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Computers are increasingly being integrated into the preschool curriculum. They effect young children’s peer-mediated cognitive development as well as their social play. Based on observations in a classroom of 4 and 5-year-olds at a full-day child development program at a major university lab school, this article applies Parten’s categories of social behavior as well as theory that comes from a Vygotskian social-cultural learning theory to young children’s computer competencies. The authors describe the behaviors and interactions of Active Navigators (including Program, Mouse, and Consolidated Navigation); Vicarious Navigation/Super-onlooker behavior; and the behavior of Spectators/On-lookers as they interact with developmentally appropriate software during the free choice center time.

We have witnessed a technological revolution. Its effects are visible in classrooms everywhere, from preschool to graduate school, but the changes it has brought might be most dramatic and unexpected in programs for young children. In 1987 only about 15% of the surveyed preschool programs had computers for children to use (Donohue, Borgh, & Dickson, 1987). Now they are included on lists of recommended equipment (Marshall & Weaver-Blackshear, 1995), and have become commonplace. There is still much to learn about how children use computers, however, if we are to understand the contribution they can make to young children’s social,
emotional, physical and cognitive development. This article includes a description of children’s playful and purposeful collaborations at the computer. It focuses on the computer’s potential contribution to preschool classrooms that promote active, play-centered, peer mediated learning in developmentally appropriate ways. The authors combine Parten’s insights describing children’s social play with Vygotskian socio-cultural learning theories. They describe their observations of how 4 and 5-year-olds scaffold each other’s growing computer competence as they engage in solitary, onlooker, associative and cooperative computer play.

Are Computers Developmentally Appropriate?

The introduction of computers into the preschool curriculum has been greeted by skepticism in some camps and enthusiasm in others. Lilian Katz (1991) and David Elkind (1996) are among those who urge caution. Katz’s skepticism reflects her concern that computers contribute to the trend to “push down” the curriculum, making preschool overly academic. She observes that “just because children can do something does not mean that they should” (1991, p. 58), and dismisses the argument that computers’ popularity offers convincing evidence that young children should be using them. Elkind has similar concerns. He cautions readers to avoid the mistake of making unfounded assumptions about children’s cognitive development based on their computer proficiency (Elkind, 1996). Challenges such as these are based on developmental and constructivist principles that favor giving children concrete materials and authentic experiences rather than asking them to manipulate symbols on a computer screen (Haugland, 1999; Shade, 1994).

Constructivists who support the use of computers in early childhood contend, however, that the “concrete objects” children manipulate can just as well be figures on the computer screen as cuisinaire rods (Bredekamp & Copple, 1997). They are convinced that preschoolers can use computers in developmentally appropriate ways. The National Association for the Education of Young Children’s (NAEYC) Position Statement on Technology and Young Children (1996), based on an extensive body of research, offers a strong rationale supporting the addition of computers to early childhood classrooms’ routines. The NAEYC paper and others describe the ways computers contribute to children’s problem solving, critical thinking, and decision making skills; creativity, language, research, and social abilities; and their self esteem (Haugland, 2000; Haugland & Wright, 1997; NAEYC, 1996).
Early childhood educators who are enthusiastic about computers in preschool see their inclusion as a natural reflection of computers’ growing popularity in every segment of society (Anderson, 2000; Shiver, 1998). These advocates for integrating technology into classrooms for young children note that economic status is likely to separate those who have computers at home from those who do not (Kominski & Newburger, 1999). They see it as their responsibility to provide all children, not just the most affluent, an opportunity to become computer literate during their preschool years.

Finally, computers’ proponents are convinced that when used appropriately, they have the potential to be more than just another piece of classroom equipment. They believe that computers can extend and transform traditional materials for children just as they do for adults, making it easier to organize and access information. Proponents are convinced that computers belong in the early childhood curriculum because, quite simply, they help children learn how to learn.

**Computers in an Active-Learning Play-Based Curriculum**

Teachers integrating computers into their developmentally appropriate active-learning classrooms are likely to ask, “Do computers offer children opportunities to play?” Michael Henninger (1994) answered that question by applying a classic definition of play to computer use. After considering whether they offer active, child-selected and directed, process-oriented, imaginative, creative, low-risk, and enjoyable experiences, he concluded that computers often fit these criteria and agreed that they can be appropriate additions to early childhood programs.

