TECHNOLOGY INTEGRATION IN THE CONTEXT OF COLLABORATION
IN EARLY CHILDHOOD SETTINGS

A Dissertation in
Curriculum and Instruction

by

Meonghee Jin

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Submitted in Partial Fulfillment
of the Requirements
for the Degree of Philosophy

Doctor of Philosophy,

August 2014
The dissertation of Meonghee Jin was reviewed and approved* by the following:

James E. Johnson  
Professor of Curriculum and Instruction  
Dissertation Advisor  
Chair of Committee

James F. Nolan  
Professor of Curriculum and Instruction

Jamie Myers  
Professor of Curriculum and Instruction

Edgar Yoder  
Professor of Agricultural and Extension Education

Carla Zembal-Saul  
Professor of Curriculum and Instruction  
Department Chair

*Signatures are on file in the Graduate School
ABSTRACT

As the concern about technology in education shifts from teachers’ technological skills to how technology can be used in appropriate ways for children’s learning and development, the challenge of technology use lies in determining how to integrate technologies into teaching practice. Due to the constantly changing nature of technological applications in teaching and learning, technology-mediated teaching practice deserves support within a social context in order to create a community of practice that encourages teachers’ professional development in a range of relevant educational technologies.

The purpose of this study was to identify how teachers integrate technology in their teaching practices in relation to the curriculum and children’s learning in a collaborative context. This study aimed to identify how collaborative teaching mediates teachers’ inquiry to technology integration in the classroom. This study also focused on the content of collaborative inquiry for technology integration in different classroom contexts.

Multiple case study was conducted over a four-month period in order to explore teachers’ teaching practice and the ways in which they collaborated on achieving technology integration goals. Seven teachers from three sites participated in the study, and three cases were analyzed on the basis of data drawn from interviews, observations, questionnaires, and field notes.

Four themes were elicited from the teaching practices focused on technology integration in the context of collaboration demonstrated by the three case teachers: (1)
teacher’s inquiry into children’s learning and play, (2) teacher’s knowledge about technology, (3) collaboration, and (4) the context for technology environment.

The teaching practices and collaborative work focused on technology integration varied according to the nature of the inquiry into the children’s learning, the teachers’ knowledge of technology, and the extent of the support offered by their organizations.

First, this study found that the teachers’ inquiry focused on developing and integrating technology activities for both the curriculum and the children’s play and learning. In addition, the teachers’ knowledge of technology, pedagogy, and play pedagogy was closely related to the ways in which and the extent to which they integrated technology into their teaching practice.

According to the findings of the study, the teachers also engaged in various modes of collaboration in technology integration by drawing on mutual support, shared responsibility, and joint work, and as well as working in isolation. In the process of collaborating on technology integration, the teachers in the present study drew on their differing knowledge bases, skills, and experience in an effort to support each other. The technology environment and organizational support constituted defining features in the teachers’ collaborative teaching practice in regard to technology integration.

Based on the present study, teachers’ inquiry, knowledge, and pedagogy as well as the contextual element of organizational support are deemed to be factors that determine and differentiate teaching practice for technology integration. Therefore, a support system for professional development in technology integration should be provided for teachers at both the personal and the social level.
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Chapter 1

STATEMENT OF PROBLEM

The purpose of this chapter is to diagnose current issues relating to teachers’ use of technology in their teaching practice and to identify ways to support teachers in order to qualify and prepare them to integrate technology appropriately at the Pre-K level. This chapter is organized into six sections: general problems, the rationale of the study, selected relevant background literature, the purpose of the study, research questions, and a glossary of terms.

General Problem

Due to the immersion of technology at school and at home, children are exposed to the digital environment through such means as software, the Internet, and multimedia including old technology such as TV and audio and video devices. Beyond the controversy of whether technology should be provided to children in the classroom, technology is regarded as a powerful tool for learning and is known to enhance children’s cognitive, social, emotional, physical, and linguistic development.

The prevalence of technology has wrought extensive changes in the ecological context of the school in general and the classroom in particular such that the teaching environment is required to reflect the demands of a technology-driven society. Technology has great potential in regard to effecting teaching and learning. However, due
to the complex and ever-changing nature of technology, its use in the classroom presents a challenge for teachers.

The presence of technology cannot by itself guarantee the success of teaching practice and school reforms. The National Association of Education for Young Children (2012) emphasized that the impact of technology for children’s learning and development is maximized when early childhood educators intentionally use technology in developmentally appropriate ways. The position statement essentially provides that educators should both become digitally literate and provide education with technology grounded in developmentally appropriate practice.

Technology should be used to guide children’s self-initiated learning such that children can experience and explore the world and nourish concepts and knowledge need for their future. Therefore, debates over technology use include a consideration of how children should use technology and how technology can support their play and learning (Johnson, Christie, & Wardle, 2005). Given the permeation of the use of technology for children’s development and learning, concerns focus on how to provide teachers with sufficient and appropriate professional development in regard to using technology at both the pre-service and in-service levels.

The challenge for teachers in using technology pertains to how best to integrate technology into their teaching practice. Even though technology was introduced to the educational context several decades ago, studies have reported that teachers continue to feel ill-prepared to use technology in the classroom (Dawson, 2008; Teo, 2009; Wepner, Ziomek, & Teo, 2003). Yet, teachers are also interested in working with technology in order to gain professional competence in terms of the appropriate use of technology and
to likewise gain the necessary skills to work with the technology in this way. Lack of knowledge and lack of confidence on the part of teachers are closely related to each other and to each other and to contexts in which there is a lack of technology integration in the classroom.

One limitation of the opportunities available for educating teachers to use technology is that they are conducted in a traditional way such that the focus is on developing technology skills in isolation from teaching practice. The problem with teacher education centered on technology integration is that teachers’ technology use is disconnected from both curriculum development and the processes and outcomes of children’s learning. Lack of knowledge and skills on the part of teachers are both regarded as barriers to integrating technology into teaching and learning. According to research (Schlager & Fusco, 2003; So & Kim, 2009), teachers lack knowledge about how to integrate technology into the classroom and that it is advisable that pre-service teachers and practicing teachers alike receive an education pertaining to technological pedagogy.

Another problem in teacher education for technology integration is that it is not contextualized in the real life classroom. Researchers have noted that workshops and teacher-training programs are sporadic and de-contextualized. According to Glazer and Hannafin (2008), sporadic external workshops on technology training tend not to be situated in authentic environments such that they lack opportunities for real-life practice.

School culture as a learning community should be cultivated to nourish professional knowledge for technology integration with social support. Thus, ongoing support for practicing teachers who are working with technologies is important in the
classroom environment. It is necessary to create a supportive learning community for teachers to foster professional learning for technology integration.

The need to adequately prepare in-service teachers to integrate technology into teaching and learning is now well-recognized. However, exactly how to do this remains an open to debate. Yet, it appears evident that and sustained support must be provided if early-childhood teachers are to become empowered to integrate technology into their teaching practice.

**Rational for the Study**

That there is a need for situated and substantive professional development to support the sustained continuous learning of teachers has by now become a truism. In Schlager and Fusco’s (2003) view, professional development does not provide ongoing support for teachers across all stages of career development and, in fact, results in gaps due to a lack of continuity.

Teachers tend to differ in regard to their comfort level with and ability to use technology according to career stage, as they have generally had opportunities to learn about technology and to acquire related skills from an early age. Therefore, sustained and substantive learning opportunities for technology integration are needed for the continuous professional development of experienced teachers as well as beginning teachers.

Powell, Diamond, and Cockburn (2012) emphasized the importance of the professional development of in-service teachers in strengthening the effect of children’s
learning and development in early-childhood classrooms. Teacher education programs
that include technology integration as a focus should provide practicing teachers with
experience using technology in the classroom, and school systems should supportive
teachers’ efforts to use technology in their teaching practice.

The process whereby teachers learn to teach should be viewed from the social
perspective that the support of colleagues sustains teachers’ growth and should illuminate
the process by which teachers learn. According to the socio-centric view of knowledge
and learning, the process of learning is a social one. However, teaching practice is not
socialized. Instead, teaching practice tends to be thought of and engaged in as the
province of the individual teachers. As Feiman-Nemser (2001) put it, “school structures
provide few opportunities for teachers to confer with fellow teachers about their
work” (p. 1043). And, according to Zeichner and Liston (1996), teaching practice can be a
social process if engaged in as a dialogical dimension of teaching practice.

Collaboration between teachers is emphasized as essential to furthering the
professional development of teachers. A collaborative system within a school can play a
key role in ensuring that teachers receive ongoing support for technology integration in
the classroom. Co-teachers in the same classroom can act as useful resources whereby
each supports the other’s teaching and learning in a collaborative and situated practice. It
is worth noting suggesting the possibility of a learning community for technology
integration so that teachers can learn about and receive support for integrating technology
into their teaching practice in a social context.

Therefore, the focal question pertains to how to move away from de-contextualized and remote from classroom practices in order to nourish inquiries into
technology integration in a collaborative context with ongoing support. We need to determine both how teachers integrate technology into the classroom and how to support their professional development as it related to technology integration in terms of children’s learning and development.

**Selected Relevant Background Literature**

There is increasing interest in the idea that technology constitutes an important way to support teachers’ instruction. Technology use in the classroom environment, however, presents new challenges to teachers due to the complicated character of technology itself.

In several research studies, most of the teachers indicated that they did not consider themselves to be well-prepared to integrate computers into their teaching (Chen & Chang, 2006a; Dawson, 2008; NCES, 2000; Teo, 2009). Teachers feel incompetent in regard to using technology in the classroom and have little experience using technology for students’ learning (Glazer & Hannafin, 2005). This means that teachers are in general less confident using technology for their teaching practice than using technology knowledge and skills. Any consideration of technology integration in the classroom, therefore, should take into account how teachers use technology, what they think of their own efforts to do so, and why they might refrain from doing so.

Recent interest in the use of technology in the classroom goes beyond teachers’ ability to use technology to consider their ability to integrate technology into their teaching practice. Researcher (Bers, 2007; NAEYC, 2009; Roblyer & Edwards, 2000)
who support the use of technology have suggested that technology per se is not enough to stimulate children’s learning and development. Rosen and Jaruszewicx (2009) stressed both the importance of the role of pedagogy in technology use and technology knowledge to integrate technology into classroom practice. They stated that developmentally appropriate technology use occurs when teachers integrate their knowledge base and pedagogy in order to create technology-rich instruction and resources.

Researchers (Schlager & Fusco, 2003; So & Kim, 2009) have pointed that teachers lack knowledge related to integrating technology into the classroom and suggested that knowledge of technological pedagogy should be provided to both pre-service and in-service teachers. Kirkwood, Shulsky, and Willis (2014) stated that technology should be integrated into the curriculum in order to foster students’ learning in a subject area as well as to provide a basis for them to develop technology skills. In this sense, pedagogy is emphasized in integrating technology into classroom practice beyond the technology knowledge of teachers.

One of the barriers to technology integration is limited to the curriculum and students’ learning. Technology should be used to reinforce children’s learning via helping them to understand concepts in other disciplines. Shulman (1986) suggested the need for pedagogical content knowledge because content knowledge of subject matter, alone, is not sufficient for teachers to contribute to students’ understanding. Therefore, support for practicing teachers’ work focused on integrating technology into children’s learning should be aligned with the content of the subject matter and pedagogy.
The role of pedagogy is emphasized in integrating technology into classroom practice beyond the need for teachers to gain and use technology knowledge productively (Schlager & Fusco, 2003; So & Kim, 2009). Technology should be provided appropriately to mediate students’ learning in a specific content area. Thus, pedagogical expertise relating to the use of technology is needed to support students’ learning experience and understanding by integrating technology according to a specific subject area.

In particular, staff development programs have limitations and are implemented at a site away from the classroom. This means that such programs are de-contextualized and disconnected from actual teaching practice. Further, they do not permit meaningful interactions or follow-up as such programs are usually taught by outside experts and attended by teachers from a number of schools—none of whom interact with each other after the program is over (Feiman-Nemser, 2001). Research (Putnam & Borko, 2000) critiqued traditional teacher education, which is transmitted in isolation from the teaching context of the school environments and rarely provides opportunities for sharing knowledge and learning with colleagues. Zeichner and Johnston (1996) commented on the importance of a social foundation for teaching practice as follows: What traditionally are called social foundations courses are typically not school-based, but set apart from some of the more realistic, practical, and engaged dilemmas of schooling (p.4).

According to Hord and Sommers (2007), school professionals should constitute and conduct professional learning communities in order to develop and share a common vision and learn collectively through collaborative work. For the professional
development of in-service teachers, a one-time workshop or coursework cannot change a teacher’s teaching practice (Benson & Benson, 2010; Powell et al., 2012). And, according to Granger (2002), “just-in-time” professional development influences teachers’ technology integration by meeting the immediate concerns of teachers in a way that is congruent with teachers’ needs. Specifically, just-in-time support for technology integration is necessary for practicing teachers to learning to teach in situated and embedded teaching context.

An important question is raised in relation to how to support practicing teachers’ endeavors to integrating technology. Even though technology has enormous potential for teaching and learning, there are few empirical studies on how practicing teachers integrate technologies into their teaching practice. It is necessary to identify how and the extent to which teachers should be taught embedded in the classroom situation.

**Purpose of the Study**

The present study describes how teachers integrate technology in the context of collaboration and the ways in which they can support each other in this process. The purpose of this study was to explore how practicing teachers build shared knowledge about technology integration through collaboration in the classroom and, simultaneously, to identify whether collaboration among teachers in the classroom can act as a catalyst for teachers to engage in professional development opportunities related to technology integration in a site-based context.
It is meaningful to explore the collaborative process between teachers who are working with technology together in the same classroom. In order to identify how contextual factors influence collaborative work, the present study compared collaborative patterns of the teachers for technology integration depending on the context of the organization in which the teachers work. Identifying what constitutes effective collaboration on technology integration in the classroom is valuable and this attempt can guide plans for offering ongoing support for teachers to work together for technology integration in more systematic and organized ways.

This study was designed to suggest how to provide on-site support for teachers’ learning to teach in terms of technology integration in the collaborative context. Ultimately, this study suggests the potential of a professional community that stimulates collaboration among teachers working with technology resources in the classroom and supports teachers in their learning and use of technology in a situated technology environment.

**Research Questions**

1. How do teachers integrate technology in the context of collaboration?
2. How do teachers collaborate on technology integration in the classroom?
3. How does the teaching environment for technology integration differ across the three sites?
Glossary of Terms

**Collaboration:** A process of implementing teaching practice with agreed-upon goals based on collaborative inquiry for technology integration by sharing ideas among teachers and performing with sharing roles mutually and complementary support as needed.

**Collaborative inquiry:** The process of probing questions on teaching practice through discussion and problem-solving efforts among the teachers.

**Collaborative reflection:** A process whereby technology is used in ways that foster teaching and learning based on principles of children’s learning and development.

**Developmentally appropriated practice (DAP):** A practice whereby teaching and learning is undertaken in a sensitive and responsive way by taking into account the children’s development stage, their cultural identities, and individual differences between them.

**Technology literacy:** The knowledge of and skills necessary to use technology and digital devices to use technology competently.

**Technology pedagogical content knowledge (TPCK):** The knowledge and skills necessary for teaching practice involving technology use. In particular, TPCK refers to the teachers’ pedagogical decisions regarding integration technologies for specific content areas in order to teach subject matter concepts in appropriate ways for children’s learning.
Beginning teacher: A teacher who has been working as such for no more than three years in the preschool context and who is mentored in the classroom by an experienced mentor teacher.
Chapter 2

LITERATURE REVIEW

This section is to review research related to teachers’ technology use including technology integration and how teachers are educated to use technology. Through this review, a rationale regarding the potential of technology in teaching and learning will emerge and likewise the nature of the teacher’s role as a facilitator of children’s learning and development will also become apparent. This chapter considers the role of technology, technology integration, collaboration for professional development, and the conditions of collaboration based on a social perspective on learning to teach.

Technology and Children’s Development

Digital tools including computers and the Internet are permeating school culture, which, has, in turn, wrought changes in the teaching and learning environment. Technology and digital media are regarded as tools capable of fostering young children’s play and learning.

The use of technology as a teaching strategy featured in teachers’ and children’s learning functions to change the classroom and school environment. According to the National Association for the Education of Young Children’s (NAEYC) (2012) position statement, technology and interactive media can support and enhance children’s learning and their social relationships when used wisely by adults and children.

Bers and Kazakoff (2013) insisted that computers can render children more isolated but on the one hand, computers can also contribute to improving social
interactions that facilitate positive peer interaction according to the context and type of technology used. Kirkwood, Shulsky, and Willis (2014) stressed that the meaningful use of technology challenges children in ways that foster their understanding both of themselves and of others in their communities.

Digital tools should be used in ways that mediate children’s learning and development grounded in the principles of developmentally appropriate practices. Therefore, current concerns focus on how technology can be used for educational purposes in developmentally appropriate ways. The focus of technology use has, therefore, moved from computer literacy or technology literacy to a new emphasis on integrating technology into the context of the classroom so that it can be reflected in daily teaching and learning.

The concept of technology literacy does not mean that technology automatically fosters children’s achievement or learning. Samara and Clements (2002) indicated that technology is not always appropriate, as it does not always contribute to children’s development. They insisted that the effect of technology depends on the design of the curriculum and the learning experiences that the teacher provides for the children. Roblyer and Edwards (2000) noted that “Integrating educational technology refers to the process of determining which electronic tools and which methods for implementing them are appropriate for given classroom situations and problems” (p. 8).

Therefore, in relation to the important role of teachers in adopting and using technologies, the NAEYC (2009a) offered guidance regarding how to teach young children in developmentally appropriate ways. Based on this guidance, teachers and their
schools should focus on using technology in developmentally appropriate ways for children based on general teaching principles.

Rosen and Jaruszewicx (2009) proposed what they referred to as developmentally appropriate technology use (DATU), which is based on the assumption that children construct their own knowledge actively and collaboratively, and digital tools are used to support child-initiated learning. However, there remains a need to guide teachers in the appropriate use of technology in association with a situated teaching environment. Trawick-Smith (2012) argued that good fit integration is associated with children’s autonomous play and occurs when a teacher’s guidance matches a child’s need for support. In this way, a specific academic outcome such as vocabulary growth and mathematical thinking as well as a general developmental outcome becomes the pedagogical focus.

Specifically, technology should be integrated into classroom practice in ways that enhance the children’s learning and development. Plowman and Stephen (2007) suggested using guided interactions in working with technology in order to support children’s learning in preschool settings. In this regard, teachers should be learned how to scaffold and guide children in playing with digital play materials.

**Technology Integration**

Previous studies on technology use focused principally on children’s use of computers (Clements & Samara, 2003; Samara & Clements, 2002). However, technology tools now include a broad range of digital devices such as computers, tablets, multi-touch
screens, interactive whiteboards, mobile devices, cameras, DVD and music players, audio and video recorders, electronic toys, games, e-book readers, and older analogue devices such as tape recorders, VCRs, VHS tapes, light tables, projectors, and microscopes (NAEYC, 2012). Accordingly, concerns in regard to computer literacy now center on digital literacy—a concept that encompasses both technology literacy and media literacy. However, according to So and Kim (2009), knowing how to use technology for personal purposes and knowing how to use it for instructional purposes are by no means the same.

The problem is that technology use is isolated to the curriculum and to students’ learning, which is irrelevant to the teachers’ teaching practice. One of the roles of technology should be that of reinforcing children’s learning of in a way that fosters their understanding of concepts in a subject matter. Technology should be provided in order to mediate students’ learning in a specific content area. In relation to the influence of teacher education in computer use, several research studies (Bell & Tai, 2003; Bennett, 2000; Cuban, 2001) have suggested that teacher preparation programs pertaining to computer technology should include instruction and curriculum development. Moreover, teacher education on technology use is generally disconnected from both the curriculum and children’s play and de-contextualized from the real-life classroom.

Therefore, teacher education programs designed to integrate technology into practice are needed. Through such programs and related opportunities, it will become possible to determine what teachers can be taught about technology use and how technology can be integrated into teaching practice related to the curriculum and to children’s learning.
Professional Development

The teacher’s role in technology use is important to improve teaching and learning. Certainly, teachers’ role is recognized as an important element in successful technology integration so that maximizes technology’s effects on children’s learning and development (NAEYC, 2009a; Saracho & Spodek, 2002). Dexter, Seashore, and Anderson (2002) asserted that innovations in teaching practice depend on what teachers know about technology and on how they use it.

According to the NAEYC’s (2009a, 2012) statements regarding technology use with young children, teachers should use technology in line with the principles of developmentally appropriate practice, that is, in ways whereby technology can contribute to child’s development in age-appropriate, individual-appropriate, and culturally appropriate ways. However, in several research studies, most teachers indicated that they were neither prepared nor trained adequately to use computer-based technologies (Chen & Chang, 2006b; Fisher & Dove, 1999; U.S. Congress Office of Technology Assessment, 1995). According to Chen and Chang (2006b), most teachers do not consider themselves to be expert in computer integration in the classroom and further most teachers are not prepared to use technology in the classroom in ways that are appropriate for children’s learning.

Teachers noted that they lacked the knowledge to integrate technology and that they were not competent to use technology in the classroom for students’ learning. According to Penny (2003), teachers were concerned about their limited state of their educational technology knowledge, and NetDay (2001) reported that teachers wanted
professional development related to how to integrate technology into their classroom work. Overall, those findings suggest that teachers need knowledge pertaining to integrating technology into their teaching that extends into pedagogical concerns—that is, to concerns beyond having knowledge and skills pertaining to the technology itself.

One of the limitations of current professional development education is that in regard to using technology in the classroom teacher education programs are not sufficient to meet the needs of individual teachers in either psychological or pedagogical terms. On the other hand, researchers have doubt that teacher training related to technology use would subsequently be reflected in teachers’ actual teaching practices (Ertmer, 2005; Glazer & Hannafin, 2008). Yamagata-Lynch (2003) attempted to design a teacher-training program that would connect technology use and classroom practices.

However, we do not yet know whether, how, or the extent to which teacher education pertaining to technology use is transferred to classroom practices. That is, research studies to date have offered little evidence that teacher education focused on the use of technology is transferred to the classroom practices. It is, however, of great importance to determine the ways in which technology can be used and to likewise to determine what teachers need to know about using technology.

**Knowledge Base for Technology Integration**

Interest in how teachers are using technology in their teaching practices in the workplace is growing, which is important in establishing how to use technology
appropriately for children’s learning. In general, a lack of knowledge about how children
learn through computer use can hinder teaching practices.

Teaching practice with technology should be conducted in alignment with
constructing a knowledge base for general teaching. Technology integration, subject
matter knowledge, pedagogical knowledge, and pedagogical content knowledge are
required if teachers are to teach and learn effectively in a technology-enriched context.
Further, using technology in the classroom is a complex and time-consuming undertaking
that requires teachers to acquire various technological skills and knowledge beyond
general standard teaching practices. However, due to the rapidly changing nature of
technology, it is difficult for teachers to gain and maintain cutting-edge knowledge,
skills, and practices.

According to several studies, teachers lack confidence in using technology in the
classroom for reasons related to lack of time, lack of technology skills, and insufficient
access to technology (Dawson, 2008; Newman & Cochran, 2007; Teo, 2009). Research
(Ottenbreit-Leftwich et al., 2012) also referred to a dissonance between teachers’
espoused beliefs or knowledge and their actions in terms of technology integration. Thus,
they pointed to a gap between what pre-service teachers are taught in their preparation
courses and what they actually do in the classroom.

**Technology pedagogy**

With acquiring technology knowledge of teachers, in recent, pedagogical
knowledge is emphasized for technology integration. The use of technology in the
classroom should focus on the educational goal beyond just learning the skills necessary
to using the technology. Such knowledge is referred to as Technological Pedagogical Content Knowledge (Mishra & Koehler, 2006; So & Kim, 2007). According to research (Dawson, 2008; Hew & Brush, 2007; Teo, 2009), the technology resources and methods must be associated with content area skills that are needed for current educational systems such as the subject matter, research, and problem-solving. According to Ottenbreit-Leftwich et al. (2012), the success of technology integration is related to the teacher’s pedagogical knowledge. They stressed both the importance of the role of pedagogical and technological knowledge in integrating technology into classroom practice.

Overall, researchers (Bers & Kazakoff, 2012; NAEYC, 2009a; Newman & Cochran, 2007) agree that technology is not a panacea for education and that technology by itself is not enough to ensure that children learn and develop new concepts and skills.

Based on a literature review related to technology use, Hew and Brush (2007) concluded that a lack of technology knowledge and skills acts as a barrier to technology integration. Therefore, they stressed the importance of technology knowledge and skills, technology-supported pedagogical knowledge, and technology-related classroom management knowledge. Snoeyink and Ertmer (2001) reported that a lack of technology knowledge and skills could mean that teachers refrain from using technology and that teachers’ limited computer knowledge and skills are connected to a lack of technology integration in their classrooms. The researchers argued that technology integration cannot be conducted in the absence of sufficient technology knowledge and skills on the part of teachers.
Technology can play a critical role in rendering any given subject matter more comprehensible and concrete such that students can understand it more easily (So & Kim, 2009). This point reflects the perspective of constructivism according to which learning is constructed by knowledge and teaching requires students to engage in meaningful activities wherein they construct their own knowledge. Therefore, the need to build a subject-specific technology inquiry in a learning community is raised in the context of technology integration. Researchers have stressed that teacher education programs should provide for technology use related to subject areas (Bell & Tai, 2003; Hughes, 2005; Milken, 2000). In Hughes’s (2005) view, teachers are able to connect new ideas and technological tools to a content area when they have been provided with training in exactly this area. That is, technology-supported pedagogy is acquired when training on technology is provided in an integrated way with training in a given content area. Similarly, Milken (2000) suggested that professional development opportunities that focus on integrating technology for practicing teachers in association with a subject ought to be made available.

Mishra and Koehler (2006) stressed the importance of pedagogy for technology integration, along with technology knowledge—a concept referred to as technological pedagogical content knowledge (TPCK). They explained that technological pedagogical content knowledge for teaching practice using technology is intertwined with technology, pedagogy, and content knowledge for technology integration.

