This article summarizes a formative evaluation of a two-year project to provide professional development in technology for urban early childhood teachers. The researcher collected and analyzed data from interviews of 18 teachers. Using the constant comparative method the researcher identified common barriers that inhibited the effective integration of technology.

The Problem and Its Setting

Efforts to integrate technology in urban early childhood classrooms should not only be predicated on developmentally appropriate pedagogical strategies but also with a consideration of the implementation issues unique to those classrooms. The pedagogical decision to use technology and the subsequent creation of engaging, developmentally appropriate curriculum are dependent on the resources and conditions of the early childhood classroom. This article presents the results of a formative evaluation of a two-year professional development initiative that focused on technology integration for 75 prekindergarten to third-grade teachers in three urban school districts. The results of this evaluation point to the unique and demanding conditions that must be considered when designing professional development in technology for teachers in these grades.

The professional development was a component of New Jersey City University’s Science, Math, and Reflective Teaching (SMART) program, a
program to improve the science and math knowledge and pedagogy of pre-kindergarten, kindergarten, first-, second-, and third-grade teachers. The program was funded by an Eisenhower grant and developed by New Jersey City University and three urban school districts in New Jersey. A total of 75 teachers, approximately 25 from each of the three districts, participated in the program.

These three districts have been designated as Abbott Districts by the New Jersey State Department of Education. Abbott Districts are the 30 of the 616 school districts that have been characterized as “poor urban districts” (New Jersey Department of Education, 2003a; New Jersey Department of Education 2003b). The districts in this study have a high concentration of minority and poor students.

Table 1
Demographic Information on Students from Participating School Districts

<table>
<thead>
<tr>
<th>District</th>
<th>White</th>
<th>Black</th>
<th>Hispanic</th>
<th>Asian</th>
<th>Native American</th>
<th>Eligible for Free or Reduced Lunch</th>
<th>Classified as Poor by Title I Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>District 1</td>
<td>9.50%</td>
<td>36.30%</td>
<td>39.30%</td>
<td>14.03%</td>
<td>0.88%</td>
<td>70.03%</td>
<td>75.69%</td>
</tr>
<tr>
<td>District 2</td>
<td>6.82%</td>
<td>59.12%</td>
<td>31.68%</td>
<td>0.9%</td>
<td>0.07%</td>
<td>76.37%</td>
<td>77%</td>
</tr>
<tr>
<td>District 3</td>
<td>4.36%</td>
<td>7.83%</td>
<td>87.19%</td>
<td>0.54%</td>
<td>0.09%</td>
<td>79.59%</td>
<td>82.80%</td>
</tr>
<tr>
<td>Averages</td>
<td>6.89%</td>
<td>34.42%</td>
<td>52.72%</td>
<td>5.16%</td>
<td>0.35%</td>
<td>75.33%</td>
<td>78.50%</td>
</tr>
</tbody>
</table>

The two-year project included three professional development workshops on Saturdays during each year, inclass support for the teachers throughout the two years and a weeklong summer institute each of the two summers. The professional development personnel from the University included three mentor teachers from the University’s Early Childhood Department and content specialists from Math, Science, Literacy Education, and Educational Technology. My role was the content specialist in Educational Technology. Over the course of the two years I gave workshops and made numerous classroom visits. In total, I conducted 28 workshops for the two-year period. I also made a total of 19 site visits to the various schools in the program, both during the teachers’ class time and during their after school mentoring meetings with the Early Childhood Education Specialists.

The overall objective for the technology component from the project proposal was driven by the idea that, “Teachers need to learn ways to integrate technology into their regular lessons, activities, and assessment and see
new possibilities rather than treating technology as an end in itself or an add-on” (Rand, 2001). To this end the workshops focused on getting the teachers to:

- apply and evaluate the developmentally appropriate integration of technology in the curriculum;
- analyze, reflect, and share their own best practices related to technology;
- incorporate quality software into their curriculums that was researched and purchased through the program; and
- develop engaging curriculum with generic applications (PowerPoint, the Internet, etc.)

