# USING TECHNOLOGY IN EARLY CHILDHOOD EDUCATION: THE 100 DAYS OF SCHOOL PROJECT

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#### **ABSTRACT**

This study has three primary objectives. First, it describes the ways in which six teachers in an urban school environment in New York City integrated technology within a common and familiar theme among lower grade students, named the 100 Days of School. Second, it presents the professional development activities that teachers engaged in while enacting the 100 Days of School project. Third, it discusses the ways in which technology contributed to student learning.

## **KEYWORDS**

Technology integration, teacher professional development, early childhood education

#### INTRODUCTION

As computers increasingly become available in our schools and society, they begin to reshape the learning experiences of students in profound ways. In the United States, there is about one computer for every five public school students (Johnston, 2001). Moreover, 95% of public elementary and secondary schools and 63% of all classrooms have access to the Internet (National Center for Education Statistics [NCES], 2000). In addition, 69% of households with children under 18 own a computer and 45% have Internet access (Roberts, Foehr, Rideout, & Brodie, 1999).

Despite the increased infusion of computers in schools and society, the role of technology in early childhood education (5-8 years of age) remains a controversial topic. Critics (e.g. Cordes & Miller, 2000; Healy, 1999) argue that use of technology may replace essential learning experiences for children such as play and experimentation with real objects. They also claim that use of technology prevents children from interacting with peers or other adults and, therefore, will promote social isolation. Finally, they assert that use of technology poses serious health hazards for children such as repetitive stress injuries, eyestrain, obesity, and occasionally some physical, emotional, or intellectual developmental damage. On the other hand, proponents (e.g. Clements & Nastasi, 1993; Haughland & Wright, 1997) contend that when successfully integrated, technology can have positive outcomes on child development without decreasing engagement with traditional essential learning experiences. Technology can also serve as catalyst for social interaction and conversation related to children's work. Finally, physical concerns can be addressed by monitoring the amount and the ways in which children work at the computer. Computer use at this age should be brief and students should be taking frequent breaks (Van Scoter, Ellis & Railsback, 2001).

While the question of whether children should be using the technology or not is important, it should not be our primary focus. Technology has become ubiquitous in our lives and teachers and students are using it for a wide variety of tasks. Therefore, attention should be given on helping teachers find meaningful ways of using technology with young children while avoiding potential risks (Van Scoter et al., 2001). This paper describes the ways in which six teachers in an elementary school in the United States integrated technology within a common and familiar theme among lower grade (K-2) students,

named *the 100 Days of School*. The *100 Days of School* is a special event that takes place every year at the school and celebrates the first 100 days of school with activities that revolve around the number 100. Specifically, this study addresses two important questions:

- 1. Did teachers integrate technology in the 100 Days of School project in developmentally appropriate ways?
- 2. What were the benefits of technology-enhanced activities on student learning?

# BACKGROUND: TECHNOLOGY AND CHILD DEVELOPMENT

The early years of children's life (birth to eight) are important for their physical, social-emotional, language, and cognitive development. Research on children's development suggests that at this age, children need opportunities to learn by doing through interacting, exploring and manipulating real world objects (e.g. Bransford, Brown, & Cocking, 1999; Piaget, 1972). Such activities allow children to actively construct knowledge (Piaget, 1972). Knowledge is also constructed through social interaction and conversations with peers and adults. This social atmosphere is crucial to the growth and development of young children (Vygotsky, 1986).

If used appropriately, technology not only does not take away from important developmental experiences, but it actually adds the potential of supporting children's unique needs. Technology can foster social interaction, peer teaching and collaboration, particularly through the use of open-ended software programs (Clements & Nastasi, 1993). According to Clements, Nastasi and Swaminathan (1993), "compared to more traditional activities, such as puzzles assembly or block building, the computer elicits more social interaction and different types of interaction" (p. 60). Such interactions contribute to students' social and language development because they foster high levels of spoken communication (Clements et al., 1993). Technology can also contribute to children's cognitive development in three ways: a) it allows teachers to easily create environments in which students can learn by doing, b) it helps students visualize difficult-to-understand concepts (Bransford et al., 1999), and c) it reinforces traditional developmentally appropriate activities (Clements & Nastasi, 1993). Clements and Nastasi (1993) found that third grade children who used both manipulatives and computer programs showed more sophistication in classification and logical thinking than children who used only manipulatives. Finally, through the use of word processors, technology allows children who are still developing their fine motor skills to compose and revise text without struggling to form letters (Davis & Shade, 1994).

