stoll et al., 2006) by moving attention away from micro-issues at individual school sites (Katz et al., 2009). Strengthening interconnections by focusing on meso and macro issues helps to disperse innovations more effectively (Black, 2008; Katz et al., 2009). In this manner, networks can be "power bases" for school improvement by enhancing the success of both individual and organizational members (Moore & Kelly, 2009).

Information and communication technologies amplify this potential (Kimble et al., 2008) allowing for new possibilities for sharing of innovation by leveraging talent, expertise and knowledge regardless of geographical boundaries. We can now more easily connect schools, communities and other players that permeate the educational landscape (Stoll et al., 2006). Chen (2003) outlines several factors that boost learning potential in networked learning communities mediated by technology. First, these networks tend to meet the needs of more members since they are not just one single, linear expression of information. Instead, they typically manifest as highly interactive with many divergent threads. This leads to more opportunities for collaboration and the potential to connect with a wider range of experts who are no longer constrained by place.

Lieberman and Mace (2010) offer the perspective that newer, more interactive technologies allow people working in communities of practice to share their new,

collective wisdom in more powerful forms. This professional knowledge creation provides an unprecedented mechanism to transform education in a multitude of new ways by allowing struggling practitioners to connect with experts in ways not possible just a few years ago, providing ubiquitous access to necessary learning tools and resources, and opening a pathway to feedback from potential mentors and colleagues worldwide. Another pathway to transformation is that networked learning communities allow learners to better design and receive professional development from their own perspective and needs (Hopkins, 2006). Ultimately networks that take advantage of continuously available and interactive, online learning spaces, make it possible to approach challenges of practice more quickly, more authentically and more meaningfully (Chen, 2003) while at the same time allowing for easily accessible expressions of knowledge creation that can help significantly more teachers transform their practice (Lieberman & Mace, 2010).

Impact of Networked Learning Communities on Teacher Practice. Professional learning networks are increasingly being promoted as a mechanism for educational transformation for a variety of reasons (Katz et al., 2009) but primarily for the potential impact participation in these communities can have on teacher learning and practice (Lieberman, 2000). Several have noted that participation in networked learning communities can promote the type of deep learning amongst teachers that results in both the improvement of and dissemination of good practice (Black, 2008; Hopkins, 2006; Katz et al., 2009; Lieberman & Grolnick, 1996; Veugelers & O'Hair, 2005). As alluded to earlier, networks also promote implementation of more student-centered learning environments by modeling that includes reflective practice, horizontal learning,

partnerships and learner empowerment (B. Caldwell, 2008; Veugelers & O'Hair, 2005). Research from some network initiatives supports these assertions.

The Bay Area School Reform Collaborative began in 1995 with the goal of increasing educational equity in six counties in Northern California by building professional knowledge of effective practice, fostering mutual accountability and collaboration, and bringing about ongoing improvement in the quality and equity of student outcomes (MDRC, 2006). In a research report covering the first five years of the project, the conclusion was that teachers from schools participating more often in network-supported activities demonstrated higher levels of inquiry practices in their classrooms (Park et al., 2002). There was also evidence that the more the professional learning community at the school site practiced inquiry types of activities, the greater the improvement in teacher practice (Park et al., 2002).

The Networked Learning Communities (NLC) initiative in the United Kingdom was probably the largest to date running from 2002 until 2006 with the participation of 137 school networks (Kubiak & Bertram, 2005). Many of the networks still exist and other new partnerships have developed as a result of this project. The scope and scale of this project resulted in several publications and studies surrounding networked learning communities. One key finding from the project is that networks can change the deep core of professional thinking and practice (Noden & Bruce, 2006). Sammons, Mujtaba, Earl and Gu (2007) found that most teachers had a very positive view of professional learning and improvement of practice that occurred within the context of the network. Researchers involved in another project study reviewed over 4,500 titles and abstracts and 383 studies involving fourteen networks and concluded that gains in knowledge, more inclusive

practices, and enhanced communication and networking skills were more evident amongst teachers in networks with specific goals and foci (Bell et al., 2006). Interestingly this work also found that the relationships developed in the network were key for knowledge transference and that professional development was at the heart of effective networking. This begets new questions. Do teachers who are more active members of networked learning communities integrate more innovative teaching practices than those who are less active? To what degree does the change in practice impact student outcomes?

In order to learn more about how networks function, Katz and Earl (2010) tested a theory of action exploring enablers of changed thinking and practice and student achievement across fourteen networks that were part of the Networked Learning Community Program in the United Kingdom. Initially identifying six enablers of changed thinking and practice: purpose and focus, relationships, collaboration, enquiry, leadership and capacity building and support, after a review of the evidence, they suggested a new lens through which to view networks in schools (Katz & Earl, 2010). Formal and informal leadership, school based relationships and collaboration, network-based relationships and collaboration and collaborative enquiry are all related to changes in thinking and practice in statistically significant ways (Katz & Earl, 2010). Alongside leadership and the level of engagement in the network, the idea of "joint work that challenges thinking and practice" emerged as a strong correlate to network effectiveness in terms of both changed thinking and practice and student success (Earl & Katz, 2007). Within this framework, continuing and informal, peer-to-peer sharing characterized the professional development in twelve of the networks examined. This suggests the need to

study participant interactions more deeply since well-designed, thoughtfully led networked learning communities fostering meaningful relationships can have a positive impact on teacher practice.

Impact of Networked Learning Communities on Student Achievement.

Drawing conclusions about the impact of networked learning communities on student achievement is challenging. Although some authors (Black, 2008; Hargreaves, 2003; D. Jackson, 2006) purport this association, relatively few studies exist. In the study of the impact of the Bay Area School Reform Collaborative, BASRC funded leadership schools posted statistically significant higher academic gains than a control group of Bay Area schools (Park et al., 2002). Researchers also found that the level of maturity a school demonstrated with regards to inquiry based teaching practices within their professional learning community could accurately predict student SAT 9 gains. (Park et al., 2002). Research from the National College for School Leadership Networked Learning Communities studies mentioned in the previous section demonstrates that network participation did raise student results significantly and that there was a direct correlation between the school's level of involvement in the network and improved outcomes (Bell et al., 2006; Noden & Bruce, 2006; Sammons et al., 2007). Katz and Earl's (2010) determined that of the key enablers impacting changes in thinking and practice, only formal leadership, informal or distributed leadership, relationships and collaboration were associated with changes in student outcomes. Interestingly, this work also found that the strength of the schools attachment to and participation in the network also had a statistically significant impact on student outcomes (Katz & Earl, 2010).

All of these examples demonstrate that the power of the network somehow rests in the quality of participation in the network and that perhaps more investigation into network participation as it relates to teacher practice needs to be conducted. With few exceptions, the studies that have been done were in relation to large-scale initiatives in other countries and/or with initiatives that no longer exists. Additionally, there has been little exploration of how digital tools are used within networked learning communities (Katz & Earl, 2010) to foster participation and collaboration. Caldwell (2008) notes that there is a lack of research with regards to network processes and outcomes in education. It is thus important to take a fresh look at a current and focused networked learning community making use of digital tools to mediate collaboration, relationship building and sharing of practice with the goal of integrating more innovative 21st century teaching and learning at the school level.

Evaluating Networked Learning Communities. In an extensive review of the literature associated with networked learning communities, Kerr, Aiston, White, Holland and Grayson (2003) concluded that the research and evaluation base is fragmented, sparse and contradictory. Additionally, there is a lack of research that captures the messy and complex nature of network processes (Kerr et al., 2003). There does appear to be some consistency in the literature in terms of both the characteristics and structures of effective networks. What should researchers examine when studying networks?

Desimone (2009) argues that since a multitude of factors impact teacher learning, network evaluation should center around a set of core features that mirror the characteristics of effective professional development including content focus, active learning, coherence, duration and collective participation. Others (Borko, 2004; Church et

al., 2002; Little, 2005) argue that we need to better understand the places in networks where learning and knowledge transfer take place. How do effective networks inspire participation? How do they encourage "trusting professional relationships" so that "joint work that challenges thinking and practice" takes place? How does a network initiate change?

Church et al. (2002) feel that any examination of networks should be both internal and external asking participants about their experiences but also make use of outside, more formal observations of network interactions, successes and challenges. The primary question should be "How does this network do its work?" with particular focus on how participants are connected and how joint work fosters change. This will allow for an understanding of participation from all angles including generation, development, and sustainment. Church et al. (2002) also recommend contributions assessments to pinpoint where resources lie within a network and participatory story building as it allows observers to see how far strategies, information and ideas are circulating and how participants in a network are connected to each other, thus providing a possible window into the benefits derived from networked work. Borko (2004) concurs with Church et al., emphasizing the need to take into consideration the teacher as learner and the complex systems in which teachers operate and with Desimone, calling for examination of critical features such as content focus, active learning, coherence, duration and collective participation. Borko (2004) also recommends a more outcomes based approach to evaluation that includes transformation of practice, philosophy, and collegial interactions.

Little (2005) builds upon both Borko and Church et al., outlining the need to move toward deeper examination of teaching practice as it relates to the activities taking place

across the network while stressing the need to research how professional learning communities and the network interact together. This is difficult to do since the important work of the network, the place where relationships are built, transfer of practice and creation of new resources happens is in the hard to define space between the network and the school (Little, 2005).

In a review of the literature that initially included 2,550 references culled down to 359 references, Kerr et al. (2003) conclude that further research giving us insight into the ever-changing nature of networks is essential since most existing research comes from the perspective of network coordinators rather than from the perspective of the participants. They recommend research that illuminates participant characteristics including backgrounds, why they participate in networks, extent of involvement and participant perspectives of network benefits (Kerr et al., 2003).

Summary of the Literature Review

After careful consideration of the literature presented exploring 21st century teaching and learning, professional development, professional learning communities and networked learning communities, what has emerged is the suggestion that professional learning communities situated within a networked learning community can foster the types of professional learning activities that can change thinking and practice and that this change can subsequently lead to improved student outcomes. The intent of this study will be to develop deeper understanding about how collaborative inquiry can change thinking and practice in a network by focusing on the interaction of participant characteristics, levels of participation, the extent to which the participants are developing new professional relationships and corresponding levels of teaching innovation within an

active networked learning community designed to support and strengthen school based professional learning communities.

Chapter 3

Overview

The most recent iteration of the learning community model for teacher development, the networked learning community, capitalizes on the increasing use of interactive, social media tools to help teachers share resources and stories of practice in the service of enhanced teaching and learning (Lieberman & Mace, 2010). Professional development, professional learning community and networked learning community literature demonstrates the potential for networked learning communities as a model for both school and system reform. Research clearly shows that this paradigm for professional learning is aligned with learning theory (Lieberman & Mace, 2010), what we know about what constitutes effective professional development and that it can lead to the kind of knowledge sharing and creation that is best aligned with the 21st century skills movement. Networks work best when there is a clear focus on learning and when the capacity of formal and informal leaders is strengthened.

The literature base reviewed demonstrates that the real power of the network rests primarily in the "collaborative inquiry that challenges thinking and practice" (Katz et al., 2009, p. 9). The nature of network participation and the informal quality of the professional relationships between network participants is worthy of more examination. Few studies have specifically explored levels of participation or details about the professional relationships that are formed and strengthened at the school level and at the network level as they relate to teaching innovation. None have specifically explored networks where digital tools were intentionally utilized both as a means to strengthen the network and to model the type of practices aligned with network purpose.

This study explores levels of participation in the network, the extent to which participants develop new professional relationships, perceived network benefits, and the type of professional learning community and intensity of professional development in place at the school level as each relates to corresponding indicators of teaching innovation, among members of an active, networked learning community. This chapter outlines the context of the study, the research design and includes a description of the participants and consent procedures. This chapter also addresses the instrumentation, validity and reliability, and data collection procedures. The chapter concludes with details on data analysis, methodological assumptions and limitations of the study.

Research Approach and Design

The primary strategy of inquiry for this descriptive, quantitative study was a cross-sectional, non-experimental survey design (Creswell, 2003). Quantitative studies are those in which concepts and variables are well defined, chosen before the study begins and measured objectively (Creswell, 2009). Descriptive studies are appropriate when attempting to "describe systematically the facts and characteristics of a given population or area of interest, factually and accurately" (Isaac & Michael, 1997). When established by previous research to be reliable and valid, surveys are an acceptable quantitative approach when there is an interest in generalizing from a sample to a population (Creswell, 2009). Data from the Levels of Teaching Innovation Digital Age (LoTi) survey was cross-referenced with data drawn from an additional ten questions embedded into the survey related to teacher participation in the networked learning community. The survey data was compared to two characteristics (intensity of professional development

and type of professional learning community) taken from a summary of school level key project characteristics generated during Year 1 of the project.

Statistical analysis for the current study includes examination of both descriptive and inferential statistics. Descriptive statistics were used to describe the current study's sample, with respect to all variables (both independent and dependent). Inferential statistics, such as t-tests, Pearson's r, chi-square, were used to determine if the independent variables (levels of teacher participation in the network, degree to which new professional relationships are established, professional learning opportunities experienced and self-identified benefits from network participation) are linearly or systematically associated to the dependent variables associated with teaching innovation, personal computer usage (PCU), current instructional practices (CIP) and levels of teaching innovation (LoTi). A correlational matrix was produced to test for significance and potential associations between several study variables. Correlational analysis allows the researcher to determine the "extent to which variations in one factor correspond with variations in one or more other factors" allowing for the exploration of the interrelationships between several variables simultaneously (Isaac & Michael, 1997, p. 53).

The research addressed the following questions in an attempt to build deeper understanding of teacher participation in a networked learning community:

1. Do teachers who participate more frequently in networked learning community activities utilize more innovative teaching strategies as measured by the LoTi Digital Age Survey?
2. Do teachers who develop more professional relationships in networked

learning communities utilize more innovative teaching strategies as measured by the LoTi Digital Age Survey?

3. Does the type of professional learning community in the school bear a relationship to levels of teaching innovation as measured by the LoTi Digital Age Survey?
4. Does the intensity of professional development in a school bear a relationship to levels of teaching innovation as measured by the LoTi Digital Age Survey?
5. What factors do the teachers with higher levels of teaching innovation as measured by the LoTi Digital Age Survey report as being significant in influencing changes in their practice?

Context of the Study

This study examined one networked learning community called "Schools of the Future" in Hawai'i funded by the Hawai'i Community Foundation. The Schools of the Future project includes 20 independent schools involved in 18 projects. The primary project goal is to promote the integration of 21st century skills and literacies into the school curricula. Digital tools are utilized to support the project goal most notably in the form of a Ning or collaborative workplace where members can get information, share ideas and resources and participate in discussion forums. Project schools submitted grant proposals during the 2008-2009 school year and were notified of their awards in either December 2008 or May 2009. Project schools demonstrated a clear intent and plan to transform their learning environments and agreed to participate in the network as part of the project. Each project school has also formed or is part of a project team at the school level that provides direction and support for teachers as they become more familiar with

21st century skills and tools. At the network level, the Hawai'i Association of Independent Schools, through a contract with the Hawai'i Community Foundation, provides technical and moral support and the opportunity for the project team leaders from each school to connect within the network through regular face-to-face and online community of learner meetings and through interactions within the project Ning.