The content and organization of the workshops and classroom visits were guided by the position statement of the National Association for the Education of Young Children (NAEYC) (1996) and the work of Haugland (2000) (Haugland & Wright, 1997). The design of the workshops was based on stages of integrating educational technology whereby teachers begin by learning the technical skills and then evolve into innovative users (Sandholtz, Ringstaff, & Dwyer, 1997). There was also a focus on consistently linking the technical skills, even at the beginning stages, to curriculum development. The ultimate goal was for teachers to seamlessly integrate the technology into rich, developmentally appropriate practice.

It was after the first workshop that I began to get a sense of the logistical problems that the teachers faced with technology integration. At the first workshop the teachers participated in hands-on activities in evaluating and integrating software and web sites. The teachers and I discussed various web sites and the software packages that were purchased through the grant, and we evaluated them with developmentally appropriate criteria using the Shade/Haugland Evaluation Scale (Haugland & Wright, 1997). The teachers also discussed and designed ways to integrate this technology into their curriculum. Although the teachers gave excellent reviews of the workshop in their evaluations, during the subsequent classroom visits and informal conversations I saw that the teachers were having unanticipated difficulties using technology. Although I did not expect significant integration of technology after one workshop, I also did not expect to see the depth and variety of problems that inhibited teachers from implementing the ideas of the workshop. The teachers had pragmatic and logistical problems in starting the implementation of the ideas and techniques from the first workshop, for example, restrictions for installing the software, older computers that were unable
to handle the programs. It was easy to predict that these difficulties would continue unless they were addressed directly.

I began a formal inquiry into the successes that the teachers had in using educational technology, the types of barriers that they faced, and the resources that they had available. The goal was to analyze this data and modify the technology component of the professional development while building on the previous goals of encouraging rich, developmentally appropriate practice.

The purpose of this formative evaluation was to examine the connection between the environmental factors and the use of educational technology. The series of interview questions and further probing stemmed from these guiding questions:

1. What are the day-to-day conditions of the early childhood classrooms and curriculum in relationship to integrating educational technology?
2. What are the current practices and successes for using technology in the curriculum?
3. What are the current and potential barriers for technology integration in early childhood classrooms?

From an analysis of this data, I would then revise and modify the professional development workshops.

**Method**

I conducted interviews with 18 early childhood teachers from six schools in the program. The research design was qualitative, in the model of basic interpretive research whereby I collected data from a series of interviews and began to look for themes, patterns, and categories (Merriam, 2002; Glaser & Strauss, 1967). This sample consisted of all of the schools that I visited beginning in the latter part of the first year until the end of the second, and final, year. I began to analyze the data and modify the workshops after the first set of interviews validated many of my hunches about the efficacy of the professional development. I collected formative data until the end of the second school year to continually improve the workshops until the final, weeklong summer retreat.

The interviews were conducted in small groups and responses were distinguished by teacher. The following questions were asked in the interview:
1. What grade do you teach?
2. How many computers do you have in your classroom? How many have working Internet access?
3. Do you use technology in your teaching? If yes, how?
4. What is your most successful practice with technology?
5. What resources do you have?
6. What are the main barriers to using technology in your teaching?

Questions 3-6 were followed up with probing. Although each teacher was given an opportunity to express his/her own views, there were modifications as teachers agreed or diverged in the discussions of their individual experiences. Each of the six group interviews lasted between a half hour and 45 minutes. Although interview techniques were used, I also used techniques of focus group research (Krueger, 1994). These group interviews were employed to accommodate the logistics of the teachers’ schedules, to create a more collegial atmosphere, and to stimulate reflection. For each group interview I recorded the responses on paper that had distinct rows. I would label the appropriate rows with each teacher’s grade level and subsequent responses to the interview prompts.

I then transcribed their responses on a word processor, coded each response by question and participant, and printed them on separate pieces of paper. All of the responses were then put into piles for each prompt. I then sifted through each pile of responses looking for themes and generating categories using the constant comparative methods (Merriam, 2002; Glaser & Strauss, 1967).