Researchers agree, however, that computers can be used in meaningful ways only if teachers are well prepared to integrate them in their curriculum and select software consistent with the way children learn and develop. Towards that end, teachers need to select software that: a) allow for active learning and exploration; b) contain sounds, music or voice; c) excite children, d) are relevant to children's prior knowledge, d) encourage investigations, and e) apply to real-life problems (Davidson & Wright, 1994; Davis & Shade, 1994; NAEYC, 1996). In particular, Buckleitner (1994) suggests that the following types of software are appropriate for children in K-2 classrooms: a) programs that focus on early skills, such as letter recognition and counting that can be used in combination with traditional approaches (e.g. use of manipulatives); b) writing and drawing software such as KidPix; c) playful exploratory programs that teach concepts; and d) storybooks, which feature animation, sound and voice output when the child selects items on the screen.

# DESCRIPTION OF THE 100 DAYS OF SCHOOL PROJECT

The 100 Days of School project is an interdisciplinary technology-enhanced curriculum project for K-2 students. The project was designed by a technology coordinator and six teachers in an urban school environment in New York City. The purpose of the project was to engage students in a series of activities revolving around the number 100 that support learning standards in disciplines such as mathematics, language arts and social studies. The 100 Days of School curriculum was designed during a summer institute in 2000. The curriculum consisted of four units:

- 1. School life interviews of 100 staff members. In this unit, students needed to survey 100 staff members in their school. Kindergarten students asked teachers which route they were taking to school. First grade students asked teachers about their favorite place to eat. Second grade students asked teachers about the number of years they had been teaching and their favorite aspect of the school. Consequently, the role of the students was to graph and analyze the data.
- 2. Recipes with 100 ingredients. The purpose of this unit was to have students create recipes that included 100 ingredients while reading relevant books.
- 3. *A 100 word poem*. This unit required students to create a poem that consisted of 100 words. In kindergarten, the words needed to be paired together (e.g. foot and sock). In first grade, the words needed to rhyme. In second grade, the words needed to represent opposites.
- 4. A quest of knowledge in the world of toys. Through this unit, teachers aimed at engaging students in learning about the history of toys 100 years in the past and making predictions for the future.

## TEACHER PROFESSIONAL DEVELOPMENT

Teachers participating in the 100 Days of School project received professional development that took many forms, such as technology integration workshops, purely technical workshops, on-demand support and school site meetings. The purpose of these professional development activities was to help teachers upgrade their technological skills, their ability to integrate technology within the 100 Days of School curriculum, and their teaching abilities in general.

Technology Integration Workshops: Between October 2000 and February 2001, teachers participated in weekly two-hour technology integration workshops organized by staff at the Institute for Learning Technologies (ILT) at Columbia University. The purpose of the workshops was to help teachers integrate technology in the 100 Days of School curriculum in meaningful ways. During the workshops, teachers explored various software tools appropriate for supporting the goals of the 100 Days of School project. They also learned how to use a variety of computer peripherals, such as scanners and digital cameras. At the same time, staff developers helped teachers address various concerns regarding teaching and technology and presented alternative pedagogical strategies that helped them seamlessly integrate technology with learning standards. A total of 9 workshops were conducted. Software tools introduced during the workshops included: a) Graph Club, a spreadsheet program for young children; b) Microsoft Word, a word processing tool; and c) Microsoft FrontPage, a program that allows users to develop web pages. In addition, teachers were introduced to various web searching strategies as well as the WebQuest concept. WebQuests are inquiry based learning activities organized around resources found on the World Wide Web.

*Technical workshops:* During the months of February and March 2001, teachers who still needed help with basic computer skills, participated in a series of after school workshops provided by New Horizons Technology Learning Centers. Those were purely technical workshops that helped teachers build their skills in word processing and multimedia authoring.

On-demand support: On demand support was provided by the school technology coordinator. This support aimed at helping teachers master technological skills involved in carrying out the activities of the 100 Days of School project or develop appropriate lesson plans that integrated technology. Activities took place either in the school's computer laboratory or directly in teacher classrooms. Ondemand pedagogical support was also provided by the school's staff developer, who often recommended non-technological resources related to the project's theme.