Pedagogical content knowledge, an idea introduced by Shulman (1986), means that teachers need both content knowledge and an understanding of students’ development in order to provide subject matter in appropriate ways. Shulman argued that
the acquisition of subject matter knowledge must be coupled with the acquisition of subject-specific pedagogy.

In relation to pedagogical framing for play, technology integration at the K-level should be considered in terms of children’s play. Kushner (2007) indicated that a teacher’s theories can influence the way he/she conceptualizes his/her own role in children’s play and determine how he/she intervenes. He suggested that teachers construct their pedagogy and plan their curriculum by observing children’s play patterns and determining the teacher’s role in supporting and extending the children’s play on this basis.

Roblyer and Edwards (2000) assumed that educational technology functions as a process rather than as a product, arguing that educational technology must focus on “the process of applying tools for educational purpose as well as the tools and materials used” (p. 6). This statement stresses the pedagogical knowledge of teachers more than technology itself when teachers plan to use technology for educational purposes.

Overall, knowledge about how teachers use technology and how they integrate technology into teaching practices should be distinguished from each other. To support the appropriate use of technology in the classroom, teacher education programs should include a consideration of pedagogical approaches to the ways in which children play and learn. Such programs should also provide guidance on curriculum development for teaching practice, especially technology-enhanced curriculum and instruction.
Teacher inquiry

As one view on a knowledge base for teaching, the conception of teacher-generated knowledge is illuminating in that teaching knowledge comes from teaching practice on a daily basis rather than from outside experts or research far from complex and unpredictable daily practice. The underlying assumption is that most teachers are professionally competent and seek to make instructional choices that will have a positive impact on student learning (Pajak, 2000). In line with this position, the emphasis on the teacher’s knowledge base has shifted from what teachers do to “knowledge teachers hold, how they organize that knowledge, and how various knowledge sources inform their teaching” (Cochran-Smith & Lytle, 1999, p. 258).

Furthermore, Hughes (2007) asserted that learning experience will support teachers in their efforts to change their practices such that they are prepared to integrate technology in ways that draw on their subject expertise. It is only in such a way that teachers will be able to apply technology and subject matter knowledge to their actions in the classroom. Palak and Walls (2009) also supported this point in their study by saying that “the way they taught, and especially the ways they had students use technology, were primarily influenced by the teachers’ educational beliefs and what they believed to be good teaching” (p. 435).

This view of teacher learning is based on the idea that knowledge comes from reflections on and inquiries put into practice. Research has suggested that the purpose of professional development is to empower teachers through reflection. According to Schon (1987), reflection is important in supporting teachers’ consistent learning to teach and reflective practitioners use reflections to direct their actions such that they engage in
continually learning from and refining their teaching experiences. He described the process of reflection as facilitating teachers’ efforts to reconstruct their thoughts and experiences by framing and reframing their teaching practices. Nolan and Hoover (2004) described the benefits of teacher inquiry as follows:

An inquiry stance is associated with reflection, self-assessment, and a mindset inclined toward continuous improvement…. The teacher must ask questions, collect and interpret evidence to answer the questions, follow the evidence where it leads, and make changes in personal practice as a result of what was learned. (p. 144)

Teacher inquiry is a way for teachers to know their own knowledge (Lytle & Cochran-Smith, 1992). In Dana and Silva’s (2004) definition, teacher inquiry is the “systematic, intentional study of one’s own professional practice and can serve as a tool for professional growth and educational reform” (p. 54), which can mean that both prospective teachers and practicing teachers commit to educational change:

Inquiry, particularly inquiry in collaborative contexts, or inquiry communities, can create opportunities for teachers to learn and lead efforts to improve their schools. Moreover, the evidence suggests that the products of teacher research—the knowledge, the findings of inquiry—can provide an impetus and direction for improvement planning and other organization changes at the school level (Nolan & Hoover, 2005).

**Social Perspectives on Teachers’ Learning to Teach**

Due to the uncertainty of the teaching context and the proliferation of teaching methods in the schools, teaching has become more complex and difficult (Hargreaves,
In addition, new technology is likely to entail new tasks for teachers and increase the burden on teachers in their daily routines.

According to the socio-centric view, the individual’s cognition should be shared with other persons and communities based on the artifact and external support. Cochran-Smith and Lytle (1999) suggested that “Teachers learn when they have opportunities to probe the knowledge embedded in the work of expert teachers” (p. 250). This assumption implies the social construction of knowledge for teaching practice through collaborative work among teachers. This is also consistent with the idea that social support from colleagues improves the professional development of teachers (Zeichner & Johnston, 1996).

Hargreaves (2000) suggested that successful innovation and education more generally cannot be achieved without support structures for teachers. He also pointed out that the school environment does not support the sharing of knowledge and learning. Therefore, prospective and practicing teachers need opportunities to share the knowledge of that they learned in teaching.

The general orientation of the new approach to teacher learning is more constructivist- than transmission-oriented—that is, it is recognized that both prospective and experienced teachers bring prior knowledge and experience to all new learning situations, which are social and specific. Experienced teachers have been socialized by playing a professional role such that they can work with colleagues or preservice teachers in ways that can foster their own growth in terms of knowledge and skills. Thus, working with colleagues could provide experienced teachers with opportunities for professional learning (Feiman-Nemser, 2001). However, most teachers do not have the opportunity to
work on systematic data with their colleagues due to both the complicated situation of the classroom and the lack of support from their schools:

Most teachers have little experience with the core activities of mentoring—observing and talking with other teachers about teaching and learning. They rarely see another teacher’s practice, and they have limited opportunities to talk about teaching in systematic and rigorous ways. (Feiman-Nemser, 1998b, p. 1033)

Hord and Sommers (2007) suggested that school professionals should constitute a professional learning community that offers development opportunities, drives forward a shared vision, and learns collectively through collaborative work.

**Collaboration**

In line with Dewey’s (1936) idea of the teacher as a continuous learner, new professional development trends focus on empowering teachers to learn to teach in the interest of continuous and long-lasting professional growth. In keeping with the notion of continuous learning opportunities for the professional development of teachers, it is essential for schools to cultivate a culture for teacher learning to support teachers in continually improving their knowledge and practice. Both beginning teachers and practicing teachers, therefore, should be provided with and avail themselves of professional development opportunities throughout their entire career cycle.

However, there is a significant problem with staff development sponsored by school districts and with university courses. Simply, put these courses are taught by outside experts. Such an arrangement may not bring any learning in the context of
teaching practice without transforming complex knowledge and skills into powerful teaching practice (Feiman-Nemser, 2001). Moreover, researchers have pointed out that workshops and teacher-training programs are sporadic and de-contextualized (Benson, 2010; Powell & Cockburn, 2012).

In relation to the meaningful functioning of the social context for learning in terms of the Vygotskyian approach, the context of the classroom can be involved in the ways that teachers think about and act in relation to technology and could influence a teacher’s beliefs and knowledge in regard to teaching (Putnam & Borko, 2000). According to Smylie et al. (2001), the professional community should provide “intellectual stimulation and feedback essential to deepen learning and promote instructional change” (p. 124). However, according to one study, teachers had very few opportunities to even observe a good model for teaching practice integrating technology (Penny, 2003).

McLaughlin (1997) emphasized the importance of supporting professional development through communities of practice so that teachers can articulate and reconceptualize their pedagogical epistemologies within a collaborative framework (Wood & Bennett, 2000). Thus, professional community practice could be helpful for teachers to learn about technology integration in terms of children’s play and learning by empowering teachers to co-construct and reconstruct their knowledge and practice.

Collaboration is considered a powerful way for teachers to gain professional development (Borko, 2004; Lassonde & Israel, 2010; Putnam & Borko, 2000). According to Schlager and Fusco (2003), professional development is a process of learning through collaboration by communicating and sharing knowledge acquired from daily teaching
practice. As a collaborative system for teachers, mentoring is a support system for the continuous and long-lasting professional growth of teachers whereby they can become empowered to learn to teach through the development of a collegial culture in school. Mentoring is based on the assumption that novice teachers need to be supported by experienced teachers so that the latter become accustomed to their work in both affective and cognitive respects.

In Bowers’ (1994) view, cooperating teachers showed an increased awareness of innovative instruction and management and also incorporated management of this nature into their teaching practice by collaborating with student teachers. Koskela and Ganser (1999) took the position that collaboration with student teachers provided cooperating teachers with opportunities to reflect on their own teaching. They also reported that cooperating teachers expected to grow professionally based on receiving new ideas and assistance from the beginning teachers working with them. In addition, collaborative apprenticeship is one type of collaborative system for teacher education to improve teachers’ skills and knowledge about technology integration.

Teachers should be able to obtain support from continuous professional learning instead of relying on training from outside experts, which is far beyond the situated practices of the classroom. Lassonde and Israel (2010) emphasized the importance of sustained and on-site learning through site-based collaborative communities for the most effective type of professional development:

With respect to the professional development of teachers, a teacher who is working with technology might need a chance for a shift in regard to the moment
of teaching, planning, and teacher conferences as the opportunity for teachers’ learning and reflection of teaching. (p. 1208)

**Components of collaboration**

Researchers emphasize the importance of collaboration for teachers’ professional development, which can provide opportunities for learning to teach. A culture of collaboration contributes to improvements in teaching and learning and to the successful implementation of change, and such a culture encourages teachers to take risks. It also means that teachers are likely to be committed to their own continuous professional growth (Hargreaves, 2000). Zeichner and Liston (1996) pointed out the lack of social process in teaching practice and emphasized teaching practice as a dialogical dimension in social contexts. Thus, they stressed collaboration between teachers as an essential factor for improving the professional development of teachers: “Teacher preparation programs often are not organized in a fashion that would encourage the discussion and examination of these sorts of shared experiences” (p. 6).

Feiman-Nemser (2001) stated that daily life in a classroom in which several teachers work together could easily be a good place to share ideas and knowledge for teaching practice through observation and collective dialogue. A condition for successful action research is that teachers are connected to colleagues when they are similarly engaged such that they can be supported as needed (Nolan & Hoover, 2005).

According to Cochran-Smith and Lytle (1999), professional learning occurs in dyadic situations as in exchanges between an expert and a less experienced or less-expert teacher and sometimes in groups or communities working together to reflect on, inquire
about, and transform their experiences. In describing the benefits of collaborative work in action research, Lieberman and Miller (1994) suggested that change of this nature arises as follows:

In the process of encouraging these activities, traditions of practicality, isolation, and privacy were replaced by shared ownership of issues and problems of practice, a willingness to consider alternative explanations, and a desire to work together as colleagues (p. 210).

The point is to encourage teachers to talk with one another about teaching and to work together to find solutions to common problems (Nolan & Hoover, 2005). Cochran-Smith & Lytle (1999) also noted that teacher learning takes place over time rather than in isolated moments in time and that active learning requires opportunities to link previous knowledge with new understanding. Little (1992) suggested that it is necessary to determine the conditions that construct collaboration among teachers to enhance their teaching practice:

Collaboration is a complex task dependent on mutual help, trust, openness, open access to various sources of information, reflective experiences from inside and outside school, and autonomy in a community of the individuals involved. It is defined as a special kind of personal and technical exchange for innovative educational planning. (p. 262)

Borko and Putnam (1996) suggested that communication among teachers is a very important tool in a teacher’s learning experience, as such communication connects theory and practice by transforming knowledge obtained from teaching practice in the classroom. Such communication also helps prevent teachers from becoming isolated in the classroom and in the teaching profession more generally. Teachers are very enthusiastic in regard to talking about their teaching practice and the children they teach.
However, just talking with other teachers is not a sufficient condition for helping experienced teachers develop their teaching. In relation to the importance of conversations among teachers in the process of their learning, Feiman-Nemser (2001) commented as follows:

Learning is an integral part of teaching and serious conversations about teaching are a valuable resource in developing and improving their practice. (p. 1019)

Additionally, researchers have pointed to teachers’ reluctance to reflect on their teaching and to inquire and dialogue with their peers as obstacles to professional development (Ball & Cohen, 1999; Grossman, Wineburg, & Woolworth, 2000). Moreover, teachers tend not to have time to reflect on their teaching practices and are reluctant to work together (Ball & Cohen, 1999) due to limits on both time and resources.

According to Hargreaves (2000), teachers learn by doing, reading and reflecting, collaborating with other teachers, looking closely at students and their work, and sharing what they see. Lassonde and Israel (2010) also suggested that collaboration fosters reflectiveness, increasing the transferability of knowledge and providing social support. Therefore, the sharing of materials and ideas and reflecting among colleagues is regarded as a construct of collaboration.

Support for Technology Integration

According to the NAEYC (2009a), in order to become active participants in the world of technology, teachers need in-depth training and ongoing support. Such measures
in the NAEYC’s view are necessary to adequately prepare teachers to make decisions
about technology and to support its effective use in learning environments for children.

Knowledge about technology has to do with context (Hughes, 2005; Zhao, 2003). Vygotsky (1978) emphasized the process and context for acquiring higher mental
functions as occurring through learning and teaching via a dialogue in social relations. He
argued that knowledge and learning are transformed from the intrapersonal to the
interpersonal dimension. Social context is directly or indirectly constituted by the culture
to which people belong. According to Vygotsky, the social context influences how and
what people think and affects the development process in the formation of cognition
(Bodrova & Leong, 2006).

Johnstein and Meehan (2000) also suggested that social construction elicits
cooperative learning through shared dialogue and joint activities such as dialogue
journals and the Internet. According to the Vygotskian perspective, interaction should
occur within the partner’s zone of proximal development for collaboration. In the process
of dialogic interaction, individuals do not simply internalize and appropriate the
consequences of activities on the social plane, they also reconstruct and co-construct
knowledge.

The context of teaching practice such as the culture and support of the
organization makes a significant difference in teaching practice because teachers in
different settings have diverse goals, activities, and ways of conducting research (Lytle,
1992). The principal and other school leaders may or may not nurture a context wherein
continuous learning is the modus operandi for staff and students and provides a broad
range of structures and resources to support the staff in learning new practices (Hord &
Sommers, 2008). In order for teachers to collaborate with the specific areas such as technology or new instruction, time and other resources should be made available.

Researchers have suggested that teachers can engage in professional development by sharing expertise and building interdependence if they participate in joint work on instructional issues with other educational personnel in a particular institutional context (Little, 1999; Sarason & Lorentz, 1998). In line with the importance of the context of teaching practice, which supports teachers’ collaborative work, Sarason (1996) also insisted that teachers can create productive learning opportunities for students when operating in contexts that provide adequate support.

According to NCATE standards (2007), educational technology facilitation programs need a support system for administrators, teachers, and students in order for improvements in technology use to be effected in relation to student learning. To integrate technology into teaching and learning, a collaborative system is necessary both within and beyond the school building. Beyond the individual level of the teachers themselves, the principal or director, and those serving as administrators, the point is that supervisors and technology specialists should all assist teachers in applying technology to their teaching for children’s learning. Building and sustaining intellectual communities of teacher-researchers would contribute to teachers’ ability to transform teaching, learning, and schooling (Cochran-Smith & Lytle, 1992b; Schlager & Fusco, 2003).

The present study is based on the social-cultural theory of learning articulated by Vygotsky, according to which learning is a process of participation and interaction in a community of practice. Sing and Khine (2006) stressed the importance of interaction among teachers, noting that “With this broad frame, interaction among members is the
key mediator for the co-construction of a shared perspective and the appropriation of cognitive strategies employed by experts within the community” (p. 250). Therefore, the present study describes teacher interaction in regard to the collaborative processes that teachers engage in as they integrate technology into the classroom.

In order to support teachers in their efforts to integrate technology into the classroom context, a teachers’ learning to teach should be taken into account in terms of the social perspectives that support and sustain teachers’ growth via a social process.
Chapter 3

METHODOLOGY

The concern in this dissertation is related to technology use and how teachers integrate technology in their teaching practice, and the process of collaboration, and how technology contributes to the dynamics of teacher’s collaboration in the classroom. This chapter is presented the study design of the qualitative research to portrait the teachers’ experience of technology use and suggested the research processing and procedure; participant selection, research settings, data generation methods, data analysis, and methods verification.

Research Design

The research design is case study method and it is used here to explore research questions based on the idea of Stake (2003) that the case study is a representative qualitative inquiry with strong naturalistic, holistic, cultural, and phenomenological interests.

Case studies are valuable in program evaluation when the program is individualized, so the evaluation needs to be attentive to and capture individual differences among participants, diverse experiences of the program, or unique variations from a program to another setting. (Patton, 2002, p.55)

This study was conducted through multiple case study with data gathered at three different sites in structure of organization. Multiple case study is an appropriate method
to explore the experience of individual teachers in depth. This study explored the understanding and inquiry of practicing teachers regarding the use of technology resources in children’s play environment. It provided a perspective on the way that teachers learn to integrate technology into their teaching practice during their collaboration with co-teachers.

Naturalistic inquiry evaluators focus on capturing process, documenting variations, and exploring important individual differences in experiences and outcomes (Patton, 1990, p.43).

For the exploration of the experience of practicing teachers in their practicum regarding technology integration, the needs, knowledge and concerns of teachers were explored based on the different contexts of teaching experience. According to Feiman-Nemser (2001a), teacher inquiry includes “the voice of the classroom teacher and focuses on the concerns of the teacher, which makes teachers engage in design of data collection, and the interpretation of the data around questions.”(p.1028)

Another concern for the study was to explore how the teachers interact in the context they work together for technology integration, which was to examine how they support each other. In relation to the examination of process and program evaluation, Patton (2002) provided the following description:

Naturalistic inquiry strategy is selected when the evaluator wants to minimize research manipulation by studying a naturally unfolding program or treatment processes and impacts.

Interaction between teachers, and teachers and children were observed while teachers work with technology in the classroom. This study tried to naturally observe and record
what the teachers do to integrate technology in the collaborative process. Through an analysis of interaction between teachers, the study examined how the teachers gain knowledge and experience of technology use and how they support each other in the process of collaboration.

In addition to the process and procedures of interaction with the children and the teachers, this study investigated the context that influences teaching practice related to technology use such as technology environment, school support of technology use, and the cultural and collegial atmosphere of the school site. This trial was to suggest the ways that teachers can be supported for professional development integrating technology.

**Site Selection**

The strategy to select participants was that cases should fit into the purpose of the study (Patton, 2002). Potential participants should have a willingness to work with technology at first and to work with colleagues in the same classroom.

Sampling was conducted to find settings and participants who were appropriate for the study. The study used the list of the early childhood education centers to visit to evaluate whether the center was appropriate for the study. Selection criteria included needing to be equipped with a technology environment in the classroom where teachers and children worked with technologies. Teachers needed to be qualified to conduct developmentally appropriate practice to teach children. At least two teachers in the same classroom were required to observe teachers’ interaction. It was relatively difficult to find
an appropriate classroom because most of the program declared that they do not use the computers for children.

After visiting several centers and meeting teachers, five appropriate centers were chosen and finally seven teachers from three sites agreed to join to the study. The sites presented different contexts that varied in technology environment and the organization support. All had computers, the Internet, and digital cameras and teachers worked together in the same classroom.

**Participant Selection**

The participants were seven teachers from three child development centers, one private and two university-affiliated. For the purpose of confidentiality, they are identified in this study by pseudonyms only.

**Nicole and Jane at Child’s Space**

Nicole, a mentor teacher with 33 years’ experience in the early childhood setting, had worked at Child’s Space for 10 years. She was very interested in using technology with the children in her classes and had drawn numerous ideas on this subject from sources such as articles, books, workshops, and training programs. She believed technology as a tool for supporting children’s learning and activities.

Jane, a teacher with for six years’ experience, had worked at Child’s Space for one and a half years. She had taken basic computer literacy courses at school and she had also taken coursework on Photoshop at University in order to learn how to work with
photographs and use them to document the curriculum in the classroom through display. She had significant experience using technology, including computers, for educational purposes.

Nicole and Jane had plentiful experience using technology in both personal and professional settings. The Pennsylvania Department of Community and Economic Development (DCED) provided the Cyberstart program for adults and children to improve the learning environment via digital media. This program was designed to apply a new medium to professional development for child care administrators, caregivers, and parents as well as for young children. Nicole and Jane both had experience joining in the Cyberstart program as the lead teacher.

Nicole was motivated to implement a digital camera project in her classroom because the Pennsylvania Start program would fund the technology she needed for this work. The children had broken the digital camera and Nicole decided to replace it, after which she and Jane planned the digital camera project as a way of integrating technology into their curriculum. After the digital camera had been purchased, the children used the broken camera as a toy in the dramatic play area. The children liked pretending they were taking pictures with the broken camera, which supported the teachers’ idea of implementing the digital camera project.

**Diane, Sophie, and Amy at Happy Kids**

A mentor teacher with 25 years of teaching experience, Diane had a background as a high school. In fact, she had transferred from the high school to the day care center where she had taught for 5 years. Although her role was formally that of a mentor and
supervisor in the classroom, she did not regard herself as such. She emphasized that she and her co-teachers worked as a team.

Sophie, who had taught for two years at an elementary school in Maryland, had worked at Happy Kids for only one year. A competent user of technology, she had received training on the use of technology for teaching at the elementary level. Sophie’s was principally responsible for the classroom technology, such that it fell to her to find sources through the Internet, to download them onto the computer, and to set up a folder or direct links for websites so that the children could use them.

Amy had majored in early childhood education and had been teaching for three years at the K-level. She was enrolled for a master’s degree program and had worked on some coursework about technology, which included creating a personal webpage. However, she said she had never been particularly interested in technology except for using the Internet to collect resources. However, even so, she still tended to use books.

Cindy and Paul at Children’s Corner

Cindy had majored in early childhood education and had 20 years of teaching experience at the K-level. She had worked at Happy Kids for five years. Her perspective on teaching and learning was child-centered. Cindy had experience with Cyber Start, a program that provides support for technology use by adults and educators in the Pennsylvania state district. She was very interested in using technology in her teaching and attempted to integrate software into the curriculum even though the technology environment was not well-equipped.
Paul did not have a background in early childhood education. He had graduated from high school and nor did he have a teaching certification at the K-level. He had one and a half years’ teaching experience at the K-level. He was very knowledgeable in using the technology and had responsibility for the technology in the classroom. He set up the computer area, changed the software, and interacted with children in the classroom.

The only technology available to Cindy and Paul in the classroom was software. Therefore, they made a concerted effort to integrate software into the curriculum. In addition, they took turns interacting with the children who were working on the computer.

Table 1 presents the demographic background of each of the teachers who participated in the study. The centers at which the teachers worked consisted of two university affiliates and one private concern. In terms of teaching experience, the range was from one and a half years to 36 years, and the teachers ranged in age from 22 to 54. Of the seven teachers, Paul was the only male; all the others were female.

Table 1. Participants Demographics

<table>
<thead>
<tr>
<th>Classroom</th>
<th>Type of center</th>
<th>Participants</th>
<th>Age</th>
<th>Gender</th>
<th>Years of teaching experience</th>
<th>Years of teaching in current center</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child’s Space</td>
<td>University affiliated</td>
<td>Nicole</td>
<td>54</td>
<td>Female</td>
<td>33</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Jane</td>
<td>34</td>
<td>Female</td>
<td>6</td>
<td>1.5</td>
</tr>
<tr>
<td>Happy Kids</td>
<td>University affiliated</td>
<td>Diane</td>
<td>47</td>
<td>Female</td>
<td>25</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sophie</td>
<td>25</td>
<td>Female</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Amy</td>
<td>27</td>
<td>Female</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Children’s Corner</td>
<td>Private</td>
<td>Cindy</td>
<td>41</td>
<td>Female</td>
<td>20</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Paul</td>
<td>22</td>
<td>Male</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>
Research Setting

Three sites were selected for the purpose of the study, two university affiliates and one a private center. The centers are referred to by pseudonyms to protect the confidentiality of the participants and to preserve the anonymity of the center.

Site A: Child’s Space

Child’s Space is a university laboratory demonstration school that espouses an emergent curriculum, and is known for documenting its actual processes over time. Nicole and Jane collected data from their classroom practice in order to assess the children’s strengths and weakness, interests and needs. The data generated by the teachers were organized in order to meet the criteria for NAEYC accreditation. While implementing the process of NAEYC accreditation, Child’s Space teachers realized that they needed evidence to inform their classroom instruction and curriculum development. At the time of this study (2007), the children at Child’s Space were aged between three and four years old and the children–teacher ratio was 5:1. In addition, in the Child’s Space classroom, the teachers and children received assistance from classroom aides who were interns, work-study students receiving credit for coursework, and volunteers.

The classroom at Child’s Space included a computer area equipped with two digital cameras and a computer as well as a printer for the children. Two chairs were placed at the computer, one for the child using the computer and one for another child or a teacher to observe. The teachers also used a TV to show DVDs to the entire class and they played audiocassettes likewise.
The teachers downloaded computer programs from the Internet so that the children could use them by simply clicking on an icon on the computer screen. The teachers did this so that they would be able to control the children would be able to access the Internet themselves. In addition, the teachers made a practice of helping the children use the Internet in the classroom.

During the first week of observation (November 2007), the teachers used digital cameras with the children for photographic activities. The teachers allowed the children to take pictures by using the digital camera to capture the children’s work and play in the classroom. Also, the children used a broken camera in their activities in the dramatic play area. In this way, the children had an opportunity to reflect on their photographic work. Two illustrations follow.

**Birthday party.** Jane used the digital camera to take photographs of all the children. And, the teachers and children posted these photographs online to celebrate the birthday of a friend of the children’s. At first, the teachers showed photographs of the children whose birthdays were in October and they showed photographs of the other children in a row in order to celebrate the friend’s birthday (Field notes, 10/30).