Developmentally Appropriate Practice

Any improvements derived from an analysis of the interview data would be based on the principles of developmentally appropriate practice. NAEYC (1996) has a position statement with three criteria for educators to consider with planning a developmentally appropriate curriculum:

- Educators should be familiar with how students learn based on scientific research.
- Educators should be knowledgeable about the individual levels of their students and how they learn.
- Educators need to be knowledgeable of the social and cultural context in which those children live and learn.
The position statement elaborates on these broad guidelines with documented research. The broad basis of the position are the Piagetian constructs of the sequential development stages and the Vygotskian premise of the interdependence of the child’s social, physical, and cognitive development.

Both opponents and supporters of educational technology in early childhood classrooms base their positions on the applications of technology to support developmentally appropriate practice. The Alliance for Childhood (2000) has become a leading advocate for the restriction of technology in the education of young children. Regarding the use of technology for children in early childhood and elementary education, they claim, “For a relatively small number of children with certain disabilities, technology offers benefits. But for the majority, computers pose health hazards and potentially serious developmental problems.” One of their main contentions is that use of technology weakens the social and emotional bonds between children and the world and this necessarily inhibits the development of child at that early age.

Too often, what computers actually connect children to are trivial games, inappropriate adult material, and aggressive advertising. They can also isolate children, emotionally and physically, from direct experience of the natural world. The “distance” education they promote is the opposite of what all children, and especially children at risk, need most—close relationships with caring adults. (Alliance for Childhood, 2000)

The authors categorically discredit many of the claims made by advocates of technology in early childhood education by pointing out the dangers it posses to the development of young children. Conversely, there are also voices in the field that support the use of educational technology in early childhood education. Several studies have shown the efficacy of technology to support developmentally appropriate practice. Elias, Railsback, and Van Scoter (2001) emphasized that technology can increase cognitive development when it is combined with language use and social interaction. In her review of research on technology in early childhood education, Haugland (2000) believed the following:

The potential gains for kindergarten and primary children are tremendous, including improved motor skills, enhanced mathematical thinking, increased creativity, higher scores on tests of critical thinking and problem solving…and increased scores on standardized language assessments. In addition, computer use enhances children’s self-concept, and children demonstrate increasing levels of spoken communication
Conditions that Inhibit the Integration of Technology

and cooperation. Children share leadership roles more frequently and develop positive attitudes toward learning.

The position statement of the NAEYC on Technology and Young Children—Ages Three Through Eight (1996) is an authoritative and broad set of principles for the use of technology in early childhood education. It has directly informed guidelines and evaluations for programs, curriculum, and software. NAEYC advocates that:

1. Professional judgment by the teacher is required to determine if a specific use of technology is age appropriate, individually appropriate, and culturally appropriate
2. Used appropriately, technology can enhance children’s cognitive and social abilities
3. Appropriate technology is integrated into the regular learning environment and used as one of many options to support children’s learning
4. Early childhood educators should promote equitable access to technology for all children and their families. Children with special needs should have increase access when this is helpful
5. The power of technology to influence children’s learning and development requires that attention be paid to eliminating stereotyping of any group and eliminating exposure to violence, especially as a problem solving strategy
6. Teachers in collaboration with parents, should advocate for more appropriate technology applications of all children
7. The appropriate use of technology has many implications for early childhood professional development (NAEYC, 1996)

Like many initiatives in educational technology, the use of technology in early childhood education has both a strong base of support and its critics. The SMART teachers program is premised on a view that educational technology can enhance the education and development of young children when used intelligently. However, the perspectives of opponents of technology and a mindfulness of their line of reasoning can be helpful caveats and quality control touchstones.

Professional Development

The initial model that guided the design of the professional development workshops was also the foundation for any modifications. This model
is based on the work of Sandholtz et al. (1997). Their 10-year study with the Apple Classrooms of Tomorrow (ACOT) project found that teachers pass through distinct stages of using technology in the classroom—from an initial stage when they learn the technical procedures, to using technology to support their existing curriculum, and finally, to using technology to reform and reconceptualized what and how they teach. The technology workshops and classroom visits were conducted with this model in mind, with the ultimate goal of the final stage, characterized by having the teachers reflect and innovate their curriculum with technology. Carlson (2000) specifically advocated an approach with these underpinnings to technology professional development for early childhood teachers. Her “multifaceted social-constructivist transformation model” was developed as an alternative to traditional decontextualized, didactic professional development in technology, and she relates its efficacy for early childhood teachers.