Mildred Parten’s (1932) classic work describes children’s social development and offers a useful way to consider computers’ role in play-based programs. Her research characterizes children’s play as unoccupied, onlooker, solitary, parallel, associative, and cooperative. It is helpful to couple Parten’s categories of social play with Vygotskian insights about the dynamics of peer-mediated learning. Those whose teaching is inspired by Vygotsky enhance children’s learning by giving expert peers opportunities to scaffold their classmates toward behaviors and understandings that are within their zone of proximal development (ZPD) (Bodrova & Leong, 1996). These teachers appreciate that learning is a social activity, best accomplished when opportunities for collaboration and cooperation are part of their classroom’s routines.
There is convincing evidence that computers are an ideal vehicle for learning in a social setting. Children find working together on them irresistible (Clements & Nastasi, 1992), seize opportunities to spontaneously stretch each other’s ZPD (King & Alloway, 1992), and effectively create a “shared problem space” as they complete tasks and solve problems together (Bergin, Ford, & Hess, 1993). Combining Parten and Vygotsky gives teachers a useful way to think about their role supporting and enhancing children’s interactions in the classroom’s computer center.

The Emergence of “Computer Experts” who Mediate Peers’ Learning

Computer experts who mediate peers’ learning are likely to emerge in classrooms that give children opportunities to work cooperatively. Children are most likely to rely on these experts when they are working with open-ended developmentally appropriate materials that require higher order thinking and complex mouse and keyboard manipulation than they are when using programs that are drills calling for specific responses (Shade, 1994). Our observations of children using developmentally appropriate programs (*Tonka Construction*, *Mr. Potato Head* and *Buzzy at the Airport*) revealed the emergence of experts with varying levels of proficiency. Several of the kinds of social behaviors Parten described were observed, and it was noted that peer tutoring and social interactions took on unique characteristics in the context of computer play, which illustrated the value of social computer play in preschool classrooms.

A Preschool Classroom with Computers

These descriptions of children’s varying computer skills, peer mentoring, and social interactions are based on a project conducted in a full-day child development program at a major research university’s laboratory school. The researchers observed, recorded and analyzed children’s computer play; designed, distributed and compiled surveys completed by their parents; and interviewed selected classmates. The class included 20, four and five-year-old children, 15 girls and 5 boys, representing a variety of ethnic and socio-economic backgrounds. Activities at the computer center were video taped for later coding 30 minutes a day, an average of four days
a week, for five weeks during afternoon free choice center time as children played with two highly-rated developmentally appropriate programs. Data analysis included qualitative as well as quantitative analysis.

Five experts, Alisha (4.2 years), Martin (4.8 years), Molly (4.9 years), Joseph (5 years), and Rick (5.1 years), dominated computer use. They frequently sat at the computer and regularly controlled activities. The parents of each of these children reported that they have computers at home, which their children use for varying amounts of time. Alisha’s mother said she used it “none most weeks” (their home computer was broken), while Martin’s parents reported he used the computer “six hours a week.” When asked, “Do you think that computer activities are appropriate for preschool children (and your child in particular)?” Rick’s parents responded that they believed “small doses” were appropriate, Molly and Martin’s parents believed that “some exposure was appropriate,” and Joseph’s and Alisha’s parents indicated they believed that “computer play should be encouraged.”

It appears that the experts’ parents’ attitudes about the desirability of computer play have been effectively communicated to their children. Alisha was one of the most adept experts, Joseph was very interested and persistent in his efforts, and the out-of-school time Martin spent on the computer was evident in the ease and expertise he demonstrated navigating a variety of programs. Student interviews confirmed that peers recognized that these children were expert computer users.

Combining Parten’s (1932) descriptions of children’s social play behaviors with Vygotsky’s constructivist, socio-cultural learning theory, the researchers identified three major kinds of computer-center-specific child/child and child/computer interactions: (a) **Active Navigators** are the children with the most expertise on the computer. Their behaviors can be further differentiated, making distinctions between **Consolidated Navigators**, **Mouse Navigators**, and **Program Navigators**. (b) **Vicarious Navigators/Super-Onlookers** are those children who are interested in the computer, but who, for whatever reason, neither claim control of the input device, nor do they make themselves indispensable resources for their actively-navigating peers; and (c) **Spectators** are the least actively involved with the classroom’s computers, but their interest in and curiosity about computers may be evidence of their emerging abilities (Figure 1).
Figure 1. Computer-center-specific child/child and child/computer interactions

1. **Active Navigators.** Children who successfully use the software as intended. They demonstrate varying computer navigation abilities.