Although some schools were awarded their grants in December 2008, the first project wide community of learner meeting was held in June of 2009. At that meeting, project team leaders were introduced to the project Ning and given an overview of the project goals and participation requirements. Implementation in all project schools began in Fall 2009, marking the official commencement of Year 1 of the 5-year project. At the beginning of the school year, project schools were sub-divided into three groups based on project goals and other school characteristics to facilitate sharing of expertise during the face-to-face and online sessions. During Year 1, all project team leaders from all of the project schools participated in the following network activities sponsored by the Hawai'i Association of Independent Schools:

1. Three day long community of learner sessions in September 2009, February 2010 and May 2010.
2. One week long study tour to High Tech High, San Diego in October 2009.
3. Four formal online discussions held during specific time frames in September 2009, November 2009, March 2010 and April 2010.

Throughout the year, each project school also engaged in its own site or project specific professional development activities related to its site-specific project goals.

Subjects

Study participants were drawn from a convenience sampling of approximately 650 teachers from the twenty project schools representing a total population of 9,690 students who are part of the "Schools of the Future Project" networked learning community in Hawai'i. The number of study participants was determined by assuming a 15:1 student/teacher ratio, which is typical for independent schools in Hawai'i. All project schools were invited to participate in the survey. The primary project goal is to promote the integration of 21st century skills and literacies into the school curricula. Since this study seeks to explore the relationship between participation in networked learning communities and the integration of innovative 21st century teaching and learning practices, this population of teachers is especially appropriate. The schools reflect a diverse, cross section of independent schools in Hawai'i, representing different school sizes, different school philosophies and affiliations and different islands as evidenced in Appendix A (Nistler, 2010).

Consent Procedures

An Institutional Review Board (IRB) exempt application was submitted to the proper authorities at Pepperdine. The proposed study met exempt status criteria as outlined in 45 CFR 46.101 (b)(2) since the research activity involved survey research with an adult population that is not protected. Additionally, the research was conducted in established or commonly accepted educational settings, involving normal educational practices. After school level leaders approved their school's participation in the study, potential participants received an e-mail invitation (Appendix G) to take the survey that included a description of the study, outlined their rights as a study participant and

explained risks and benefits. Participation in this study was strictly voluntary and participants indicated their understanding of the aforementioned and their consent by clicking on the survey link. Participants were required to finish the survey if they decided to discontinue at any time. Participants entered a user name and e-mail address when they registered to take the survey. This information was coded by the researcher when the raw data is received at the end of the survey period to ensure confidentiality. The revised raw data set was kept secure on a password protected, back up external hard drive with a password known only to the researcher. The survey itself did not ask for information that could link the participants to the survey data nor was or will the data be disclosed in a manner that could place the participant at any risk of criminal or civil liability or cause damage to their employability or reputation. The only identified risk was the imposition on the participant's time. The revised raw data set will be kept for five years and then archived so that it may potentially be used for future research associated with the School of the Future project.

Instrumentation

Teaching innovation, the primary dependent variable of the current study, will be measured using a customized version of the Levels of Teaching Innovation Digital Age Survey (LoTi; Appendix B). The original Loti is a 37 item self-report survey that measures levels of teaching innovation utilizing a combination of three primary indicators: levels of teaching innovation (LoTi), current instructional practices (CIP), and personal computer usage (PCU). Each participant's responses on LoTi result in a Digital Age profile, approximating the degree to which she/he is either supporting or implementing tenets of student-centered 21st century teaching and learning practices in

their classroom. The Digital Age profile provides summary scores in the three areas mentioned above. Scales vary slightly for each area indicator and are included as Appendix C. Three LoTi developed demographic questions were added to the survey relating to years teaching, primary subject area and participation in school based technology sessions. An additional 10 custom questions (Appendix D) related to participation in the networked learning community in terms of frequency, usefulness and relationships formed with other educators were also embedded into the LoTi Digital Age Survey resulting in a 50 item survey. The researcher designed the custom questions, with content-validity established through collaboration with experts in the field. The purpose of these questions is to determine levels of teacher participation in the networked learning community, perceived benefits of participation in the network, and the nature of professional relationships formed or strengthened as a result of participation in the network. The custom questions are ultimately designed to provide more insight into the nature of network participation and benefits as they relate to levels of teaching innovation as measured by LoTi, PCU and CIP scores.

The LoTi Digital Age Survey was selected for a variety of reasons. Firstly, the tool focuses on teacher behaviors, perceptions, and instructional practices using digital tools and resources aligned with the recommendations laid out by the Partnership for 21st Century Skills and the International Society of Technology in Education (ISTE). These recommendations were explained fully in Chapter 2 of this study. Since this study seeks to explore teaching innovation that is aligned with 21st century teaching and learning, this tool will provide directly relevant data. The tool was also selected for feasibility of use, including economy of design, the ability to be delivered online, quick access to results

and ease of use with the population under study. The tool can be given in subsequent years of the project, which can provide useful comparison data for project leaders as they assess the overall efficacy of their project over time.

Reliability and Validity. Previous research that utilized the LoTi established it as a statistically reliable and valid tool, which was refined over the years and used in over 40 dissertations. The LoTi is based on the Levels of Technology Implementation framework originally developed in 1994 by Dr. Chris Moersch (Stoltzfus, 2006). The original tool was designed to accurately and objectively assess the degree to which teachers were using technology in the classroom. The original Loti questionnaire reflected the Concerns-Based Adoption Model. The content validity of the tool was established by its strong theoretical framework and the expert panel involved in its development, which took place over the course of two years (Stoltzfus, 2006). The second iteration of the survey, the LoTi DETAILS questionnaire was construct-validated in 2006. Construct validity is established when an instrument accurately reflects a person's standing on the construct it was intended to measure. The LoTi also demonstrated appropriate internal consistency and reliability (Stoltzfus, 2006). The term reliability refers to the stability and consistency of test measurement (Isaac & Michael, 1997).

The LoTi Digital Age Survey, which is the latest iteration of the tool possesses both the content and construct validity of previous versions of the tool and also demonstrated sufficient criterion validity in extant research (Stoltzfus, 2009). Criterion validity means that the test compares well with external variables considered to provide a "direct measure of the characteristic or behavior in question" (Isaac & Michael, 1997, p.

129). At that time, the researcher concluded that the LoTi Digital Age Survey "accurately capture(s) teaching innovation" (Stoltzfus, 2009, p. 6).

The study utilized an existing data set that was generated by an external evaluation commissioned by the Hawai'i Community Foundation during Year 1 of the project. This work was compiled into a report called the *Schools of the Future Project Profiles* and provides an overview and categorization of project schools breaking them down into a variety of key characteristics including demographics, project purpose and focus, curricular adaptations, technology purpose, implementation approach, professional learning opportunities (both professional development and professional learning communities) and evaluation (Nistler, 2010). The key characteristic matrix (Appendix E) was developed during Year 1 of the project as an outcome of an analysis of individual school project profiles. Learning Point Associates project evaluation staff conducted thorough document reviews to create initial project profiles. These draft profiles were then reviewed by the project leadership team at each school who made revisions and provided supplementary information related to project goals and objectives. Revised project profiles were reviewed and coded. NVivo qualitative software was then used to document the coding which allowed for numerical representation so that all data could then be entered into an SPSS database for analysis. Evaluators then determined if and how the project characteristics clustered and looked for correlations (Nistler, 2010). For purposes of this research, the two sub-factors of the professional learning opportunities factor will be utilized. Both the type of professional learning community - school-wide, grade or subject, or early adopters and the intensity of professional development -

multiple intense options, one intense option, or no intense options will be compared to levels of participation in the network and levels of teaching innovation.

Table 1 presents all key constructs of the current study, indicating which research questions(s) each construct was addressed in, as well as which custom items were relevant to each respective construct.

Table 1

Variables, Custom Survey Questions and Research Questions

Participant Factors	Variables	Custom Question Number	Research Questions Addressed
Levels of Teaching Innovation Survey (LoTi) – PCU, LoTi, and CIP scores	Dependent	NA	ALL
Network Factors			
Level of Participation in Network (SOTF Activities, NING)	Independent	1,2,3,4	#1
Level of Relationships in Network (Colleagues at School, Colleagues at Other Schools – quality and frequency)	Independent	5,6,7,8,9	#2
Network Factors Impacting Practice (collaboration, networking, experts, digital tools, different forms of pd)	Independent	10	#5
School Level Factors			
Type of Professional Learning Community	Independent	Existing Data from SOTF Project Profile Report	#3
Intensity of Professional Development	Independent	Existing Data from SOTF Project Profile Report	#4

Data Collection and Recording

Permission to conduct the study was originally sought by the researcher from the School of the Future project leader in Fall 2009 and verified again in Summer 2010. The

researcher was school principal in a School of the Future project school during the 2009-2010 school year but is no longer officially associated with any of the schools in the project. Permission for individual schools to offer the survey to their teachers was requested in January 2011 and received shortly thereafter from all participating schools.

Methods of data collection in non-experimental, cross-sectional quantitative designs commonly rely on surveys. Survey designs provide an opportunity for the researcher to examine "numeric description of trends, attitudes, or opinions of a population by studying a sample of that population" (Creswell, 2009, p. 145). The LoTi Digital Age Survey was administered over a six-week period in the winter of the project's second year (2010). Approximately two weeks prior to sending the survey to the project leaders, an e-mail providing an overview of the study was sent to all to project leaders involved in the project (Appendix F). Survey instructions and an access link were sent at the beginning of the data collection period via e-mail to all school level project leaders with a request to forward on to all teachers in their school. The consent information was embedded into the e-mail sent to potential participants (Appendix G). By clicking on the survey link, participants consented to be part of the study. Project leaders received several e-mail reminders to forward on to their teachers to encourage maximum participation as recommended by Salant and Dillman (1994). Study participants received a digital age teaching and learning profile after completing the survey.

Data Process and Analysis

After the survey was closed, LoTi staff provided the researcher with a Digital Age Profile summarizing the data. Additionally, the researcher received the raw data in CSV format. User names and e-mail addresses were included in the initial raw data set.

However, each participant was given a randomly generated identification number prior to data analysis to protect participants' privacy. No information was included in the analysis that would allow the researcher to associate response data with any individual participant. Prior to analysis, data was imported into SPSS 18.0, common statistical software, where it was cleaned, appropriately coded, and prepared for analysis. Analysis was conducted using SPSS 18.0, where both descriptive and inferential statistics were produced so that the researcher could begin to meaningfully describe the data. This included determining frequencies, means and standard deviations for all independent variables listed in survey questions #1-10 as follows:

- Frequency of participation in School of the Future Sponsored Activities (Custom Question #2)
- Frequency of participation in School of the Future project Ning (Custom Question #3)
- Frequency of contribution of resources and/or participation in discussions in project Ning (Custom Question #4)
- Frequency of collaboration with colleagues from own school (Custom Question #5)
- Quality of collaboration with colleagues from own school (Custom Question #6)
- Frequency of collaboration with colleagues from other schools (Custom Question #7)
- Frequency of new professional relationships (Custom Question #8)
- Frequency of communication with teachers from other schools outside of SOTF (Custom Question #9)
- Factor most impacting ability to transform teaching (Custom Question #10)
- Type of Professional Learning Community (Year 1 Report)
- Intensity of Professional Development (Year 1 Report)

After describing the variables, inferential statistics were used to determine if significant differences existed between independent variables and the dependent variable (LoTi scores). Correlational research including T-Tests and ANOVA tests were employed since they are appropriate when variables are complex, allowing for measurement of interrelationships between variables simultaneously (Isaac & Michael, 1997). Pearson's r analysis was completed to determine if linear relationships existed between variables. See Table 2 for a variable analysis matrix.

Table 2

Variable Analysis Matrix

Network Factors	LOTI (DV)	Custom Questions	Research Question
Level of Participation in Network (IV)	Pearson's r	1,2,3,4	#1
Level of Relationships in Network (IV)	Pearson's r	5,6,7,8,9	#2
Network Factors Shaping Teaching Innovation (IV)	ANOVA	10	#5
School Level Factors			
Intensity of Professional Development (IV)	Descriptive ANOVA	Existing Data from SOTF Profiles Report	#3
Type of Professional Learning Community (IV)	Descriptive ANOVA	Existing Data from SOTF Profiles Report	#4

Limitations

Although every attempt was made to design the study carefully and thoughtfully, there are inherently some limitations that arise when conducting any type of research. One limitation of this study is that correlational research can only identify that variables are associated with each other but it does not necessarily identify cause and effect (Isaac & Michael, 1997). Additionally, correlational research is less rigorous than forms of experimental design since there is less control over the independent variables (Isaac & Michael, 1997). Utilizing surveys as the primary mechanism for data collection can also be problematic particularly when participants are self-reporting. There may be a tendency to over or under report a particular phenomena. However, surveys are the most feasible mechanism for efficiently collecting data on large, dispersed samples and the LoTi survey instrument has demonstrated reliability in previous research as well as content, construct and criterion validity (Stoltzfus, 2009).

Summary

Teachers from 20 School of the Future project schools were invited to participate in an online survey designed to measure levels of teaching innovation based on three indicators, personal computer usage, (PCU), current instructional practices (CIP) and levels of teaching innovation (LoTi). The survey included ten custom questions designed to collect information on independent variables such as level of participation in network activities, level of participation in the network Ning, frequency and quality of collaboration with colleagues at the school-site, frequency of collaboration with colleagues at other project schools and outside experts, and perceived network benefits. Data was analyzed using both descriptive and inferential statistics. The results of this

study will be used to provide feedback to network leaders on any relationships that were found to exist between network participation, professional relationships, type of professional learning community, intensity of professional development, and overall levels of teaching innovation. The current study will also contribute to the literature base in the area of networked learning communities.

Chapter 4

Introduction

Traditional approaches to professional development are evolving in response to the rapid increase in the use of social media. Teachers are now blogging, tweeting, participating in Nings and creating web-based content that is easily accessible to others. This opportunity to network more readily is allowing educators to share both expertise and problems of practice instantaneously, opening up an entirely new way of thinking about the power of networked professional learning communities to transform practice in education. The intent of this quantitative, descriptive study was to build understanding about teacher participation in a networked learning community as it relates to innovative teacher practice by examining five key factors: levels of participation in the network; the extent to which participants are developing new professional relationships; perceived transformative practices; the type of professional learning community; and the intensity of professional development in place at the school level. These factors were analyzed as they related to corresponding levels of teaching innovation such as personal computer usage (PCU), current instructional practices (CIP) and levels of teaching innovation (LoTi) as measured by the LoTi Digital Age Survey tool amongst teachers in schools that are members of an active networked learning community promoting teacher collaboration and practices associated with the 21st century skills movement.