Swaminathan’s (2000) research with educational technology and early childhood teachers complicates a strict adherence to the work of Sandholtz et al. Swaminathan concluded that the technical training should be integrally tied to curriculum development, as opposed to an initial technical orientation. She advocated professional development in technology for early childhood teachers that dynamically blends curriculum development with technology training.

Her research is premised on the work of Clements (1994) who distinguished three distinct characterizations of technology use in classrooms. The first model is when a teacher uses computers to teach in isolation, with one or two students working on a computer program with little connection to the classroom activities. The second model is when the computer is used as an add-on, to extend the work of the class. The third, and desirable, model is when “on and off computer activities lead seamlessly from one to the other in a mutually beneficial spiraling curricular activity” (Swaminathan, 2000). While these models correlate with the stages that Sandholtz et al. articulated, Swaminathan saw a problem among early childhood teachers who became fixed on the “add-on” approach. Her research revealed that early childhood teachers tended to use this second approach, even when the professional development targeted the third, integrated approach (Swaminathan). Swaminathan’s research highlighted the sticking point that can occur after teachers have learned the technical features of a particular technology.
Findings

I visited six schools involved in the program and interviewed 18 teachers in small groups of two to four. Ultimately, I wanted to identify how they were using technology in their classrooms and the main barriers to improved technology integration. Besides preliminary data on the number and condition of their computers and Internet access, I wanted to delineate their use of technology and successful practices. Most importantly, I wanted to discover and analyze the barriers to using technology in their classrooms.

Resources and use. Table 2 lists the participants, grade levels, the number of computers for students to use in each classroom, the number of computers with Internet access, and whether the teachers used technology for their teaching. The teachers were asked a broad prompt if and how they used technology in their classroom, the latitude of the question allowed for a variety of responses. Many teachers indicated ways in which they used computers with the students, and some discussed ways that they used technology to prepare for their classes. Of the 18 teachers, 6 unambiguously said that they did not use technology for their teaching.

Table 2
Resources in the Classrooms

<table>
<thead>
<tr>
<th>Grade</th>
<th>Number of Teachers in Grade Level</th>
<th>Average Number of Computers per Classroom</th>
<th>Percentage of Computers with Internet Access</th>
<th>Percentage of Teachers who Report that They Use Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>PreK</td>
<td>3</td>
<td>1.66</td>
<td>40%</td>
<td>66%</td>
</tr>
<tr>
<td>K</td>
<td>4</td>
<td>2.25</td>
<td>66%</td>
<td>50%</td>
</tr>
<tr>
<td>1st</td>
<td>3</td>
<td>1.66</td>
<td>0</td>
<td>100%</td>
</tr>
<tr>
<td>2nd</td>
<td>4</td>
<td>2.25</td>
<td>33%</td>
<td>50%</td>
</tr>
<tr>
<td>3rd</td>
<td>3</td>
<td>2.33</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Special Ed/ Resource (SE/R)</td>
<td>1</td>
<td>No Classroom</td>
<td>No Classroom</td>
<td>0</td>
</tr>
<tr>
<td>Totals/Averages</td>
<td>18 Total</td>
<td>Mean = 2</td>
<td>51%</td>
<td>66%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mode = 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Median = 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Not Including SE/R)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
This data was helpful in developing the professional development workshops. There was an average (Mean, Mode, and Median) of two computers per classroom and half of all of the computers did not have Internet access. Two out of three teachers reported that they use technology at some level in their teaching. It is also important to note that computer use did not correlate with grade level. All of these factors were used in the modification and improvement of the workshops.