School site meetings: Between March 2001 and May 2001, teachers held weekly after-school meetings at their own school site. These meetings were about one hour long. During those meetings, teachers were able to collaboratively develop lesson plans, exchange ideas, provide support to each other, practice technical skills or acquire new ones, and reflect on their experiences using technology. Their school technology coordinator orchestrated the after school meetings and provided technical support.

The ILT staff developers continued providing support to teachers by occasionally participating in teacher meetings and by collaborating with the technology coordinator.

#### RESEARCH DESIGN

# **Population of the Study**

A total of six teachers and their students (approximately 180 students) participated in the 100 Days of School project. All teachers were serving at the same public elementary school located in New York City. The school is serving approximately 1,400 students. The majority of the student population (93.6%) is of Hispanic origin and come from economically disadvantaged families. The study included one kindergarten teacher, two first-grade teachers, and three second-grade teachers. Their teaching experience ranged from 2-10 years. They all had two I-Mac computers available in their classroom that were loaded with word processing software, spreadsheets (Graph Club), and drawing tools (e.g. KidPix). All computers were connected to the Internet via a T1 line. They were also connected to a color printer.

Three teachers were real beginners on the use of technology and lacked fundamental computer skills. Even very basic computer operations such as turning a computer on, managing files and saving to a disk presented a challenge. The other three teachers felt relatively comfortable with technology. Only one teacher, however, who had participated in professional development offered by the ILT the year before, felt comfortable in applying technology in her classroom.

## Methodology

This study was conducted over a period of one year (2000-2001). A qualitative research design (Merriam, 1998) was employed in order to gather rich and descriptive data on teacher experiences and their use of technology to support the 100 Days of School project. Data were collected from multiple sources that included: a) field notes from workshops and school site meetings, b) classroom observations, c) a series of interviews with a sub-set of three teachers and the technology coordinator, and d) reviews of documents, such as the 100 Days of School curriculum, teacher lesson plans, samples of student work, schedules and meeting notes.

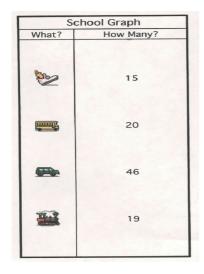
## TECHNOLOGY INTEGRATION IN THE 100 DAYS OF SCHOOL PROJECT

Data analysis demonstrated that teachers were successful in integrating technology with the 100 Days of School project in ways that contributed to student understanding. This section describes the pedagogical activities designed by teachers and the software selected to support them.

School life interviews of 100 staff members. Each class participating in this unit surveyed 100 staff members. Kindergarten students asked 100 staff members how they each come to school. First graders asked teachers where they usually eat for lunch everyday. Second graders asked teachers how long they had been working at the school and what they like best about teaching there. Second graders used a tape-recorder to record teacher responses. According to Novick (1998), use of tape recorders can support literacy experiences since they allow children to speak, listen, read and write, and develop an understanding of how sound translates to print. To collect the data, students were sent out in small groups. Groups were always accompanied by the teacher or the teacher assistant. Students were encouraged to approach staff members, speak with them and record their answers. Upon collection of the data, students tallied the responses and created graphs on poster paper.

According to participating teachers, they initially focused on helping students understand number concepts through the use of objects and manipulatives. Subsequently, students met as a group and had conversations about the nature of the data. Once students understood how to tally the results, and create bar graphs on paper, they were introduced to a software package called Graph Club. Graph Club is a spreadsheet program appropriate for students in the primary grades (K-4). Graph Club allowed students to enter the data collected through the surveys on the computer, analyze them, and create various types

of graphs, such as bar graphs, pies, and pictographs. The manipulative environment of Graph Club helped students move from graphing concrete objects to creating and interpreting abstract graphs. By creating different types of graphs, students were also able to see the relationship between different representations of the same data. Figure 1 demonstrates the results of the surveys distributed by kindergarten students.