The conceptual framework underpinning the study emerged from analysis of the research associated with professional learning communities and networked learning communities which suggests that professional learning communities situated within networked learning communities can foster professional learning activities that change

teacher thinking and practice and that the heart of these changes rests in the relationships developed amongst participants in the learning communities both at the school site and at the network level.

The purpose of this chapter is to report the results of analysis of the research questions. The first section presents basic demographic information about the respondents as well as summary data of the most important factors examined. The second section gives results of the analysis related to the five primary research questions. The first research question examines frequency of participation in networked learning community activities as it relates to teaching innovation. The second explores professional relationships developed as a result of participation in the networked learning community and teaching innovation. The third and fourth questions relate to teaching innovation in relation to the type of professional learning community and intensity of professional development in place at the school situated in the networked learning community. The final question explores which network practices were identified as having the most transformative impact on teaching practice by the most innovative teachers. The third and final section of this chapter offers an examination of additional questions generated by the analysis of all questions taken together.

Description of the Sample

This study relied on data collected from forty-one participants from ten of the project schools who took a fifty item customized LoTi Digital Age Survey. Additionally, the study utilized existing data providing background information beyond the scope of the study related to the type of professional learning community and intensity of professional development opportunities in place at each of the project schools. The data is

organized into four categories. The first includes basic demographic data including number of participants, schools represented, years teaching and subject areas. The second category focuses on the dependent Levels of Innovative Teaching variables including Levels of Teaching Innovation (LoTi), Personal Computer Use (PCU) and Current Instructional Practices (CIP). The third category includes independent variable data related to participation, professional relationships and transformative practices in the School of the Future network, and the fourth category includes data at the school level related to intensity and quantity of professional development opportunities.

Demographic Data. Study participants were drawn from a convenience sampling of approximately 650 teachers from schools representing a total population of approximately 9,700 students who are part of the "Schools of the Future Project" networked learning community in Hawai'i. Forty-one teachers representing 10 of the 20 project schools participated in the survey as shown in Table 3.

Table 3

School of the Future Participation by School

School	*Number of Participants*
Assets School	2
Hanalani Schools	7
Iolani School	3
Kaua'i Pacific School	4
KCCL Project (2 schools)	4
Maui Preparatory Academy	3
Mid-Pacific Institute	18
Sacred Heart Academy	1
Seabury Hall	1

Table 4 describes teaching experience of participants ranging from less than five years to more than 20 years with 39% of participants in the 0-9 year range, 35% in the 10-20 year range and 26% in the more than 20 years experience range. In all, 64% of the teachers surveyed have been teaching for ten or more years.

Table 4

Years Teaching

Response - How many years of experience do you have in education?	Percent of Participants	Number of Participants
Less than Five Years	9%	4
Five to Nine Years	30%	13
Ten to Twenty Years	35%	15
More than Twenty Years	26%	11

Table 5 presents primary subject specialty of participant with 33% percent of the teachers identifying themselves as humanities teachers, 9% as science teachers, 14% as math teachers and the remaining 44% as Other (Physical education, Industrial Technology, Administration, Elementary, Other Electives).

Table 5

Subject Specialty

Response - Which category best describes your primary subject/specialty?	Percent of Participants	Number of Participants
Humanities (e.g., Language Arts, Fine Arts, Theatrical Arts, Social Studies)	33%	14
Sciences (e.g., Physical Science, Chemistry, Health Science)	9%	4
Mathematics (e.g., Geometry, Algebra, Statistics)	14%	16
Other (e.g., Physical Education, Industrial Technology, Administration, Elementary, Other Electives)	44%	19

Levels of Teaching Innovation Profile Data. The LoTi Digital-Age Survey generates a profile for each participant based on three components essential to digital-age literacy and innovative teaching practices: LoTi (Levels of Teaching Innovation), PCU (Personal Computer Use), and CIP (Current Instructional Practices). The three components contribute to an overall Levels of Teaching Innovation (LoTi) profile approximating the degree to which each participant either supports or implements the tenets of digital-age teaching and learning in a classroom setting. Table 6 summarizes the LoTi scores of survey participants. Overall scores ranged from zero to four with 40% at Level 2 or Exploration, 19% at Level 3 or Infusion and 26% at Level 4 or Integration.

The Personal Computer Use (PCU) profile results in Table 7 address each participant's fluency level with digital tools and resources for student learning as well as their use in the workplace. Scores for this component range from zero (no inclination or skill) to seven (extremely high fluency). Personal Computer Usage (PCU) of survey participants ranged from PCU Intensity Level 0 to Level 7 with 33% percent ranging from no inclination (Level 0) to little/moderate fluency (Level 2) with using digital tools for student learning. Forty-five percent fell into Levels 3 and 4 indicating moderate to high fluency when utilizing digital tools for student learning. High to extremely high fluency levels (Levels 5-7) were achieved by 23% of the survey participants who demonstrate more sophisticated use of both existing and emerging digital age media and tools to support student learning.

Table 6

Levels of Teaching Innovation Scores (LoTi)

LoTi Level	Description	Percent of Participants	Number of Participants
Level 0: Non-use	Instructional focus may vary; digital tools and resources are not used during the instructional day.	2%	1
Level 1: Awareness	Instructional focus emphasizes information dissemination; teachers use digital tools and resources for classroom management tasks or instructional presentations.	14 %	6
Level 2: Exploration	Instructional focus emphasizes content understanding; students use digital tools and resources to generate multimedia products that showcase content understanding.	40 %	17
Level 3: Infusion	Instructional focus emphasizes engaged higher order learning; students use digital tools and resources to solve teacher-directed problems related to the content under investigation.	19%	8
Level 4a: Integration	Instructional focus emphasizes student-directed exploration of real-world issues; students use digital tools and resources to answer self-generated questions that dictate the content, process, and product. Level 4a teachers experience classroom management or climate issues that restrict full-scale integration.	19%	8
Level 4b: Integration (Routine)	Instructional focus emphasizes student-directed exploration of real-world issues; students use digital tools and resources to answer self-generated questions that dictate the content, process, and product. Level 4b teachers facilitate full-scale inquiry-based teaching regularly with minimal implementation issues.	7%	3
Level 5: Expansion	Instructional focus emphasizes global student collaboration to solve world issues; students use digital tools and resources for authentic problem-solving opportunities beyond the classroom.	0%	0
Level 6: Refinement	Instructional focus is entirely learner-based; students experience seamless integration of digital tools and resources for their self-directed problem solving and issues resolution.	0%	0

Table 7

Personal Computer Usage Scores (PCU)

PCU Level	Description	Percent of Participants	Number of Participants
PCU Intensity Level 0	No inclination or skill level to use digital tools and resources for either personal or professional use.	5%	2
PCU Intensity Level 1	Little fluency with using digital tools and resources for student learning; may have a general awareness of various digital tools and media but is not using them.	12%	5
PCU Intensity Level 2	Little to moderate fluency with using digital tools and resources for student learning; does not feel comfortable using digital tools/resources beyond classroom management.	16%	7
PCU Intensity Level 3	Moderate fluency with using digital tools and resources for student learning; may begin to become "regular" user of selected digital-age media and formats.	19%	8
PCU Intensity Level 4	Moderate to high fluency with using digital tools and resources for student learning; commonly uses a broader range of digital-age media and formats in support of curriculum.	26%	11
PCU Intensity Level 5	High fluency level with using digital tools and resources for student learning; commonly able to expand range of emerging digital-age media and formats in support of curriculum.	19%	8
PCU Intensity Level 6	High to extremely high fluency level with using digital tools and resources for student learning; sophisticated in the use of most existing and emerging digital-age media or format.	2%	1
PCU Intensity Level 7	Extremely high fluency level with using digital tools and resources for student learning; sophisticated in the use of any existing and emerging digital-age media or format.	2%	1

Table 8

Current Instructional Practices (CIP)

CIP Level	Description	Percent of Participants	Number of Participants
Intensity Level 0	No formal classroom setting	0%	0
Intensity Level 1	Instructional practices align exclusively with a subject-matter based approach to teaching and learning; teaching strategies lean toward lectures and/or teacher-led presentations.	0%	0
Intensity Level 2	Instructional practices still consistent with a subject-matter based approach to teaching and learning; emphasis on didactic instruction and teacher-generated questions.	9%	4
Intensity Level 3	Instructional practices align somewhat with a subject-matter based approach to teaching and learning with limited options given to students for their final products.	23%	10
Intensity Level 4	Instructional practices align with a subject-matter based approach to teaching and learning, but students are given expanded options with the content, process, and/or products.	23%	10
Intensity Level 5	Instructional practices lean toward a learner-based approach; teaching strategies and assessments used for learning are diversified and driven by student questions.	19%	8
Intensity Level 6	Instructional practices consistent with a learner-based approach; student inquiry and self-directed problem solving influence the content and context of instruction.	16%	7
Intensity Level 7	Instructional practices align exclusively with a learner-based approach to teaching and learning; students establish personal goals and monitor their own pace and progress with a purposeful learning space.	9%	4

The Current Instructional Practices (CIP) profile results presented in Table 8 reveals each participant's support for or implementation of instructional practices consistent with a learner-based curriculum design (e.g., learning materials determined by the problem areas under investigation, multiple assessment strategies integrated authentically throughout the curriculum, teacher as co-learner/facilitator, focus on learner-based questions) and research-based best practices. Scores ranging from zero (subject-matter approach) to seven (learner-based approach) are possible. None of the respondents scored at Levels 0 or 1, 9% scored at Level 2, 46% were at either Level 3 or 4. Forty-four percent of participants scored at Levels 5 through 7 indicating more learner -based instructional approaches in their classrooms.

School of the Future Network Data. In addition to the LoTi Digital Age Profile questions, survey participants responded to a series of custom questions found in Appendix D designed to measure three key areas related specifically to the School of the Future Network. The first series of questions (#s 1-4) measured the degree and level of participation in the School of the Future (SOTF) networked learning community. The second series of questions (#s 5-9) related to the level of professional relationships established and strengthened by participation in the School of the Future Networked Learning Community. The final question (#10) was designed to answer research question number five by asking participants to identify the highest impact School of the Future network practices.

Network Participation. Table 9 results indicate that the majority of respondents (74 %) identified themselves as teachers in SOTF Project schools. An additional 16 percent identified themselves as teachers serving as a member of the

school's Schools of the Future Project team. Nine percent of respondents were administrators. Forty-four percent of respondents indicated that they had not participated in any of the activities sponsored by the School of the Future networked learning community. Forty-two percent had participated in some (2 or 3) of the activities with 14% participating in most (4 or more) of the activities sponsored by the network. With regards to Ning usage, 7% of survey participants visit the School of the Future Ning daily or weekly, 17% visit monthly or quarterly with 76% percent rarely (less than quarterly) visiting the site. Contributions to the Ning are made occasionally (monthly or quarterly) by 14% of participants with the remaining 86% rarely (less than once per quarter) contributing.

Table 9

Participation Matrix

Level of Personal Involvement	Percent of Participants	SOTF Activity Participation	Percent of Participants
Teacher	74%	Participated in Most Activities (4 or more)	14%
Teacher on School's SOTF Project Team	16%	Participated in Some Activities (2 or 3)	42%
Administrator or Other School Leader	9%	Participated in None of the Activities (0)	44%
Visits to Ning	**Percent of Participants**	**Contributions to Ning**	**Percent of Participants**
Frequently (daily or weekly)	7%	Frequently (daily or weekly)	Less than 1%
Occasionally (monthly or quarterly)	17%	Occasionally (monthly or quarterly)	14%
Rarely (less than once per quarter)	76%	Rarely (less than once per quarter)	86%

Professional Relationships. Participants responded to five questions regarding the frequency and quality of collaboration and new professional relationships formed as a result of participation in the School of the Future Network. Table 10 summarizes the responses showing that 51% of participants reported that they participated more often with their colleagues as a result of their school's participation in the School of the Future project with 47% reporting that the frequency of collaboration had not changed. Two percent responded that collaboration occurred less often. With regards to frequency of collaboration with other schools in the network, 44% responded that this was occurring more often with 56% reporting that the frequency had not changed. When asked about the level of communication with other schools outside of School of the Future sponsored Project Activities, the majority, or 70% responded that this occurred rarely or less than once per quarter, while 30% percent reported that communication of this type occurred occasionally (monthly or quarterly). Fifty-eight percent of the respondents reported that they had established some (1-9) new professional relationships due to SOTF participation, with 12% indicating that they had established many (10 or more) new relationships. Thirty percent reported that they had not established any new professional relationships due to SOTF participation.

Transformative Practices. From a list of school and/or network supported professional learning activities, participants were asked to select the one practice/activity that most impacted their ability to transform their teaching practices to be more aligned with 21st century teaching and learning. As shown in Table 11, 28% reported that collaborating with teachers from their own school had the most impact. Twenty-six percent reported that participating in different forms of professional development

impacted their practice the most, while 23% percent felt that becoming more comfortable with digital tools was most impactful. Twenty-one percent of respondents selected learning from experts outside of the project schools who had been introduced to the schools by the School of the Future Network as high impact. Only 2% of respondents felt that networking with peers from other project schools had the most impact on their teaching practice.

Table 10

Professional Relationships Matrix

Frequency of Collaboration Own School (5)	%	Frequency of Collaboration Other Schools in Network (7)	%	Communication with Other Schools Outside of SOTF Project Activities (9)	%
More Often	51%	More Often	44%	Frequently (daily or weekly)	Less than 1%
Same	47%	Same	56%	Occasionally (monthly or quarterly)	30%
Less Often	2%	Less Often	Less than 1%	Rarely (less than once per quarter)	70%
Quality of Collaboration Own Schools (6)	%	Established New Professional Relationships Due to SOTF Participation (8)		%	
Positive Impact	63%	Many (10 or more)		12%	
No Impact	33%	Some (1-9)		58%	
Negative Impact	5%	None (0)		30%	

Table 11

Factors Impacting Practice

Factors	Number of Respondents	Percent of Respondents
Collaborating with teachers at my school site	12	28%
Networking with teachers from other project schools	1	2%
Learning from experts outside of the project schools such as Tony Wagner, Ken Robinson, High Tech High staff or others who may have visited my school	9	21%
Becoming more comfortable with digital tools	10	23%
Participating in different forms of professional development	9	26%

School Level Factors Data. While all School of the Future project schools have professional learning communities (PLCs), the PLCs vary in purpose and format. A School of the Future Project Profile conducted by Learning Point Associates during the first year of the project indicates three patterns of distribution (Table 12):

- **School-wide.** All or nearly all teachers engage in a professional learning community.
- **Grade and/or subject area specific.** Teachers in certain grades or teaching certain subject areas engage in PLCs.
- **Early adopters**. It is mainly the early adopters (volunteers) in the school who engage in PLCs.