**Making a storybook.** The children wanted to copy pictures from books. So, the teachers suggested scanning the pictures in the books. Then, children cut the pictures and decorated it. (Field notes, 11/30)

**Daily Schedule**

The daily classroom schedule at Child’s Space is presented in Table 2. Observations of computer play were conducted during free play time.
Table 2. Daily Schedule at Child’s Space

<table>
<thead>
<tr>
<th>Time</th>
<th>Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:30-9:00 am</td>
<td>Opening &amp; arrival free choice activities</td>
</tr>
<tr>
<td>9:00-9:30 am</td>
<td>Breakfast</td>
</tr>
<tr>
<td>9:30-10:35 am</td>
<td>Free choice &amp; small group instructional activities</td>
</tr>
<tr>
<td>10:35-10:45 am</td>
<td>Clean up time</td>
</tr>
<tr>
<td>10:45-11:00 am</td>
<td>Morning gathering (calendar, community announcement, discussion)</td>
</tr>
<tr>
<td>11:00-11:55 am</td>
<td>Outdoor activities</td>
</tr>
<tr>
<td>11:55 am -12:10 pm</td>
<td>Gather for transition to lunch (classroom helper choose a song)</td>
</tr>
<tr>
<td>12:10-12:45 pm</td>
<td>Lunch</td>
</tr>
<tr>
<td>12:45-1:10 pm</td>
<td>Lunch clean up, bathroom routines, story on CD</td>
</tr>
<tr>
<td>1:10-2:15 pm</td>
<td>Nap time</td>
</tr>
<tr>
<td>2:15-3:00 pm</td>
<td>Activities</td>
</tr>
<tr>
<td>3:00-3:45 pm</td>
<td>Afternoon snack</td>
</tr>
<tr>
<td>4:05-4:15 pm</td>
<td>Clean up time</td>
</tr>
<tr>
<td>4:15-4:30 pm</td>
<td>Afternoon gathering(Story or discussion)</td>
</tr>
<tr>
<td>4:30- 5:15 pm</td>
<td>Outdoor activities</td>
</tr>
<tr>
<td>5:15-6:00 pm</td>
<td>Indoor limited choice activities</td>
</tr>
</tbody>
</table>

Figure 1 presents an illustration of the classroom at Child’s Space. One computer and two chairs were set up in the computer area so that two children could use the computer together or so that a child could use the computer while another child or a teacher acted as an observer. Therefore, the teachers could guide the children as they used the computer. In addition, the children played in the computer area during free play time.
Figure 1. The Child’s Space classroom

Site B: Happy Kids

Happy Kids is a family child care center situated on a university campus. The teachers at Happy Kids conducted daily activities based on curriculum themes. The teachers had a scheduled planning period of approximately one hour every Friday. The
children at Happy Kids were aged from three to four years old and the children–teacher ratio was 4:1.

Three teachers, Diane, Sophie, and Amy, worked together in the same classroom. Each teacher had responsibility for a specific area of the curriculum: literacy, math and science, and art. Their roles in these three areas rotated on a weekly basis. Each teacher took charge of an interest area, and each interacted with the children during free play time. During the first week of observation, Diane was responsible for art, Sophie for math, and Amy for literacy. They planned the curriculum based on a theme unit and provided various activities aligned with theme every week. They also provided computer activities in line with the other activities in the interest areas. Further, one of the teachers would usually take photographs with a digital camera for the daily reflection.

The teachers spent considerable time creating the daily reflection by using technologies to provide information to the parents. For this purpose, one of the teachers always carried a digital camera and took pictures of the teachers and children in the classroom every day. The teachers would email the daily reflection to the parents in order to show them what their children had been doing.

Compared to the other sites, Happy Kids was equipped with an abundant technology environment for both the children and the teachers including computers, digital cameras, and Internet access.

**Daily Schedule**

The daily schedule at Happy Kids is presented in Table 3. Observations of computer play were conducted during free play time.
Table 3. Daily Schedule at Happy Kids

<table>
<thead>
<tr>
<th>Time</th>
<th>Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:30-8:45 am</td>
<td>Arrival/ Free play</td>
</tr>
<tr>
<td>8:45-9:00 am</td>
<td>Morning Greeting(transition to breakfast)</td>
</tr>
<tr>
<td>9:00-9:40 am</td>
<td>Breakfast/ Bathroom/ Hand washing</td>
</tr>
<tr>
<td>9:40-9:50 am</td>
<td>Journal time(transition)</td>
</tr>
<tr>
<td>09:50-10:00 am</td>
<td>Calendar</td>
</tr>
<tr>
<td>10:00-11:00 am</td>
<td>Center time</td>
</tr>
<tr>
<td>11:00-11:05 am</td>
<td>Transition to outdoor/Indoor gross motor</td>
</tr>
<tr>
<td>11:05 am- 12:10 pm</td>
<td>Outdoor/Indoor gross motor</td>
</tr>
<tr>
<td>12:10-12:50 m</td>
<td>Lunch/ Bathroom / Teeth</td>
</tr>
<tr>
<td>12:50-1:00 pm</td>
<td>Story(transition to nap)</td>
</tr>
<tr>
<td>1:00-3:00 pm</td>
<td>Nap time</td>
</tr>
<tr>
<td>3:00-3:35 pm</td>
<td>Bathroom/ Hand washing/ Center</td>
</tr>
<tr>
<td>3:35-3:40 pm</td>
<td>Transition to snack</td>
</tr>
<tr>
<td>3:40-4:10 pm</td>
<td>Snack time/ Bathroom/ Hand washing</td>
</tr>
<tr>
<td>4:10-4:15 pm</td>
<td>Transition to outdoor/Indoor/Center</td>
</tr>
<tr>
<td>4:15-5:45 pm</td>
<td>Outdoor/ Indoor/ Center time and departure</td>
</tr>
</tbody>
</table>

Figure 2 presents an illustration of the Happy Kids classroom. Two computers each with a single chair were set up in the computer area. Additionally, the teachers downloaded computer programs and pictures to one of these computers where a teacher’s folder had been set up, and the children played in the computer area during free play time.
Figure 2. The Happy Kids Classroom

**Site C: Children’s Corner**

Children’s Corner is a learning corporation that operates according to curricular principles set by the central coalition. The computer programs in use at Children’s Corner were provided by the Cyberstart program. And, in accordance with the requirements of this program, the teachers could not add new programs that they want to provide for
children’s play. The children at Children’s Corner were three to four years old, and the children–teacher ratio was 6:1.

Cindy and Paul had not established a regular time to talk at length about their classes, but immediately after a class they generally spent a couple of minutes discussing what had transpired. It was observed that the teachers did not have any time to discuss or reflect on their teaching practice due to their very busy daily routines. It was, therefore, difficult for the researcher to interview the teachers given these time constraints.

**Daily Schedule**

The daily classroom schedule at Child’s Space is presented in Table 4. Observations of computer play were conducted during free play time.

Table 4. Daily Schedule at Children’s Corner

<table>
<thead>
<tr>
<th>Time</th>
<th>Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:30-8:30 am</td>
<td>Arrival/ Free play</td>
</tr>
<tr>
<td>8:30-9:00 am</td>
<td>Morning greeting</td>
</tr>
<tr>
<td>9:00-9:50 am</td>
<td>Free play time</td>
</tr>
<tr>
<td>9:50-10:00 am</td>
<td>Clean up time</td>
</tr>
<tr>
<td>10:00-10:50 am</td>
<td>Center time</td>
</tr>
<tr>
<td>10:50-11:50 am</td>
<td>Outdoor play</td>
</tr>
<tr>
<td>11:50 am-12:05 pm</td>
<td>Transition to lunch</td>
</tr>
<tr>
<td>12:05- 12:40 pm</td>
<td>Lunch</td>
</tr>
<tr>
<td>12:40-12:50 pm</td>
<td>Transition to nap</td>
</tr>
<tr>
<td>12:50-2:30 pm</td>
<td>Nap Time</td>
</tr>
<tr>
<td>2:30-3:00 pm</td>
<td>Free play time</td>
</tr>
<tr>
<td>3:00-3:15 pm</td>
<td>Snack time</td>
</tr>
<tr>
<td>3:15-4:15 pm</td>
<td>Activities</td>
</tr>
<tr>
<td>4:15-4:25 pm</td>
<td>Transition to Outdoor/ Indoor/Centers</td>
</tr>
<tr>
<td>4:35-5:20 pm</td>
<td>Outdoor/ Indoor/ Centers</td>
</tr>
</tbody>
</table>
Figure 3 presents an illustration of the classroom of Children’s Corner. One computer and two chairs were set up in the computer area so that two children could work there together. The teachers guided the children who were playing on the computer and used educational software to teach concepts related to the curriculum themes. In addition, the children played in the computer area during free play time.

Figure 3. The Children’s Corner Classroom
Table 5 lists technology resources used in the classroom by each site. The teachers mainly used digital cameras, the Internet, email, and software. However, they also used old technology such as audio and video in the classroom. The technology was available for the teachers and/or the children to use, depending on the technology.

<table>
<thead>
<tr>
<th>Type</th>
<th>Site User</th>
<th>Child’s Space</th>
<th>Happy Kids</th>
<th>Children’s Corner</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital Camera</td>
<td>Teacher</td>
<td>O</td>
<td>O</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Children</td>
<td>O</td>
<td>O</td>
<td>X</td>
</tr>
<tr>
<td>Internet</td>
<td>Teacher</td>
<td>O</td>
<td>O</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Children</td>
<td>O</td>
<td>O</td>
<td>X</td>
</tr>
<tr>
<td>Email</td>
<td>Teacher</td>
<td>O</td>
<td>O</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Children</td>
<td>O</td>
<td>O</td>
<td>X</td>
</tr>
<tr>
<td>Software</td>
<td>Teacher</td>
<td>O</td>
<td>X</td>
<td>O</td>
</tr>
<tr>
<td></td>
<td>Children</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
</tbody>
</table>

Data Generalization

The data collected in the study included interviews, observations, questionnaire, field notes, and documents and artifacts. In order to identify what extent teachers are using technology within the overall curriculum and daily program, interview was conducted at first of the methods of data. Participants’ classroom was observed to investigate in what ways the teachers integrate technology in the classroom and how they interacted with children and other teachers while worked with technologies.
Semi-structured questionnaire distributed to participants to identify the conceptual level of their teaching practice, their growth, and any changes regarding technology integration that may be evident following interaction with the counterpart teachers. The dialogue that the teachers share ideas about technology use during planning time was also recorded with audiotapes by the researcher.

The data collection was conducted from November 2007 to February 2008.

**In-depth interviews**

Researcher interviewed seven participants individually for one in every month. Interview questions are in Appendix A. Interview questions focused on the teachers’ understanding of the role of technology in their teaching and learning in the classroom and what the teachers expect to learn about technology integration from their colleagues in the process of collaboration. Interview questions also included questions on the learning or any challenges related technology integration. Interview questions included questions on any obstacles or any supports provided from the organization where the participants worked.

Interviews were audiotaped and the researcher took notes during interviews. Interview was conducted for one hour per each teacher in free play time or nap time, which was conducted in the teachers’ room, teachers’ lounge or the other classrooms of the sites while the teachers were alternatively taking care of children. For the accuracy of what the teachers tried to say about their teaching practice, interviews were transcribed by the native speaker because English is a second language to the researcher. While interviews were transcribed, the researcher played the audiotapes repeatedly and took a
field notes to understand the exact meaning of the teachers’ experience in using technology.

Observations

During the course of research, I visited the classrooms of participants one or two time in every month to observe their teaching practice. The observation was conducted for one and a half hours during free play time or one session of a lesson such as circle time or storytelling.

The classroom that the teachers were playing with children using computer technology was observed. The purpose of observation was to describe settings and activities using technology that the teachers provide to children. Participants were observed during they worked with children in the classroom to diagnose how the teachers use technology in their teaching practice, including the extent of understanding exhibited by each teacher of the role of technology as evidenced by the ways they use technology with the children.

Observation also focused on identifying any changes perceived in the teachers’ learning related to technology integration through interaction with co-teachers in the same classroom. Based on observation, teaching practice regarding technology integration can be evaluated to identify the potential contribution of teachers’ role in terms of children’s play and learning.

Participants’ teaching practice in using technology with children was observed, which is embedded in real and natural classroom surroundings. According to Patton (2002) that observation should last long enough to get answers for study, I ended up
observing the classroom of participants when teaching practices are repeated in the same pattern and could not find any further answers from the practices.

**Questionnaire**

To identify teachers’ understanding of the role of technology and any learning from colleagues in the collaborative process, semi-structured questionnaire distributed to all participants at the beginning the research. The questionnaire provided to both new teachers and experienced teachers focused on the role of technology and teachers in the classroom. The questions focused on what they learned and how they supported each other. They were also asked what they expect to learn about teaching related to technology integration from their colleagues. The teachers were asked about any changes they experienced and barriers the encountered in integrating technology in the classroom. Sample of questionnaire was included in Appendix C.

**Documents and artifacts review**

Documents and artifacts such as email communications, lesson plans, curriculum log, minutes of meetings and planning notes were included for analysis.

The dialogue among the teachers in the planning time was recorded in audiotape, and the dialogue that the teachers were sharing while they were reflecting on by watching the videotapes the researcher recorded was also recorded by the teachers.
Field notes

In addition to interview protocol and observation, field notes were included for analysis. Field notes were taken from what the researcher see, hear, and think during conducting interview and observation. Filed notes also included the ideas taken from what I reviewed the documents and artifacts.

Table 6 presents the data processing methods those were used in the study.

Table 6. Data Processing Methods

<table>
<thead>
<tr>
<th>Methods</th>
<th>Participants</th>
<th>November</th>
<th>December</th>
<th>January</th>
<th>February</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interviews</td>
<td>Nicole and Jane</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Diane</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cindy and Paul</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>Nicole and Jane</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Diane</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cindy and Paul</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Questionnaire</td>
<td>Nicole and Jane</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Diane</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cindy and Paul</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Field Notes</td>
<td>Nicole and Jane</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Diane</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cindy and Paul</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Data Processing

To analyze the experience of technology use embedded in the classroom, analysis was conducted based on the specific aspects of the needs, knowledge and concerns of practicing teachers who have different backgrounds and different knowledge bases regarding technology use in their teaching experience. To find the themes through the analysis of data, within-case analysis for each case was conducted. For the analysis of themes across the cases of teachers (Creswell, 2007), cross-case analysis was implemented to compare the meaning of particular experiences of each practicing teachers in technology use.

Creswell (2007) suggested that an analysis be conducted of the context that cases present to gain a more detailed description. Therefore, once themes begin to emerge through the analysis in each case of practicing teachers, the context of their teaching experience including school support they currently receive, atmosphere in which they work (collaborative or otherwise), and a school environment equipped with technology materials was analyzed to get a picture of the supportive environments or barriers to professional development that are encountered by student teachers.

Constant comparative method was used for analysis. The data for analysis included interviews, observations, and questionnaire of each teachers, and field notes that recorded what the researcher observed in the classroom. In addition, documents and artifacts such as curriculum log and the transcript of videotapes and audiotapes of interviews and observations, email communications were included for analysis.
The data were sorted and coded to find pattern of teaching practice and collaboration for technology integration and extracted themes from the data to interpret what is evident or emerging from the data. For the task of categorizing data to extract themes, the data was inspected by the unit and concerted to emerging themes.

The units of data were congregated as indicated in semi-structured interview and questionnaire; 1) technology-supported practice in the classroom 2) the teachers’ experience in collaboration for technology integration 3) technology environment.

**Methods of Verification**

**Triangulation**

According to Patton (1996), triangulation allows the researcher to compare and cross-checks consistency of information derived at different times and by different means. Triangulations consisted of cross-referencing from different data, interviews, observations, documents and journals.

At first, the transcripts of interviews were examined to find emerging themes related to technology integration in the classroom. Field notes of observation were compared to the responses of questionnaire and interviews in order to evidence teaching practice for technology integration. Triangulation was conducted repeatedly by revisiting data collected to measure the validity of data and interpretation.

**Member checks**

Member check was used for the validity of study. Stakes (1995) recommends that the researcher ask to participants to examine documents in which actions and words of
the participants are featured. To check the accuracy of findings, documents and artifacts including interview transcripts and field notes were taken back to each participant so that any mistakes or misunderstandings can be corrected by themselves. All types of writings emailed to participants to identify if it is accurately reflected as their own words and experiences. Further information was added while email was in back and forth between participants and researcher. If further information is needed, I visited the sites again and interviewed participants to detail the findings.
Chapter 4

CASE ONE: NICOLE AND JANE

Collaborative Practice for Technology Integration

Nicole and Jane worked together to explore how to integrate technology into both a curriculum and children’s play. Their collaborative inquiry into how best to integrate technology into these spheres focused on curriculum development, technological resources, children’s learning processes, and the communication between parents and children. More specifically, in regard to the nature of their collaborative inquiry, Nicola and Jane considered technology integration through a process of collaborative reflection.

Integrating children’s learning and play

Nicole and Jane attempted to incorporate technology activities into various areas of the curriculum and they made efforts to use technology in purposeful ways in support of children’s learning and development. Nicole and Jane were also interested in various digital tools that could be adapted to the goals of the curriculum and/or children’s learning and play.

In one digital camera project, Nicole and Jane considered ways in which digital cameras could be used meaningfully to both support children’s play and advance the curriculum. In order to integrate digital cameras into the curriculum, the teachers planned
to document the children’s play by using the digital cameras to take photographs and to extend this documentation into a literacy activity. The teachers downloaded the children’s photographs and used word-processing software to capture what the children said. The teachers also printed out the children’s work for the gallery exhibition.

Maybe, we could drag and drop it [the photograph] into a Word program, and they [the children] could tell me about the photo and I could write it [down], or use the photo to tell a story. (Interview-Nicole, 12/13)

In addition to the digital camera activity with the theme of friends, the teachers displayed the children’s photographs and asked them about what it meant to have and to be a friend—a concept that was subsequently extended into the literacy activity whereby the teachers wrote down what the children said.

After displaying pictures of children who were playing with friends and play materials, Nicole asked the children about what they saw in the pictures on the wall. And, she took notes on what the children said about the pictures. Then, she wrote down what the children said by using the computer and displayed it again under the pictures. (Field note, 01/12)

Nicole and Jane planned to incorporate the contents of software into the children’s play. The teachers used software that included programs for games and drawings in planning the children’s play. For example, Nicole used a building program in Millie’s Math house with the goal of having the children connect the computer program with their block play. More specifically, the goal of both teachers was that each child would use the program to create a building plan in the following way:
We want to use the computer to have the children make a design on the computer with the squares and rectangles and triangles and print it and use it as a blueprint to build an actual structure with blocks in the block area. (Interview-Jane, 12/19)

Children’s views as a resource for constructing the curriculum

Nicole and Jane’s primary concern was that of integrating technology into their teaching practice in light of the children’s learning and development. The teachers were committed to learning about the ways in which technology could be used to facilitate children’s efforts to reflect on their classroom activities. Through shared notions pertaining to incorporating technology in appropriate ways for children, the teachers focused on integrating technology into the children’s play and learning.

As Nicole and Jane shared ideas about how to adapt the digital camera activity they had developed for children’s play, they decided to display the photographs the children had taken outside the classroom in a gallery format for other children, other school personnel, and visitors to see. During the initial stage of displaying the photographs the children had taken, the teachers chose pictures and displayed them according to an arrangement of their own choosing, i.e., without discussing with the children in any way.

However, the teachers suggested that the children choose their favorite pictures among the photographs they had taken. And, as the children made their choices, Nicole saw distinct differences between how the teachers and the children viewed the photographs:
It took some time with the children to look through the pictures. And, we said, “You choose a picture, and we’ll put it out there for people to see and to talk about.” We talked about why they chose the pictures, and so we found that the teachers chose different pictures, so the teachers did a display of their choices. (Interview-Nicole, 12/19)

After learning that the children had a different perspective in regard to the photographs, Nicole and Jane decided to have the children choose the photographs that would be displayed. The teachers began to see the children themselves as an important resource for the curriculum planning and so the teachers decided to more fully involve the children in the process of planning activities with technology:

Um, I printed up the picture that somebody took of Carol. I particularly like that picture because it’s such a child’s-eye view. I got the idea that, okay, we’ve got a bunch of people with a bunch of photos and let’s help each one who has a file to choose their favorite photo at this point and print it up and do a photo exhibit. (Interview-Nicole, 11/23)

In the process whereby the teachers worked with the children to select photographs to include in the exhibition, Nicole realized that she and Jane were learning from the children while the latter were working with the technology. In fact, the teachers gained some clear ideas about how to plan a curriculum that would include technology, and they determined what they would do next in the classroom. In response to a question from the researcher about the teacher’s role in the use of technology in the classroom, Nicole noted that she saw her role as that of “exploring using the children’s own photographs to document their work and [of] learn[ing] more clearly from their [the children’s] own point of view” (Interview-Nicole, 1/17).
Having come to understand that the children’s responses to the photographs differed from their own, Nicole and Jane planned and revised the curriculum in collaboration with the children. Therefore, Nicole and Jane began to regard teaching as a learning process for teachers—a learning process, too, whereby the teachers could expect to learn from the children. For Nicole and Jane, the teaching process is simultaneously a continuous learning process founded on interacting with the children and on establishing how children experience and what they learn from the use of technology in the classroom.

*Building bridges between a curriculum and technology*

Based on their collaborative inquiry, Nicole and Jane focused on questions pertaining to planning and developing a curriculum and instructional strategies with the goal of integrating technology into their teaching practice. In Nicole’s view, the role of technology is to support a curriculum in, for example, literacy, art, and mathematics, in a way that goes beyond the idea of playing with the technology itself. She also considered technology as also useful for the purpose of documentation of children’s play.

If I were mentoring novice teachers, what I would say is just the idea that you don’t have to just use the technology to baby-sit the children. “Oh, don’t bother me, go and play....” That you can use it to support your curriculum goals in literacy, in the arts, artistic expression, and mathematical experimentation. There are a lot of different ways to use the computers besides entertainment, also documentation. It can be really useful for documentation. (Interview-Nicole, 12/19)

Nicole and Jane were interested in using technology to extend the curriculum in order to incorporate technology into various curricula areas such as literacy, art, and math.
Jane noted the effects of their efforts in this regard as affording them the opportunity of extending the curriculum in meaningful ways rather than increasing the extent to which the children used the technology:

We’ve experienced increased technology not necessarily use, because I think children use it the same amount but I think, because it’s been on Nicole and my mind, we have thought of more extensions of the curriculum of technology use and so we’ve done more. (Interview-Jane, 01/14)

In the process of planning how to integrate technology into the curriculum, the teachers discovered a way of using technology to connect literacy and art activity. In December, Nicole and Jane planned to use technology for the purpose of storytelling as an early literacy activity:

I think our goals are always to think of new ways to use it and to think of where the children are at developmentally and how technology might help to take them to the next step. I think we really fulfilled that goal in using technology to write the stories [the] children are working on [and in this way help them to develop] early literacy skills. And then using the computer to make the pictures and then writing the story to go with the pictures really helped them to begin to reach the next step. (Interview-Jane, 12/19)

Jane combined a clip art program into the literacy activity in this way. First, if the children draw pictures using the clip art program and they describe their drawings, the teachers capture these descriptions using a word-processing program.

We’ve done some storytelling with technology, and they like it. To make pictures on the computer, we have a children’s art program that lets them choose a background and choose pictures to put onto the background or effects that can happen. (Interview-Jane, 01/14)
Jane explained how the teachers incorporate the process of storytelling into a computer program designed for drawing for the curriculum development. The drawing activity using the computer program was extended to writing activity. Jane introduced an art program in order to create pictures to accompany the children’s stories. The children used the art program to choose pictures to serve as a background to their stories. Through this process the technology was used to extend the curriculum to include a literacy activity.

Beyond using the computer programs in the curriculum, Nicole and Jane also attempted to connect computer and non-computer activities in planning the curriculum. According to Roblyer and Edwards (2000), computer-based materials and strategies should be integrated carefully with other resources and teacher activities.

In an effort to bridge computer and non-computer experiences, they planned and implemented a curriculum wherein traditional activities were offered first followed by activities using digital tools—a structure that was reflected in the curriculum:

We did some puppet shows [through which] the children told a story. They made puppets and made a puppet show of the story, and then I would do the puppets and they would photograph them. And [then], we would make a book and write the words in that literacy activity. (Interview-Nicole, 12/19)

We want to use the computer to have the children make a design on the computer with the squares and rectangles and triangles and print it and use it as a blueprint to build an actual structure with blocks in the block area. It’s … almost like a blueprint a construction worker would use to build a house. They [the children] will use the one they made on the computer to make something with blocks. I think it will be exciting. (Interview-Jane, 12/19)
Involving children’s play

Nicole and Jane carefully observed as the children played with the computer in order to understand how and what the children were learning. They placed two chairs at one computer, one for a child and another for a teacher. And, to explore the children’s ideas in the computer play, the teachers took turns sitting near the children in the computer area and observed the children’s computer play.

Jane was sitting next to two children who are in the computer area and introduced a new computer program for them. Jane guided the children step by step on how to use the program and kept watching while they were exploring with the new computer program, and encouraged them by responding “Wow!” Jane opened the computer program for the children or often typed children’s names to save work on the computer for those who cannot type the alphabet of their name. (Field note, 12/13)

As the children played with the computer, Jane interacted with them by giving technical and pedagogical assistance as needed. For example, she demonstrated how to drag icons and save files on the computer:

A boy was playing with the computer game and he could not put the apples into the basket on the screen because he did not know how to drag the pictures. Jane demonstrated how to drag the apples icon into the basket by guiding the boy’s hand. (Field note, 11/19)

Three children were taking pictures with the digital cameras, respectively. Nicole found a girl who didn’t participate in the activity involving a digital camera and asked if she wanted to take a picture. But the girl didn’t want to take a picture. A few minutes later, Nicole talked about how to use the camera to the girl and demonstrated it by taking a picture. Nicole helped the girl to take a picture by herself and then the girl showed an interest in the use of the camera. (Field note, 12/13)
Nicole encouraged the children and asked them questions in order to facilitate their play with the digital camera. For example, she asked, “What do you want to do with that?” in order to make the children set goals for their use of the camera:

While she was taking care of the children in the reading area, Nicole saw a girl who went around the classroom just holding a camera without taking a picture and she asked [her] a question … “What would you like to take a picture of? (Field note, 12/13)

Nicole observed the children using a digital camera in the classroom, and then she guided them to use the digital camera in purposeful ways by posing questions like “What do you want to take a picture with your camera?” “Do you want to take my picture?” (Field note, 12/13)

When a child was playing with the digital camera and focusing into the air or on the floor, Nicole helped the girl by saying “Look at the window” to make her focus on objects for taking pictures. (Field note, 12/13)

Overall, Nicole worked with the children to help them use the technology intentionally. She also made consistent efforts to ensure that the children understood the goal of using the digital camera by asking a series of questions:

While children were taking pictures, Nicole involved herself in the children’s play by asking, “What are you doing?” One child said, “I’m taking a picture.” Then Nicole said, “You’re taking a picture of everyone!” (Field note, 12/13)

Nicole also mentioned that she always played with the children when they were playing with the computer. She thought of playing with the children in the computer area
as a time for the teacher to explore the computer’s software. For play time, she would explore the computer program and decide whether the program was suitable for children.