- **Consolidated Navigators** have sufficient eye-hand coordination to successfully make the computer respond appropriately. They are adept maneuvering through the software purposefully. They are able to work at the computer independently, and show impressive persistence trying to make the program work even when it malfunctions. **Consolidated Navigation** appears when children have successfully integrated the abilities demonstrated by **Mouse Navigators** and **Program Navigators**. Their play may be solitary, parallel, associative, or cooperative.
- **Mouse Navigators** control the mouse and cause purposeful action on the screen. They are cooperative players.
- **Program Navigators** point to the screen and guide the **Mouse Navigator**’s progress through the program. They also demonstrate skillful cooperative play.

Martin is seated directly in front of the computer screen with his hand firmly and comfortably on the mouse. Joseph’s chair is slightly to the side of the computer, where he can see the screen easily. Martin is purposefully moving the mouse while watching the screen. The boys’ interactions with the program seem successful and enjoyable.
Joseph and Martin are communicating and, although their conversation is inaudible, Joseph is pointing to the screen. It seems he is giving suggestions to Martin. Before long Joseph reaches over and takes control of the mouse from Martin, who does not object. Joseph unsuccessfully tries to navigate through the program, then relinquishes control back to Martin. Martin maneuvers through the program successfully, then the two boys clap and rejoice together over their accomplishments.

In the previous example, Martin is, at the beginning, the Mouse Navigator and Joseph is a Program Navigator. Joseph tries unsuccessfully to assume the Consolidated Navigator role by taking control of the mouse. When he is unsuccessful he relinquishes control and seems to be conceding that he cannot yet manage Consolidated Navigation. He is willing, and in fact eager, to take advantage of Martin’s scaffolding. At that point Martin becomes a Consolidated Navigator. In the end Joseph seems to take genuine satisfaction from his classmate’s success as a Consolidated Navigator, and is, perhaps, advancing toward that goal himself.

The cooperative interactions described above are unlike simple turn taking behaviors. Both Mouse and Program Navigators are, on occasion, taking advantage of the scaffolding supplied by their computer partner as they pursue the shared goal presented by the program. This is evidence that Consolidated Navigation is within the ZPD of Mouse and Program Navigators alike. What’s more, these peers are seen to take turns, assuming Mouse and Program Navigator roles interchangeably, while scaffolding each other’s attempts to assume a Consolidated Navigator’s role.

This description of Alisha’s reaction to the computer’s malfunction illustrates the persistence shown by computer experts who have confidence in their ability to use technology successfully.

Alisha is playing Mr. Potato Head. It freezes. She pushes the button to restart the computer. She opens the games icon, then finds Mr. Potato Head and opens it. She signs in on the game and chooses the ‘easy’ versus the ‘hard’ option. The game begins and she looks at the external speakers. She picks one up and holds it to her ear. She hears nothing then proceeds to push the on/off button on the speaker and tries to turn the volume up. (It turns out that the batteries are dead.)

Alisha demonstrates confidence in her ability to master the computer and to overcome the seemingly insurmountable obstacles created when it malfunctions. There are a number of additional ways Consolidated Navigators show their confidence in their ability to solve their own problems. Rick
looks through the instruction book when his computer freezes up. He cannot read but seems to find satisfaction in pursuing a solution that he, presumably, has seen work for adults. In another incident Rick hypothesizes that his problems are caused by the mouse cord. He wiggles it when he can’t get the arrow to move, and tries looping it first on one side of the speaker, and then on the other, in an attempt to make the mouse work correctly. Joseph and Alisha frequently blow into the bottom of the mouse when it becomes balky; perhaps they’ve seen adults try this remedy too. In any event, all of these children are confident in their ability to make the program work as intended. Consolidated Navigators are competent and confident using various programs and believe they can find and correct problems with the program or the equipment.

2. **Vicarious Navigators or Super-Onlookers.** Children who watch from the sidelines and offer advice to Consolidated, Mouse, or Program Navigators engaged with the computer.