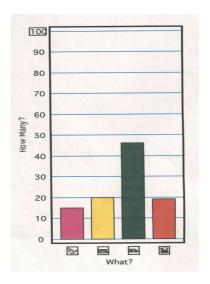


Figure 1. Results of the Survey Distributed by Kindergarten Children

Recipes with 100 ingredients. Teachers launched this unit by reading and discussing books that included recipes, such as the book *Thunder Cake* by author Patricia Polacco. Then, each class prepared a recipe related to the book they had read. Subsequently, first grade students illustrated the process of creating a recipe using KidPix. Second grade students used a word processor to type recipes they brought from home and KidPix to illustrate those recipes. At the end, they compiled their recipes and created a class recipe book. Some classes became highly creative and combined the recipe unit with elements extracted from the graphing and poetry units. The kindergarten class, for example, turned its recipe into a poem and then into a song that was also accompanied by relevant illustrations (Figure 2).

According to participating teachers, this unit contributed to student learning in three ways. First, it allowed students to develop number sense by counting the number of ingredients included in the recipes. Second, it helped them understand sequencing since it required them to follow directions in creating a recipe. Third, it helped them to review elements of graphing by creating graphs with the number of ingredients used in their recipe. The introduction of technology helped the students create a product that they were able to share with their parents as well as with other teachers.

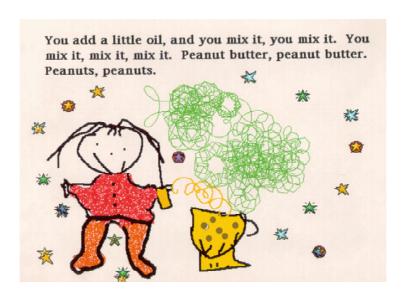


Figure 2. An Illustrated Recipe Song Created by Kindergarten Children in KidPix

A 100 word poem. Teachers initiated this unit by reading and discussing poetry with their students. Subsequently, kindergarten students created a poem that contained pairing words, such as *foot* with *socks*. First grade students used rhyming words like *fat cat*. Second grade students used antonyms, such as *up* and *down*. Once the poem was completed, students worked in pairs on the computer and illustrated their poems using KidPix. Some teachers compiled student work and created storybooks. Figure 3 shows a screen shot from a poetry illustration completed by first grade students. Reflecting on the value of this activity, participating teachers commented that it allowed students to develop skills in language arts and writing, as well as in arts and technology.

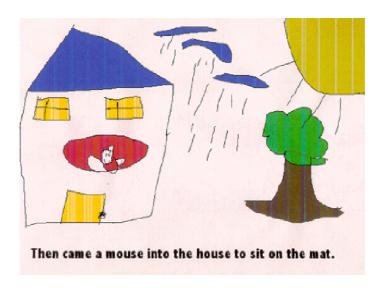


Figure 3. A Poetry Illustration Created by First Grade Students in KidPix

A quest of knowledge in the world of toys. Although this unit was designed for all participating teachers, only second grade teachers were able to complete it due to time constraints. Specifically, second grade teachers developed a WebQuest, an inquiry based online learning activity, that engaged students in using Internet resources to study the history of toys. The WebQuest was developed by teachers during their participation in the ILT workshops and was refined during their school site meetings. The purpose of the activity was to help students understand the ways in which toys have changed over time. The teachers launched the activity by looking at historical books and engaging students in various activities, such as creating personal timelines that allowed them to understand the concept of looking back into the

past. Subsequently, the WebQuest allowed students to read and view information over the Internet pertaining to toys in the past and present. They were then asked to find similarities and differences among toys from the past and present and use this information to make predictions regarding new toys in the future. Looking at toys from the past encouraged students to get engaged in discussions pertaining to living habits and daily activities among people 100 years ago. Therefore, the WebQuest allowed students to use the Internet in order to develop and research social studies concepts.

The activities described in this section demonstrated that teachers were successful in integrating technology within the 100 Days of School project in developmentally appropriate ways. Adding technology to the classroom did not limit in any way the traditional hands-on activities necessary for young children. In fact, computers were only used to reinforce and extend traditional activities. Students had hands-on experiences using objects and manipulatives in mathematics before moving to graphing data on the computer. They also had hands-on experiences preparing recipes before starting to type and illustrate recipes with technology. Finally, all teachers required students to hand-write their recipes and poems and then do final drafts on the computer, therefore enabling students to continue to develop their handwriting and other fine motor skills.