**Collaborative inquiry and reflection**

Nicole and Jane shared many ideas with each other with the goal of developing the learning process through technology so that the children in their classes would gain hands-on experience using technology in creative ways, whether oriented to play or to research and discovery activities. It is evident Nicole and Jane’s use of a digital camera to document their own teaching practice prompted them to consider the possibilities of technology integration in their educational practice and facilitated their reflections on what children could do with technology in the classroom. Therefore, for the purpose of the present study, the teachers’ photographic documentation of the children’s activities was used as data for a systematic analysis of the teachers’ teaching practice, which resulted in developing the curriculum.

**Documenting children’s learning with a digital camera**

The present inquiry into Nicole and Jane’s use of focuses on their efforts to provide the children with opportunities to experience technology in the way that is meaningful for their learning.

Because we’ve spent a lot of time, we’ve got the opportunity to talk about it more, [and] we have discovered more ways to use it. And, by collaborating together and talking about technology, we’ve thought of more ways that we [can] use the technology to scaffold the children’s learning. (Interview-Nicole, 12/19)
As they discussed the potential of the digital camera in advancing the children’s learning, Nicole and Jane discovered a way in which the children could use the camera to document their own work. Therefore, the teachers decided to provide a digital camera for this very purpose.

I’ve kind of worked on that by taking pictures of some of their block buildings.... So, it’s kind of a first step. So I take a picture of [the] children’s building, [and] we talk about it. Then, say you take a picture of your building now, and then hopefully they will get more accustomed to using the camera to document things to show people. (Interview-Nicole, 12/19)

*Reflecting on children’s learning with a digital camera*

In the process of using a digital camera to document classroom activities, the teachers wanted children to have experiences reflecting on what they had done in the play area with blocks and Play dough:

Documenting on the wall is very helpful for children to reflect on what they did. And, they got some ideas through their work. Documenting is also helpful for teachers on what we are thinking, what we believe, and what we tried. (Interview-Jane, 11/09)

In the process of exhibiting their work in the gallery activity, the children had a chance to reflect on what they had done with the digital camera by choosing their favorite pictures and appreciating how their works appeared in the exhibition. Nicole and Jane both emphasized that this activity offered the children a chance to reflect on their achievements:
We’re helping children to record their own work in the camera and then maybe we’ll print that and have it on display. And, indirectly, I’ve kind of worked on that by taking pictures of some of their block buildings and having them tell me about them. And, I would type up what they tell me, and then we’ll make a display. (Interview-Nicole, 12/19)

Nicole and Jane’s inquiry into technology integration began from their reflections on their use of technology in their teaching practice. They engaged in teaching and learning with technology through collaborative reflection. And, as a result, they developed activities with technology for children’s play by incorporating in the curriculum.

In conclusion, by using a digital camera to document the children’s work, the teachers were able to reflect on their teaching practice with technology through a shared dialogue with each other. As a result of documenting with a digital camera, Nicole and Jane were able to reflect on what the children achieved in the classroom, and to consider ways in which to refine the activity in future iterations.

**Incorporating technological resources into teaching practice**

Incorporating digital tools into the curriculum constitutes an important concern for Nicole and Jane, who were engaged in an ongoing decision-making process in terms both of selecting appropriate tools and incorporating them effectively. In general, the teachers were interested in exploring a range of technologies, but wanted to select those that would be applicable to several curriculum areas.
In our room, we have a children’s CD player that they [the children] control. And, they use it to explore music and dance. We have a children’s computer. It is used for a variety of games chosen by teachers to support learning in various areas including problem-solving, drawing, exploring music, and various math, language, and science skills. We also have two children’s digital cameras. (Questionnaire-Nicole, 11/02)

Nicole and Jane used various technology resources such as software, digital cameras, word processors, the Internet, and a printer in their classroom, and they attempted to integrate various technologies into their pedagogical practice accordingly.

Among the numerous technologies that Nicole and Jane sought to integrate, the Internet was used as an important research tool to search for both instructional resources for the teachers and play materials for the children. The teachers searched the Internet in order to find instructional resources associated with specific curriculum themes such as dinosaur, and they planned activities such as making pattern and games using educational resources found on the Internet. The teachers and children sometimes used the Internet together in order to search for answers to the children’s questions.

We use it on occasion with the children to play games or research information that cannot be found in the classroom. Last week a child wanted to know how many panda bears are left and so we looked it up at the World Wildlife Federation online. (Interview-Jane 02/25)

Nicole and Jane also used the Internet to find technological resources to adapt to the curriculum and for the children’s play. For example, Nicole shared information with Jane about a microscope that the children could use to observe insects, which Jane subsequently bought online:
It’s almost like a handheld microscope that hooks into the television, it’s like a big magnifier, you can hold it up to things like hair and it will magnify 200 times the size, we’re hoping to be able to get this as well to be able to connect that to the TV out in the classroom so the children can use a powerful handheld microscope to look at their stuffed animals or whatever they want to look at, technology and science. (Interview-Jane, 01/17)

Nicole and Jane engaged in reflective teaching practices in their efforts to integrate technology. In their classroom, Nicole and Jane use of a computer and printer appeared to constitute a crucial foundation for the other tools they used in technology activities with the children. For example, the teachers supported the children’s efforts to reflect on their classroom work through the use of digital cameras.

By printing out photographs that the children had taken and then describing and displaying them in a bulletin of Child’s Space classroom and sent home for their parents, the teachers created opportunities for the children and their parents to reflect both on the creative work of the photographs and accompanying descriptions and on the process of creating these.

We’ve got a bunch of people with a bunch of photos, and let’s help each one who has a file to choose their favorite photo at this point and print it up and do a photo exhibit. (Interview-Nicole, 11/23)

On the other hand, the teachers very much hoped to obtain an additional computer solely for their own use in the classroom. They reasoned that a classroom with two computers would enable them to take advantage of this technology by for example conducting research or printing photographs taken by children without interrupting their
play or their work on the other computer, which, therefore, remain available to the children.

Well, we want to set it up in a new way. We want to have a computer [for the teachers] that is just for downloading pictures and is connected to a printer. And the children won’t be playing games at the same time. They can click anywhere, and they click on a print picture and it’s just printed. (Interview-Nicole 02/25)

The presence of a printer in the classroom made it possible for the teachers to both reflect on what the children had learned and to extend digital activities in a way that furthered their curriculum goals. The availability of this technology is in contrast to the other two cases in which the children’s computers were not connected to printers.

In regard to communicating outside the classroom, Nicole and Jane used email to provide information to the children’s parents. Specifically, the teachers communicated with the children’s parents by using email to share photographs taken of their children during free play time accompanied by brief daily accounts of the children’s activities that day.

In addition, the teachers created slide shows based on the photographs in order to share information about the curriculum with the parents and to involve them in the school’s celebrations of special events such as the children’s birthdays or graduation day.

Right now we are using them [digital cameras] for children to explore photography, to illustrate their stories, and to document their buildings or other work that is not permanent. … We also use it [a VCR and DVDs] to show … slide shows [created by the teachers] about the curriculum or special events.
Communication with parents

Through a shared dialogue about how to use a digital camera for children’s play, Nicole and Jane developed activities wherein a digital camera was used to document the children’s play. The photographs taken by the children for this project were displayed along with their stories about the photographs in a gallery format for others at the school to see.

Nicole and Jane extended this documentation effort from the exhibition of the children’s work into a focal point of their communication with the children’s parents. The teachers sent an email to the parents as a daily reflection and communication strategy.

The teachers extended their digital photographic documentation of the children’s work and play into an activity that also involved the children’s parents. This extension arose from Nicole’s interest in ensuring that the photographs taken by the children be used as fully possibly. For this reason, the teachers both decided on the email communications with the children’s parents and to display the photographs for the children, their parents, the center’s other teachers and administrators, and visitors to the center:

I asked them to tell us stories about their work, and so, like, I’ll write down their story and place it in the classroom or in the hallway so their parents can read it with them, or other parents, so other people can read their stories. I don’t know if I’ll get it done this week, but sometime. And, I gave them copies to take home, of their stories. So it’s a technology activity, but it’s also an early literacy activity. (Interview-Jane, 12/19)

Nicole and Jane created a board on the wall called “Curriculum at a Glance,” where they posted photographs taken by the children as well as other work the children
had completed. Nicole explained that the purpose of posting these items on the board is to inform their curriculum and to provide transparency in regard to how the teachers are approaching the curriculum and the outcomes arising from the children’s work and play in this context.

**Collaboration**

This section describes how the teachers work together in their efforts to integrate technology into their classroom practice. The questions that arise on this point have to do with establishing and exploring the constructs of collaboration that influence effective technology integration and also with interrogating the group dynamics in operation in the teachers’ respective educational contexts.

**Joint work**

Nicole and Jane worked in a collegial way in regard to developing a curriculum featuring the integration of technological tools. They engaged in an ongoing dialogue that constituted a reflective inquiry into how best to integrate technology into their teaching practice and the children’s play. The teachers presented a trajectory of joint work through this shared dialogue, which they began by setting goals and reflecting on their teaching practice by documenting their teaching practice and observing the children’s activities and development.
Establishing goals for technology activities

Nicole and Jane’s collaborative work on technology integration began with a collaborative effort to set goals. Through dialogue, they set goals for their technology use in regard to how to develop the curriculum with technology, how the children would use the technology, and how to address logistical issues associated with an environment featuring technology. Only after goal setting did the teachers begin offering technology-integrated activities in the classroom. And, given the goal setting, the teachers were subsequently able to reflect on their teaching practice as it related to those goals:

I think that the first goal was to think about how they [the children] could use these cameras to put their view of things out to people, or to tell stories, or something like that. (Interview-Nicole, 11/28)

The goal was really to have the children use the camera, learn how to download them. Now, we have some new goals, which is to see if we can help the children to use them to document other experiences or work. (Interview-Nicole, 12/19)

In regard to the children’s use of the digital camera, Nicole and Jane planned to provide an experience for the children to record their own play and work. As an example of their goal setting, the teachers shared their ideas relating to adapting digital cameras to document activities such as block play, as follows:

Jane: It can be sort of strictly a digital camera for kids to use.
Nicole: Does that make sense to you? That would be available.
Jane: I don’t see the demand being as high as it was for the cameras.
Nicole: Only problem is some people would definitely want the pink, and someone would definitely want the blue. But we want to stop it. Make that
choice less. So let’s list the things that we think we might have the children document what they want to preserve.
Jane: Block structures
Nicole: Blocks works. What else? Performance day? Could we have a photographer for performance day?
Jane: Yeah, that would be a good idea. That would add a small role.
(Vignette-planning time 12/13)

**Observing and reflecting on teaching practice**

Nicole and Jane observed the children carefully while they played with the technology. And, this observation was used in the present study as data in regard to the teachers’ reflections on the children’s activities as they arose from instructional practice:

We provide materials for technology in free play time and observe [the] children. After observing [the] children, we talk about what we’ve seen and what we’d like to do with [the] children. (Interview-Jane, 11/09)

Nicole and Jane noted that they often discuss their teaching during the class, at snack time, and during cleaning up after observing the children during free play time and small group time. The teachers set goals for the curriculum entailing technology use in the classroom. They had planned ways in which the children would use technology before the semester started.

When Nicole and Jane reflected on the process of documenting children’s play with a digital camera, they considered ways in which the children might find the technology challenging. For example, they noted they the children might delete photographs accidentally. The teachers also reflected on the fact that they had to delete most of the photographs taken by the children given the camera’s limited storage capacity:
Jane: Friday afternoon was a big photo-taking session, too. Some kids had, Sam was one for sure, who after we got back from that walk he had built an airport and he was taking pictures of his airport.

Nicole: Um, so, children are taking pictures of their own work, it might be that what we want to do is to try to keep, or even go in and clear off a few shots.

Jane: Yeah, something I helped Jeffery or Ali. I’m not one hundred percent sure he completely understood what I was doing but he wanted to take more pictures and the camera was full, and there were a lot that were complete like almost blanks or complete floor shots, you know, and I took those off so he could have a longer turn. I thought that was more important to him. I also noticed that Sam was just taking interest in the delete button and then deleting all his shots, so not really making the connection that there might be some you want to just save.

(Vignette-planning time 11/12)

The teachers could not identify which pictures were taken by whom. To solve this problem, they carefully observed what the children were doing with the digital camera in the classroom and shared ideas related to logistics. Nicole suggested the idea for downloading pictures between each child’s turn taking photographs in order to easily establish which pictures each child had taken:

Jane: I noticed [that] someone knew how to delete. And that just sort of messed up the whole thing because I had written down the numbers of the photos the previous child had taken. But when the next child went and erased all those and put theirs on top, I had no way of knowing how far back they [had] erased and whose photos belonged to who.

Nicole: So in that case, what we want to do is, we want to download in between everybody’s turn.

(Vignette-planning time 12/13)

Based on observing the children’s play, Nicole and Jane reflected on their teaching practice and developed their technology-integration plan. Observing children is a crucial method for reflective teaching (Nolan & Silva, 2004). Through a collaborative
reflection based on observing how the children used the digital camera, the teachers found ways to improve their logistical approach to technology integration.

**Documenting and reflecting on teaching practice**

Nicole and Jane have a curriculum meeting every Monday in order to discuss their progress to date and to establish next steps. During these meetings, they reflected on what they had achieved with the technology in the classroom based on their observations and assessments of the children and they considered the next steps in terms of ways to adapt their teaching practice more productively in the future. For example, Nicole noted that they tended to begin these meetings with questions such as this one: “What have you observed this week?” (Interview-Nicole, 11/09).

The teachers were interested in data collection and documentation related to curriculum planning, implementation, and assessment due to the influence of the NAEYC accreditation process, which had begun in the spring of 2007.

Nicole and Jane created a curriculum meeting log and recorded what they had discussed in terms of planning and instructional strategies for each curriculum area, whether literacy, arithmetic, math, science, art and music, or technology. The teachers reflected on how they had used the technology in the classroom based on the curriculum meeting log and documented their planning for the next stage in adapting their teaching practice.

In order to systematically collect data based on observing the children, the teachers revised the form of their curriculum meeting log:
Previously, we randomly included observations, extensions, documentation, and suggestions in the curriculum log. But we revised the contents of the curriculum log form as observations, the curriculum, extensions, and documentation.

(Interview-Nicole, 11/09)

The teachers also created a sign-up log to document the children’s digital camera activity in order to observe and assess children’s ability to use technology. Nicole and Jane discussed the children’s digital camera activity and reviewed the sign-up log, and in doing so they found that the sign-up log was not being used in the way they had expected. The teachers had planned for the children to sign the log before using a camera, but the digital cameras were handed down individually without a sign-up process and this created a problem in terms of tracking who had taken which pictures:

Nicole: Do you remember whose pictures, who was waiting to see their pictures? Jane: I think some of these we didn’t even know for sure who they belonged to. Ended up putting them in an unknown folder.
Nicole: Now, I think we talked about time, that maybe what we should do is train the children to give the camera right back, after one child has done it, because they’ve been handing them to each other. And then we don’t really know. Jane: And, it’s possible the next child signed up doesn’t get their turn.
(Vignette-planning time 12/13)

As Nicole and Jane reviewed their curriculum log and the sign-up log for technology use, they reconstructed their knowledge and experience of technology integration. Thus, by reflecting on activities with technology and examining situations in the classroom, Nicole and Jane refined and developed the ways technology mediates children’s learning and development. Next, the teachers analyzed and interpreted data
and revisited their goals for curriculum and instruction with technology. In this process, they established the next goal for integrating technology into their teaching practice.

Figure 4 shows the trajectory of their joint technology integration work whereby they initially set goals and planned curriculum and activities integrating technology and subsequently reflected on their teaching practice based on data derived from observing and documenting their teaching practice.

Figure 4. A Trajectory of the Joint Work for Technology Integration based on Collaborative Reflection
**Mutual support: Complementary roles**

In the collaborative process whereby they integrated technology into their instructional practice, Nicole and Jane supported each other by drawing on their respective abilities and knowledge, and experience. Nicole initiated ideas about how to integrate technology resources into the curriculum and children’s learning whereas Jane provided technical support to the children as they used the technology in the classroom. The teachers, therefore, took on distinct and complementary roles in their collaborative work.

I’ll support Jennifer by sharing my thoughts as we collaborate about uses of technology in our classroom. I’ll listen to and affirm her ideas. We will continually extend each other’s thinking about how to best use technology in Bridge for Learning [the classroom]. (Questionnaire-Nicole, 11/09)

**Support of technology pedagogy**

Nicole’s concern related to technology integration focused on children’s learning and play. She considered how to adapt technology in diverse ways in an effort to advance children’s play and learning, and she suggested pedagogical strategies for integrating technology into the children’s play and learning.

Nicole: They can’t really take a picture of themselves. Teachers could help take a picture of that.
Jane: Yeah. Or sometimes they build something out of Play dough or in the sensory table. Everyone [would] rather just show something that they [have] built that they feel … [is] significant.

Nicole: So any work, or like any Lego work that they want to take apart and put away. If you want to take a picture of that, what camera do you want to use for documentation?

*(Vignette-planning time 11/26)*

Nicole supported and guided her co-teacher by offering a more pedagogical perspective on adapting technology to teaching and learning in order to develop instructional strategies. Jane commented on Nicole’s expertise in connecting technology to the curriculum and children’s play and noted her suggestions such as writing stories with a word-processing program and printing a blueprint for the children’s block building.

Nicole is really good at linking things together like taking the technology and linking it to early literacy and coming up with the idea to use the computer to write a story. I think that Nicole is really good at making connections like that, or how to use the block-building program on the computer to print out and go from blocks. She’s really good at thinking of how to link things together so that learning happens in more than one area. She’s really good at that, I think. *(Interview-Jane, 12/19)*

There are a lot of things that I have to do as the lead teacher. I need to give support for reflection time to think about what we’re doing. I have to make sure that the curriculum meetings happen. How is this going? Where might we go now? I have to make sure as the supervising teacher that we make that happen in the classroom. *(Interview-Nicole, 12/19)*

**Support of technology knowledge**

Jane’s role was to take responsibility for the technical area of the computer play. She also took pictures with the digital cameras and downloaded the photographs from the
camera to the computer. If Nicole suggested an idea about the logistics of the technology, Jane committed to providing technical support so that the idea could be realized.

My co-teacher is younger than I am and has better technology skills than I do. Often she can teach me how to get the computer to do what I want it to do. (Questionnaire-Nicole, 11/09)

The help that I get from Jane is I say, “Help! Jane! I can’t make this work. How to make this happen? Can you figure this out? Sometimes, she can. Sometimes, we have to go to tech support. Why isn’t this working? She often can help me with that. She would be the first person I would go to if I can’t get tech to do what I want tech to do. And, what I do for her is I think I connect for her what we’re doing with tech to reflect on how we might be using the tech on what we want to do. (Interview-Nicole, 12/19)

In the digital camera activity, Nicole and Jane encountered problems with using the camera. They could not initially determine and which photographs had been taken by which child. Nicole asked Jane if she could overcome this problem given that it was necessary to download the photographs before the children deleted them. Nicole and Jane reflected on the logistics necessary for this tracking. And, they determined a solution: download the photographs after each child’s turn with the camera into files set up for each child’s work. Nicole suggested that Jane download the photographs at nap time so that the children’s play would not be interrupted.

Nicole: Do we have a note of whose pictures those are, so I know where to put them?
Jane: I will have to check the log. I wrote it down, like what numbers the pictures were.
Nicole: So that naptime thing is a time to get logged on as staff and to download this
(Vignette-planning 11/12)
Nicole suggested creating a sign-up log in order to track the photographs, and Jane created one for the children’s computer play and checked whether all the children had participated in the photographic activity by taking a turn.

In addition, Nicole and Jane were interested in finding technology resources beyond computers and digital cameras to apply to the curriculum planning and children’s learning. Nicole gave information to Jane about a handheld microscope and Jane searched the Internet in order to acquire it for the children’s science activities:

Something else we looked for, over here, this is something Nicole found, and then I found on Amazon.com. It’s almost like a handheld microscope that hooks into the television, it’s like a big magnifier, you can hold it up to things like hair and it will magnify 200 times the size. We’re hoping to be able to get this as well to be able to connect that to the TV out in the classroom so the children can use a powerful handheld microscope to look at their stuffed animals or whatever they want to look at, technology and science. (Interview-Jane, 01/17)

**Shared responsibility**

The teachers alternated in regard to taking care of the children who were playing on the computer by introducing and demonstrating how to use computer programs and/or helping with the children’s play in the computer area.

Even though Jane, a beginning teacher, was in large part responsible for addressing technology matters in the computer area, both teachers monitored and interacted with children in the computer area by taking turns. Whenever the children were playing with the computer and/or the digital camera, Nina and Jane monitored and observed the children playing with digital tools. And then, they alternatively interacted
with children. They shared responsibility in interacting with children by taking their turn. While Nina was interacting with the children playing with digital cameras, Jane interacted with the children playing with the computer.

The teachers also took turns acting as a floater by taking photographs with a digital camera and Emailing daily reflections to the children’s parents. The teachers documented their daily teaching practice by taking pictures of the children in the classroom. To this end, Nicole and Jane took turns photographing the children with the digital camera, and Jane downloaded the photographs and added some explanations with a word-processor during her office hours. She also emailed the parents to inform them about what their children had worked on that day:

The teachers took pictures while the children were playing in free play time. The classroom teachers including the student teachers took pictures of the children alternately while the children played in the classroom. After free play time, Jane showed me [the researcher] the daily reflection for the parents. (Field note, 12/13)

The Context of Technology Environment

The technology environment in the classroom comprised one computer with a printer and two digital cameras. The classroom also equipped a CD player and TV monitor with a VCR with a DVD-playing function. Internet was also available in the classroom for the use of both the teachers and the children. During the initial stage of using technology, the teachers were interested in integrating technology in ways that would be meaningful for the children’s play and learning. And, although they did stay
true to this purpose over time, they also discovered that many of their ideas required a more technology-rich environment.

The teachers planned a lot of activities using various technologies for their curriculum and had many experiences using the technology to extend the children’s learning through such projects and events as digital camera project, video day, and performance day:

We use it [the VCR] to show movies connected to the curriculum for a half an hour per week. We also use it to show the teacher-made slide shows about curriculum or special events including shows about individual children for their birthday and last day celebrations. (Questionnaire-Nicole, 11/16)

Technology resources

A limited technology environment could be an obstacle in using digital tools in the classroom. Nicole and Jane had two cameras, one of which they used to take photographs of the children for the purpose of documentation. However, the teachers could not take photographs when the children were using both cameras. Nor could the teachers download photographs from the cameras when the children were using the computer. It was, likewise, difficult for the teachers to work with the computer while the children were playing on it. Nicole and Jane, therefore, felt that an additional computer—one set aside for the teachers to use—was necessary if they were to work effectively:

Well, we want to set it up in a new way. We want to have a computer that is just for downloading pictures and is connected to a printer. And, the children won’t be playing games at the same time. They can click anywhere, and they click on print picture. And, it’s just print whatever, and then you have to clear those out before
you can print a photograph. It’s hard. They are always fighting when on the computer. (Interview-Nicole, 02/25)

One computer and two digital cameras were not sufficient for Nicole and Jane to plan and conduct activities using technology with the children. The teachers needed another computer to complete for such work as downloading the photographs taken by the children without interrupting the children’s play. Nicole and Jane discussed this logistical problem and they planned to buy a computer for teacher use in the near future with a grant they had received from the state:

We have ideas that we just need more technology and equipment. So we are planning to have two computers in the classroom, one that is just for use with the teacher. So when the teacher wants to use it for some project with someone, they don’t have to kick the children off of their game they’re working on. (Interview-Nicole, 12/19)

We have a plan to change them. We have grant money from the state. We do have plans to buy. It’s not a lot of money, but at least maybe one computer. And, maybe, we’re hoping we can buy one computer for in here. And, maybe, the people from ITS [a technology support unit at the university] can fix this one, fix the disk drive. And, then, we can move this one out of the classroom for the children to use. And, we’re hoping to get a second computer, maybe, from somewhere, to put in the classroom. We’d like to have those two in the classroom. (Interview-Jane, 01/17)

It wouldn’t print. It went right to fax. I think we don’t have the printer set up on the children’s login. (Interview-Jane, 11/14)

In addition to the limited computer and digital camera resources, the relatively old operating systems of the computers available also caused problems. It took a long time to open games and to download photographs. And, sometimes, the Windows program
would shut down. Further, it was difficult for the teachers to get technical support from the school and expensive and inefficient to have the computers serviced elsewhere:

Our computers are not doing too well. We need updates, service performed on that one. It’s kind of hard to get the service people here to fix them. So I know that the children have been having trouble playing their games, getting photos, and so forth with that computer in the classroom. (Interview-Jane, 01/17)

The limited capacity and unreliability of the computers also meant that the teachers were obliged to spend time struggling with the computer instead of advancing to the next step in their planning process.