   This behavior seems unique to computer play. It is more like on-looker behavior described by Parten (1932) than ordinary turn taking, but it takes on distinctive characteristics as children remain consistently on the sidelines, engaged in the program’s operation, but playing no controlling role.

   Molly sits down at the computer to play *Buzzy at the Airport*. The game is frozen so she pushes the ‘restart’ button. It begins to restart and commands flash quickly across the screen. She stands up and scans the room. She spots Alisha and calls her name. Alisha comes over and Molly gives her the chair at the computer. Alisha navigates through the windows and into the program again. Alisha begins to play the game and Molly remains standing and watches until the computer freezes again when they both leave the computer center.

   Molly assumed different levels of involvement during this incident. She begins expecting to be a Consolidated Navigator, but readily becomes a Vicarious Navigator so that she can stay involved. This vignette illustrates an important and distinctive behavior children exhibit when they watch Active Navigators, sometimes for as long as 20 minutes, without the expectation that they will get their own turn. It seems possible that Consolidated, Mouse, or Program Navigation is at the edge of Molly’s ZPD, and perhaps these observations will provide the scaffolding she needs for successful navigation skills to emerge before long. It could be, however, that rather than being one step away from Active Navigation, that Vicarious Navigation reflects her temperament and preferred way of interacting. It is important to
appreciate that *Vicarious Navigation* may be an interim stage for some children, and a preferred interactional style for others.

Computers give children the opportunity to play a variety of roles. The computer center invites children’s active involvement as well as their careful observations. Computers encourage children to be flexible and responsive to their peers’ as well as their own interests and preferences as they shift from one role to another.

3. **Spectator/Onlooker.** Children who watch from the perimeter while interacting with the active computer navigators. Their involvement with the computer is minimal.

These children are likely to have no history as *Program Navigators*. Navigational skills may be just at the outer edge of their ZPD, soon to emerge. There is evidence that they are interested in the computer and are in the process of acquiring beginning computer competencies, however. They have more than a passing interest in what is happening on the screen and would be classified by Parten (1932) as onlookers.

Rick is seated directly in front of the computer using a recently introduced program. Joseph is seated to the side watching the action and begins playing with another program on his computer. Anthony pulls up a chair and sits on the other side of Rick. Anthony and Rick talk about the program. Anthony’s attention alternates between Rick’s and Joseph’s computer activities.

In this example, Anthony exhibits a classic example of *Spectator/Onlooker* behavior. During the course of this project he interacted at the computer center on only two occasions. He shows increased interest, but is not yet ready to spend significant amounts of time observing. He neither attempts to control the equipment, nor to explicitly request help. It seems possible, and even likely, however, that he will continue to be a *Spectator*, and will, before long, become a *Super On-Looker* as he moves closer to playing a controlling role. *Computer Navigation* is at this time beyond his ZPD, but competencies will likely emerge as a result of his efforts to actively seek scaffolding from his peers.

Anthony reminds teachers of their responsibility to provide the equipment, environment, and encouragement, which will serve as scaffolding as children progress from an awareness of, and interest in, computers into effective independent *Consolidated Navigation* of developmentally appropriate software. Teachers set the scene by choosing software that encourages
cooperation and higher-level thinking and by encouraging and supporting peer mentoring and scaffolding like that described in this study.

CONCLUSION

These observations illustrate the complex dimensions of preschoolers’ playful and purposeful use of computers. The computer center can effectively encourage supportive scaffolding interactions among children as they work side-by-side to achieve the goals created by developmentally appropriate software. Teachers who observe carefully are likely to see that children who may seem to be minimally and only superficially involved with their peers and the computer are actually learning by carefully observing their peers’ success navigating developmentally appropriate software. Computer experts are valuable assets to the classroom. The scaffolding they provide their interested but less adept peers support their classmates’ emergence as super onlookers or navigators. Computer centers that encourage collaboration and cooperation make important contributions to the development of a community of learners and children’s growing cognitive, fine motor, and social competencies.

The findings of this study lay the groundwork for and suggest future research including projects designed to investigate gender differences among computer experts in preschool settings, patterns of computer use when programs are explicitly related to classroom instructional themes, and the effect of giving children opportunities to choose among a variety of developmentally appropriate programs on their progression through the identified stages of computer competence.

References