Another component of interest shown in Table 12 is the intensity of professional development offered at the school level. The professional development offerings provided by the individual schools were also examined by Learning Points Associates to determine if the level of professional development in SOTF Project Schools included multiple, single, or no options for participating in intense professional development.

Intense offerings were characterized as courses, institutes, consultants and in-school trainings. Schools were categorized according to the degree to which they offered multiple, one or no intense options to their teachers.

- **None**. No intense course, institute, consultant and/or in-school training offered at the school level during Year 1.
- **One**. One intense course, institute, consultant and/or in-school training offered at the school level during Year 1.
- **Multiple.** More than one intense course, institute, consultant and/or in-school training offered at the school level during Year 1.

Table 12

PLC Type/Intensity of Professional Development

School	# of Parti-cipants	PLC Type	Intensity of Professional Development
Assets School	2	School-wide	Multiple
KCCL Project (2 schools)	4	School-wide	Multiple
Mid-Pacific Institute	17	School-wide	Multiple
Sacred Hearts Academy	1	School-wide	One
Hanalani Schools	7	Grade/Subject	One
Kaua'i Pacific School	4	Grade/Subject	None
Maui Preparatory Academy	3	Grade/Subject	None
Iolani School	3	Early Adopters	None
Seabury Hall	1	Early Adopters	None

Results

This section of the results chapter presents the results of the statistical analyses of the five research questions utilizing the descriptive data presented in the previous section.

Research Question One: Levels of Participation. The results of the analyses presented in this section address the first research question related to participation in networked learning communities and levels of the three teaching innovation indicators measured by the LoTi Digital Age Survey. To fully explore the question, *Do teachers who participate more frequently in networked learning community activities utilize more innovative teaching strategies as measured by the LoTi Digital Age Survey?*, a composite score of factors related to network participation was created using responses for custom questions 2, 3 and 4 which asked participants about frequency of participation in network activities, frequency of participation in the network Ning and frequency of contributions to the network Ning. The composite score was created in order to focus on the larger concept of participation in the networked learning community. Prior to creating the composite or sum score, responses for each custom questions were given ordinal labels, appropriate when response sets are not explicit quantitative values. Pearson R analyses were then run to measure the correlation between the resulting Participation in Network Sum Score and the three dependent variables derived from the Levels of Innovative Teaching Profile.

Results of the Pearson's R Analyses shown in Table 13 indicate that participation in the network is most significantly correlated to Personal Computer Use (PCU) with a correlation of .005. This finding makes sense since teachers with higher digital fluency are probably more likely to become aware of SOTF Network activities and to explore

and/or contribute to the SOTF Project Ning. Participation in the network was less significantly but positively correlated to Current Instructional Practices (CIP) with a correlation of .031.

While it is not possible to establish a causal relationship, this correlation is worth noting. If teachers who integrate more learner-centered instructional approaches in their classrooms are participating more in network activities, it suggests that perhaps the more learner-centered teachers seek out and participate in professional learning and networking opportunities more often or vice-versa. The relationship between Participation in the Network and Teaching Innovation Stage (LoTi) was approaching significance with a correlation of .091. This finding substantiates the PCU and CIP findings since the LoTi score represents overall teaching innovation. Teachers with higher LoTi scores utilize more learner-centered practices and integrate digital tools into their instruction more seamlessly. Teachers with both higher PCU and CIP scores would be more likely to have higher LoTi scores.

Table 13

Pearson R Correlation Coefficients between Participation in Network and LoTi, PCU and CIP Ratings

		Participation in Network Sum Score (Custom Questions #2-4)
Teaching Innovation Stage (LoTi)	Pearson r	.267
	Sig.	.091
Personal Computer Use (PCU)	Pearson r	.429
	Sig.	.005
Current Instructional Practices (CIP)	Pearson r	.337
	Sig.	.031

*p<0.05

Research Question Two: Professional Relationship. The second research question addresses the quality and quantity of professional relationships in the network and levels of teaching innovation on levels of the three teaching innovation indicators measured by the LoTi Digital Age Survey. The question is *do teachers who develop more professional relationships in networked learning communities utilize more innovative teaching strategies as measured by the LoTi Digital Age Survey?* To fully explore this question, a composite score of factors related to professional relationships in the network was developed using responses for custom questions 5, 6, 7, 8 and 9 which asked participants about the frequency and quality of relationships forged and strengthened with teachers at their own school and at other schools due to network related activities.

Similar to research question 1, a composite score was created in order to focus on the larger concept of collegial relationships formed and strengthened in the networked learning community. Prior to creating the composite or sum score, responses for each custom question were given ordinal labels, appropriate when response sets are not explicit quantitative values. Pearson R analyses were then run to measure the correlation between the resulting Relationships in Network Sum Score and the three dependent variables derived from the Levels of Innovative Teaching Profile.

Table 14 expresses the results of the Pearson's R Analyses indicating that relationships in the network are significantly correlated to Personal Computer Use (PCU) with a correlation of .001. As in research question 1, this finding makes sense since teachers with higher digital fluency are probably more likely to utilize technological tools to communicate with and build relationships with other educators. There was no

significant correlation between the Relationships in the Network Sum Score and Teaching Innovation Stage (LoTi) or Current Instructional Practices (CIP).

Table 14

Pearson R Correlation Coefficients between Relationships in Network and LoTi, PCU and CIP Ratings

		Level of Relationships in Network Sum Score (Custom Questions #5-9)
Teaching Innovation Stage (LoTi)	Pearson r	.158
	Sig.	.337
Personal Computer Use (PCU)	Pearson r	.512
	Sig.	.001
Current Instructional Practices (CIP)	Pearson r	.159
	Sig.	.333

*p<0.05

Research Question Three: Professional Learning Community. The third research question addresses the type of professional learning community in place at the school level and levels of the three teaching innovation indicators measured by the LoTi Digital Age Survey. *Does the type of professional learning community in the school bear a relationship to levels of teaching innovation as measured by the LoTi Digital Age Survey?* For the independent variable, type of professional learning community, existing data summarized previously in Table 12 was extracted. Schools were grouped according to professional learning community type before creating frequency and mean tables (Tables 15 and 16).

Table 15

Type of Professional Learning Community Frequency Table

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	School-wide	23	56.1	56.1	56.1
	Grade-subject	14	34.1	34.1	90.2
	Early-adopters	4	9.8	9.8	100.0
	Total	41	100.0	100.0	

Most survey participants (56.1%) were part of school-wide professional learning communities and mean LoTi scores were highest (2.52) for those teachers. Teachers in schools with PLCs organized around grades/subjects (34.1%) had the highest mean PCU scores (3.5) while the relatively few in Early Adopter type professional learning communities (9.8%) had the highest mean CIP scores (4.75).

Table 16

Type of PLC and LoTi, PCU and CIP Ratings Mean Table

Type of PLC		LoTi	PCU	CIP
School-wide	N	23	23	23
	Mean	2.52	3.13	4.70
	Std. Deviation	1.039	1.486	1.396
Grade-subject	N	14	14	14
	Mean	2.50	3.50	3.79
	Std. Deviation	1.286	1.506	1.528
Early-adopters	N	4	4	4
	Mean	2.00	2.50	4.75
	Std. Deviation	.816	1.291	.957
Total	N	41	41	41
	Mean	2.46	3.20	4.39
	Std. Deviation	1.098	1.470	1.447

One-way ANOVA tests (Table 17) were run to determine possible correlations between type of professional learning community and the three teaching innovation

indicators, LoTi, PCU and CIP. Results indicate that there were no statistically significant correlations between the types of professional learning community in place at the school and either LoTi, PCU or CIP scores.

Table 17

ANOVA Results: Type of PLC and LoTi, PCU and CIP Scores

		Sum of Squares	df	Mean Square	F	Sig.
(LoTi) * Type of PLC	Between Groups (Combined)	.956	2	.478	.385	.683
	Within Groups	47.239	38	1.243		
	Total	48.195	40			
(PCU) * Type of PLC	Between Groups (Combined)	3.330	2	1.665	.761	.474
	Within Groups	83.109	38	2.187		
	Total	86.439	40			
(CIP) * Type of PLC	Between Groups (Combined)	7.779	2	3.890	1.945	.157
	Within Groups	75.977	38	1.999		
	Total	83.756	40			

*$p<0.05$

Research Question Four: Professional Development. The fourth research question addresses the intensity of professional development options at the school level and levels of the three teaching innovation indicators measured by the LoTi Digital Age Survey. *Does the intensity of professional development in a school bear a relationship to levels of teaching innovation as measured by the LoTi Digital Age Survey?* For the independent intensity of professional development variable, existing data was extracted from research conducted by Learning Point Associates during Year 1 of the project summarized previously in Table 9. Schools were grouped according to intensity of professional development before creating frequency and mean tables (Tables 18 & 19).

Table 18

Intensity of Professional Development Frequency Table

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	None	28	68.3	68.3	68.3
	One	7	17.1	17.1	85.4
	Multiple	6	14.6	14.6	100.0
	Total	41	100.0	100.0	

Table 19

Intensity of Professional Development and LoTi, PCU and CIP Ratings Mean Table

Intensity of Professional Development		LoTi	PCU	CIP
None	N	28	28	28
	Mean	2.46	3.04	4.43
	Std. Deviation	1.138	1.598	1.620
One	N	7	7	7
	Mean	2.71	3.14	4.43
	Std. Deviation	1.113	1.215	.976
Multiple	N	6	6	6
	Mean	2.17	4.00	4.17
	Std. Deviation	.983	.894	1.169
Total	N	41	41	41
	Mean	2.46	3.20	4.39
	Std. Deviation	1.098	1.470	1.447

The majority of teachers, or 68.3% were in schools where no intense professional development options were available. Slightly over 17% were in schools where one professional development option was available. This group had the highest mean LoTi score of 2.71. Teachers in schools with either no options or one option had the highest mean CIP score (4.43). The 14.6% of teachers in schools with multiple intense professional development options had the highest mean PCU scores (4.0).

Table 20

ANOVA Results: Intensity of Professional Development and LoTi, PCU, CIP Ratings

		Sum of Squares	df	Mean Square	F	Sig.
(LoTi) Teaching Innovation Stage * Intensity of Professional Development	Between (Combined) Groups	.969	2	.484	.390	.680
	Within Groups	47.226	38	1.243		
	Total	48.195	40			
(PCU) Personal Computer Use * Intensity of Professional Development	Between (Combined) Groups	4.618	2	2.309	1.072	.352
	Within Groups	81.821	38	2.153		
	Total	86.439	40			
(CIP) Current Instructional Practices * Intensity of Professional Development	Between (Combined) Groups	.351	2	.176	.080	.923

*p<0.05

One-way ANOVA tests (Table 20) were run to determine possible correlations between intensity of professional development and the three teaching innovation indicators, LoTi, PCU and CIP. Results indicate that there were no statistically significant correlations between intensity of professional development at the school and either LoTi, PCU or CIP scores.

Research Question Five: Transformative Practices. The final research question examined factors impacting teaching practice. What factors do the teachers with higher levels of teaching innovation as measured by the LoTi Digital Age Survey report as being

significant in influencing changes in their practice? In order to respond to this question, a mean table was created for each individual transformative practice for teaching innovation stage (LoTi), personal computer use (PCU) and current instructional practices (CIP). Although "Collaborating with Teachers at My School" garnered the highest number of selections, Table 21 demonstrates that the highest mean LoTi (2.56) and PCU (4.22) scores were amongst teachers who selected "Learning from Experts Outside of Project Schools" as the most transformative practice. That same group had a mean CIP score of 4.56, slightly lower than that of teachers who selected "Collaborating with Teachers at My School". The highest mean CIP (4.75) score was indeed among teachers who selected "Collaborating with Teachers at My School" as the most transformative practice. The mean LoTi (2.5) score of that same group of teachers was the second highest, slightly lower than the LoTi (2.56) score of teachers who selected "Learning from Experts Outside of Project Schools". The mean PCU score of teachers who selected "Collaborating with Teachers at My School" was 3.0.

However, examination of means on the line chart shown in Figure 3 suggests that both "Collaborating with Teachers at My School" and "Learning from Experts Outside of Project Schools" are both viewed as the more transformative practices by teachers with higher LoTi Digital Age Profile scores across all three LoTi indicators. ANOVA Tests were run for each dependent variable to test for significance. Results of the ANOVA tests in Table 22 indicate no significant correlations between specific transformative practices and either LoTi, PCU or CIP.

Table 21

Transformative Practices and LoTi, PCU and CIP Ratings Mean Table

Transformative Practices (10)		LoTi	PCU	CIP
Becoming more comfortable with digital tools	N	10	10	10
	Mean	2.50	2.60	4.30
	Std. Deviation	.972	1.350	1.494
Collaborating with teachers at my school site	N	12	12	12
	Mean	2.50	3.00	4.75
	Std. Deviation	1.168	1.706	1.485
Learning from experts outside of the project schools	N	9	9	9
	Mean	2.56	4.22	4.56
	Std. Deviation	1.333	1.202	1.667
Networking with teachers from other project schools	N	1	1	1
	Mean	2.00	3.00	3.00
	Std. Deviation	.	.	.
Participating in different forms of professional development	N	9	9	9
	Mean	2.33	3.11	4.00
	Std. Deviation	1.118	1.269	1.225
Total	N	41	41	41
	Mean	2.46	3.20	4.39
	Std. Deviation	1.098	1.470	1.447