**Personnel resources**

Nicole and Jane were both committed to their weekly planning sessions. They usually had their curriculum meetings in the classroom while the children watched a video with the student teachers during group time. Nicole and Jane were able to spend extra time on such activities as planning and documenting the curriculum because of the assistance afforded by the student teachers. This benefit is the result of collaboration between the university and the organization to which Nicole and Jane belong. Without extra resources of this nature, the teachers would not have had sufficient time to plan and conduct activities using technology:

It helps to have the extra person, extra staff in the room so we can sit at the computer and put our attention on the computer and take our attention away from the children. And, if you don’t have enough people in the classroom, you don’t
feel good about taking your attention away from the children. (Interview-Jane, 12/19)

We’ll have three teachers usually, and we’ll have an intern as a fourth person. And, we usually have two work-study students in the classroom. I’d say we average two at a time. Sometimes, there are more. Sometimes, only one. Sometimes, none. You know, depending on the day. But we have a lot of help, and next semester we’ll have even more help with an intern. (Interview-Jane, 12/19)

Nicole and Jane mentioned that they need extra help when their children are playing with the computer. They, therefore, expected to use more personal resources in order to have enough time to engage in the research and planning activities necessary to their work:

The challenge is finding a child who wants to do that when we have time to help them, because often it doesn’t coincide. Like a child might be on the computer who would want to use the block program to do that when we’re not available…. Or, when we’re available to help, they want to play in another game. Beginning in the new semester, we’ll have an intern. And, we did not have an intern this semester. And, an intern is a big help in terms of hours a week of another person. We’ll be able to do more things like that, even if we have to set. (Interview-Jane, 12/19)

Time

The organization for which Nicole and Jane work provides time for them to have office hours every week, and both take the time to do this. As technology-related work is very time-consuming, the provision of office hours away from school contributes to the teachers’ efforts to improve their teaching practice with technology in the classroom:
This is the most office time that I have to get for documenting. It’s a big reason. Sometimes, [at] my last day care center, I got about an hour a week. Here, we get about 5 hours a week. It’s really what allows us to do as much documentation, so much assessment, that office time is what allows us to do those things. Because, really, in the classroom, it’s hard to work on a portfolio, or to work on assessment, or anything, because you feel your time is better spent engaging and interacting with the children. When you try to do something else, you are not really there for them. And, it’s not a really good use of your time to be in the room and trying to do those things. So if we need to do those things, we need the time to do them. (Interview-Jane, 1/17)

During most of the time spent in office hours, Jane would search the Internet to find good resources for digital tools, books, and sites for children. Nicole and Jane also downloaded photographs taken by both the children and the teachers and printed out the children’s work decorated with an art program. In addition, the teachers made slide shows using photographs of the children’s activities in the classroom and presented the show on special days like the children’s birthdays or graduation day.

Lack of time is another obstacle preventing teachers from reflectively applying technology in appropriate ways for children’s play. Due to time limitations, Nicole’s and Jane’s reflections on teaching or co-planning occurred in transient times such as cleaning-up time or lunch time. Their reflective dialogue also took place rather randomly after class and during class, and at snack time and nap time:

We discuss about our lesson and teaching practice in free time such as … cleaning-up time or lunch time. And, sometimes, it takes just one or two minutes. (Interview-Nicole, 11/09)

Haugland and Wright (1997) suggested that teachers have a right to use technology by, for example, exploring computer programs, and that they should be
afforded sufficient time to explore these programs. However, it is difficult for teachers to make time to explore new programs or games on the computer in the midst of daily routines. Nicole emphasized the importance of adequately exploring games and programs before sharing them with children both to ensure the suitability of the games and to become proficient with them:

Because it takes a long time to figure out what is on all of these new games and until you know that you can’t really offer it intelligently to the next child. You want to be able to say, “Oh have you tried this game? This connects to what you just did here or what you’re learning about.” But you have to learn the games. A lot of them are new to us. (Interview-Nicole, 12/19)

Nicole mentioned that she has to know all the programs on the computer in order to guide the children. However, given a lack of time, she found that she could not fully explore all the programs. She would, therefore, explore the programs as the children played with them in order to become familiar with each program’s menu:

We also got some new games on the computer, and we’re helping the children to explore them. And, at the same time that the children explore them, we try to be there so we know what the new games are. (Interview-Nicole, 12/19)
Chapter 5

CASE TWO: DIANE, SOPHIE, AND AMY

Collaborative Practice for Technology Integration

Three teachers, Diane, Sophie, and Amy work together in the same classroom, and each is responsible for a specific subject area, either literacy, math and science or art. Their curriculum is traditional in that it is based on theme unit. In November, 2007 when the research for the present study was conducted, the teachers were working on dinosaurs and recycling in November, animals in December, the human body in January, and doctors and the human body in February as the theme units in the curriculum.

Incorporating technologies into children’s play

The teachers at the Happy Kids tried to adapt various technologies for the children’s play. These resources included digital cameras and email programs. The teachers bought digital cameras for the children in August with the goal of having the children take photographs by themselves. For the photography activities, which began in November, the children took photographs during free play time of whatever interested them.

In December, the teachers’ goal for technology use focused on a project whereby the children would send emails to their parents. The teachers’ next goal was to email the
parents so that they could share information with them about what their children were doing in the classroom. After the teachers had decided to use for this project, Sophie set up parents email address into children’s computer. The teachers alternatively helped the children to email their parents by writing down what the children wanted to relate including information about what they had done that day. In early November, the teachers set the goal of using technology to send email including both text about what the children want to tell their parents and some of the photographs taken by each child:

Our next goal is to let the kids email to their parents. They can’t type but they can tell us what they want to say, and we can send it to their parents. We already have their email addresses and everything, so we would just need one person in the classroom. (Interview-Diane, 11/16)

At the beginning of December, Sophie made a folder for each child’s emailing activities and photographs. She also set up the parents’ email addresses into the Eudora email program at the end of the month:

I made something special in school today if they wanted to take a picture of it and email it to their parents right there in the classroom. I mean the teacher would type up whatever they wanted to say, and we could email. That’s another goal to get into a swing of things where if a child says, “I want to email this to my mommy, or daddy,” whatever, we’ll have their email addresses. And, we can just take a picture of them. Say it’s a picture of their painting, and then we can send it to them saying this is what I painted today. And, it might help us keep in touch with the parents, a little bit more. I think the parents might like that. That’s the next step that I would like to see happen. (Interview-Diane, 12/03)

The teachers used the Internet as the primary resource for play materials such as games and songs. They browsed the Internet to find children’s play materials such as
nutcracker or dinosaur games on the basis of the curriculum theme. The teachers used the Internet to find children’s play materials by connecting TV cartoons such as Dora or games linked with a shortcut icon so that the children would easily be able to access them with just a click. Before providing access to the TV cartoons and games from the children’s computer, Sophie would select an appropriate computer program for the children’s play:

I mean, I think that the websites are very good, and the digital cameras. It’s getting kids used to using technology. And, with today, you need that. You definitely need to have some experience with technology, even at a young age. I think you need to be exposed to it in some way, and I think the websites are a great way for these kids to learn how to do that … even … in preschool. (Interview-Sophie, 12/03)

**Building bridges between curriculum and technology**

Diane, Sophie, and Amy planned daily activities together based on the curriculum themes, and in this process they used the Internet to find resources to use as a basis for instructional materials aligned with given curricula themes:

We have a lot of information that we have found on the Internet. You know, activities for Hanukkah, like all of this stuff we got from the Internet… Here’s that Hanukkah folder. We made different … individual folders for different holidays, and it has some different recipes that we found online. We’ll make gingerbread. These are a whole bunch of songs and games that we can use with kids, Hanukkah songs, and these are a few like clipart. Most of these were found on like the mailbox website. We use that a lot. (Interview-Amy, 12/03)

I mean I use a lot of technology in terms of I’ll research ideas on the Internet. I’ll use like ABC Teach, so I can print off things and use them in the classroom. So I do use it that way…. Instead of teaching every subject, we focus on things. And, it’s a different atmosphere, especially technology wise. (Interview-Sophie, 12/03)
Diane, Sophie, and Amy used the Internet as the main tool for planning curriculum and instruction. The teachers used the Internet to plan a curriculum based on themes through a collective inquiry. They gathered information and resources from the Internet related to the given curriculum theme for instruction, and they incorporated information and ideas that they regarded as useful into their curriculum activities. In November, the teachers were working on the theme of dinosaurs and recycling.

If we have a new theme like the dinosaurs or the recycling, I’ll go online and look up the topics, like I did today. And, I often use like for templates, I go to ABC Teach, and I have a membership to there. I draw up templates to use for the things we do. Next week, I’ll be using the dinosaur to make patterns with the kids so we’ll be using that. And like I just looked up and found a whole bunch of shows, dinosaur games, activities related to dinosaurs that I can possibly look at math- or science-related activities. (Interview-Sophie, 11/16)

**Collective inquiry for technology use**

Diane, Sophie, and Amy used technology itself as a tool for finding resources to use in their instruction and to supplement the children’s play activities. The teachers selected the materials from the Internet and built a teaching plan together:

Amy will be language arts, Sophie will be math and science, and I’m art. And that is what we normally do is go through the books and just pick out activities. And, we try to as a team, we try to work on picking out activities so they build on one another. (Interview-Diane, 11/16)

When we plan, we try to make it flow together as nicely as possible. Like this week, we’re doing Hanukkah. I’m doing an activity with Hanukkah that coincides with what Diane’s doing. (Interview-Amy, 12/03)
Diane, Sophie, and Amy met for a 45-minute conference every Wednesday during which they planned the curriculum including considering how best integrate technology into it. When the teachers were planning activities for the dinosaur theme, they worked to create activities and materials that would be cohesive in nature. The teachers emphasized that they strive to work as a team during this process:

We want to make sure they are cohesive, if we’re all talking about the Tyrannosaurus; you know she might do something in language arts with that dinosaur or a math activity with that dinosaur. We try to make it cohesive as much as possible, and build on that. (Interview-Diane, 11/16)

The teachers collected instructional resources from the Internet during their office hours and then adapted the resources to suit their educational purpose for the curriculum and the children’s play:

You get a lot of songs. Like they might have the old melody that we know, but they change the words so it makes up songs that go with theme. We do that all the time. We come up with different games and things. You can pull all that off the Internet. (Interview-Diane, 11/16)

After searching for resources through the Internet, the teachers piled up what they found online in each folder aligned to the curriculum theme. After gathering instructional materials through a collective effort from the Internet, books, and magazines, the teachers each planned and developed activities according to a specific curriculum area, i.e., art, math and science, and literacy.
Communication with parents

Diane, Sophie, and Amy used technology to communicate with the children’s parents through daily reflections and emailing activity. For their daily reflections, the teachers took photographs of the children as they played in the classroom and saved them in the children’s individual folders ready to email to the parents.

Based on the next goal for technology use in December, the teachers planned to email the photographs to the parents with a brief description of and reflection on the children’s classroom activities:

We took pictures as we did our activities today. And, whatever we did, we’ll type that up, look at the pictures, pull pictures out. Then, we make a hard copy for the classroom but then we email it to all the parents. (Interview-Diane, 11/16)

The teachers had, thus, succeeded in extending their technology use in a way that involved the parents more closely in their children’s education.

Collaboration

In this section, the role of collaboration among the teachers in terms of how they seek to integrate technology into their teaching practice is considered. Additionally, the patterns governing the teachers’ efforts to collaborate in terms of integrating technology into the same classroom are considered likewise.
Mutual support and learning

In the process of technology integration for teaching practice, Diane and Sophie played complementary roles in regard to conducting activities with technology. There were differences among the teachers in regard to knowledge and experience—differences that meant the teachers tended to take on different roles. The more experienced teachers suggested ideas relating to planning and developing the use of technology in children’s activities whereas the beginning teachers provided technological knowledge.

Diane and Sophie worked collaboratively in order to advance technology integration in the classroom. Diane, an experienced teacher, suggested ideas pertaining to planning the curriculum and activities with technology for young children. However, Sophie provided technological support by finding digital resources and building a technological system for use on the computers for both the teachers and the children. For example, Diane suggested an idea in regard to instructional resources related to the dinosaur theme, and Sophie searched the Internet for related information, games, and artwork and then set them up on the computers where the children and teachers could use them:

I talked to Sophie. She pulled up some dinosaur information.... And, she found clips for them to watch on dinosaurs. Then, we looked for games. There might be some dinosaur games we might be able to use, and then the CDs. (Interview-Diane, 11/16)

We took pictures as we did our activities today and whatever we did. We’ll type that up, look at the pictures, pool pictures out. Then, we make a hard copy for the classroom. But then we email it to all the parents. (Interview-Diane, 11/16)
Lack of technological ability

As reported in the literature (Ertmer, 2005; Schlager & Fusco, 2003) compared to beginning teachers, experienced teachers usually have considerably less experience with the technology or may even have no experience using it. Diane, who has been teaching for over 30 years, was acting as a mentor to the beginning teachers in her classroom. She initiated planning sessions during which she suggested ideas and provided materials such as books and magazines, etc., in an effort to provide guidance to the other teachers.

However, Diane has little experience using the technology for teaching. She lacks confidence in her ability in this regard to the extent that she does not know how to correct her mistakes. Yet, she believes that technology has the potential to be useful in teaching practice and that she personally will succeed in using it to support and streamline her daily teaching routines:

I’m probably the least [experienced], as the oldest, I’m probably the least [competent] with technology. Maybe even four, five years ago, I refused to even touch the computer. I would not even use the computer. I said, “If I can’t do [it], I can’t do it. So from what I did then and what I do now, they’ve changed. (Questionnaire-Diane, 11/20)

In Diane’s view, the other beginning teachers are skilled computer users whereas she lacked experience in this regard. However, she had come to realize that all teachers must develop such skills as they are required in all areas of teaching, whether in regard to administration, pedagogy, or supervision. In order then to stay up to date and to continue to advance in her career, she had decided to learn how to use the technology albeit she was doing so slowly:
I wouldn’t even go near the computer when I first started here…. When I first started, I was across the hall in a baby room, so I just didn’t need to use the computer that much. And, then I got the supervisor position over here. You sort of [get] forced into having to do all kinds of things, emailing their reflections, [and the] children’s assessments are on computer. So it made me [learn]. It took time, you know, slowly but surely. (Interview-Diane, 12/03)

I don’t think I know near as [much as] what the younger girls do. I mean, I think I can do anything my job requires right now, but they may be able to do it faster…. And, some things I’m sure Sophie and Amy know a lot more than I do…. But I can do what I need to do to get me through the day for school. It’s a learning process for me, too. Sometimes, I feel like the children in my class can do better than I can. (Interview-Diane, 12/03)

**Learning about technology**

The collaborative context of the classroom provided an opportunity for the teachers to learn how to use technology. Through collaboration on their use of technology, experienced teachers who lack experience using a computer, for example, can learn from beginning teachers how to use technology to create instructional materials, how to print labels, and/or how to use a video-making program. Diane did not know how to make labels with the computer. Therefore, Sophie set up the form so that Diane would be able to print out labels as needed:

I feel like they’re better at it. Now I didn’t know how to do the labels, and Sophie set that up for us…. We have to label everything in the classroom, [so]that was nice. I don’t know how to do it, but she did it, and it’s on the computer for me. (Interview-Diane, 12/03)

She put labels on them[the computer] for us. I mean it works either way, but the way she did it requires a little less work…. I just didn’t know how to set it up. I can
print them out, but she set up the form for me, which made it easier. There’s probably easier ways to do some things, and I probably do it the harder way. (Interview-Diane, 12/03)

Diane also learned from Sophie about how to use a movie-player program in Windows. She did not know how to download and save pictures from the Internet, but Sophie showed her how to save pictures in a folder for games and how to import those pictures into the movie player. And, Sophie made a folder for games in the movie-player program so that Diane would be able save pictures from the Internet:

I learned from Sophie how to download and save pictures from the Internet. But I was confused [about] how to download and save pictures…. I wanted [to] practice myself with [the] help of Sophie because I’m a hands-on person. And, they decided to have a time in the afternoon to learn how to use the movie-player to make a video. (Interview-Diane, 02/22)

Amy, a beginning teacher who is interested in technology use, wanted Sophie to teach her how to make videos using the computer program. She wanted to learn about a video program such as the Proshow Gold program in order to make DVDs of the children for conferences with their parents and for special events like a birthday or graduation.

There is a program called Proshow Gold that we’re trying to learn how to use and we make a video, DVD, of the children when they graduate from here or when we have a conference…. That’s something that I wanted to learn how to work on. I think Sophie started to look at Proshow Gold, but I haven’t had the time to sit down and work with that. (Interview-Amy, 12/03)

Support pedagogical knowledge. As an experienced teacher, Diane has been being learning technology skills from the new teachers. However, Diane helped the beginning teachers by suggesting ideas such as finding websites related to themes and suggesting
making changes to graphics and displays on the computer. Diane called this a “give and take” relationship. Despite lacking technical expertise, Diane mentioned that she was able to suggest ways in which her co-teachers could use the computer more efficiently:

I also feel like it’s a give and take, too, because she’ll be sitting here sometimes and I say “Why don’t you just try that? It’s easier for me to tell somebody to do something than for me to do it. And, they’ll say, “Oh, yeah, you were right.” Or, one of the other girls will say, “Why don’t you do this? Why are you putting in all of those numbers on the calendar? Why don’t you just push this button? I’m afraid I might mess something up [if I actually do it myself]. But I’m not afraid to give suggestions, and sometimes they might work and sometimes they don’t… (Interview-Diane, 12/03)

For emailing activities, Diane suggested ideas for the children’s email activity, whereas Sophie set up the email program and populated it with email addresses so that the children could send email to their parents.

This result presents an example of mutual learning as it occurred during a collaborative process designed to facilitate the technology integration process in which experienced teachers learned technology skills from the beginning teachers and beginning teachers learned pedagogical approaches useful to integrating technology from the experienced teachers. This result is consistent with previous research reporting that novice teachers help experienced teachers to develop technology skills whereas experienced teachers offer pedagogical knowledge to beginning teachers (Glazer & Hannafin, 2006).
Shared responsibility

Diane, Sophie, and Amy are each responsible for a specific curriculum area, i.e., language arts, math and science, and art. The interest area for which each teacher is responsible revolves on a weekly basis. In the first observation in November, Amy’s focus was language arts, Sophie’s was math and science, and Diane’s was art:

Amy will be language arts, Sophie will be math and science, and I’m art. And, what we normally do is go through the books and just pick out activities. And, we try to [work] as a team. We try to work on picking out activities so they build on one another. (Interview-Diane, 11/16)

Classroom management computer area

Sophie mainly took responsibility for managing the technology environment, including setting up the computer area and providing software and the computer program for both the teachers and the children. However, Diane and Amy also had shared responsibility for taking care of the children in the computer area during free play time. The teachers took turns monitoring the computer area and arranging the waiting list for the children’s computer play. During free play time, one of the three teachers usually acted as a general resource, helping the other teachers as needed and helping the children playing on the computer when they requested assistance.

Sophie was enthusiastic about having shared responsibility in the pre-K classroom compared to her work in an elementary school where she had been expected to take responsibility for everything:
I love the setup, and I think you have more support. You’re not, as a classroom
teacher in an elementary school, you find that, I don’t know my stress level was a
lot higher because we have the responsibility for everything. It’s more of a shared
responsibility in a pre-K classroom, here. I mean this is a very good center. It’s a
shared responsibility, and you know that Diane is in charge of certain things, Amy
is in charge of certain things, and I’m in charge of certain things. So I mean we all
take on different roles. If I didn’t have Diane or Amy, this would be
overwhelming. The stuff that you have to do, it would be, well, more than one
could get done. (Interview-Sophie, 12/03)

**Daily reflection**

The teachers also had shared responsibility for daily reflections such as center
time and free play time. For the daily reflections, the teachers would take turns serving as
a floater, a role that included taking photographs of the children as they worked and
played in the classroom setting. During office hours, the teachers downloaded the
photographs onto the computer and wrote daily reflections about the children’s classroom
activities that day. These reflections were then emailed together with the photographs to
the children’s parents on a daily basis:

We do that day of reflection. Amy’s been working on that. We took pictures as we
did our activities today and whatever we did. We’ll type that up, look at the
pictures, pull pictures out, then we make a hard copy for the classroom but then we
email it to all the parents. And, we just take turns. Whoever stays back, every day
someone usually gets to stay back, unless we’re short staffed. During the morning
and after, we do our center time, say go into the office and then type that up to the
parents. (Interview-Diane, 11/16)

The teachers also shared responsibility for sending emails to the children’s
parents. Sophie took responsibility for the email program, and the three teachers each
played a role in facilitating the children’s email activities. If the children wanted to send
an email to their parents, the teachers would take turns working in the computer area in
order to do this. They would find the parents’ email addresses and type up what the
children wanted to tell their parents.

*Lack of engagement in the children’s play*

The teachers both monitored and interacted with the children at least while the
children were playing in the computer area. However, because of the range of their
duties, the teachers helped the children in the computer area only when the children
requested assistance:

A girl needed help to turn on the speaker of the computer. “I can’t hear the sound
from the speaker.” A girl requested help, “Can you help me?” Sophie asked her
“What do you want, Claire?” and explained and demonstrated how to turn on the
speaker. (Field note, 11/20)

Overall, during the observation period of the present study, it was rare to see the
teachers intervening in or even carefully monitoring the children’s play in the computer
area. Diane did make an effort to interact with the children playing in the computer area,
and it was observed that she sometimes sat near the children’s seat and interacted with
them for that vantage point. But this was an infrequent occurrence because she was also
charged with simultaneously taking care of the children in the other interest area. This
attitude can be attributed to the structure whereby the teachers share responsibility for the
three curricula areas.

In the computer area of Happy Kids classroom, two computers were set up so that
each child sat at one computer. This principle is resulted from teachers’ belief that
computers were solely used for children without interruption, Therefore, children who
were on the waiting list could stand in the computer area to watch what their friends were
doing on the computer. While two children worked at each computer, five children could stand and watch until it was their turn. However, Diane did not consider this arrangement to be conducive to learning. In her view, standing around watching what others are doing on a computer screen is very similar to watching television:

> I don’t like when they’re all standing around watching. It’s not good for their eyes, so much in staring at the computer when they can be playing with something else. And their names can go up on that chart over there on the side so that they know they’re waiting for a turn and so they don’t have to stand right there and watch it. They get so absorbed. Almost like television, you know. I don’t mind if they’re learning, if it’s something they’re learning like their letters and their numbers. But I feel like that should be an individual time, a time for one child without all of these other children standing over top of them waiting for a turn. So that’s something I’d like to see monitored. (Interview-Diane, 12/03)

**Isolation**

Sophie was principally responsible for the technology in the classroom. She made it a practice to search the Internet in an effort to find creative and educational computer programs for children such as Dora the Explorer and PBS Kids, both of which she downloaded onto the children’s computers. She also created a folder on the teachers’ computer for children’s computer activities based on the thematic unit. Additionally, she created a folder of albums for each child where she saved the photographs of each child accordingly.

I’m the one who downloads the pictures with the kids and sets up their albums so they can click on their picture and see. We’re still in the process of teaching the kids that, getting that implemented. I set up the computers, too.... Some of the pictures aren’t quite staying with each website, so I have to figure out why that’s doing that. But I set up the computers so that they’re kid-friendly, so they know
what to click on, where to click on, you know. But the pictures are having some issues... So, hopefully, I’ll figure that out in this next month. (Interview-Sophie, 12/03)

Sophie was very confident in regard to her ability to apply technology to her teaching, and she was very proud of the training whereby she had learned how to integrate technology into the classroom that she had received at a school where she had taught previously:

I was trained on, we each had a laptop, it was a trial thing to see how teachers would do with their own individual laptop.... We had a docking station for that laptop, which connected the laptop to the overhead projector. So I was able to teach from my computer, and I was able to use my computer consistently and daily. I can show websites and have the kids come up and [use] the Elmo, they call it, visual projectors. (Interview-Sophie, 12/03)

However, Sophie found it difficult to apply what she learned about technology integration from the previous school due to the limited technology environment of her current place of employ and because she was now teaching children in a grade with which she had no experience. Yet, Sophie wanted to try different things for the children’s activities. And, although she felt limited in this regard given the limits of the technology available to her, she still persisted in her efforts to find out what would be most beneficial to the children:

I do have a lot of experience [that] I try to teach them. But some of my experience I can’t use because it [the technology] is not available to me. But what is available I try to use. I know there are things I don’t know. And, they’re like “Oh, this is where it’s at.” Or, you know, I can figure out quite a bit on my own. I have to say, I try and figure it out. (Interview-Sophie, 11/16)
Sophie described her efforts to work productively with the technology afforded to her in order to facilitate the children’s play and learning. But at the time of the present study, she had noted that working on the email program and activity was proving a time-consuming undertaking:

Well, my next goal is I’m hoping just to get them acclimated or adjusted more to using the digital camera…. And, I’m going to have to download them right now because it’s a really hard concept to try and download those pictures. For them to be able to know where to click on, to click to find their pictures if they want to look at them is one of the next steps I’d like to do with them. (Interview-Sophie, 12/03)

Sophie planned to adapt the email program in order to render it more kid-friendly. However, she found setting up the program to be relatively complicated because preschool children do not know either their parents’ names or their email addresses. Sophie, therefore, worked with the system so that the children would be able to bring up their parents’ email addresses by clicking on their names. Sophie worked on the program in this way without any assistance from either within the school or from outside sources:

I would like to get that implemented, and I’m trying to figure out if I can get it set up so that they know which one is their parents, or at least recognize their name and then click on their name and bring up the parent’s email. So, I’m going to have to fiddle with that. I’m not familiar with working with that, so I’m just going to have to fiddle with it for a while. (Interview-Sophie, 01/03)

It is evident that Sophie made a considerable effort to render the computer program kid-friendly. However, it was an independent endeavor such that she was isolated in her attempts to work directly with the technology.
**Lack of mentoring**

Diane refrained from advising or guiding her co-teachers’ teaching, as she did not think consider herself to be eligible to be a mentor. Therefore, she emphasized that she was working in collaboration with her colleagues. She seemed to respect her co-teachers’ instructional practices such that she did not try to lead or guide them to any great extent.