Data that I anticipated would be helpful for the development of the workshops was an overview of the teachers’ existing successful practices using technology. When asked to report their current successful practices, the most common technique the teachers described was the use of specific software packages as an addition to an existing curriculum. Swaminathan (2000) has found this to be one of the most common, though not ideal, uses for technology among early childhood teachers even after professional development that targeted an integrated approach. In the prekindergarten and kindergarten classes, use of the software was organized around a “center,” an optional or rotational activity area where a small number of students spent a limited amount of time. In grades one, two, and three computer software was used as an extension for a lesson for a small number of students. For some, computers were used as a reward or a classroom management technique for students who completed their work early.

Regardless of the types of use, in almost all of the interviews the teachers were very mindful of the quality and developmental appropriateness of individual software packages. They spoke analytically and detailed about the packages and features that was most successful, for example, Math Blaster, Winnie the Pooh, Sammy’s Science House, and Millie’s Math House.

Three of the teachers used technology as a resource for their own teaching—looking up lesson plans and projects, finding images and clip art for student work, and creating original tests and handouts. Two of the teachers used digital photography to take pictures of the students and incorporate the images into various projects and displays (calendars, bulletin boards, portfolios), and one used a Polaroid camera for similar projects and displays. All three spoke highly of the ease, productivity, and student engagement with photography.

Barriers for technology integration in urban early childhood classrooms. This was the main research focus of this formative evaluation. From this data, I hoped to improve the topics and delivery of the professional development. I came to discover that early childhood teachers face unique and complex obstacles to the integration of technology in the classroom. On a
pedagogical level, the appropriate use of technology in developmentally appropriate practice is, by itself, a challenge for curriculum development. At the level of implementation, there are a variety of interrelated challenges stemming from the context and character of the early childhood classroom. Although there was some slight variation among schools and districts, there was general agreement on the major issues that hinder the effective use of technology. There was a difference between the lower grade teachers (pre-kindergarten and kindergarten) and the upper grade teachers to the degree to which each group focused on problems related to classroom management. This was due to the dramatic change in pedagogy that occurs between kindergarten and first grade as the use of centers disappears and an emphasis on seatwork and whole class instruction increases.

When questioning the teachers on the barriers to using educational technology, the prompt was broad enough to solicit a spectrum of response and allowed me to probe for elaboration. Using the constant comparison method (Merriam, 2002; Glaser & Strauss, 1967), four themes arose from the interviews:

- curricular and administrative demands;
- negotiating resources;
- professional development requests; and
- classroom management.

Although each of these factors was distinct, the reality was that they interrelated factors contributing to the difficulties of technology integration.

**CURRICULAR AND ADMINISTRATIVE DEMANDS**

The single controlling theme that came from the interviews is that there are complex curricular demands placed on early childhood teachers. Although a general sense of the importance of using computers permeates their school culture and is formally required by state curriculum requirements, they all have mandated instructional units and, in the first, second, third grades, the urgency of test preparation and curricular benchmarks dominate their priorities. Fulfilling these directives prevented them from the type of exploration and experimentation that they felt was needed to familiarize themselves with technology. One second-grade teacher said, “There is not enough time for me to learn the software for the kids to use it…we have a
set curriculum plan and testing mandates. We’re just too busy to do anything extra.” Another teacher quipped, “The district sends us mixed messages. They want us to use computers but we only get a little, and we don’t have the time to play around,” and “I really don’t get a chance to use it—there are too many other things to do.” One comment from a first-grade teacher was particularly incisive when she complained about professional development workshops, “It’s interesting but hard to focus like other teachers because I know I can’t use it in class.”

Interestingly, the teachers consistently associated their own experimentation with the technology as an initial step in curricular integration. With increasing demands for improving the quality of content instruction and formalized benchmarks and assessments, there was little time for experimentation and a sense of the decreasing opportunities to use the technology with the students.

There were also technical restrictions imposed by the administrations that the teachers described. Many with Internet access reported misguided filtering software. Also, it had been common for teachers to purchase software on their own and install it on the computers in their classrooms. However, every group of teachers reported recent increases in security that prohibited this.