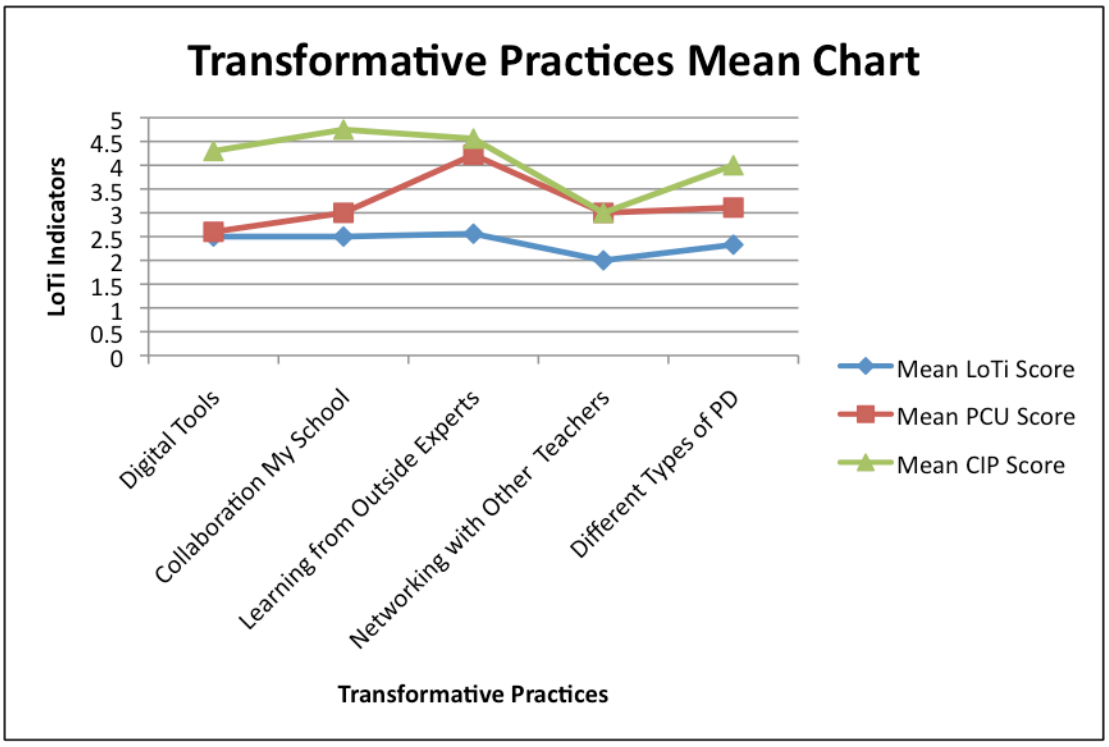

Figure 3. Transformative Practices Mean Chart

Table 22

ANOVA Table: Transformative Practices and LoTi, PCU, CIP Ratings

			Sum of Squares	df	Mean Square	F	Sig.
(LoTi) * Transforming Practices Abilities (10)	Between Groups	(Combined)	.473	4	.118	.089	.985
	Within Groups		47.722	36	1.326		
	Total		48.195	40			
(PCU)* Transforming Practices Abilities (10)	Between Groups	(Combined)	13.595	4	3.399	1.680	.176
	Within Groups		72.844	36	2.023		
	Total		86.439	40			
(CIP)* Transforming Practices Abilities (10)	Between Groups	(Combined)	5.184	4	1.296	.594	.669
	Within Groups		78.572	36	2.183		
	Total		83.756	40			

*p<0.05

Examination of Additional Questions Generated by the Results

Upon review of the data analysis, questions related to other factors that might impact the LoTi indicator scores of LoTi, PCU and CIP Scores were raised. Did LoTi indicator scores differ based on years teaching? Did LoTi indicator scores differ based on primary subject area of the participants? Did LoTi indicator scores vary significantly from school to school? Did they differ significantly when examining only the school with the most participants?

To explore the first question, frequency and mean tables were created based on years teaching (Tables 4 and 23). The majority of teachers surveyed have taught between 5 and 20 years. Interestingly, although there were only 4 of them, the teachers with the least experience had the highest mean LoTi (3.0) and PCU (4.25) scores. Additionally, the mean CIP score (5.0) of that same group was only slightly lower than the mean CIP Score (5.07) of participants who had taught for 10-20 years. Teachers who had taught for 10-20 years had the second highest mean LoTi (2.71) and CIP (3.57) scores. ANOVA tests (Table 24) were run to test for significance. Results were approaching significance in both the PCU (.076) and CIP (.068) indicators. There was no significant correlation between years teaching and the LoTi indicator.

To explore the question related to subject area and overall LoTi Digital Age Survey scores, frequency and mean tables were created based on subject area specialty (Table 5 and 25). The majority of participants (41.5%) indicated “Other” as their subject area. The next largest group (34.1%) was comprised of Humanities teachers. The smallest groups were math teachers (14.6%) and science (9.8%) teachers.

However, science teachers had the highest mean LoTi (2.75) and PCU (4.25) scores while those indicating "other" had the highest mean CIP (4.59) scores. Math teachers had the lowest mean CIP score of 1.5 with those indicating "other" having the lowest mean PCU score of 2.76. Interestingly, math teachers also had the lowest mean LoTi score of 1.5. ANOVA tests (Table 26) were run to test for significance. There were no significant correlations between subject specialty and any of the LoTi indicators.

Table 23

Years Teaching and LoTi, PCU, CIP Ratings Mean Table

Years Teaching		LoTi	PCU	CIP
Less than Five Years	N	4	4	4
	Mean	3.00	4.25	5.00
	Std. Deviation	1.414	.957	1.155
Five to Nine	N	13	13	13
	Mean	2.54	3.15	3.77
	Std. Deviation	1.050	1.405	1.481
Ten to Twenty Years	N	14	14	14
	Mean	2.71	3.57	5.07
	Std. Deviation	1.069	1.697	1.439
More than Twenty Years	N	10	10	10
	Mean	1.80	2.30	4.00
	Std. Deviation	.919	.949	1.155
Total	N	41	41	41
	Mean	2.46	3.20	4.39
	Std. Deviation	1.098	1.470	1.447

Table 24

ANOVA TABLE: Years Teaching and LoTi, PCU, CIP Ratings

			Sum of Squares	df	Mean Square	F	Sig.
LoTi * Years Teaching	Between Groups	(Combined)	6.507	3	2.169	1.925	.142
	Within Groups		41.688	37	1.127		
	Total		48.195	40			
PCU * Years Teaching	Between Groups	(Combined)	14.468	3	4.823	2.479	.076
	Within Groups		71.971	37	1.945		
	Total		86.439	40			
CIP * Years Teaching	Between Groups	(Combined)	14.520	3	4.840	2.586	.068
	Within Groups		69.236	37	1.871		
	Total		83.756	40			

*p<0.05

Table 25

Subject Specialty and LoTi, PCU, CIP Ratings Mean Table

Subject Specialty		LoTi	PCU	CIP
Humanities	N	14	14	14
	Mean	2.57	3.43	4.50
	Std. Deviation	1.016	1.399	1.225
Mathematics	N	6	6	6
	Mean	1.50	3.17	3.50
	Std. Deviation	.837	1.169	1.378
Sciences	N	4	4	4
	Mean	2.75	4.25	4.50
	Std. Deviation	.957	.957	1.291
Other	N	17	17	17
	Mean	2.65	2.76	4.59
	Std. Deviation	1.169	1.640	1.661
Total	N	41	41	41
	Mean	2.46	3.20	4.39

Table 26

ANOVA Table: Subject Specialty and LoTi, PCU, CIP Ratings

		Sum of Squares	df	Mean Square	F	Sig.
LoTi * Subject Specialty	Between (Combined) Groups	6.634	3	2.211	1.969	.136
	Within Groups	41.561	37	1.123		
	Total	48.195	40			
PCU * Subject Specialty	Between (Combined) Groups	8.368	3	2.789	1.322	.282
	Within Groups	78.071	37	2.110		
	Total	86.439	40			
CIP * Subject Specialty	Between (Combined) Groups	5.638	3	1.879	.890	.455
	Within Groups	78.118	37	2.111		
	Total	83.756	40			

*$p<0.05$

To better understand overall LoTi Digital Age Profile scores on a school-by-school basis and to determine if the scores from the school with the largest number of participants differed significantly from the scores of the other schools, a mean table of LoTi, PCU and CIP scores by school was created (Table 27). The school with the highest LoTi score (3.33) was Maui Preparatory Academy. Maui Preparatory Academy and Seabury Hall had the highest mean PCU scores of 5.0. The highest CIP scoring school was Assets School with a mean score of 5.5. Mid-Pacific Institute had the largest number of participants with scores above the mean in two of the three indicators. The school's mean LoTi score (2.65) was higher than the overall sample mean (2.46). Mid-Pacific Institute's mean CIP Score (4.88) was also higher than the overall sample mean (4.39). The school's mean PCU score (2.82) was lower than the overall sample mean (3.2).

Table 27

School by School and LoTi, PCU, CIP Ratings Mean Table

School		LoTi	PCU	CIP
Assets School	N	2	2	2
	Mean	3.00	4.50	5.50
	Std. Deviation	1.414	.707	.707
Hanalani Schools	N	7	7	7
	Mean	1.71	2.71	3.00
	Std. Deviation	1.113	1.604	1.155
Iolani School	N	3	3	3
	Mean	2.00	2.33	4.33
	Std. Deviation	1.000	1.528	.577
Kailua Catholic Community of Learners	N	3	3	3
	Mean	1.67	3.33	3.67
	Std. Deviation	.577	.577	.577
Kaua'i Pacific School	N	4	4	4
	Mean	3.25	3.75	4.50
	Std. Deviation	.957	.500	1.291
Maui Preparatory Academy	N	3	3	3
	Mean	3.33	5.00	4.67
	Std. Deviation	1.155	1.000	2.082
Mid-Pacific Institute	N	17	17	17
	Mean	2.65	2.82	4.88
	Std. Deviation	1.057	1.551	1.453
Sacred Hearts Academy	N	1	1	1
	Mean	2.00	5.00	3.00
	Std. Deviation	.	.	.
Seabury Hall	N	1	1	1
	Mean	2.00	3.00	6.00
	Std. Deviation	.	.	.
Total	N	41	41	41
	Mean	2.46	3.20	4.39
	Std. Deviation	1.098	1.470	1.447

Subsequently, an ANOVA analysis (Table 28) was run to determine if LoTi indicator scores varied significantly from school to school. Results of the ANOVA

analysis indicate that there is no significant difference in LoTi indicator ratings based on school.

Table 28

ANOVA Table: School by School and LoTi, PCU, CIP Ratings

			Sum of Squares	df	Mean Square	F	Sig.
LoTi * school	Between Groups	(Combined)	12.801	8	1.600	1.447	.216
	Within Groups		35.394	32	1.106		
	Total		48.195	40			
PCU * school	Between Groups	(Combined)	23.957	8	2.995	1.534	.185
	Within Groups		62.482	32	1.953		
	Total		86.439	40			
CIP * school	Between Groups	(Combined)	26.491	8	3.311	1.850	.104
	Within Groups		57.265	32	1.790		
	Total		83.756	40			

*p<0.05

A related area of interest generated by the data analysis related to the school with the largest number of survey participants. Mid-Pacific Institute had 18 participants accounting for 44% of the participants in the survey. All of the frequency tables, mean tables and tests described in this chapter were run separately with just the participants from Mid-Pacific Institute. The resulting correlational coefficients suggest similar associations between variables meaning that the sample did not substantially differ from the larger group. This is most likely because the number of people in the sample impacts the p value. It is more difficult to find significance due to the smaller sample resulting in insufficient power.

Summary

This chapter analyzed data received from 41 independent school educators representing 10 School of the Future Network Project schools in Hawaii. The study analyzed participants' Level of Teaching Innovation (LoTi), Personal Computer Use (PCU) and Current Instructional Practices (CIP) scores, as well as other indicators related to network participation, relationships in the network, type of professional learning community, intensity of professional development at the school level, and factors with high impact on teaching practice. Since the primary purpose of the School of the Future Network is to transform schools in Hawaii, the study examined whether any relationships existed between the aforementioned indicators and the LoTi, PCU and CIP scores of participants.

Results indicate that overall participation in network activities are positively and significantly correlated to Personal Computer Use (PCU) and Current Instructional Practices (CIP) with Levels of Teaching Innovation (LoTi) approaching significance. Relationships in the network were also positively and significantly correlated to Personal Computer Use. Neither the type of professional learning community nor intensity of professional development was significantly correlated to PCU, CIP or LoTi. Although not significantly correlated, teachers who selected "Learning from Experts Outside of Project Schools" as the most transformative practice had the highest mean LoTi (2.56) and PCU (4.22) scores. Teachers selecting "Collaborating with Teachers at My School" as the most transformative practice had the highest mean CIP (4.75) score. Demographics were also analyzed with respect to years teaching, subjects areas and by individual

schools to determine if any significant data could be disaggregated. Such analyses did not result in any significant findings.

Chapter 5

Introduction

This final chapter reviews the purpose of the study, key literature and the methodology. It also contains a brief summary of the results presented in Chapter 4. Most importantly, conclusions for each research question are presented based on the results and related to the existing knowledge base. The chapter ends with limitations and suggestions for further research.

Review of Study

Traditional models of professional development in education have proven to be largely ineffective with regards to transforming teacher practice. Networked learning communities have been shown to help individual schools accomplish instructional transformation that they had been previously unable to do on their own (Little, 2005). Researchers indicate the need to further explore the nature and quality of the professional relationships between network participants (Kerr et al., 2003; Little, 2005).

Purpose. Networked Learning Theory suggests that the real power of networked learning communities rests primarily in "collaborative inquiry that challenges thinking and practice" based on the richness of professional knowledge sharing and creation (Katz et al., 2009, p. 21) and that this type of collaborative inquiry rests on the strength of the relationships between the actors or nodes in the network (Church et al., 2002; Haythornwaite & de Laat, 2010). This descriptive, quantitative study sought to build understanding about specific network and school level factors such as teacher participation, professional relationships, professional learning and how these factors might relate to teaching innovation.

Methodology. Forty-one teachers participated; representing 10 of 20 project schools that are part of the "Schools of the Future Project" networked learning community in Hawai'i. Participants took a customized 50-item LoTi Digital Age Survey to generate ratings in three key areas: Personal Computer Use (PCU), or fluency level with digital tools and resources for student learning as well as workplace use; Current Instructional Practices (CIP), or support for or implementation of instructional practices consistent with a learner-based curriculum design and research-based best practices; and Levels of Teaching Innovation (LoTi), or the degree to which the tenets of digital-age teaching and learning are supported or implemented in the classroom setting. The survey was customized with 13 questions related to basic demographic information, network participation; professional relationships formed in the network, quality of collaboration and perceived network benefits. Existing data related to type of professional learning community and intensity of professional development at each school was also utilized.

Statistical analysis included examination of both descriptive and inferential statistics. Descriptive statistics were used to describe the sample with respect to all variables (both independent and dependent). Inferential statistics, such as t-tests, Pearson's r, and chi-square, were used to determine if the independent variables (levels of teacher participation in the network, degree to which new professional relationships are established, professional learning opportunities experienced and self-identified benefits from network participation) were linearly or systematically associated to the dependent variables associated with teaching innovation (PCU, CIP and LoTi levels). Results were analyzed in order to better understand the nature of the participation in the networked

learning community as it relates to teaching practices associated with 21st century teaching and learning.

Specifically, the study aimed to answer the following 5 research questions:

1. Do teachers who participate more frequently in networked learning community activities utilize more innovative teaching strategies as measured by the LoTi Digital Age Survey?
2. Do teachers who develop new professional relationships in networked learning communities utilize more innovative teaching strategies as measured by the LoTi Digital Age Survey?
3. Does the type of professional learning community in the school bear a relationship to levels of teaching innovation as measured by the LoTi Digital Age Survey?
4. Does the intensity of professional development in a school bear a relationship to levels of teaching innovation as measured by the LoTi Digital Age Survey?
5. What factors do the teachers with higher levels of teaching innovation as measured by the LoTi Digital Age Survey report as being significant in influencing changes in their practice?