Diane did not mentor her co-teachers in any direct way. Instead, she emphasized “team work.” Despite this, she modeled good mentoring for the new teachers through her own effective teaching practice. However, she appeared to be afraid that in the classroom she would not be able to counter-balance her co-teachers’ power as expressed through their technological ability.

In Diane’s view, even though she was their supervisor, she felt that all three teachers worked as a team rather than engaging in a mentor–mentee relationship. In particular, she valued the team work they brought to their daily teaching practice. Little(1990b) described this orientation as follows: “Teachers with many years’ experience, armed with well-grounded views on effective teaching, nonetheless refrain from advocating specific approaches even to beginning teachers” (1990b, p.512).

Ballantyne (1995) pointed out that teachers are reluctant to play a “critical role” with their colleagues, and according to Christenson et al. (1996), “school cultures make it difficult for one teacher to openly question the performance of another” (p.275).

Therefore, for beginning teachers and experienced teachers alike, a system to support their efforts to learn how to use technology is necessary if are to successfully integrate technologies into the classroom.
The Context of Technology Integration

The support from the organization where teachers work has to do with the quality of teaching and learning through technology and the teachers’ own collaborative efforts. Further, the nature of the technology environment, how enriched it is and the specific resources available as well as the number of resources available, have a profound effect on how teachers work with technology and the extent to which they can integrate it into their pedagogical practice.

Personnel resources

Working with technology is a time-consuming endeavor, such that it is difficult for teachers to implement technological tools into their overall classroom management. The Happy Kids, therefore, works with a university to bring student interns to the center in order to assist the teachers with matters such as managing the classroom and assisting the children:

It’s hard to get so much done, like when we had an intern in the room, I mean we’re lucky with three but we always do a language activity, a science activity, an art activity. That is, sometimes, it’s hard to spend more time at the computer…. Maybe, we can spend more time at the computer and work on the emailing or something if we have an intern that comes in this next semester. You know we can have a fourth person kind of in charge of the computer area, which might make it easier for us. (Interview-Diane, 12/03)
Usually one of the three teachers acts as a floater by monitoring the children in the computer area and helping the children who need assistance. However, the student interns also offer much-needed and very welcome assistance:

Sometimes, we can build our literacy into the computer where they can do letter searches on the computer and things like that. Usually, it’s very hard for us to do that. If we have another person in the room like a teacher’s assistant, then they can help with that. This semester, we will be getting a student teacher, and she will be more in the room every day to help implement those kinds of things for us. I think when we have that extra person it’s nice. Then we can spend time on the computer with them. … It’s hard when we’re all trying to teach our different sections to the students and to try to also get on the computer. (Interview-Diane, 01/30)

Lack of technical support

The quality of the education that is offered when technology is part of the classroom practice depends to a great extent on the quality of the technological equipment. The using of technology in the classroom often means that teachers face obstacles such as a lack of support for troubleshooting or computers that shut down frequently. In the following field note, we can see that the teaching and learning process is hindered by malfunctioning technology:

Melik played with the Kid Pix program on the computer. But suddenly the screen shut down, and then they requested help from Sophie. Sophie opened the KidPix program again, but the screen disappeared again, and Melik left the computer area. Sophie explained [to the researcher] that the screen disappeared often. (Field note, 11/20)

Technical problems associated with computers or the Internet can translate into problems in both teaching and learning processes. However, it was difficult for the
teachers to obtain support from an outside person to address computer problems such that Sophie would try to figure problems out by herself without any technical support:

I learn as I go, I sort of just figure things out sometimes, because I have to…. If I can’t, I don’t call technical support anymore because they never return my calls…. Most of the time, I just fiddle with it and I can figure it out. Like with the pictures, I tried to call the tech support person, and he never called me back. (Interview-Sophie, 12/03)

In conclusion, if technology is to be effectively integrated into the classroom, ongoing support for technology environment such as abundant resources and technical support is necessary.

Time

Using technology is very time-consuming work that requires a teacher to spend considerable time searching, downloading, and setting up various resources on the computer in order to teach the children and facilitate their play. To assist the teachers in this regard, therefore, the Happy Kids allowed its teachers time for office hours, i.e., time in which they could prepare for their teaching in various ways, whether researching the technology, practicing with it, or developing a curriculum:

We do that all the time. We come up with different games and things. You can pull all that off the Internet, that would be more office work, and we do that day of reflection. Amy’s been working on that. (Interview-Diane, 11/16)
Time is deemed the principal issue in regard to resolving problems associated with teachers’ efforts to learn how to use technology. The teachers at the Happy Kids were enthusiastic about using technology in advancing their teaching and facilitating children’s play. They reported that they enjoyed and valued using computer programs to create instructional materials and to communicate with the children’s parents. However, even though, for example, Sophie wished the other teachers to learn how to use the video-editing program Proshow Gold and the other teachers were equally interested in acquiring the skills to use this program, lack of time prevented them from doing so:

It’s called Proshow Gold. It’s one that we installed on there. That’s something that I wanted to learn how to work on, but I haven’t had time to sit down and work with that…. It was time for conferences, so we didn’t have a lot of time to sit down with it. So we used another, we used a movie-maker, which is a lot easier. I know for Diane and me, it was a lot easier to use. So maybe some time when we have more time to sit down, we can play around with it and get a feel for how to use it. (Interview-Amy, 12/03)

In addition, it was not until January that the email program was in operation. Because of her busy schedule, Sophie was unable to finish her work on setting up the program in December as planned:

I’d also like to start working on the email. It depends on how much time. With December, it’s kind of crazy. But I’d like to try and get the parents’ emails. I don’t know how I’m going to do that. So they can email their parents with the pictures that they take. I’m going to try and get it set up. It's a goal. But I'll see if I can get it set up by then. December’s kind of crazy. (Interview-Sophie, 12/03)
Chapter 6

CASE THREE: CINDY AND PAUL

This chapter describes how Cindy and Paul integrated technology in their teaching practice and how these two teachers collaborated on this work in the same classroom for the Happy Kids organization.

Practice for Technology Integration

Cindy and Paul regarded technology as a good tool for both teaching and learning. They were interested in adapting existing technology for the children’s play and learning. Cindy and Paul hoped to find answers to their questions about how to integrate technology into the existing curriculum in ways appropriate for play and learning.

Incorporating children’s learning and play

Cindy and Paul used digital resources for both their teaching and the children’s learning. The teachers implemented their teaching practice in a traditional way in alignment with their curriculum themes, and they incorporated educational software in developing instructional activities in alignment with the curriculum theme likewise.
**Intervening in children’s computer play**

Paul reported that he enjoys using technology whether for activities with the children or as a resource for his own work as a teacher. He considered the computer to be a good toy for the children such that he thought it was productive to allow the children to explore computer programs freely:

> Let them explore. Let them use it on their own. So just using teacher-directed time to show them what can be done and then giving them free time to explore on their own. It’s very important to let them do it on their own. (Interview-Paul, 01/29)

Teacher-directed is the word we try not to do. We try to always have the kids learning on their own. So, it’s an interesting way of teaching. (Questionnaire-Paul, 11/02)

Cindy also regarded the computer as a good play material for the children. In fact, she was convinced that children should be allowed to play with computers in their own way rather than always being subject to a teacher’s direction:

> We would just let them [the children] play on them [the computers]. And, now, it’s just let them go. It used to be a one-on-one thing. (Interview-Cindy, 01/29)

However, even though they felt the children should be afforded opportunities to play freely with computer programs, Cindy and Paul still extensively involved themselves in the children’s play in this regard. This emphasis on the part of Cindy and Paul appeared to be directly related to their shared position on the importance of children’s play and the role a teacher could play in facilitating it:
I’m trying to check in every few minutes. If they’re using it right, I don’t say a word, just let them keep going…. When we have 20 children, sometimes they just want to do whatever they want on the computer. Sometimes, they get to let out some energy. Sometimes, they get to click around. That’s part of technology, too, just having fun with it, technology is fun. (Interview-Paul, 01/29)

Cindy and Paul introduced and explained the computer programs and menu to the children and helped the children who were not familiar with the programs. When necessary, the teachers demonstrated the program’s functions and offered guidance to the children on matters such as how to use the mouse or how to click on an icon:

When Carina did not know which program she wanted to use, Paul explained the programs’ icons in order to help her choose. He identified the programs and icons for her: “This is Math House, this is Science House, and that’s a stop sign.” Paul also demonstrated the features of the Thinking Things program when Carina did not know what to do next when using that software. (Field note, 12/18)

A boy asked Cindy for help, and she came to the computer area and explained how to open the menu of the Thinking Things program: “You have to be here.” (Field note, 01/15)

From a Vygotskian perspective, the construction of children’s knowledge and understanding is socially mediated by interaction (Bodrova & Leong, 2012). Cindy and Paul continually monitored the computer area and observed the children playing with the computer. Through consistent monitoring and observation, the teachers were involved in the children’s computer play and interacted with them when they determined that guidance and instruction were necessary. While the children played with Millie’s Math
House, Paul commented that he saw opportunity to use this software to teach mathematical concepts—and he felt that this could be some without disrupting their play:

I’m trying to check in every few minutes. If they’re using it right, I don’t say a word. [I] just let them keep going. If they’re, like with the jellybeans, they have to put in five jellybeans, and if they’re just sitting there clicking repeatedly and have forty jellybeans that’s when I have to say, “Oh, how many jellybeans do you need? And there’s the number, oh five. And, how many do you have?” And then I’m like “Let’s start over. Clear it.” [I] only assist … when it’s not being used how it’s supposed to be. (Interview-Paul, 01/29)

Cindy and Paul involved themselves in the computer center by setting time limits and making sure that all the children who wanted to join in the computer play had an opportunity to do so. Paul asked the children questions to remind them that everyone should have a turn, e.g., “If the timer goes up, whose turn is it?” Cindy made it a practice to approach the children and remind them of the time limit: “You have two minutes.” (Field note, 01/15)

Cindy and Paul involved themselves in the computer area when the children asked for help but also when wither teacher thought a child might need assistance. The teachers consistently monitored and observed the children, and then made a decision to involve themselves in the children’s play in the computer area:

As a girl failed to arrange the numbers in order in the Math House program, Cindy became involved in her play and guided the child by asking questions like “Which number should be first and what number would be next?” “Which number goes to the first?” “What’s the next?” “Here we go.” Cindy watched until the girl had arranged the numbers in order from one to five. (Field note, 12/04)

In contrast to their interventions in the children’s computer play, Cindy and Paul did not involve themselves when the children were using a digital camera, which some of them did during free play time:
In the drama area, one boy was taking pictures with the children’s camera. He did this in a sporadic way without any involvement of the teachers. (Field note, 12/12).

**Building bridges between curriculum and technology**

The Children’s Corner provided only software programs derived from the Cyber Start program. Cindy and Paul, therefore, worked to adapt these programs into their curriculum and instructional activities. The teachers made an effort to incorporate the contents of the software into various curriculum areas, such as language, math, music, and art, which included software such as Bailey’s Book House, Math House, Science House, and Kid Pix. Paul explained how the teachers integrated the Bailey Book Software into the literacy program as follows:

It’s just talking appropriately. “I want that.” And then, no matter what choice gets made, all the kids sit down quietly. They listen to the song and then, when it’s time for the next activity, you hear them say, “I want language, I want words, I want counting.” But it’s a Bailey’s Book House: What they say is appropriate because Bailey’s Book House is a typewriter. They click a letter and it says “D, dinosaurs, dance.” So they hear “dinosaurs dance.” It’s all very well done for three year olds. They love the dinosaurs dancing. (Interview-Paul, 01/29)

Cindy and Paul mainly used software programs for their instruction with the children who they organized into a circle, yielding time for the whole class to integrate the computer activities into various areas of the curriculum. On one occasion, Cindy and the children listened to songs from different countries through the software program and explored the flags of countries worldwide by watching the computer screen together. The
teachers worked to extend the software program in order to integrate it into the curriculum and the children’s activities. Paul explained that these software-driven activities are not just for music activities. Instead, they extend the music activity into multicultural education:

That is … teacher directed. That isn’t just language. It’s a culture program, not language. And, you can click on the flag of the country. Cindy clicks on the flag, and they know they have the option of music, writing, counting. You click on the flag, the picture menu comes up. It’s got the flag. Above the flag, it’s got all the choices. They've never used the program. But they know just by looking, “Oh, music’s there.” They don't know a word, but they know purple is music. So that’s a very nice culture program. (Interview-Paul, 11/29)

Cindy considered making pedagogical decisions focused on integrating technology in terms of the children’s play and learning in order to integrate technology into curriculum planning. Her inquiry into technology integration began with the question of how teachers could adapt technology for the children’s play:

We would just let them [the children] play on them [the computers]. And, now, it’s just let them go. It used to be a one-on-one thing. I’m still learning as to how it works or how to fit it into the curriculum. (Questionnaire-Cindy, 11/02)

**Balancing computer activities with hands-on experience**

Due to their increasing use of technology in the classroom, Cindy was monitored the children’s activities in order to ensure that a balance was maintained between hands-on experience in a non-computer context and computer use. Cindy underscored the importance of maintaining such a balance in planning and implementing a curriculum
involving technology. Researchers suggest that computer activities should be provided with hands-on experience for young children (Clements & Swaminathan, 2003; Haugland & Wright, 1997). Cindy’s own view was in line with those expressed by the researchers:

Some people think that when the kids are on computers and stuff they’re learning. But they’re going to get more out of hands-on [experience]. Like we bring in puzzles, and instead of looking at it on the screen, they can pick it up and touch it. That is what Happy Kids promotes, a lot of hands-on. And, I wish it was more mixed but I can see their point, too. (Interview-Cindy, 02/29)

In order to reflect this rationale in planning and developing a curriculum, Cindy planned and prepared instructional materials by using the Internet and modifying them in order to meet the objectives of specific curriculum units. On the occasion Martin Luther King Jr. Day, Cindy read a story about Martin Luther King Jr. to the children, and she also involved them in an art activity in which she used materials printed from the Internet.

It was Martin Luther King Jr. Day, and Cindy planned an art activity using a painting of his face. She printed this painting and provided copies, which they were then to decorate. After completing the painting activity, she displayed the children’s work on a classroom wall. (Field note, 01/29, 2008)

**Internet as a research tool**

Cindy and Paul’s classroom was equipped with only one computer for the children’s use. Furthermore, their classroom was not wired for Internet access. Due to the limited technology environment of their workplace, therefore, Cindy and Paul’s daily
teaching practice with technology relied entirely on the software already installed on the computer.

The Internet constituted the main tool through which Cindy and Paul looked for and discovered educational resources for curriculum and instruction. In particular, Cindy made a consistent effort to optimize her instructional knowledge and related skills by mining the Internet as often as she could with the goal of finding creative resources for the children’s play. However, because their classroom lacked Internet access, Cindy and Paul were obliged to restrict their Internet searches to after-school and at-home hours. Overall, the lack of support for technology at their place of work constrained Cindy and Paul’s efforts to develop curriculum and instruction using technology:

I would like to get programs that meet what we’re doing right now. Like, we’re doing dinosaurs right now. If I could get something for dinosaurs, that would be great. If you don’t want to play the game that’s up, then you’re not on the computer. Just leave it up and running all day long. That’s what I would like to be able to do. The way they have it set up, you can’t. (Interview-Cindy, 02/29)

Cindy and Paul searched the Internet looking for instructional resources in line with their curriculum themes. Cindy reported that she would get ideas for instructional resources from the Internet and then she would plan instructional activities grounded on those resources for the children. Cindy also commented that she used computer games on the Internet as instructional resources and that she counted on them as resources for the children’s learning and play. Both Cindy and Paul regarded the Internet as a valuable tool in that it offered vast resources suitable for instructional purposes:
I got some ideas about instructional activities from computer games, figuring out how to work them. Different Internet sites, I get tons of info from them. (Interview-Cindy, 01/29)

We have a set, like different, a set of games they can play, [such as] Clifford. Some are more popular kids’ show. (Paul, 01/29)

Given their recognition of the Internet’s potential for instructional use, Cindy and Paul very much wished to provide Internet access in their classroom to facilitate their efforts to plan and develop instructional activities using the Internet. They also felt the Internet had value inasmuch as they could offer activities based on using the Internet to the children. Yet, this was a point of some ambivalence—as they considered the Internet to be dangerous to children:

I’m still trying to figure it out, and I would love to have the Internet in here and to be able to pull up some of the sites and show them that kind of stuff. But then, it’s dangerous to have [the] Internet. Who knows what they’ll get into? They can’t read yet.” (Interview-Cindy, 01/29)

Therefore, Cindy and Paul took the position that the Internet should be turned to the purpose of teachers’ instruction rather than to children’s play. This result reveals the nature of the relationship between teachers’ beliefs and teaching practice and its impact on technology use in the classroom. Cindy and Paul worried about the children’s use of the Internet to the extent that they considered the Internet essential to their teaching practice. And, indeed, they were enthusiastic about using it for their teaching. In fact, they emphasized the teachers’ need to have an Internet connection available in their classroom.
Overall, Cindy and Paul stated that they could not use technologies for instructional purposes in a comprehensive way because of the limited technology resources of their classroom. They, therefore, wanted a more technologically enriched environment in their classroom that would be capable of supporting their goal of integrating technologies into teaching practice. On this point, they did not envision a wide range of technological tools. Instead, they wished for a computer and an Internet connection for the teachers to use together with some computers for the children:

Yes. Once the other changes happen here, I would love an Internet connection for teachers, not for kids. I want a teacher computer because with a teacher computer and the technology I could have stuff downloaded and then run it into a TV. It doesn’t have to be on a computer screen. So I’m the one manipulating it…. Once the Internet is available to teachers, they can download clip art [and] pictures to color. I have an hour for break that could be planning that could be looking stuff up. Instead, where do you go for new ideas without the Internet? (Interview-Paul, 02/29)

Collaboration

This section describes how Cindy and Paul worked together on technology integration in a collaborative process. The principal themes of these collaboration comprised (1) shared responsibility and (2) isolation within a community.

Shared responsibility

Cindy and Paul took turns in regard to monitoring the computer area every day. Even when they were taking care of children who were playing in other interest areas in
the classroom, the teachers involved themselves in the children’s computer play in many ways, including monitoring and demonstrating in the computer area, simultaneously:

Yeah, it’s definitely one teacher is directing and one is going around helping kids. “Oh, you’re playing with blocks.” [One of us will] sit down with them for two minutes, put a couple blocks, and say “Keep going! Keep going!” If they’re working with a puzzle, you get them started. And then, [you] go over to the computer and get them going. And then, [you go] over to the blocks and get them going. And then, [you go] over to the doctor’s office…. One teacher is directing [and] one teacher is basically playing with the rest of the children. (Interview-Paul, 01/29)

While Paul took care of the children who were playing with a puzzle, role playing, or playing in the computer area, Cindy helped the children who were painting in a small group. (Field note, 01/15)

Cindy and Paul alternated in regard to taking charge of the various interest areas. And, at any given time, each would have the care of circa half of the children. If the children were playing with software on the computer, the teachers would observe and monitor the children’s computer play, but at the same time they would take care of the children in the other interest areas:

The thing here is teacher-directed. So one activity, I’ll direct and I’ll have six kids at a table, and Cindy will be the rest of the class. And then the next activity, Cindy will do with six kids at a table, and I’ll be watching the rest of the class. We never want two teachers sitting down teaching. We want the children learning on their own. That is why you’ll never see us both sitting down for more than two minutes with all the kids except during circle time. (Interview-Paul, 01/29)
Isolation

Cindy and Paul shared responsibility for monitoring the computer area. However, the management of technology resources and the performance of technical skills such as downloading and fixing programs was Paul’s province.

Paul, a beginning teacher, was considerably more knowledgeable and skilled in regard to the technology than the experienced teacher, Cindy, was. Cindy reported that she counted on Paul to taking care of the computer area precisely because of his superior technical skills:

Paul has a lot of ideas. He has more of the computer brains. He’s very good at that. He’s younger. He brought up downloading, but it doesn’t work well. I would be like, “But I don’t know how to fix it.” My ideas are like, “Pull the plug on it, and plug it in later.” But he is very good at that. (Interview-Cindy, 01/29)

Despite the fact that both Cindy and Paul worked together with shared responsibility in the use of technology, signs of isolation from each other were apparent in terms of their teaching practice. Even though Cindy counted on Paul’s technical knowledge and skills in the use of technology, collaborative dialogues or reflections focused on planning a technology-integrated curriculum were rarely observed.

Paul was not a certified teacher. He, therefore, counted on Cindy’s ability to manage the classroom. It was evident that he respecting her expertise as a teacher even though she lacked technical knowledge. Neither teacher engaged the other in a collaborative dialogue about instructional practice. Instead, Paul followed Cindy’s guidance and direction in this area. The disparity between their respective positions
wherein Paul was not a certified teacher and Cindy was an experienced certified teacher appeared to be a central reason for the lack of collaboration on this point observed during the research period.

On a personal level, neither teacher appeared to recognize the need for collaborative reflection or inquiry in relation to technology integration. And, in terms of organizational context, the teachers were operating in an environment that was not supportive of efforts to teach with technology. Lack of time for planning and reflection is regarded as one of the obstacles to collaborative teaching practice for technology integration for Cindy and Paul. This limitation appeared to derive from lack of support at the organizational level. For example, Cindy and Paul did not have office hours, and the teachers were expected to follow complicated and busy routines. It should be noted that the researcher found it challenging to arrange a time to interview these teachers because they had such little time available at the site:

We talk about at least as far as what works with the children…. [But] we don’t do it [use the technology] because we don’t have the resources that we need to do it. I would love to introduce programs, but we don’t have [time]. (Interview-Cindy, 01/29)

The Context of Technology Environment

Cindy and Paul wanted to use a range of digital resources to develop instructional activities based on curriculum units for the children’s learning and their teaching.
However, the technology environment was limited in regard to the including technology resources and personnel resources available in the classroom of Children’s Corner.

**Technology resources**

Due to the character of the Children’s Corner center, the teachers faced numerous restrictions in regard to using technology. Specifically, the center was corporate-run and used only computer programs provided by the corporation. The teachers, therefore, worked with the programs provided in order to make the conducive to children’s activities and education:

> The company provides the curriculum and then we enhance the curriculum. (Interview-Cindy, 01/29)

> With our computer, because it’s locked, we can’t change anything. (Interview-Paul, 01/29)

In Cindy and Paul’s classroom, the computer center was deployed as part of the interest center and comprised one computer, without a printer, and two chairs so that two children could play together. During free play time, the children played with educational software such as KidPix, Math House, Science House, Bailey’s Book House, and Thinking Things.

Cindy and Paul wanted an enriched technology environment so that they could use software and online systems in the classroom for their teaching practice. However,
such an environment could not be created because of the lack of administrative and financial support. Cindy and Paul wanted to have two computers for children and one for the teachers with an Internet connection in their classroom:

I would love a teacher’s computer and probably one more. One computer is not enough for twenty children. I guess what I would ask for is one more for the kids [and] one for me. That would be three computers in the classroom, one for the teacher, and Internet for the teacher. That sounds pretty good. (Interview-Paul, 02/22)

The limited technology environment of the Children’s Corner center influenced teaching and learning with technology. The teachers and children could use technology only in a restricted way, and the teachers were hindered in their effort to integrate technologies into the curriculum:

There’s a lot of other stuff going on right now. If it was me, I’d say, “Just put it on! New games!” If you go to Walmart, they’ve got simple programs for a dollar. If we put five new ones on the computer, that would be perfect, because kids learning brand-new programs, not just doing what they’re familiar with, actually learning while they go. (Interview-Paul, 02/29)

The restricted technology resources limit the children’s learning as well as the teaching. The excerpt below depicts the situation that old and low versions of computers hinder children’s play and learning:

Three boys were trying to play with the computer, but they couldn’t start the program. Then Cindy went to the computer area and asked what the matter was. As soon as she realized that the computer was not working well, Cindy shut it down and restarted Windows. When the program had restarted, she left the computer area. While Cindy was restarting Windows, the children tried to leave the computer area. (Field notes, 01/15)
Personnel resources

Using and running computer programs in the classroom is accompanied by a lot of problems which require technical skills to be resolved and to help children’s play. There was no support from the Happy Kids center for service to fix technical problems and to provide technical assistance for the teachers:

I know you can, but there’s no time to, because we don’t have a computer expert here. I’m an expert with what I need to be. With the lock, I don’t know how to get around [it]. I know programs, [but] I don’t know Windows. I can fix programs, but I can’t fix Windows. (Interview-Paul, 01/29)

We have so many changes going on right now, that it’s not a priority…. There’s so many things going on that one computer getting new software and it’s all got to be bought legally. It has to be paid for by the company, I’m sure. So all of a sudden, getting new software involves calling five people. (Interview-Paul, 01/29)

Need for learning

Managing a computer area constitutes a significant responsibility for teachers. It is very time-consuming work in terms of preparation and setting up programs. And, it also demands technical skills and knowledge.

Cindy was in pursuit of resources for learning about technology integration from outside such as other teachers and teacher education programs. She also wanted to learn about various technology resources that could be integrated into her teaching and the children’s play:
I would love to learn more about how to introduce it [technology] to the kids so they are not just over there banging on it. That will [not] be for a while yet, because I just don’t have the financial means yet. I mean there are tons of things we can do with technology in the classroom, [but] I just don’t have access to a lot of it. (Interview-Cindy, 02/29)

Sometimes, she learned high-level technology skills and knowledge from her teenage daughter. However, she also commented that she said no opportunities to apply these skills in the classroom due to the limitations of the computer in her classroom.

[A] computer is very helpful for research. I know my daughter uses it to research papers. It’s very cool, like the one place I was at, very briefly, they were doing a unit on outer space, and we pulled up the NASA website and the kids got to go through. The kids are part of it. They loved it. If it’s used properly, it can be very helpful. But if you just put the kids in front of it and let them go all the time, it’s nothing more than video games they play now. (Interview-Cindy, 02/29)
Chapter 7

SUMMARY OF THE CASES

This chapter describes and compares the range of teaching practices employed by the teachers in the present study in terms of their collaborative technology integration efforts. The three cases showed both commonalities and differences in teaching practice for technology integration. Further, the collaborative pattern for technology integration differed according to organizational context. This chapter consists of three sections: (1) collaborative teaching practice for technology integration, (2) collaboration, and (3) the context of technology environment.