**NEGOTIATING RESOURCES**

Another theme that emerged related to the teachers’ allocations of technical resources. Of the 18 teachers interviewed, 1 was an in-class support teacher without a permanent classroom. Of the other 17, almost all said that they got older computers that had been given to them as the upper grades got newer replacements. Other than computers in the classroom, there were other resources that the teachers managed. From one school there were three teachers who shared a digital camera for their grade with two other teachers, and one of the teachers interviewed used it consistently. A teacher from another group used her own digital camera and a teacher from a third group used her own Polaroid. Two of the six schools provided computer labs for the teachers to reserve, and one teacher had taken advantage of the lab on a consistent basis. For the teachers who had access to the digital camera and computer labs but did not use them, their reasons related to both time and curricular restrictions.

There were even problems beyond the administrative restrictions with the common practice of teachers purchasing software for the students. Of the
10 teachers that reported purchasing software, 3 claimed to have difficulty finding appropriate software. One response was typical, “Anything I get is either too easy or too hard.”

There were some innovative practices that the teachers used in adapting to the limited resources. An early childhood teacher from one school who was not involved in the program created a popular list of helpful Internet resources, enlarged and laminated it and distributed to the other early childhood teachers. Though consistent use of the list was hindered by spotty Internet service, all of the teachers interviewed from that school said that they found it very helpful. One of the six schools had a computer teacher who visited each class periodically. She would introduce students to resources and information on the Internet using a mobile computer, cached files, and a projector. These presentations would focus on particular theme like Black or Women’s History Month.

PROFESSIONAL DEVELOPMENT REQUESTS

The issue of professional development came up in four of the six schools. All of these discussions fell into requests for training in three particular areas: training in specific software packages; training in generic applications such as PowerPoint, the Internet, and Excel; technical training in troubleshooting printers and file management; and instructions on getting and using clip art and images for teacher-generated materials. Several of the teachers mentioned a disconnect between past professional development workshops and the resources and curriculum of their classrooms. Consistently, the teachers associated a lack of training to a lack of time, seeming to indicate a desire and a confidence to work independently. It was also interesting that the teachers focused on the technical aspects of the training and professional development as opposed to the curricular integration.

CLASSROOM MANAGEMENT

Although some of the first-, second-, and third-grade teachers complained about the difficulties of managing computer work with a large class, this problem was more prevalent among the prekindergarten and kindergarten teachers. This difference was due to a dramatic shift in practice from kindergarten to first grade, from an emphasis on play and activity centers to a classroom more focused on seatwork, direct instruction, and the comple-
tion of a single activity at a time. The prekindergarten and kindergarten teachers complained about managing centers focused on computers. They said that when a center was dedicated to a computer program, it required an inordinate amount of the teacher’s time. The teacher had two major issues; she had to teach many, if not all, of the students the software or manage student use of the software to assure an equitable amount of time on the computer for each child.

Discussion

The premise that is revealed from this data is that these teachers have a complex array of demands and an intrinsic sense of isolation in their classrooms. The curricular demands, particularly for first-, second-, and third-grade teachers, were especially intense as initiatives relating to state assessment and federal legislation were being implemented in the schools. This left little time for the experimentation with technology that many of them associated with integrating technology in their teaching.

Secondly, the teachers felt that they had an inordinate amount of technical obstacles, particularly in comparison to their peers. The computers that these teachers had were the slowest and oldest in the school. The schools and districts had various installation policies, enforced by administrative procedures or technical restrictions, that restricted one of their most successful practices, installing software that they bought themselves. It also made choosing particular software programs for grades or schools a risky endeavor because, even after installation restrictions were addressed, various packages had minimum system requirements that were not met on a significant number of the machines.

In regard to professional development, the conversations appeared to focus on the technical rather than the pedagogical, and these technical issues related to requests for particular training topics. The requests for technical training run the gamut, from particular software programs to hardware use and troubleshooting to work with generic applications like the Microsoft Office Suite. Similar to the teachers’ association of curricular integration with time to experiment, the association of professional development with specific technical training seem to emerge from the independent (and isolated) nature of early childhood teaching. In both instances teachers were ready to take on pedagogical leaps after the initial time and training.