Summary of Findings. Quantitative results of the survey data were presented in Chapter 4. Findings indicate that teachers who participated more often in the network and those with stronger professional relationships as a result of network participation reported higher levels of personal computer usage (PCU) meaning that they had higher fluency with using digital tools and resources for student learning and were more sophisticated in using digital-age media. More active network participants also utilized instructional

practices more aligned with a learner-based approach to teaching and learning (CIP) substantiating previous research indicating that network participation can positively impact teaching practice and that changes in thinking and practice rest in the power of relationships in networked learning communities. Seemingly contradicting the research base, neither the type of professional learning community or intensity of professional development correlated to personal computer usage (PCU), current instructional practices (CIP) or levels of teaching innovation (LoTi). However, teachers with the highest mean LoTi and PCU scores indicated that *learning from experts outside of project schools* was the most transformative network practice. Teachers with the highest CIP scores selected *collaborating with teachers at my school* as the most transformative practice. Both of these findings strengthen the previous literature base indicating that effective networks need both peer-to-peer collaboration and expert input to support the transfer of knowledge and practice.

Study Conclusions

After careful analysis of the findings, at least one conclusion for each research question was found to be related to teaching innovation. Considering areas of network participation, professional relationships, professional learning communities, professional development and transformative practices, the researcher concluded the following:

- Teachers with higher levels of network participation demonstrate higher fluency with digital tools and learner-based methodologies.
- Teachers who collaborated more often with higher quality collaboration and established more new professional relationships demonstrate higher fluency with digital tools.

- The type of professional learning community in place at the school level does not bear a relationship to levels of teaching innovation.
- The intensity of professional development offerings in place at the school level does not bear a relationship to levels of teaching innovation.
- Teachers with higher levels of teaching innovation place greater value on learning from experts outside the network and collaboration at individual schools in transforming their practice.

Chapter 2 of this study presented the relevant literature associated with 21st century teaching innovation, professional development, and professional learning communities and networked learning communities. In this section, each individual conclusion is supported by a reconnection to the literature.

Teachers with higher levels of network participation demonstrate higher fluency with digital tools and learner-based methodologies. The first research question aimed to generate deeper understanding of the relationship between frequency of network participation and participant's fluency level with digital tools and resources for student learning, as well as their use in the workplace (PCU), participant's support for or implementation of instructional practices consistent with a learner-based curriculum design and research-based best practices (CIP), and the degree to which survey participants either support or implement the tenets of digital-age teaching and learning in a classroom setting (LoTi). Results from the first research question addressed by this study indicate that the relationships between participation in the networked learning community and both PCU (.005) and CIP (.031) were significant. The relationship

between participation in the network and LoTi was approaching significance (.091), warranting further examination in subsequent research.

Several researchers have noted that participation in networked learning communities can promote the type of deep learning amongst teachers that results in both the improvement of and dissemination of good practice (Black, 2008; Hopkins, 2006; Katz et al., 2009; Lieberman & Grolnick, 1996; Veugelers & O'Hair, 2005). Networks also appear to promote implementation of more student-centered learning environments by modeling that includes reflective practice, horizontal learning, partnerships and learner empowerment (B. Caldwell, 2008; Veugelers & O'Hair, 2005). Little asserts that the power of a network in changing practice is related to the quality of participation (Little, 2005). Church et al. (2002) believe that participation is what makes a network work. Additionally, it has been established that teachers who have higher levels of personal computer use tend to use constructivist instructional practices more often (Rakes et al., 2006).

The results from research question one substantiated previous findings. There was a statistically significant positive correlation between participation in networked learning communities and both PCU and CIP. In other words, teachers who participated more frequently in the network were more comfortable with digital tools and more likely to integrate higher levels of learner-based or student-centered learning into their classrooms. However, it is difficult to discern causality within the framework of the current study. Did the teachers who participated more often in the network possess higher levels of digital fluency (PCU) and/or did they integrate more learner-based types of instruction (CIP) prior to becoming network participants? Are the more innovative teachers more

likely to seek out new knowledge and learning from the network? Did the network participation inspire teachers to experiment more with digital tools and to integrate more innovative teaching or are the teachers more familiar with digital tools more likely to participate in the network? Are the more innovative teachers spreading practice throughout the network? These questions seem worthy of further exploration in subsequent research.

Teachers who collaborated more often with higher quality collaboration and established more new professional relationships demonstrate higher fluency with digital tools. The second research question focused on professional relationships to determine if a connection existed between the quantity and quality of professional relationships formed in a network and participant's PCU, CIP and LoTi levels. Professional Relationships were marked by frequency and/or quality of collaboration with colleagues both at the school and network level as well as by the number of new professional relationships established as a result of network participation. Professional relationships were significantly correlated to PCU with a correlation of .001.

In this study, there was a statistically significant relationship between the quality and quantity of professional relationships and PCU. This finding makes sense, as teachers who are more comfortable with digital tools are more likely to utilize those digital tools to communicate with and collaborate with colleagues. It is well established in the literature that digital tools allow for real time collaboration regardless of geography, new and more diverse collegial relationships and sustained learning (Chen, 2003; Lieberman, 1999; Lieberman & Mace, 2010; Salpeter & Bray, 2003). However, leaders of successful networks recognize that relationships are of fundamental importance

(Church et al., 2002). Networks must have a clear focus, build collaboration and provide a variety of activities that strengthen relationships (Katz et al., 2009). Church (2002) and others more recently (Haythornwaite & de Laat, 2010) explain that networks are a "pattern of connections formed by a designated set of individuals" (p.185) and that the net will be more dynamic if relationships based on trust and communication, or threads, are connected by knots, or the rich joint activities that change thinking and practice.

Interestingly, there was no statistically significant correlation between the quality and quantity of professional relationships and LoTi or CIP scores, which is surprising when considering previous literature in this area. Katz and Earl (2010) identified six enablers of changed thinking and practice in networked learning communities: purpose and focus, relationships, collaboration, enquiry, leadership and capacity building and support. They subsequently determined that both school and network based relationships and collaboration are related to changes in thinking and practice in statistically significant ways. One possibility is that the network is too new to be able to measure or determine if the professional relationships formed in this network are impacting practice. This study was conducted during the second year of a 5-year project. Although 70% of participants surveyed reported that they established at least one new professional relationship, only 12% established several (more than 10) new professional relationships. Fifty-one percent of participants reported an increase in collaboration at the school site while 44% reported an increase in collaboration with colleagues from other schools.

However, just having newly established professional relationships does not necessarily guarantee the depth of collaboration and collegiality necessary for sustained changes in thinking and practice. Several researchers have asserted that the quality of

collaboration matters more when it comes to relationships and improvement in teacher practice (Bezzina, 2006; Darling-Hammond & Richardson, 2009; DuFour, R., 2004b, 2007). Although 63% of survey participants reported that network participation had a positive impact on the quality of collaboration experienced, it may be that more time is needed to strengthen professional relationships both at the school and network level so that participants have the opportunity to experience the deeper types of collaborative experiences necessary for significant impact on individual teaching practice. It would be extremely interesting and beneficial to conduct similar studies within this same network in Years 3, 4 and 5 of the project to gain further insight in this area.

The type of professional learning community in place at the school level does not bear a relationship to levels of teaching innovation. Research question three focused on the type of professional learning community (PLC) in place at the individual school to determine if the type of PLC impacted individual levels of teaching innovation including participant fluency level with digital tools and resources for student learning as well as their use in the workplace (PCU), participant support for or implementation of instructional practices consistent with a learner-based curriculum design and research-based best practices (CIP), and the degree to which survey participants either support or implement the tenets of digital-age teaching and learning in a classroom setting (LoTi). The three types of professional learning community explored were (a) school-wide, (b) grade/subject, and (c) early adopter. Results indicated no significant correlation between the type of school-level professional learning community and Personal Computer Use (PCU), Current Instructional Practices (CIP) or Teaching Innovation Stage (LoTi).

In 1992, Eastwood and Louis identified creating a collaborative environment as the single most important factor for successful school improvement (Eastwood & Louis, 1992). As established previously, researchers have also suggested that powerful collaboration within the framework of true professional learning communities can change and improve teacher practice (Bezzina, 2006; Darling-Hammond & Richardson, 2009; DuFour, R., 2004b; 2007). Vescio, et al. (2008) reviewed 11 research articles and concluded that participation in a professional learning community does lead to changes in teaching practice. Previous research also suggests that having a professional learning community in place at the individual school site positively impacts levels of teaching innovation. The current study attempted to take this concept one step further by attempting to establish a relationship between the type of professional learning community in place at the school level and levels of teaching innovation. However, results did not show any statistically significant correlations between the type of professional learning community in place at the school and teaching innovation as measured by LoTi, PCU and/or CIP scores.

One possible explanation substantiated by the literature might be the relationships between teaching innovation and professional learning communities is not so much about the type of professional learning community in place at the school (school-wide, grade level/subject, early adopter) as it is about other characteristics that are shaping the quality of the professional learning community such as focus of the PLC, the emphasis on strengthening professional relationships, the time devoted to professional learning activities, the richness of the professional dialogue in the PLC, and the alignment with the focus of the networked learning community (Bezzina, 2006; DuFour, R., & Eaker, 1998;

McLaughlin, 1993). Again, we may also have a problem with newness. It is possible that since the relationships are not showing a correlation with teaching innovation and part of the strength of PLC's rests with the strength of collegial relationships, that the PLC's at each school are too new to be demonstrating an impact on practice. This study did not explore specific PLC factors in detail so further generalizations or conclusions are difficult to proclaim.

Another and perhaps more interesting factor to consider when interpreting the results is that networked learning community theory rests on the power of the simultaneous upload/download flow of knowledge and practice between school-based professional learning communities and the networked learning community. As network participants share more professional learning experiences in the network and become more familiar with digital tools for sharing their new knowledge and practice, we may see a strengthening and/or morphing of professional learning communities at the school level which may in turn impact levels of teaching innovation, personal computer usage and current instructional practices in subsequent years across the network. The power of technology to spread practice in the network is well documented in the literature (Black, 2008; Lieberman & Mace, 2010; Salpeter & Bray, 2003; Veugelers & O'Hair, 2005).

This is an area ripe for more study in Years 3, 4 and 5 of the project. It would be especially interesting to try to track via the project Ning to what degree teaching practice is being transferred across the network by more closely examining and comparing specific practices, such as the use of protocols or the integration of project based learning, emphasized in both school based and network based professional learning community activities.

The intensity of professional development offerings in place at the school level does not bear a relationship to levels of teaching innovation. Research question four examined the intensity of professional development at the school site (no intense options, one intense option, multiple intense options). Intense options were described as longer-term courses, institutes, consultants and in-school trainings. Analysis of the fourth research question indicated no significant correlations between intensity of professional development at the school level and either LoTi, PCU or CIP scores.

Although extensive research published by the NSDC in February 2009 found very few studies that showed a direct relationship between traditional professional development and either sustained changes in teacher practice or a positive impact on student achievement (Darling-Hammond et al., 2009b), several studies have found that the intensity and duration of professional development does have a direct and positive correlation to changes in teacher practice (Desimone et al., 2002). Participation in such research-based professional development can result in long lasting change in teacher's abilities to design learning experiences that integrate digital tools for students and their overall educational technology knowledge (Mouza, 2009). Additionally, teachers who participate more deeply in professional development are more likely to have constructivist compatible 21st century teaching philosophies, utilize computers more often in exemplary ways and more often integrate teaching strategies aligned with the constructivist philosophy espoused by 21st century skill advocates (Becker & Riel, 2000).

Surprisingly, the results from this study do not appear to be aligned with previous research in this area. There were no statistically significant correlations between intensity of professional development and PCU, CIP or LoTi levels. Possible reasons for these

results range from the possibility that the study participants did not take advantage of the more intense school based professional development opportunities or that the teachers were already well versed in the strategies and ideas presented in such opportunities. Another possibility is that there was insufficient time allotted for teachers to practice, discuss and reflect on strategies learned to ensure the integration of such strategies into their practice on a regular basis.

The research is clear that teachers are more likely to change their teaching and practice if they are provided with adequate time for collaborative types of professional development in which they are able to be involved in the planning, share their concerns and triumphs with their colleagues and if the training simultaneously teaches digital skills and methods of integrating digital tools into subject matter curriculum (Heine, 2002; W. Richardson, 2009; Wood, 2007a). Again, without knowing more about the specifics associated with the professional development offerings available at each school site and the nature of the participation, it is difficult to draw conclusions in this area. Further research that more specifically identifies the type of teaching strategies and practices emphasized in professional development activities at the school site should be considered.

Teachers with higher levels of teaching innovation place greater value on learning from experts outside the network and collaboration at individual schools in transforming their practice. The final research question focused on the benefits of network activities in terms of changing teacher practice from the perspective of network participants. From a list of network opportunities including such options as becoming more comfortable with digital tools, collaborating with teachers at their school

site, networking with teachers from other project schools, learning from experts outside of project schools, and participating in different forms of professional development, participants were asked to select the network practice that most significantly influenced changes in their teaching practice. Results indicated no statistically significant correlations between specific transformative practices and either teaching innovation (LoTi), personal computer use (PCU) or current instructional practices (CIP). However, an examination of mean scores demonstrated that the highest mean LoTi (2.56) and PCU (4.22) scores and second highest CIP (4.56) scores were amongst teachers who selected "Learning from Experts Outside of Project Schools" as the most transformative practice. The highest mean CIP scores were from teachers who selected "Collaborating with Teachers at My School" meaning that a combination of learning from experts outside the network and collaborating with teachers at each individual school were valued more in terms of transforming practice by the more innovative teachers.

As previously established, Networked Learning Community theory rests on the assumption that networks can change thinking and practice in classrooms and schools by developing informal and formal leaders who promote deep, collaborative inquiry that challenges thinking and practice with a clear emphasis on student learning (Earl et al., 2006; Katz et al., 2009). Network benefits established in the literature include the encouragement and establishment of student-centered learning environments, increased interaction across schools, better analysis of and solution to problems of practice (Veugelers & O'Hair, 2005) and enhancement of practice (Sammons et al., 2007). By exploring what the most innovative teachers believe to be the most transformative

practices, we can begin to discover perceived benefits of network participation as well as what practices to emphasize across the network.

Although the findings from this study did not find statistically significant correlations between specific transformative practices and either teaching innovation, personal computer use or current instructional practices, it was determined that teachers who selected "learning from experts outside project schools" had the highest mean LoTi (2.56) and PCU (4.22) scores and second highest CIP (4.56) scores. The highest mean CIP scores were from teachers who selected "Collaborating With Teachers at My School" meaning that a combination of learning from experts outside the network and collaborating with teachers at each individual school were valued more in terms of transforming practice by the more innovative teachers. These findings are substantiated by the literature as effective networks demonstrate strong usage of both peer-to-peer collaboration and expert input to support the transfer of knowledge and practice (Church et al., 2002; Earl & Katz, 2007).