Collaborative Practice for Technology Integration

The participants were all interested in integrating technology into both their teaching practice and the children’s play. The teachers’ technology use commonly focused on how to integrate technology into children’s learning and play, and all teachers tried to integrate technologies in alignment with their curriculum themes. The teachers used technologies to communicate with the children’s parents in order to inform their children’s learning and development. The teachers’ teaching practice for technology integration focused on (1) integrating technology into children’s learning and play, (2) integrating technology resources, and (3) collaborative vs collective inquiry, (4) communication with parents.
Integrating technology into children’s learning and play

The teachers all focused on integrating technology into children’s learning and play. All the teachers attempted to connect technologies with curriculum areas mainly by using software, digital cameras, and the Internet in the classroom. They planned and developed their curriculum with technology based on themes, which extended across curriculum areas such as art, math and science, and literacy. However, despite using the same digital tools, the teachers used those technologies differently depending on the nature of their inquiry. It should be noted that their efforts to integrate technologies into teaching practice did not always appear to be associated with subject-specific content learning.

The teachers in all three cases shared a commitment to the educational value of the computer and commonly provided software such as Math House, Science House, and Kidpix for children’s play. Only Cindy and Paul incorporated the contents of software into children’s learning in alignment with the curriculum theme, which stands in contrast to the other cases in which software was provided for the sole purpose of facilitating children’s play. Cindy and Paul conducted teacher-initiated activities by using software such as Math house to teach math concepts to the children. They used software for group activities in circle time and incorporated software programs into subjects such as language, music, and math.

Compared to other two cases used the digital cameras only for the children’s play, only Nicole and Jane incorporated and extended digital camera activities into children’s learning. Beginning by using digital cameras to document the children’s work, Nicole
and Jane extended their photography activity into an art exhibition in which photographs taken by the children were displayed. Nicole and Jane used the digital camera to mediate the children’s literacy activity by writing down what the children said about why they chose certain photographs to include in the exhibition. In addition, Nicole and Jane developed and extended curriculum by integrating a computer drawing program into the digital literacy activity.

In the Child’s Space and Happy Kids classrooms, the teachers built an Email system so that the parents could receive Email from their children. The teachers helped the children to use Email by setting the system with Email addresses and by typing up what the children wanted to say to their parents. Nicole and Jane extended their Email program into children’s literacy activities by writing down what the children said.

**Children as resources for curriculum planning**

Nicole and Jane planned and implemented a curriculum incorporating technology in ways that allowed the children to engage in meaningful experiences with the technology. They reflected on the children’s activities with digital cameras and computer play and reconsidered the impact of the technology on the children’s experience on an ongoing basis. Based on their reflections, they implemented changes to their curriculum planning and instruction using technology.

When Nicole and Jane reflected on the digital camera activities, they realized that the children could act as a resource for teachers learning to teach. For example, in the
gallery project, the teachers found that the children differed from the teachers in regard to the photographs each selected for display. Nicole stated that the teachers learned about the children’s viewpoints based on this activity. In her opinion:

The teacher’s role in technology use is that of exploring using the children’s own photographs to document their work and learning more clearly from their own point of view…. (Interview-Nicole, 1/17).

Nicole realized that the children’s ideas constituted a valuable resource that the teachers could draw on to inform their own thinking. She brought the children’s ideas into the curriculum for technology integration through careful and considerate observation. After that, the teachers decided to work directly with the children by planning activities using technology to determine new ways to conduct activities from the children’s viewpoint.

As a result of their collaboration with the children in regard to technology use, Nicole and Jane revised and developed some of the ways in which they were using technology in the curriculum based on the children’s input. According to Lang (2000), collaboration of this nature with children functions as a kind of partnership whereby the present curriculum and instructional planning can be advanced. Furthermore, this kind of interpersonal partnership provides an impetus for teachers to reconsider their classroom role such that they may refocus their approach to more fully understand and support the children’s views and activities.
Involving in children’s play

On the other hand, the three cases differed in regard to the patterns whereby the teachers interacted with the children in their play with the digital tools. Nicole and Jane took turns at observing and interacting with the children as the latter played using the technologies. While Jane worked with the children who were playing on the computer, Nicole would take care of the children who were playing with the digital cameras.

Based on the observation of children’s play, Nicole and Jane tried to help the children to experience digital tools in meaningful ways with the educational goals in their mind. The teachers interacted with the children by asking questions and also demonstrated how to play with the computer games and provided guidance to the children how to use the computer program. Moreover, they provided technical assistance when a computer malfunctioned or when a child required assistance controlling the mouse.

Cindy and Paul did enthusiastically involve themselves in the children’s play and interacted with the children playing with the computer program. They monitored and interacted with the children in a continual way by asking questions and providing guidance as the children played on the computer during free play time.

Similarly, Cindy and Paul also took turns monitoring the children playing on the computer, even while they were taking care of children in other interest areas. They alternately intervened in the children’s computer play and interacted with children in the other areas determining where assistance was most needed based on their continuous observations.
Compared to the other two cases, the teachers at Happy Kids barely interacted with the children playing on the computer or with the digital camera only when the children asked for help. The teachers did not involve themselves in the children’s play with the technology at all except in regard to setting play time or determining whose turn it was to play. Of the teachers, only Diane, the experienced teacher, tried to interact with the children using the technology even though she was taking care of children in other play areas.

**Collaborative versus collective inquiry**

Teaching practices with technology varied among the three cases from collaborative to collective mode. The difference between the collective mode and the collaborative mode is whether the teachers share and reflect on their teaching with technology with each other.

Nicole and Jane explored the role of technology through collaborative reflection in an effort to find ways to successfully and appropriately integrate technology into the curriculum and the children’s play. They continually posed questions about approaches they could take to ensuring that the children could experience technology in ways that would advance meaningful learning. With this stance on technology use in common, they worked collaboratively for technology integration based on carefully observing the children and reflecting on their work.
In their collaborative work focused on the digital camera, Nicole and Jane planned to record the children’s play and activities. This effort to document the children’s activity and to enable the children to produce their own creative documentation with the digital camera also afforded the children opportunities to reflect on their own ideas and activities. Documenting the children’s play using a digital camera also provided a chance for the teachers to reflect on their own classroom work. These reflective activities gave rise to insights into how to plan children’s activities in the future. Through collaborative inquiry and reflection, therefore, Nicole and Jane developed instructional activities with technology and reconstructed curriculum with technology.

That is, in order to integrate technology into their curriculum planning and the children’s play, Nicole and Jane planned curriculum and instruction with technology through collaborative reflection, followed by revising and improving curriculum and instruction with technology.

Documenting the children’s work by using digital cameras was extended to so that the parents could be involved on an ongoing basis. Nicole and Jane decided to create a gallery space in a hallway in order to display photographs taken by and selected by the children for their parents and other stakeholders and interested parties to see.

Unlike Nicole and Jane, who concentrated on curriculum goals and classroom learning through technology, Diane, Sophie, and Amy concentrated on finding resources for instructional materials and children’s activities at Happy Kids. The Happy Kids teachers sought information related to instructional resources through the Internet. They collectively searched online to find instructional resources in alignment with curriculum
themes for their teaching. They also collected instructional resources such as games and songs and saved them on the computer where they were shared and used in their curriculum planning. After that, each teacher drew on the resources to plan and develop instructional activities based on curriculum themes. Happy Kids teachers worked in a collective way whether in terms of seeking and adapting resources for planning the curriculum.

Only Nicole and Jane showed evidence of reflecting collaboratively on their teaching practice with technology after they had worked with the technology in the classroom. Overall, Happy Kids did not create an environment designed to encourage teachers to develop new methodologies or to collaborate. In fact, the director commented that the teachers do not work together very much. Diane, Amy, and Sophie did not have a chance to provide feedback or guide each other based on reflection on their teaching.

And, it appeared that Cindy and Paul did not have any time to reflect and plan through collaboration. In fact, even the time available to them for planning technology integration appeared extremely limited. Overall, the organization for which they worked was not supportive such as providing office hours. Further, Cindy and Paul did not conference with each other after class either. Cindy and Paul had few chances to reflect on their teaching practice. This is common to other sites that participated in the study, except for the Child’s Space teachers.

According to Little (1990b), teachers who lack opportunities to engage in professional dialogue also tend not to reflect on their teaching practice. This does not serve to enhance student’s learning. Teachers should be prepared and supported to reflect
on their teaching practices with technology. Under such circumstances, they would have time and opportunities to analyze their ongoing experience with technology and to consider the outcomes of their teaching practice.

**Integrating technology resources into teaching practice**

The teachers were also interested in integrating a range of technology resources into the curriculum and the children’s play. Specifically, the teachers worked with computers, the Internet, and digital cameras, as well as old technologies such as audio and video devices among other electronic technologies in the classroom.

The Internet was used as an essential tool for teaching and learning in all three cases, although there were differences in how the Internet was used in the classroom. With the exception of Cindy and Paul’s classroom, the Internet was used for both the teachers and the children. Unlike the other teachers, Cindy and Paul’s classroom was not connected to the Internet due to organizational limitations.

All the teachers used the Internet as a research tool to find good resources for curriculum planning and children’s play. For example, Nicole and Jane searched to the Internet to seek find good instructional resources related to their curricula themes and to seek technology resources such as a handheld microscope to use in science activities with the children. Similarly, Diane, Sophie, and Amy also worked together to find and download instructional resources from the Internet for curriculum planning. Based on their curriculum themes, Diane, Sophie, and Amy collected a great deal of information
and resources such as songs and games from the Internet and shared those resources in their curriculum-planning sessions.

The Internet was used not only for instructional resources for curriculum planning, but also used for children’s play. The teachers of Child’s Space and Happy Kids selected appropriate programs and set them up on the children’s computers so that the children could play with them. Nicole and Jane worked directly with the children to explore the Internet in order to find answers to the children’s questions.

Related to the availability of the Internet in the classroom, with the exception of Cindy and Paul, the teachers planned and conducted an Email activity with the children so that their parents could receive Email. In both cases, the beginning teachers set up the Email system on the teachers’ computer and the teachers worked with the children so that Email could be sent to their parents.

Only Nicole and Jane had a printer connected to the children’s computer in the classroom, and they printed out photographs taken by the children for the purpose of display. Using a printer in the classroom made it possible for the teachers to reflect on how the children were playing and to extend digital activities into the curriculum such as art and literacy. In terms of direct positive outcomes for the children, the presence of the printer meant that they could immediately reflect on their work with the digital camera by considering the photographs they had produced. The other two cases did not have a printer connected to the children’s computer in their classrooms.
Communication with parents through technology

Practitioners and parents should work together as members of the learning community and that developmentally appropriate practices ought to convey a partnership between teachers and families (NAEYC, 2009).

With the exceptions of Cindy and Paul, all the teachers recognized the importance of communication with parents, and they, therefore, used technology as a tool for exactly this purpose. The teachers used a digital camera and Email to communicate with the children’s parents. Nicole and Jane believed communicating with the children’s parents through technology to be very important to their daily practice. The digital cameras were used for daily reflections, which the teachers sent to the parents through Email. In addition to using digital cameras to document the children’s work, Nicole and Jane also used documenting as a resource for the parents. In Cindy and Paul’s classroom, however, there was no reported communication with the children’s parents through technology. They simply posted photographs of children on a bulletin board in the classroom.

In summation, the teachers communicated with the children’s parents by sending daily reflections through an electronic network. They communicated with the parents through various technologies such as Email, daily reflections, and videos. Technology, therefore, served as a mediator for the exchange of information about teaching and learning in the classroom between parents, teachers, and children. The teachers’ use of technology in this way accords with the professional standards by the NAEYC (2009).
Collaboration

The three cases varied in regard to how they collaborated on working with the technology. Four main themes emerged from a comparison of the patterns of collaboration for all three cases in regard to technology integration: (1) mutual support (2) shared responsibility (3) joint work, and (4) isolation. The teachers’ collaborative patterns were consistent with Glazer, Hannafin, and Song’s study (2005), which presented mutual engagement, a shared repertoire, and a joint enterprise as constructs of a collaborative apprenticeship between mentor and novice.

Mutual support and learning

In the process of collaborating on technology integration, the beginning teachers, Sophie, Jane, and Paul primarily played a support role in which they drew on their technological skills and knowledge for such purposes as researching technology resources on the Internet and downloading files onto the computer so that the other teachers and the children would be able to use the resources. The beginning teachers also solved technical problems during computer play time such as trouble-shooting on the Internet or the cause of a malfunctioning printer. The experienced teachers, Nicole, Diane, and Cindy, suggested ideas pertaining to connecting the technology resources into the curriculum and the children’s play.
Whereas the beginning teachers brought technical skills and knowledge to the counterpart teacher, the experienced teachers stimulated the beginning teachers to think about using technology in the classroom in explicitly pedagogical terms.

Diane, an experienced teacher, suggested ideas for using technology in appropriate ways for the children’s play. In support of her pedagogical approach, she suggested that the beginning teachers search the Internet for instructional resources such as games and songs associated with curriculum themes.

Sophie, a beginning teacher at Happy Kids, had received training on how to use technology at her previous school. Therefore, she was well-versed with the technology and was an asset to her team in this regard. She searched good play resources such as games and TV cartoons for children on the internet and set up them on the computer in the classroom. She also created Email accounts for the children’s parents so that the children could send Emails to their parents.

Nicole, an experienced teacher at Child’s Space, often raised questions regarding how teachers can use technology for curriculum and children’s play. During a discussion focused on how best to use digital cameras in the classroom, Nicole suggested ways to use them for documenting the children’s play and displaying photographs taken by the children for their parents. At Nicole’s suggestion, Jane created a sign-up log for the children’s digital camera activity in order to ensure that each child had participated in the documentation activities with the digital camera. Jane, a beginning teacher at Child’s Space, downloaded the photographs taken by the children using digital cameras and
saved them in folders on the computer. She also sent daily reflections to parents through Email.

Paul, a beginning teacher at Children’s Corner, also took charge in terms of using technical skills in the classroom’s computer area, whereas Cindy, an experienced teacher, suggested ideas regarding how to extend the software for the children’s activities. Cindy planned and integrated software programs into the curriculum and children’s learning even though she worked in a limited technology environment.

Shared responsibility

In all three cases, the teachers shared responsibility for using the technologies and for managing the computer area. The beginning teachers mainly took charge of managing the computer area. However, in each case, all the teachers took turns monitoring the computer area when the children were playing on a computer play area.

Commonly in the three cases, a beginning teacher, mainly took charge of managing the computer area by providing a computer program to the children. However, all teachers shared the responsibility of monitoring and setting play time for the children’s computer play.

In addition, the teachers also shared responsibility for creating the daily reflections. The teachers took turns photographing the children and wrote up brief descriptions on a word-processor. The teacher would then attach photographs and send Emails to the children’s parents during office hours.
Joint work

Nicole and Jane showed a trajectory of joint work in technology integration by setting goals and then conducting an activity in line with those goals, reflecting on that activity, and then re-planning the activity through a collaborative inquiry. They were interested in developing activities with technology focusing on curriculum goals and children’s learning through collaborative reflection. They conducted technology activities based on strategic planning such as by setting specific goals for the use of a given technology in the children’s play.

In their collaborative planning of activities involving digital cameras, for example, Nicole and Jane set a goal of documenting the children’s work using this tool. Sparks (2008) emphasized that the common goals of a collaborative team serve as the foundation for building a professional learning community. Team goals provide opportunities to reflect on and adjust content and instruction accordingly, and they also provide a way of establishing whether teaching practices are in line with a school’s goals.

Through joint work, Nicole and Jane refined their process for keeping track of the photographs taken by the children by creating a system that included a sign-up log and by downloading photographs during nap time in order to identify which photographs had been taken by which child.

With the exceptions of Nicole and Jane, the teachers worked together on setting goals for using technology, albeit often in a limited way. Diane, Sophie, and Amy simply referred to the agreed-upon goal for teaching practice with technology as a basis for seeking educational resources online, and then they worked together on using those
resources in their planning of the curriculum based on their established themes. Their goal was set to extend technology resources into instruction and children’s play.

Nicole and Jane’s approach toward technology integration proceeded from inquiry basis. They questioned and adapted their work based their reflections and on systematic data collection as evidenced by their curriculum log, the children’s work, and their observations of the children’s activities in the classroom. Nicole and Jane gathered data related to technology use from their teaching practice, and they subsequently analyzed and reflected on that systematic data. Their approach accords with the position of Nolan and Hoover (2004), who have argued that teachers who take an approach characterized by inquiry stance follow and interpret evidence in order to obtain a more comprehensive picture of their teaching and its outcomes for learners.

**Isolated context**

The beginning teachers mainly took charge of managing the computer area. As technology tasks such as building an Email system are time-consuming and require technical skills, beginning teachers who take charge of technology still feel isolation in their work.

Although Diane was in a position to act as a mentor to the beginning teachers, Sophie and Amy, in the classroom, she was reluctant to provide either advice or mentoring because she felt that all teachers should be considered equal. Further, she felt that she did not deserve to teach or guide the other teachers because of her limited
technological skills. The members of this team showed respect for each other’s teaching in part by not intervening in each other’s teaching practice.

Mentor teacher, Diane, held the view that all teachers should work together as equals, and she also felt that she did not deserve to guide or comment on the other teachers’ teaching given her lack of technological skills. This is consistent with the perspective of critical constructivism, a tenet of which is “the equal value of each participant in collaborative inquiry” (Cochran-Smith, 1991, p.282). However, the teachers at Happy Kids just respected and/or accepted suggestions and ideas of their counterpart teachers on teaching practice.

Wang and Odell (2000) pointed out that the belief of “equal value among teachers” can neither draw critical judgment leading to good decisions on matters such as best practices nor improve teaching and schooling by encouraging a commitment toward knowledge, skills, and attitudes related to teaching. They emphasized the importance of challenging and questioning mentors and of beginning teachers striving to create new knowledge and to apply it for the benefit of the students’ learning enacting those roles in the classroom in line up with developing an approach.

On the other hand, according to NAEYC standards (2009b), early childhood professional preparation programs should emphasize supervised and reflective field experience for high-quality professional preparation. The conceptual discussion or exchange between Nicole and Jane in terms of their reflective practice for technology integration led the teachers to develop a curriculum that incorporates technology with the purpose of supporting children’s learning in meaningful ways.
In the process of mentoring, experienced teachers would play an active role in integrating technology into the classroom and lead joint work through collaboration. The mentor’s role is important in supporting teachers’ efforts to integrate technology, as mentoring in this context would involve providing support and for feedback on technological inquiry. Therefore, support from a mentor or peer coach in the area of technology use should be provided to support the collaboration of practicing teachers through sharing and communication among teachers.

**The Context of Technology Environment**

The results showed that the context in which teachers work with colleagues also influence teaching practice and collaboration for technology integration. The context of technology environment such as technology resources, personnel and technical support, and time are seemed as a factor which could act upon as either restrict or facilitate the way of use the certain kinds of technology in the classroom.

**Technology resources**

The most popular technology resources used in the classroom were digital cameras, educational software, the Internet, and Email. These were provided for the children and/or the teachers, but were used differently in all three cases.

Of the three cases, Diane, Sophie, and Amy worked in the most abundant technological environment—an environment equipped with two computers and three
digital cameras for the children and one digital camera for the teachers. Internet access was installed in the classroom for both the children and the teachers to use, but the printer was not available for the children’s use.

Nicole and Jane worked in a technological classroom environment equipped with one computer, a printer, and two digital cameras for the children. The Internet was connected in the classroom and both the children and the teachers could access it.

In Cindy and Paul’s classroom, only one computer (without a printer) and one digital camera were provided for children. They recognized that the ability to access the Internet in the classroom would support their teaching. However, they did not have such access, and apparently no prospect of obtaining it. Their ability to work effectively with the technology, therefore, was compromised in a fundamental way.

With the exceptions of Diane, Sophie, and Amy, the teachers wanted a more enriched technological environment for their teaching practice. The teachers commonly wanted to have more computers exclusively for teachers and also needed more abundant technology resources, including software. In the process of solving the problem of tracking the photographs taken by the children, Nicole and Jane realized that there was a need for more computers so that the teachers would be able to download photographs without interrupting the children’s computer play:

I get quite a lot of support here, certainly time, expert support from the university. I have money to buy new equipment. Well we’re expecting to get a new computer for the classroom. (Interview-Nicole, 12/19)
The teachers wanted opportunities to learn technology skills and likewise they wanted to know more about various technologies. The teachers also wanted to learn how to choose appropriate digital tools and how to integrate them into children’s learning play. Thus, the teachers were interested in acquiring both technical knowledge and pedagogical knowledge in order to use new technology in a suitable way for teaching and learning. This focus is related to Snoeyink and Ertmer’s (2001) position that the lack of knowledge and skills relating to technology could mean that instead of embracing technology, teachers from refrain from using it. The researchers asserted that technology integration cannot be effected without teachers who have sound technology knowledge and skills.

The teachers also wanted support from their organizations or at least easy access to a professional with whom they could communicate about technology matters. And, the lack of access to technical personnel and services in a timely manner was an obstacle to the teachers’ efforts to teach with technology. Cindy and Paul, the teachers at Children’s Corner, worked in a context characterized by a lack of support for personnel and technological resources at the organizational level. Their technology environment and teacher education opportunities were, therefore, correspondingly limited. In contrast, the Child’s Space teachers received ongoing support for professional development at the organizational level, which included training for the accreditation criteria and supervision based on the NAEYC principle. Support of this nature was possible at schools such as Child’s Space and Happy Kids in large measure because each collaborated with a university program.
The extent of the support the teachers received from their respective organizations to create and support a technological environment in the classroom differed considerably. It is evident that differences in the extent and quality of the technological resources available in the classroom made for differences in the extent and quality of the teachers’ teaching practices related to that technology. An organization’s spending on technology determines the effective use of technology for teaching and learning (Roblyer & Edwards, 2000), acting as a support for the permeation of technology in the classroom or as a constraint on such a process.

**Personnel resources**

The provision of abundant personnel resources in the form of interns and student teachers at Child’s Space and Happy Kids appeared to be very helpful to the teachers as they planned how to use technology and executed these plans in the classroom. However, it may be that Child’s Space and Happy Kids were able to provide these personnel resources because of their collaboration with a university program.

In regard to integrating technology into their teaching practices, the teachers wanted to determine which technology resources could be applied to the curriculum and to the children’s play. Cindy and Paul expected to have an opportunity and to be able to draw on personnel resources in order to learn about technology resources and how to use them appropriately and successfully. The teachers also wanted to learn how to integrate technology in appropriate ways for the children’s play and the curriculum. Thus, they
pursued learning opportunities in order to obtain information from outside classrooms, forums, and workshops. Even though Nicole and Jane had worked out some successful approaches to integrating technology into their teaching practice, they still very much wanted to learn more about knowledge and skills related to technology use for children’s play. They, therefore, sought out strategies and approaches that would be appropriate for technology integration in terms of children’s play and learning.

**Time**

The teachers regarded lack of time as a serious obstacle to their ability to use technology effectively. Due to the rapidly changing nature of technology, teachers for whom time is a limited resource can be expected to find acquiring new skills a considerable, even an insurmountable, challenge.

The teachers participating in the present study regarded time as an important factor in supporting teaching practices with technology as well as in terms of supporting teachers in their learning to teach processes. According to NetDay (2001), teachers would have more success integrating technology into their practice if they were afforded more time for this purpose. Support in the shape of the provision of office hours was helpful to the teachers at both Child’s Space and Happy Kids as they developed the curriculum and instruction integrating technology. And, over time, the teachers at both these centers came to rely on their office hours for conducting research, planning, and reflecting in regard to their teaching practice with technology.
Chapter 8

DISCUSSION AND CONCLUSION

This chapter offers a discussion of the findings in regard to technology integration and collaboration in the three cases. This chapter is organized into the following sections: the overall findings, conclusion, limitations of study, and suggestions for future research.

Discussion of Findings

In regard to technology integration in the collaborative process, the three cases of teachers differed in their teaching practices regarding technology integration depending on their inquiry stances toward and knowledge of technology and children’s play and learning. In addition, the context of the classroom such as the availability of technology resources and the extent and nature of the support provided by their workplaces also had an impact on technology integration in teaching practice.

Four themes were elicited from the findings focused on technology integration in the collaborative context, as follows: (1) inquiry into children’s learning and play, (2) teachers’ knowledge of technology, (3) collaboration, and (4) the context for technology environment. Based on these four factors, a framework is offered for supporting professional development focused on technology integration. This framework was designed to show how the four factors work together to effect technology integration and how they can be used to support teachers’ efforts to integrate technology into their
teaching practice. This framework is presented and discussed later in the chapter (see Figure 5, 159).

Building a collaborative community for professional development

The findings of the present study suggested how and the extent to which teachers are working together in the pre-K classroom to integrate technology into their teaching practice. The study found that the teacher’s inquiry into children’s learning and play, their knowledge of technology, and the nature of the technology environment all had an impact on the teacher’s teaching practice regarding technology integration and the ways and extent to which they collaborated on integrating technology into the classroom.

At first, it is assumed that the ways teachers integrate technology into their teaching practice is related to their inquiry into and knowledge of technology. The teacher’s inquiry influenced teaching practice in technology integration. All the teachers believed that technology should be used to foster children’s learning and play in meaningful ways but they adapted the same technology in different ways according to teachers’ inquiry into children’s learning and play.