The practice of teacher-directed, whole-class instruction that commonly begins in the first grade inhibits the integration of technology. This change
can be characterized as a movement away from various activity centers in the kindergarten class to teacher-directed class work with students following in relative unison. While prekindergarten and kindergarten teachers feel the stress of technology integration because of the center orientation of their classrooms, teachers in first, second, and third grades have managed to avoid these problems because the dominance of teacher-directed, whole class instruction. However, most of suggested classroom designs for technology integration correlate with the classrooms described by the prekindergarten and kindergarten teachers (Sandholtz et al., 1997). First-, second-, and third-grade educators will have to address fundamental questions about the employment of collaborative, learner-centered, and constructivist classrooms—like the centers of earlier grades—to address the successful integration of technology in the curriculum.

Conclusions and Recommendations

The initial goal of this formative evaluation was to obtain data that would inform the professional development needs in technology. Based on an analysis of the data and continuing dialogue with the teachers, I identified particular areas for future workshops, areas that were built on the principles of developmentally appropriate curriculum. Embedding techniques and technology that were flexible and interoperable became extremely important. The skills and dispositions taught in the workshops should allow the teachers to scale the integration of technology to the subjects, grade level, class size, and available technology.

Concepts and skills that can be applied in a lab setting should be useful to a classroom with a few computers or a single station. The teachers should be able to adjust the applications of technology from using it themselves to create material or as part of an integrated activity (a station or resource for a larger project), to having students work individually or in groups on a computer. Many educationally dedicated software programs that are tailored for a single user inhibit the ability to adapt and innovate. To facilitate the seamless use of technology described by Sandholtz et al. (1997) Clements, (1994) and Swaminathan (2000) teachers need the skills to adapt to the varying and unique conditions of their classrooms and curriculums. Generic applications, such as Excel, Word, and PowerPoint offer this type of flexibility. The formatting options and security features can allow a teacher to create customized, developmentally appropriate templates for students to use in integrated curriculum projects. In the same vein, digital cameras offer flexibility for a variety of applications. The use of digital cameras offers op-
portunities for collaboration, conversation, and reflection. They can be catalysts for young children to learn with technology in the socially mediated ways advocated by Haugland (2000) and Elias et al. (2001).

There are other, broader skills and dispositions that should be emphasized in the professional development of early childhood teachers, areas that do not necessarily relate directly to technology but would facilitate its effective use. Based on the data collection process and analysis, I would recommend an approach to professional development that emphasizes the social dimensions of learning for classroom teachers, in the spirit of the work by Carlson (2000), that would facilitate learning channels among professional developers and teachers, with an emphasis on formalizing opportunities for teachers to share and reflect with each other.

A final, related recommendation would be to encourage teacher advocacy. This comes from the data that suggests the institutional inertia created when teachers do indeed get by with what they have. As opposed to other grades, where rotating classes becomes more common and teachers have more opportunities to interact, the lot of the early childhood teacher is especially isolated (in a profession that is known for isolation).

This isolation not only inhibits collaboration but also appears to discourage advocacy by the teachers themselves. The teachers, in some medium, could have addressed many of the barriers they faced, though did not. For example, there are administrators and staff responsible for the maintenance of the computers, yet there was no evidence of this being done. This idea of teacher advocacy did not come up in any of the interviews. The teachers resourcefully coped with their conditions, but they did little or nothing to step outside of the context of the classroom to improve their situations.

To lay the blame on the school administrations for these issues would be over simplistic and inaccurate. It seems defensible in the calculations of allocating resources in schools with budget restrictions that administrators would place the newer computers and emphasize technology in classes with more formalized opportunities in their curriculum to use them. However, the early childhood teachers could begin a stronger dialogue regarding their needs and concerns regarding technology, as well as for other areas of concern.

This formative evaluation was extremely helpful in improving the technology workshops, as well as illuminating the gap between professional development and the conditions of the classrooms. The conditions, dispositions, and responsibilities of teachers are crucial areas of consideration for professional development, and should be explored further. Although a broader consideration of the role and treatment of urban early childhood ed-
ucation was not the focus of this research, the findings and conclusions point to a need to take a more systemic perspective for the effective use of technology, professional development, and education of young children.

References


New Jersey Department of Education (2003a). *Abbott implementation*. Re-