Buckleitner and Hohman (1987) suggest that computers have a positive developmental impact on children when they are used as a support to active learning. They also suggest that children learn best when taught a concept with manipulative materials first, before showing them how to do an activity targeting the same concept on the computer. As demonstrated earlier in this paper, this is exactly how teachers participating in this study used technology. Thus, it is clear that the introduction of technology through word processing, drawing, mathematics software and Internet resources allowed teachers to enhance student experiences. It also allowed students to use technology for real purposes and create better-looking products that were shared with a larger community that included their parents, teachers and peers.

# BENEFITS FOR STUDENT LEARNING

All teachers felt that technology had a positive impact on students' language, cognitive and social development. Teachers observed that students were more motivated to read and write on the computer. They even took responsibility for reminding the teacher about reading and writing tasks that needed to be completed, such as the refinement of their surveys and poems. One of the second grade teachers, who had her students read information on the Internet on the history of toys, observed:

I saw that a lot of students, who normally hesitated with reading and did not get engaged in books, became more motivated to read on the computer screen. I think that computers helped motivate some of the slower readers. Now, my students even bring their own CDs from home, like Encarta and Encyclopedias, to do research on various topics we cover in class (Sue, June 2001)

Participating teachers also noted that their students were more eager to edit and revise their assignments on the computer. Moreover, they became critical of their work and often took the extra time to improve and enhance their projects. As a first grade teacher explained, her students often realized by themselves that their poetry did not match their drawings, and willingly revised it appropriately. Finally, technology did not only have an impact on students' reading and writing, but also reinforced mathematics concepts. All teachers recognized that the use of spreadsheets had a significant impact on student understanding of data manipulation and graphing.

In addition to having an impact on student reading, writing and mathematics skills, use of technology had also an impact on students' sense of self-efficacy. Teachers reported that use of computers helped students build confidence in their abilities to perform well in school because they were able to produce polished, professional looking products. As a first grade teacher noted, her students gained confidence and pride when they saw their poetry books published on the computer. A second grade teacher also

observed that her students became proud as they shared with their peers on the computer. The fact that they knew how to explain certain tasks on the computer added to their confidence level. Other studies also indicate that children often develop a sense of self-efficacy, self-esteem, and overall satisfaction with their performance when using computers (e.g. Cohen, 1993).

Finally, teachers observed that use of computers not only did not isolate students, but in contrary it encouraged peer teaching and sharing. A first grade teacher explained:

Working on the computer encouraged children to socialize and interact with one another. Even students who were shy, started talking and feeling more comfortable when they were working on the computer.

A second grade teacher shared the same feelings and added that her students were really teaching each other on the computer and, therefore, developed the ability to communicate what they had learned. Clements and Nastasi (1992) also found that there is a greater and more spontaneous peer teaching and helping when children use computers.

#### DISCUSSION AND CONCLUSION

The purpose of this paper was to discuss the ways in which six teachers integrated technology in a familiar theme among lower grade students and the impact of such integration on student learning. Findings of the study indicate that teachers were successful in using technology in developmentally appropriate ways and fostering learning gains in areas such as reading, writing and mathematics.

Despite the obvious success of the project, teachers faced various challenges in their efforts to use technology. A key challenge was classroom management, so that all students get opportunities to work on the two computers available. Teachers often had difficulty organizing group work, setting up rotating groups on the computer, and monitoring simultaneous tasks. The experience acquired through the school life interviews unit, the first unit completed by teachers, helped them overcome the above difficulties. Another critical challenge was time constraints. Use of technology required significant upfront planning, collection of resources, and selection of appropriate software and web-sites. The actual enactment of the activities also took much longer than anticipated. A third significant challenge was related to equipment failure and/or technological glitches that made technology integration a struggle. Finally, another important challenge was associated with teachers' lack of experience with technology. Most teachers had never used technology as an instructional tool and, therefore, did not know how to initiate and continue their projects or envision what the end product might look like.

The above issues illustrate the difficulties involved in integrating technology in ways that could benefit student learning. Professional development was a key ingredient to the success of the project, because it helped teachers overcome these difficulties. Support from the school administration was also another important element that contributed to the success of the project. Administrative support took many forms, such as release time for teachers to attend workshops and re-arrangement of schedules to provide blocks of time for teachers to plan together and exchange opinions and experiences. This sharing motivated teachers to persist in their efforts to implement technology in their classrooms. Despite those findings, more research is needed with regard to new forms of professional development that could support early childhood teachers in their efforts to build capacity for technology integration.

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