Limitations of the Study

There were several limitations to this study. The study explored one relatively new network in Hawai'i comprised of only independent schools. The response rate for this study was also lower than desired. Further research with a larger, more heterogeneous population of teachers should be conducted before any irrefutable conclusions can be made concerning network participation, professional relationships, professional learning communities, professional development at the school site and perceived network benefits as they relate to LoTi, PCU and CIP scores representing teaching innovation. The network in this study was explored through a snapshot lens rather than an intervention lens, making causality for particular findings difficult to

establish. Finally, since the composition and characteristics of individual network participants are dynamic, the conclusions from this study should only be used as a means for focusing further research in this area.

Recommendations for Further Study

Considering the findings of all five questions together raises new and interesting questions and possibilities for further research. Some teachers clearly have higher levels of teaching innovation with statistically positive and significant correlations between network participation levels and both personal computer usage (PCU) and current instructional practices (CIP) with a relationship approaching significance between participation and teaching innovation (LoTi). Additionally, there is a statistically significant correlation between relationships and personal computer usage (PCU). Are the more innovative teachers naturally inclined to be more active in the network to seek out new knowledge and/or more inclined to establish new relationships, or is the network itself inspiring participation, new relationships and subsequent changes in thinking and practice as measured by LoTi, CIP and PCU scores?

There were no significant correlations between teaching innovation and type of school based professional learning communities or intensity of school based professional development. Perhaps the most innovative teachers have already learned all they could learn from colleagues at their own school site? Could the more innovative teachers be limited by the practice and knowledge of those at their own school and thus depend on the expertise of those in the network to further stretch their teaching practice? Another possibility to consider when looking at the results from network participation and relationships is that the networked learning community is providing greater impact in

terms of practice than the school-based professional learning communities or professional development. From the findings of this study, it is to difficult to determine if the teachers with higher levels of teaching innovation are changing their practice as a result of their experiences with the professional learning community at the school site, as a result of their participation in the network, or if it is a combination of these two factors.

In order to further contribute to the fledgling literature base surrounding networked learning communities, researchers should consider replicating and refining this study with the same group in Years 3, 4 and 5 of the study by focusing on and/or adding:

- Additional representation from each school by encouraging greater participation to substantiate findings.
- Follow-up interviews and/or observations to determine alignment between self-report and actual practice (LoTi has a handheld observation tool aligned with the Digital Age Survey).
- Follow-up surveys, interviews and/or observations with the teachers who participate more often in the network to determine the nature of the participation and reasons for participation in order to better understand why some teachers participate in networks and others resist participation.
- Follow-up surveys, interviews and/or observations with the teachers who establish new and strengthen existing professional relationships to better understand the nature of the relationships and how knowledge and practice might be transferred across the network.

- The focus and nature of professional learning community and professional development activities at the school site as it relates to the focus of the activities sponsored or fostered by the networked learning community to ascertain alignment, to understand how knowledge and practice might be transferred across the network, and to determine if the school based or networked based activities are reflective of each other.

Since a great deal of research on Networked Learning Communities discusses the benefits of online tools and communications to strengthen collaboration and improve practice amongst teachers, future studies could also explore participation in the Ning in this particular network. The purpose of the Ning is to serve as a network hub for the transfer of knowledge and practice, thus future researchers could focus on the most active participants to determine reasons for their participation, the type of ideas and resources that they are sharing in the Ning and what specific changes in practice are being implemented as a result of their experience with the Ning. This tool mediates the space between the school, the network and the participants and is worthy of further examination. Finally, this study could be replicated in an entirely different network to attempt to substantiate findings.

Summary

Educators are beginning to recognize that networked learning communities have the potential to transform teacher practice more than traditional professional development by amplifying the power of the professional learning community model with a more dynamic structure for professional knowledge sharing and creation. Previous research indicates that networks can help expand the pool of resources and ideas to draw upon and

engage participants in mutual problem solving (Little, 2005). The nature of network participation and the informal quality of professional relationships is worthy of examination (Kerr et al., 2003; Little, 2005). Kerr (2003) specifically suggested the need for research exploring both the type of involvement in networks and the benefits of being involved in networks as they relate to teaching and learning. The intent of this descriptive, quantitative study was to build understanding about possible network benefits and how factors such as teacher participation, professional relationships, and professional learning might relate to teaching innovation in a networked learning community in Hawai'i dedicated to creating Schools of the Future.

Study participants were drawn from a convenience sampling of approximately 650 teachers from 20 schools who are part of the "Schools of the Future Project" networked learning community in Hawai'i. Forty-one teachers took a customized 37 item Levels of Teaching Innovation Digital Age Survey to generate ratings in three key areas: Personal Computer Use (PCU), Current Instructional Practices (CIP), and Levels of Teaching Innovation (LoTi). Customization included the addition of 13 questions related to demographics, network participation; professional relationships formed in the network, quality of collaboration and perceived network benefits. Existing data related to type of professional learning community and intensity of professional development at each school was also utilized. Descriptive statistics were used to describe the current study's sample with respect to all variables (both independent and dependent). Inferential statistics were used to determine if the independent variables were linearly or systematically associated to the dependent variables associated with teaching innovation (PCU, CIP and LoTi levels). Results were analyzed in order to better understand the

nature of the participation in the networked learning community as it relates to teaching practices associated with 21st century teaching and learning. Specifically the study aimed to answer the following 5 research questions:

1. Do teachers who participate more frequently in networked learning community activities utilize more innovative teaching strategies as measured by the LoTi Digital Age Survey?
2. Do teachers who develop new professional relationships in networked learning communities utilize more innovative teaching strategies as measured by the LoTi Digital Age Survey?
3. Does the type of professional learning community in the school bear a relationship to levels of teaching innovation as measured by the LoTi Digital Age Survey?
4. Does the intensity of professional development in a school bear a relationship to levels of teaching innovation as measured by the LoTi Digital Age Survey?
5. What factors do the teachers with higher levels of teaching innovation as measured by the LoTi Digital Age Survey report as being significant in influencing changes in their practice?

The researcher analyzed quantitative results of the survey data and determined the following conclusions:

- Teachers with higher levels of network participation demonstrate higher fluency with digital tools and learner-based methodologies.

- Teachers who collaborated more often with higher quality collaboration and established more new professional relationships demonstrate higher fluency with digital tools.
- The type of professional learning community in place at the school level does not bear a relationship to levels of teaching innovation.
- The intensity of professional development offerings in place at the school level does not bear a relationship to levels of teaching innovation.
- Teachers with higher levels of teaching innovation place greater value on learning from experts outside the network and collaboration at individual schools in transforming their practice.

This study was limited because it studied only one network, there was a lower than expected response rate, and the design of the study relied on a snapshot versus intervention lens. Recommendations for future studies include replicating the study in subsequent years of the project, replicating the study in a similar network, further exploring the nature of professional relationships formed in the network, focusing on the online Ning tool as the tool that mediates the space between the school, the network and the participants, and designing studies that examine the specific characteristics of school based professional learning communities and professional development.

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Appendix A
The Schools of the Future

Eighteen Schools of the Future have been formed through this initiative. Two of these are partnerships between two schools; thus, 20 schools are participating in the initiative. Table 1 provides general information about the schools, including location, grades served, and number of students enrolled, affiliation, and the amount of the SOTF grant award for 2009-2010.

School	Island	Grades Served	Enrollment	Affiliation
Assets School	O'ahu	1-12	354	Special population
Academy of the Pacific	O'ahu	6-12	100	Special population
Hanahau'oli School	O'ahu	P-6	207	
Hanalani Schools	O'ahu	P-12	757	Christian
Hongwanji Buddhist Mission School	O'ahu	P-8	330	Buddhist
Hualalai Academy	Hawai'i	K-12	171	
Iolani School	O'ahu	K-12	1842	Nat'l Assn of Episcopal Schools
Island Pacific Academy	O'ahu	P-12	630	Int'l Baccalaureate candidate; new school
Kalihi No Ka Oi Partnership	O'ahu	K-8	97 in 1 school; 225 in 1 school	Catholic
Kaua'i Pacific School	Kaua'i	K-6	64	Former Waldorf
Kalihi Catholic Community of Learners (KCCL)	O'ahu	K-8	370 in 1 school; 274 in 1 school	Catholic
Le Jardin Academy	O'ahu	P-12	800	International Baccalaureate
Maui Preparatory Academy	Maui	P-12	200	New school
Mid-Pacific Institute	O'ahu	P-12	1509	
Montessori Hale O Keiki	Maui	P-8	113	Montessori
Sacred Hearts Academy	O'ahu	P-12	1100	Catholic
St. Joseph School	Hawai'i	P-12	126	Catholic
Seabury Hall	Maui	6-12	421	Nat'l Assn of Episcopal Schools

(Nistler, 2010)

Appendix B
LoTi Digital Age Survey Questions/Key

Q1: I engage students in learning activities that require them to analyze information, think creatively, make predictions, and/or draw conclusions using the digital tools and resources (e.g., Inspiration/Kidspiration, Excel, InspireData) available in my classroom.

Q2: Students in my classroom use the digital tools and resources primarily to create web-based (e.g., web posters, student blogs or wikis, basic webpages) or multimedia presentations (e.g., PowerPoint) that showcase digitally their research (i.e., information gathering) on topics that I assign.

Q3: I assign web-based projects (e.g., web collaborations, WebQuests) to my students that emphasize complex thinking strategies (e.g., problem-solving, decision-making, experimental inquiry) aligned to the content standards.

Q4: I provide multiple and varied formative and summative assessment opportunities that encourage students to "showcase" their content understanding in nontraditional ways.

Q5: I use the digital tools and resources in my classroom to promote student creativity and innovative thinking (e.g., thinking outside the box, exploring multiple solutions) rather using specific web-based applications to support my current lesson plans.

Q6: My students identify important real world issues or problems (e.g., environmental pollution, elections, health awareness), then use collaborative tools and human resources beyond the school building (e.g., partnerships with business professionals, community groups) to solve them.

Q7: I promote, monitor, and model the ethical use of digital information and technology in my classroom (e.g., appropriate citing of resources, respecting copyright permissions).

Q8: I use different digital media and formats (e.g, blogs, online newsletters, online lesson plans, podcasting, digital documents) to communicate information effectively to students, parents, and peers.

Q9: My students discover innovative ways to use our school's advanced digital tools (e.g., digital media authoring tools, graphics programs, probeware with GPS systems) and resources (e.g., publishing software, media production software, advanced web design software) to pursue their individual curiosities and make a difference in their lives and in their community.

Q10: I model and facilitate the effective use of current and emerging digital tools and resources (e.g., streaming media, wikis, podcasting) to support teaching and learning in my classroom.

Q11: I use my school's digital tools and resources exclusively to access the Internet, communicate with colleagues or parents, grade student work and/or plan instructional activities for my students.

Q12: I use digital tools and resources to plan, prepare, present, and/or grade instructional activities rather than allowing students to use the digital tools or resources as part of the instructional day.

Q13: I use different technology systems unique to my grade level or content area (e.g., online courseware, Moodle, WAN/LAN, interactive online curriculum tools) to sup- port student success and innovation in class.

Q14: I employ learner-centered strategies (e.g., communities of inquiry, learning stations / centers) to address the diverse needs of all students using developmentally- appropriate digital tools and resources.

Q15: Students' use of information and inquiry skills to solve problems of personal relevance influences the types of instructional materials used in my classroom.

Q16: My students participate in collaborative projects (e.g., Jason Project, GlobalSchoolNet) involving face-to-face and/or virtual environments with students of other cultures that address current problems, issues, and/or themes.

Q17: My students use the available digital tools and resources for (1) collaboration with others, (2) publishing, (3) communication, and (4) research to solve issues and problems of personal interest that address specific content standards.

Q18: I model for my students the safe and legal use of digital tools and resources only when I am delivering content and/or reinforcing their understanding of pertinent concepts using multimedia resources (e.g., PowerPoint, Keynote), web-based tools (e.g., Google Presentations), or an interactive whiteboard.

Q19: My students model the "correct and careful" (e.g., ethical usage, proper digital etiquette, protecting their personal information) use of digital resources and are aware of the consequences regarding their misuse.

Q20: I participate in local and global learning communities to explore creative applications of technology to improve student learning.

Q21: I continue to offer students learning activities that emphasize the use of digital tools and resources to solve "real-world" problems or issues, even though I experience issues during project implementation (e.g., student discipline problems, network errors, lack of time to plan the lessons, technical glitches.)

Q22: I prefer using standards-based instructional units and related student learning

experiences recommended by colleagues that emphasize innovative thinking, student use of digital tools and resources, and student relevancy to the real world.

Q23: I seek outside help with designing student-centered performance assessments using the available digital tools and resources that involve students transferring what they have learned to a real world context.

Q24: I rely heavily on my students' questions and previous experiences when designing learning activities that address the content that I teach.

Q25: My students use the classroom digital tools and resources to engage in relevant, challenging, self-directed learning experiences that address the content standards.

Q26: I design and/or implement web-based projects (e.g., WebQuests, web collaborations) in my classroom that emphasize the higher levels of student cognition (e.g., analyzing, evaluating, creating).

Q27: My students use the digital tools and resources in my classroom primarily to increase their content understanding (e.g., digital flipcharts, simulations) or to improve their basic math and literacy skills (e.g., online tutorials, content-specific software).

Q28: My students use digital tools and resources for research purposes (e.g., data collection, online questionnaires, Internet research) that require them to investigate an issue/problem, take a position, make decisions, and/or seek out a solution.

Q29: My students collaborate with me in setting both group and individual academic goals that provide opportunities for them to direct their own learning aligned to the content standards.

Q30: I promote global awareness in my classroom by providing students with digital opportunities to collaborate with others of various cultures.

Q31: My students apply their classroom content learning to real-world problems within the local or global community using the digital tools and resources at our disposal.

Q32: My students and I use the digital tools and resources (e.g., interactive whiteboard, digital student response system, online tutorials) primarily to supplement the curriculum and reinforce specific content standards.

Q34: Problem-based learning occurs in my classroom because it allows students to use the classroom digital tools and resources for higher-order thinking (e.g., analyzing, evaluating, creating) and personal inquiry.

Q34: My students use all forms of the most advanced digital tools (e.g., digital media authoring tools, graphics programs, probeware with GPS systems, handheld devices) and

resources (e.g., publishing software, media production software, advanced web design software) to pursue collaborative problem-solving opportunities surrounding issues of personal and/or social importance.

Q35: I advocate for the use of different assistive technologies on my campus that are available to meet the diverse demands of special needs students.

Q36: I promote the effective use of digital tools and resources on my campus and within my professional community and actively develop the technology skills of others.

Q37: I consider how my students will apply what they have learned in class to the world they live when planning instruction and assessment strategies.