The teachers fulfilled the role to facilitate children’s play to integrate technology into the curriculum and children’s play. However, the teachers still questioned whether their technology use is best suited to their teaching practice. In addition, the teachers desired opportunities to learn about various technology resources and how to apply them to their teaching practice. This showed that they are not confident in the level of their knowledge of either the technology or the pedagogy.
In a collaborative process on integrating technology into the classroom, the teachers performed complementary roles by exchanging technology knowledge and pedagogical knowledge with other teachers. In order to stimulate the beginning teachers to think about and apply technology into the children’s play, the experienced teachers supported the beginning teachers’ teaching practices with technology at the pedagogical level, and likewise, the beginning teachers supported the experienced teachers by providing technology knowledge and skills. Nicole, an experienced teacher, noted that she had learned about technology from Jane, a beginning teacher. And, Diane, an experienced teacher, also indicated that she learned from Sophie, a beginning teacher, about a computer such as how to print labels and how to make video programs.

Even though all three cases were working with colleagues in the same classroom, the teachers did not always result in collaboration on technology integration. The teachers varied in the collaborative modes from mutual support to working in isolation. This result is contrasted to the study (Glazer and Hannafin, 2008; Newman & Cochran, 2007) reporting that technology mediates collaboration among teachers. Technology use calls for teachers to collaborate, which could play a key meditational role in the co-construction of curriculum and instruction through a shared perspective on the use of technology in the classroom. However, the present study demonstrated that technology alone cannot mediate collaborative work among teachers.

Organizational supports such as technology resources and time had a strong influence on the teachers’ teaching practices and the collaborative patterns in technology use. For example, the presence of an Internet connection in the classroom was closely associated with the difference in teachers’ teaching practice regardless of the teachers’
beliefs regarding Internet use. Providing an abundant technological environment including sufficient time can be instrumental in teachers’ efforts to integrate technology or it could hinder teachers’ technology integration work.

Based on the result of the present study, a collaborative system to support teachers’ professional development should be provided so that teachers can share ideas and knowledge pertaining to technology integration in the classroom.

Given the proliferation of technology resources and their rapidly changing nature, teachers need sustained support to obtain and effectively use skills and knowledge related to technology integration. Teachers’ inquiry into technology integration should be focused on the children’s learning and play to achieve educational goals. In order to integrate technology into teaching practice, a knowledge base relevant to technology literacy, technology pedagogy, and play pedagogy is required for teachers, which can be applied to teaching practice in accordance with general principle of developmentally appropriate practice for children’s learning and play.

In addition, support at the organizational and social levels is essential to the success of efforts to integrate technology into the classroom. Collaboration among teachers within the classroom or at the school building level could prevent teachers from becoming isolated within the profession and encourage them to acquire the technology knowledge and pedagogy necessary to use technology effectively in the classroom. In addition, fostering inquiry and knowledge among teachers about how to collaborate also should be required to ensure that they work with their colleagues in more organic and complex ways for technology integration.
This study examined teachers working in the same classroom collaborating on integrating technology in real classroom situations in order to consider ways to fully support practicing teachers in a social context. In conclusion, this study suggested that teaching practice and collaboration regarding technology integration is related to teachers’ inquiry and knowledge as well as the extent of the school support available to each team. Therefore, support for technology integration should be provided both at the personal and social levels and both inside and outside the school within a collaborative framework. In such a way, the specific needs of and challenges faced by teachers relating to technology knowledge and technology pedagogy can be met.

It is valuable to provide a model for a collaborative learning community to empower teachers to integrate technology in ways that are meaningful and effective for children’s learning and development. Figure 5 presents a framework to support professional development in technology integration for practicing teachers based on the four factors discussed in this study. The figure shows how these factors interact in a dynamic way to support teachers’ work in terms of technology integration.
In the following sections, the four themes identified in the present study about technology integration and collaboration are elaborated in the following order: teacher’s inquiry into children’s learning and play, teacher’s knowledge of technology, collaboration, and the context for technology environment.

**Inquiry into children’s learning and play**

The teachers in this study all shared an interest in incorporating technology into children’s learning and play. In regard to using technology appropriately in their teaching...
practices, all the teachers considered technology to be an essential tool for teaching and learning. The teachers’ primary concern was centered on how best to adapt technologies for curriculum planning and instruction purposes. Even though they used the same digital tools, the teachers differed in their teaching practice in integrating technology for children’s learning and play.

Nicole and Jane stressed the children’s learning and play as the rationale for integrating technology into their teaching practices. The teachers worked collaboratively with the children in the digital camera activities in order to adapt the technology in meaningful ways to support their play and learning. Nicole and Jane’s inquiry into technology use began with Vygotskian pedagogical considerations with goal of using technology to enhance children’s growth and development.

Nicole and Jane integrated technology into their classroom through a collaborative reflection geared to supporting the children’s learning and developing the curriculum. By documenting their teaching practice with a digital camera, the teachers were prompted to make a professional inquiry into how to use technology for children’s learning and play. They then pursued this inquiry in order to develop and implement a curriculum incorporating technology.

The collaborative inquiry of Nicole and Jane resulted in the teachers learning to teach through technology integration, which gave rise to the children’s learning as well. Nicole and Jane’s teaching practice and their reflection on this process, in a sense, represented a small-scale classroom study based on planning, documenting, and reflecting on their classroom work. This is in contrast with the other two cases wherein digital cameras were used only for the children’s play regardless of the curriculum.
Cindy and Paul regarded technology as an efficient way to facilitate both teaching and learning practices. They strived to use technology to provide meaningful experiences in the context of the children’s learning and play despite limited support from their workplace. Due to the limited technology resources available at their work site, Cindy and Paul could only use software in the classroom but Cindy and Paul planned and revised activities with software in their own way in order to work with the children on concepts associated with math, science, and multicultural education.

Inquiry-based pedagogy, therefore, appears to be an important factor in the different ways that the teachers in the three cases engaged in technology integration practices.

The child’s view: Vygotskian-based pedagogy

Nicole and Jane created child-initiated play using digital cameras by incorporating a Vygotskian perspective into teaching and learning practices. They were interested in representing activities through technology for children’s play. As they worked with the children in the digital camera activity, Nicole and Jane learned that the children had their own views in regard to the photographs they wanted to display for the gallery project. Once the teachers realized the importance of the children’s views to see the situation through the children’s eyes, the teachers changed the procedure through which the children selected their photographs to be displayed.

Nicole and Jane’s teaching practices with technology improved through collaborating with the children in the classroom context. This collaborative process with
the children engendered a renewal of the curriculum through technology. In fact, Nicole and Jane regarded the children’s viewpoints as resources for curriculum planning. According to New and Cochran (2007), the idea that children constitute resources for curriculum renewal derives from socio-cultural pedagogy—a perspective in which children function as competent co-constructors of their own learning. This is consistent with the assertion of Johnson (2014) that children and teachers are co-constructors in play and learning situations.

**Teacher knowledge about technology**

The teachers attempted to incorporate and extend various technology resources into children’s learning and curriculum. The ways in which the technologies were used varied considerably among the three cases according to the teachers’ technology knowledge, technology pedagogy, and play pedagogy, which can facilitate or restrict teachers’ teaching practice for technology integration in the classroom.

**Technology knowledge**

The teachers all shared concerns about determining which types of technologies were suitable for classroom use and how best to integrate them into teaching practice.

The teachers used various technology resources such as software, digital cameras, the Internet, and Email in their classroom for the teachers and/or the children. Based on the findings of study, the teachers’ technology use differed according to the nature of the
inquiry into children’s learning and play and according to the teacher’s pedagogical knowledge of the technology. Further, each teacher simultaneously pursued technology resources with the goal of incorporating and extending them into the curriculum and the children’s play.

The teachers absolutely depended on the Internet to find instructional resources related to the curriculum. They searched for instructional resources for planning the curriculum and then incorporated those resources into instruction related to literacy, math, science, and art. The teachers regarded the Internet as a reliable source of instructional resources and play materials. In addition, the teachers also wanted to learn about the various types of technology resources and how to integrate them into the curriculum and children’s play. The teachers were interested in the current repertoire of technologies for teaching and learning and wanted to know how to access those technology resources for both their instruction and the children’s play. Yet, despite this high level of interest, the teachers’ knowledge in regard to technology was clearly limited in terms of both the resources themselves and the pedagogical knowledge necessary to use them effectively in the classroom.

This finding revealed a lack of confidence in technology knowledge and resources in the teachers, which is consistent with studies of Dawson (2008) and Teo (2009) that lack of time, lack of technology skills, and insufficient access to technology are all related to teacher’s confidence in technology use. This finding is in contrast with the result of previous studies (Ertmer, 2005; So & Kim, 2009), which emphasized teacher’s pedagogical knowledge in technology use.
According to Rosen and Jaruszewicz (2009), teachers must determine a kind of technologies children use and the extent to which children use. Further, teachers should decide whether it is worthwhile to integrate any given technology into their efforts to foster children’s learning and development. Thus, seeking information about educational technology resources is necessary to meet the goals of teaching and learning within the curriculum (NAEYC, 2009a).

It is difficult for teachers to acquire new skills and gain new technical knowledge relating to new digital tools due to the rapidly changing nature of such technologies. According to Mishra and Koehler (2006), technology drives teachers to make decisions about both content and pedagogy. They argue that providing pedagogical content knowledge about technology would make it easier for teachers to teach with technology whenever new technologies are introduced.

**Technology pedagogy**

The main issue pertaining to technology use is that of how to integrate technology such that it aligns with a given educational objective and such that it is geared to improve students’ chances of educational success (Roblyer & Edwards, 2000).

Educational goals can be met through a teacher’s pedagogical decisions in the area of technology use when, for example, teachers transform subject matter using technology in order to improve students’ knowledge and understanding of specific topics and issues. Hughes (2005) explained the relationship between pedagogical knowledge and the subject-specific technology inquiry as follows:
Teachers should be supported to develop technological pedagogical content knowledge for students’ learning. First of all, subject-specific technology inquiry is built up through collaborative community and teachers can learn about technology-supported curriculum. (p. 277)

Mishra and Koehler (2006) asserted that “knowing how to use technology is not the same as knowing how to teach with it” (p. 1033). Even though the teachers adopted the same technology, their respective pedagogical principles made for differences in how they integrated technology into their teaching practice to support children’s learning.

Nicole and Jane focused on integrating technology into curriculum development through collaborative inquiry in order to find ways to connect children’s experience with technology for educational purposes. For example, they developed a digital camera activity as a way of documenting the children’s work and extended this photographic activity across the curriculum into areas such as literacy and art. Nicole and Jane also extended their documentation of the children’s play with a digital camera into the exhibition of photos in order to communicate with parents by sharing children’s work.

Hughes (2005) stressed the importance of recognizing and leveraging connections between the subject matter and pedagogical content knowledge in teaching with technology. However, some teachers seemed to have limitations in terms of connecting content and pedagogy for technology integration for children’s learning. That is, some teachers lacked the requisite pedagogical content knowledge to integrate technology into their teaching practices. This result is consistent with recent research suggesting the need to prepare teachers to integrate technology into teaching and learning beyond learning about various technological tools (Glazer & Hannafin, 2005; Rosen & Jaruszewicz,
In a study by Glazer and Hannafin (2008), teacher-leaders who participated in mentoring focused on technology integration were interested in using technology to support learning rather than in learning about the technology in a general way.

All the teachers regarded technology as a critical tool for children’s play and learning, as well as for the teachers’ instructional practice. Even though the teachers focused on integrating technology into the children’s play, it needs to be proved whether technology use draw on children’s learning outcomes. This result points to a dissonance between the espoused beliefs or knowledge of the teachers and the actions they take in regard to technology integration (Ottenbreit-Lefwich et al, 2012).

Therefore, technological pedagogical content knowledge (TPCK) is essential if teachers are to integrate technologies into children’s learning. Technology integration should be conducted keeping in mind explicit goals relating to furthering children’s learning, which is the ultimate goal of using technology in the classroom.

**Play pedagogy**

The teachers differed in regard to the ways in which they intervened with the children working on the computer. Through a guided interaction approach, Nicole and Jane involved themselves in the children’s play with digital tools, which is compared to the teachers at Happy Kids, who were hardly involved in the children’s play with digital tools. Even in their limited technology environment, Cindy and Paul interacted with children who playing with the computer to teach concepts by connecting the contents of the software to the children’s learning.
An integrated approach to teaching play emphasizes both the teacher’s role in scaffolding the children’s play by providing real experience and ideas for the play, and the play environment beyond playing and observing children (Johnson, 2014). Nicole and Jane caught a teachable moment based on their observations of the children. That is, the teachers intervened in the children’s play with technology on the basis of observation when they made decisions that the children needed support. Trawick-Smith (2012) emphasized the importance of observing and interpreting children’s play as it relates to teachers’ ability to identify the right moments to intervene in children’s play, avoiding inappropriately interrupting children’s autonomous play.

Nicole and Jane observed the children playing with technology on a moment-to-moment basis in order to inquire into the children’s experience and learning related to technology. Observing children’s play was critical to the teachers’ efforts to create a bridge between their curriculum planning and children’s learning with technology. Through reflecting in an ongoing and collaborative way on their classroom practices, the teachers posed questions and regarding how to adapt technologies for the children’s play. According to NAEYC (2009a), teachers should continually gather information about children in a variety of ways and monitor each child’s learning and development in order to make plans designed to help the children progress.

Compared to Nicole and Jane, who conducted teacher-guided play, Cindy and Paul interacted with the children by employing play-generated curriculum model as defined by Johnson (2014), in which they incorporated software into children’s learning concepts related to curriculum subjects such as math and language.
On the other hand, in the Happy Kids classroom, in comparison with the other two cases, Diane, Sophie, and Amy did not interact with the children in the computer area frequently. In general, the Happy Kids teachers’ use of technology focused on providing technological resources for children’s play rather than for instruction.

Therefore, play pedagogy is demanded for teachers to teach children playing with technology in terms of children’s learning and play.

**Collaboration**

The three cases varied in regard to the collaborative patterns for technology integration according to the context in which the teachers worked. The patterns of collaborating on technology integration were shown from mutual support, shared responsibility, joint work, and working in isolation.

The experienced teachers and beginning teachers were mutually supportive in regard to sharing their knowledge about technology integration with each other. Whereas the beginning teachers were charged with responsibility for the technology tasks in the classroom by providing technical knowledge and skills, the experienced teachers provided knowledge related to technology pedagogy.

In general, experienced teachers suggested ideas regarding technology resources related to the curriculum theme or how to adapt technologies into children’s play whereas beginning teachers searched for and downloaded technology resources from the Internet and/or provided instruction to the experienced teachers on using a computer program or other technological equipment. This result is consistent with the results of a previous
study (Ertmer, 2005; Schlager & Fusco, 2003) showing that beginning teachers in a team tend to provide technology knowledge to their colleagues whereas the experienced teachers provide pedagogical knowledge.

Furthermore, the teachers commonly shared the responsibility for managing the computer area. In all three cases, the teachers showed classroom management skills related to technology use by setting up play times and monitoring the children playing with the digital tools. Hew and Brush (2007) suggested that technology-related classroom management skills are required for technology integration in regard to such matters as how to organize a classroom in order to provide the children with equal access to the computers and to deal effectively with technical problems associated with computer use.

The teachers varied in regard to their patterns of collaboration even though all the teachers were teaching in the same circumstances. Nicole and Jane also recognized that they had a mutually beneficial relationship. Each regarded the other as a good resource for learning to teach. Nicole and Jane showed a trajectory of joint work for technology integration by setting goals and by reflecting on and re-planning their teaching practice through a process of collaborative inquiry. As a result of their joint work based on their collaborative reflections, Nicole and Jane acquired a new knowledge to reconstruct the curriculum so that technology can be integrated effectively into it.

However, Cindy and Paul worked in an isolated way in teaching with technology at both the personal and the organizational levels. Furthermore, Cindy and Paul did not have either the time or the opportunity to work together in more collegial ways. On the other hand, beginning teachers exclusively took responsibility for managing and setting up the computer area by installing new computer programs and/or downloading them.
The ways in which the teachers collaborated on technology integration seemed to be related to teacher’s knowledge and the organizational support such as a limited technology environment or a limited time.

The context of technology environment

The teaching practices with technology and the teachers’ collaborative patterns varied according to the contexts in which the teachers were working. Support from the school for a technology environment including the Internet, software, and a printer made a difference in the teachers’ technology integration practices among the three cases. The context of the classroom, such as the technological environment and the level and nature of organizational support, appeared to influence the ways the teachers used technology for their teaching and learning. Mishra and Koehler (2006) pointed out that technology use for teaching should be based on context with regard to subject matter and student background and on the equipment, including computers and software programs, available in the classroom.

Regardless of the teachers’ need for technology resources, limitations in the technology environment such as no Internet access, limited software, and/or the lack of a printer acted as an obstacle to the teachers’ efforts to integrate technology into the classroom across all three cases. Cindy and Paul considered the Internet an important tool for teaching and learning. However, the lack of support from their organization result in that Cindy and Paul worked in a limited way in a classroom that was not wired for the Internet. This situation
was in contrast with the other two cases in which the teachers worked in classrooms connected to the Internet.

The teachers wanted for a more enriched technology environment such as Internet access, and even time to develop their teaching practice including both technological and personnel resources, in the technological environment.

Time was a pivotal factor for the technology use of all the teachers. On this point, lack of time proved to be a limiting factor, as classroom management in terms of technology use such as downloading and setting up technology resources on the computer is time-consuming. Further, pursuing an inquiry into and reflecting on technology integration is time-consuming work likewise.

Cindy and Paul made very little mention of having opportunities to learn from each other about technology integration. This significant gap in their collaborative relationship appears to have arisen from a lack of time to share ideas and knowledge, which, in turn, appears to be related to their work place. For example, their workplace did not provide support such as office hours. Researchers have pointed out that it is very difficult for teachers to find time to either reflect on issues or share ideas with colleagues and that this lack of time also undermines attempts to collect data during a teaching process (Cochran-Smith & Lytle, 1992; Zeichner & Liston, 1996).

In discussing the necessity of time for collaboration, Hargreaves (2000) stated that teachers need more time committed to them by the organization if they are to work in a more collegial mode. Additionally, Hord and Sommers (2008) pointed out that time is a serious challenge for professionals to overcome if they are to work together for the goals of building a professional learning community in a school. In particular, along with
personnel resources, sufficient time is important for reflective practice and collaboration so that teachers can learn about technology and share ideas with colleagues. Organizations, therefore, should provide time for teachers to learn and reflect through collaboration themselves.

An abundant technology environment would enhance the quality of teaching practices with technology in the classroom. Schools are urged, therefore, to provide a technological environment that allows teachers to plan and utilize technology resources in line with educational goals. In addition, sufficient time must be provided to teachers if they are to be successful in implementing their technology integration plans.

**Conclusion**

The results of the present study suggest aspects that lead to differences in teaching practice using technology integration and collaboration among the teachers. And, further, these differences seem to be related to multiple conditions such as each teacher’s inquiry into and knowledge of technology and of children’s learning.

Especially, a lack of inquiry-based pedagogy seemed to be a barrier to the teachers’ efforts to integrate technology into the children’s learning and play. This result suggests that technology-mediated learning derives from teacher-generated knowledge about technology use rather than from the technology per se.

In order to support for teachers to integrate technology into teaching practice in the classroom, it is necessary for teachers to acquire a strong set of skills and a
fundamental knowledge base such as technology knowledge, technology pedagogy, play pedagogy, as well as classroom management skills regarding technology use.

Another way to support how to integrate technology into the classroom context is related to the social level such as organizational support or collegial culture for learning to teach. Support for technology integration from organizations is an aspect of assessing school reform and is regarded as a value capable of enhancing professional development (Anderson & Dexter, 2000; Becker, 1992). Anderson and Dexter (2000) proposed a leadership model to determine whether an organization has established a culture of continuous learning.

The teachers in the present study worked together in the context of collaboration for technology integration at the local level, but they doubted the efficacy of their teaching with technology and wanted more learning opportunities. This result is consistent with Hughes’ (2005) position that collaboration that takes place only on a local level limits teachers’ professional development. Schlager and Fusco (2003) pointed out that the limitations of local values and norms of practice constitute formidable barriers to effective professional development. They suggested the need for a socio-cultural support structure for technology use through providing professional networking.

The present study suggests that collaboration among teachers for professional development should be undertaken at all possible levels, personal, local, and organizational, as well as more broadly within the profession. Lassonde and Israel (2010) underscored the point that networking engages support from external experts, which aids collaboration. Networking among teachers, therefore, is necessary to share knowledge and resources with colleagues that transcend professional collaboration at the local level.
Therefore, teachers’ efforts to integrate technology into their teaching practice should be encouraged through a collaborative system that provides support for such work across the organizational and local community levels.

**Limitations of the Study**

All the participants in this study were teachers who were working in day care centers. The participants’ classroom situations in terms of using technology, therefore, may differ significantly from those of teachers in kindergarten classrooms. Therefore, the results of the present study may not be applicable beyond the kindergarten context. Due to the ages of the children, all of whom were 3 to 4 years old, there were limitations in extending technology use into various curriculum areas. For example, the teachers reported that it was difficult to extend Email activities into some curriculum areas such as literacy.

Another limitation of the present study relates to the teaching practices of the experienced and the beginning teachers in terms of identifying the influence of collaboration. That is, the lapse of time between the presentation of this study (2014) and the period during which the data were collected (2007) may present a problem in terms of applying the results to teachers now. Briefly, it may be that compared with the study participants, present-day teachers have a different knowledge base and are likely to be better-prepared than the study participants were or even well-prepared for technology use.
Further Study

Further study is needed to identify specific components as a basis for building collaboration among teachers for the purpose of helping them to develop the skills and knowledge necessary for successful technology integration. Such an approach would serve as an overarching goal for effecting authentic collaboration and authentic professional growth. It is also necessary to reveal how collaborative inquiry and practice related to technology use can contribute to learning, both that of the teachers and the children. It is of great value to identify what teachers learn through collaborating with colleagues and how the use of technology can facilitate such learning. Moreover, further study of the relationship between teachers’ collaborative practices and children’s learning should be conducted to determine whether the ultimate educational goal of using technology is achieved.
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Appendix A

IRB Approval

Date: October 11, 2007
From: Dolores W. Maney, IRB Administrator
To: Meong Hee Jin
Subject: Results of Review of Proposal – Expedited (IRB #26507)

Approval Expiration Date: September 18, 2008
“Collaborative Process and Context for Technology Integration into Children’s Play”

The Social Science Institutional Review Board (IRB) has reviewed and approved your proposal for use of human participants in your research. By accepting this decision, you agree to obtain prior approval from the IRB for any changes to your study. Unanticipated participant events that are encountered during the conduct of this research must be reported in a timely fashion.

Enclosed is/are the dated, IRB-approved informed consent(s) to be used when recruiting participants for this research. Participants must receive a copy of the approved informed consent form to keep for their records.

If signed consent is obtained, the principal investigator is expected to maintain the original signed consent forms along with the IRB research records for this research at least three (3) years after termination of IRB approval. For projects that involve protected health information (PHI) and are regulated by HIPAA, records are to be maintained for six (6) years. The principal investigator must determine and adhere to additional requirements established by the FDA and any outside sponsors.

If this study will extend beyond the above noted approval expiration date, the principal investigator must submit a completed Continuing Progress Report to the Office for Research Protections (ORP) to request renewed approval for this research.

On behalf of the IRB and the University, thank you for your efforts to conduct your research in compliance with the federal regulations that have been established for the protection of human participants.

Please Note: The ORP encourages you to subscribe to the ORP listserv for protocol and research-related information. Send a blank email to: L-ORP-Research-L-subscribe-request@lists.psu.edu

DWM/dwn
Enclosure
cc: James E. Johnson
Appendix B

Interview Question

1. Could you tell me about your experiences with technology use in this month? What did you do with tech this month? What activities regarding technology have you been involved in thus far?

2. Do you have any goals for the use of technology with the children? What was your goal for the use of technology with children?

3. Would you explain how technology is useful for your teaching? To what extent do you expect technology to be useful for your work?

4. Please tell me how often both of you plan and conduct technology use in the classroom? What is your role in the classroom for the use of technology? What roles do you and your co-teacher take in regard to the computer area?

5. What kind of help did you get from your co-teacher for tech integration in the classroom? In what ways are you learning to teach from your co-teacher?

6. In what ways are you helping your co-teachers with respect to technology use?

7. Could you tell me about any challenges you are encountering using technology in your teaching?

8. Do you have anything that you want to learn about technology use?

9. What do you want to learn from the experience of collaboration regarding technology use in the classroom?

10. What do you want to know more about tech use for your teaching practice?
Appendix C

Questionnaire

1. How would you describe the role of technology in the classroom?
2. What role do you think teachers play in the use of technology in the classroom?
3. What do you expect to learn from the experience of collaboration with your co-teacher about technology use in the classroom?
4. How do you hope to support your co-teachers in learning about technology use for their teaching practice?
5. What do you think is the most important element needed to use technology in the classroom?
Appendix D

Observation Protocol

1. How do teachers use technology in the classroom?

2. How do teachers use technology with children in the classroom?

3. What role do teachers play in the use of technology in the classroom?

4. What environments for the use of technology are provided for teachers and children in the classroom?
Appendix E

Questions for the demographic information of participants

Name: __________

Age of teacher: __________

Ages of the children in the classroom: ____________

1. How long have you been a teacher?

2. How long have you taught at this center?

3. To what extent do you use a computer for your personal use and to what extent do you use technology in your teaching? (Give me examples of the programs, e.g., email, Internet surfing, whiteboard.)

4. Have you had previous experience with educational technology and computers in your teaching practice? If so, tell me something about your experience. What technology did you use and how did you use it? (Give me some examples of activities (e.g., writing a story with a word-processor or creating a PowerPoint program for developing instructional materials.)

5. Have you taken any educational technology or computer training through either a pre-service or an in-service program? If you have, please explain in detail where you had your technology training experiences and what those experiences have been.
Vita

Meonghee Jin

Education
Ph. D. in Curriculum and Instruction (2014). Pennsylvania State University

Professional Experience
Full time instructor (1989-1990) Department of Early Childhood Education in
Gwangju University
Assistant professor (1991-1994) Department of Early Childhood Education in
Gwangju University.
Associate professor (1995-1999) Department of Early Childhood Education in
Gwangju University.
Professor (2000- present) Department of Early Childhood Education in Gwangju
University.

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