Response Key

0 – Never

1 – At least once a year

2 – At least once a semester

3 - At least once a month

4 – A few times a month

5 – At least once a week

6 – A few times a week

7 – At least once a day

Appendix C
Loti, PCU & CIP Levels

Personal Computer Usage (PCU)

PCU Level	**Description**
PCU Intensity Level 0	No inclination or skill level to use digital tools and resources for either personal or professional use.
PCU Intensity Level 1	Little fluency with using digital tools and resources for student learning; may have a general awareness of various digital tools and media but is not using them.
PCU Intensity Level 2	Little to moderate fluency with using digital tools and resources for student learning; does not feel comfortable using digital tools/resources beyond classroom management.
PCU Intensity Level 3	Moderate fluency with using digital tools and resources for student learning; may begin to become "regular" user of selected digital-age media and formats.
PCU Intensity Level 4	Moderate to high fluency with using digital tools and resources for student learning; commonly uses a broader range of digital-age media and formats in support of curriculum.
PCU Intensity Level 5	High fluency level with using digital tools and resources for student learning; commonly able to expand range of emerging digital-age media and formats in support of curriculum.
PCU Intensity Level 6	High to extremely high fluency level with using digital tools and resources for student learning; sophisticated in the use of most existing and emerging digital-age media or format.
PCU Intensity Level 7	Extremely high fluency level with using digital tools and resources for student learning; sophisticated in the use of any existing and emerging digital-age media or format.

Current Instructional Practices (CIP)

CIP Level	**Description**
CIP Intensity Level 0	No formal classroom setting
CIP Intensity Level 1	Instructional practices align exclusively with a subject-matter based approach to teaching and learning; teaching strategies lean toward lectures and/or teacher-led presentations.
CIP Intensity Level 2	Instructional practices still consistent with a subject-matter based approach to teaching and learning; emphasis on didactic

	instruction and teacher-generated questions.
CIP Intensity Level 3	Instructional practices align somewhat with a subject-matter based approach to teaching and learning with limited options given to students for their final products.
CIP Intensity Level 4	Instructional practices align with a subject-matter based approach to teaching and learning, but students are given expanded options with the content, process, and/or products.
CIP Intensity Level 5	Instructional practices lean toward a learner-based approach; teaching strategies and assessments used for learning are diversified and driven by student questions.
CIP Intensity Level 6	Instructional practices consistent with a learner-based approach; student inquiry and self-directed problem solving influence the content and context of instruction.
CIP Intensity Level 7	Instructional practices align exclusively with a learner-based approach to teaching and learning; students establish personal goals and monitor their own pace and progress with a purposeful learning space.

Levels of Teaching Innovation (LoTi)

LoTi Level	**Description**
Level 0: Non-use	Instructional focus may vary; digital tools and resources are not used during the instructional day.
Level 1:Awareness	Instructional focus emphasizes information dissemination; teachers use digital tools and resources for classroom management tasks or instructional presentations.
Level 2:Exploration	Instructional focus emphasizes content understanding; students use digital tools and resources to generate multimedia products that showcase content understanding.
Level 3:Infusion	Instructional focus emphasizes engaged higher order learning; students use digital tools and resources to solve teacher-directed problems related to the content under investigation.
Level 4a:Integration	Instructional focus emphasizes student-directed exploration of real-world issues; students use digital tools and resources to answer self-generated questions that dictate the content, process, and product. Level 4a teachers experience classroom management or climate issues that restrict full-scale integration.

Level 4b:Integration	Instructional focus emphasizes student-directed exploration of real-world issues; students use digital tools and resources to answer self-generated questions that dictate the content, process, and product. Level 4b teachers facilitate full-scale inquiry-based teaching regularly with minimal implementation issues.
Level 5: Expansion	Instructional focus emphasizes global student collaboration to solve world issues; students use digital tools and resources for authentic problem-solving opportunities beyond the classroom.
Level 6: Refinement	Instructional focus is entirely learner-based; students experience seamless integration of digital tools and resources for their self-directed problem solving and issues resolution.

Appendix D
Custom Survey Questions

1. How would you best characterize the level of your personal involvement in the School of the Future Project?

- Teacher in a School of the Future Project School
- Teacher who is also a member of a School of the Future Project team
- Administrator or other School Leader in a School of the Future Project School

2. Which of the following best describes the extent to which have you participated in the following School of the Future Project sponsored activities – the Ning, High Tech High, ISTE 2010, Quarterly Community of Learner Meetings or the formal Online Discussions in the Ning?

- I have participated in most of the activities listed above (4 or more)
- I have participated in some of the activities listed above (1, 2 or 3)
- I have participated in none of the activities listed above (none)

3. Which response best describes how often you visit the School of the Future Ning?

- Frequently (daily or weekly)
- Occasionally (monthly or quarterly)
- Rarely (less than once per quarter)

4. Which response best describes how often you contribute resources or participate in discussions in the School of the Future Ning?

- Frequently (daily or weekly)
- Occasionally (monthly or quarterly)
- Rarely (less than once per quarter)

5. Which response best describes the degree to which participation in the School of the Future project has affected the frequency of collaboration you have with teachers/colleagues from your school?
   - I collaborate more often with my colleagues
   - I collaborate the same amount of time with my colleagues
   - I collaborate less often with my colleagues.

6. Which response best describes the degree to which participation in the School of the Future project affected the quality of collaboration you have with teachers/colleagues from your school?

   - Participation has had positive impact on the quality of collaboration with teachers/colleagues from other schools.
   - Participation has had no impact on the quality of collaboration with teachers/colleagues from other schools.
   - Participation has had negative impact on the quality of collaboration with teachers/colleagues from other schools.

7. Which response best describes the degree to which participation in the School of the Future project affected the frequency of collaboration you have with teachers/colleagues from other schools?

   - Participation has had positive impact on the frequency of collaboration with teachers/colleagues from other schools
   - Participation has had no impact on the frequency of collaboration with teachers/colleagues from other schools
   - Participation has had negative impact on the frequency of collaboration with teachers/colleagues from other schools

8. Which response best describes the degree to which you have established new professional relationships as a result of your participation in the Schools of the Future project?

   - Established many new professional relationships (10 or more)
   - Established some new professional relationships (1-9)
   - Established no new professional relationships (None)

9. How often do you communicate with teachers from other project schools outside of official School of the Future project activities?

   - Frequently (daily or weekly)
   - Occasionally (monthly or quarterly)
   - Rarely (less than once per quarter)

10. Of the following choices, what has most impacted your ability to transform your teaching practices to be more aligned with 21st century teaching and learning such as more student-centered instruction, project-based learning, inquiry or other new strategies that you may not have tried before?

    - Collaborating with teachers at my school site
    - Networking with teachers from other project schools
    - Learning from experts outside of the project schools such as Tony Wagner, Ken Robinson, High Tech High staff or others who may have visited my school.
    - Becoming more comfortable with digital tools
    - Participating in different forms of professional development

Appendix E
Summary Table of Key Characteristics of Project Schools

	SOTF Role	**Extent of Curricula Adapta-tion**	**Tech Use**	**Assess Student Learning**	**Implement -ation approach**	**PLCs**	**PD Intense Options**
Assets	Support	Somewhat	High	None	Preparatory	School-wide	Multiple
AOP	Support	Moderate	High	School tool	Preparatory	School-wide	One
Hanahaouli	Support	None	Moderate	School tool	Unclear	School-wide	One
Hanalani	Augment	Moderate	Low	School tool	Preparatory	Grade/ subject	None
Hongwanji	Support	Somewhat	Moderate	School tool	Unclear	School-wide	None
Hualalai	Support	Somewhat	Moderate	None	Unclear	School-wide	None
Iolani	Support	Somewhat	Low	School tool	Unclear	Early adopters	One
IPA	Support	Moderate	High	None	Immediate	School-wide	One
Kalihi	Change	Major	High	Formal	Immediate	School-wide	Multiple
K-Pac	Augment	Somewhat	Moderate	Formal	Immediate	Grade/ subject	One
KCCL	Change	Major	Moderate	School tool	Immediate	School-wide	Multiple
Le Jardin	Support	Somewhat	Major	School tool	Preparatory	School-wide	None
Maui Prep	Change	Major	Moderate	School tool	Preparatory	Grade/ subject	None

	SOTF Role	Extent of Curricula Adapta-tion	Tech Use	Assess Student Learning	Implement-ation approach	PLCs	PD Intense Options
Mid-Pac	Change	Major	Moderate	School tool	Preparatory	School-wide	None
Montessori Keiki	Augment	Major	Moderate	School tool	Preparatory	School-wide	One
Sacred Hearts	Change	Major	Moderate	None	Early Adopters	School-wide	Multiple
St. Joseph	Change	Somewhat	Moderate	None	Early Adopters	School-wide	Multiple
Sea-bury	Augment	Moderate	Low	School tool	Early Adopters	Early adopters	None

(Nistler, 2010)

APPENDIX F
DRAFT LETTER TO PROJECT SCHOOL LEADERS

Dear School of the Future project leaders,

My name is Lisa Mireles, and I was formerly the principal at Kaua'i Pacific School. I am also a doctoral student in educational technology at Pepperdine University, currently in the process of planning a study entitled, "Schools of the Future: The Impact of Networked Learning Communities on Teaching Practice". The professor supervising my work is Dr. Paul Sparks.

I am writing to ask for your support by allowing and encouraging your teachers to participate in this IRB approved, voluntary study designed to help us learn more about how participation in the School of the Future learning community might be impacting teaching practice across the project schools. Teachers will be asked to complete a 50 item online Levels of Teaching Innovation Survey. The survey should take about 30 minutes to complete after a 5-minute registration process. The LoTi Digital-Age Survey provides each participant with an empirically validated tool that creates a personalized digital-age professional development profile aligned to the NETS for Teachers (NETS-T). This profile offers recommendations aligned to five popular instructional initiatives including (1) Level of Teaching Innovation (LoTi), (2) Partnership for 21st Century Skills, (3) Marzano's Research-based Instructional Practices, (4) Daggett's Rigor & Relevance, and (5) Webb's Depth of Knowledge.

Once the survey is launched on February 1st, 2011, it will remain open for one month. I would ask that you forward a list of teacher e-mails to so that I can create a group e-mail list for your school and e-mail the teachers directly. If you prefer not to divulge their school e-mails, perhaps you would be willing to forward the survey e-mail to your staff instead. There will be no more than 4 e-mails sent out: an initial request at the beginning of the survey period, a reminder about two weeks into the survey period, a reminder with one week to go and one final reminder the day before the survey closes. The Hawaii Association of Independent Schools is in support of this study. Results of the study will be made available to all participating schools and the School of the Future Project Leadership team to help inform the overall knowledge base about the project and impact to date.

I realize that your teachers are extremely busy. Again, participation is strictly voluntary, although the more schools and teachers that participate, the more we will learn. Please let me know if you are willing to allow the teachers from your school to have the option of participating in this study by responding to this e-mail with any of the three options listed below:

Option 1_____ (name of school) will allow Lisa Mireles to contact our teachers for purposes of conducting dissertation research on the Schools of the Future Project. Attached is a list of teacher e-mails.

Option 2_____ (name of school) will allow Lisa Mireles to contact our teachers for purposes of conducting dissertation research on the Schools of the Future Project. We will forward the four dissertation related e-mails to our staff. Please send them to _____(name) at _____ (e-mail).

Option 3 _____ (name of school) is not interested in giving teachers the option of participating in this study.

If you are willing to participate, I will follow up with a script you can send to your faculty to introduce the project. Should you have any questions or concerns about the study, please do not hesitate to contact me at or by phone at

With warmest mahalo for your time and support,

Lisa V. Mireles
Doctoral Student, Pepperdine University

PROJECT LEADER SCRIPT TO INTRODUCE STUDY

Dear Faculty,

One of our colleagues, Lisa Mireles, formerly the principal of Kaua'i Pacific School and currently the Smaller Learning Communities Coordinator at Kapa'a High School, is a doctoral student at Pepperdine University. She is currently conducting a study entitled, "Schools of the Future: The Impact of Networked Learning Communities on Teaching Practice". The study is designed to investigate the relationship between participation in networked learning communities and innovative teaching practices. All teachers in School of the Future project schools are being invited to participate in this voluntary study.

I realize you are extremely busy but I do hope you can find 20 minutes to take this important and potentially very useful survey. Please read the e-mail below from Lisa to learn more about the study. Thank you for your time and consideration.

Sincerely,

Project Leader's Name

APPENDIX G
DRAFT CONSENT FORM FOR STUDY PARTICIPANTS

Dear teachers,

My name is Lisa Mireles, and I was formerly the principal at Kaua'i Pacific School. I am also a student in educational technology at Pepperdine University, currently in the process of conducting a **dissertation study** entitled, "Schools of the Future: The Impact of Networked Learning Communities on Teaching Practice". The professor supervising my work is Dr. Paul Sparks. The study is designed to investigate the relationship between participation in networked learning communities and innovative teaching practices, so I am inviting individuals who are teachers in School of the Future project schools to participate in this study. Please understand that your participation in this study is strictly voluntary. The following is a description of what your study participation entails, the terms for participating in the study, and a discussion of your rights as a study participant. Please read this information carefully before deciding whether or not you wish to participate.

If you should decide to participate in the study, you will be asked to click on a link at the bottom of this e-mail to take a 50 item online survey. It should take approximately 30 minutes to complete the survey you have been asked to complete. Please complete the survey alone in a single setting. At the end of the survey, you will receive a customized, empirically validated personalized digital-age professional development profile aligned to the NETS for Teachers (NETS-T).

The only potential risk identified with participation in this study will be the personal time you will invest in taking the survey. The potential benefit to you for participating in the study is the receipt of a free, personalized digital-age profile.

If you should decide to participate and find you are not interested in completing the survey in its entirely, you have the right to discontinue at any point without being questioned about your decision. You also do not have to answer any of the questions on the survey that you prefer not to answer--just leave such items blank. A reminder note will be sent to you after two weeks, with one week left and 24 hours before the survey closes. Since these reminders will go out to everyone, I apologize ahead of time for sending them to you if you have complied with the deadline.

If the findings of the study are presented to professional audiences or published, no information that identifies you personally will be released. Your confidentiality will be strictly maintained. The only item associating you with the survey results will be the e-mail address you provide upon registration. Upon receipt of the raw data, I will replace e-mail addresses with random **identification** codes so that you cannot be associated with

your survey results. The data will be kept on a **password protected external hard drive** for at least five years at which time the data will be archived. The data may potentially be used in other studies associated with the School of the Future project.

If you have any questions regarding the information that I have provided above, please do not hesitate to contact me at or at . If you have further questions or do not feel I have adequately addressed your concerns, please contact Dr. Paul Sparks at **.** If you have questions about your rights as a research participant, contact **Dr. Doug Leigh,** Chairperson of the GSEP IRB, Pepperdine University, at or

By clicking the survey link below, you are acknowledging that you have read and understand what your study participation entails, and are consenting to participate in the study.

School of the Future Networked Learning Communities Survey Link

Thank you for taking the time to read this information, and I hope you decide to complete the survey. You are welcome to a brief summary of the study findings in about one year. If you decide you are interested in receiving the summary, please send me a personal e-mail.

Sincerely,

Lisa V. Mireles
Doctoral Student, Pepperdine University