What Early Childhood Educators Need to Know About Computers in Order to Enhance the Learning Environment

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Abstract

Recent research in early childhood education centres suggests that the classroom environment and educators' knowledge about computers are not at a level that would support computer learning opportunities. The purpose of the present study was to determine what areas of support educators require in order to provide a smooth introduction of the computer into the early childhood classroom. Questionnaires assessing basic knowledge, attitudes towards computers, and information that teachers would like to have regarding computers were completed by 196 (192 females and 4 males) early childhood educators from 3 mid-size Canadian cities. Overall, educators support the use of computers in the early childhood learning environment, but require information that is reliable, systematic and informed. Ideas for a computer workshop for early childhood educators are provided along with suggestions for future research.

Résumé

Des recherches récentes, effectuées dans des centres d’éducation de la petite enfance, suggèrent que l’environnement des salles de classe et que les connaissances en informatique des éducateurs ne sont pas d’un niveau qui puisse encourager les possibilités pédagogiques par le biais d’un ordinateur. L’objectif de la présente étude est de déterminer les domaines dans lesquels les éducateurs ont besoin de soutien, afin
d'introduire, dans les meilleures conditions, l'ordinateur dans une salle de classe de la petite enfance. Des questionnaires évaluant leurs connaissances de base en informatique, leurs attitudes face à l'informatique et les informations qu’ils souhaiteraient recevoir à propos des ordinateurs ont été remplis par 196 (192 femmes et 4 hommes) éducateurs de la petite enfance, situés dans 3 villes canadiennes de taille moyenne. D’une manière générale, les éducateurs encouragent l’utilisation de l’ordinateur dans l’environnement de la petite enfance, mais ils ont besoin d’informations fiables, méthodiques et documentées. Des idées d’ateliers informatiques pour éducateurs de la petite enfance sont présentées, ainsi que des suggestions pour la recherche à venir.

Introduction

Research in brain development makes it clear that the first five years of life are the most important in terms of making connections for later learning (Siegler, 1998). This finding stresses the importance of examining the learning environment provided in early childhood classrooms. Given that the classroom environment is an important predictor of student achievement and attitude (Fraser, 1998), it would follow that if we want our children to learn well, learning must be fostered at an early age in a developmentally appropriate environment.

It has been suggested that young learners can benefit both socially and cognitively through the introduction of computer technology (Clements, Nastasi, & Swaininathan, 1993; Podmore, 1991). Although very few experimentally controlled studies have been conducted on the cognitive learning of young children when using computers, those that exist show benefits. Clements and Nastasi (1999), in a review of the literature, conclude that Logo environments promote more metacognitive awareness in children compared to control groups. Of course, most software used in the early childhood environment is commercial software unlike that of Logo programming software. Haugland (1992) illustrated the need to provide developmentally appropriate software to children. Children who were provided with open ended, problem-solving software, rather than drill and practice software, showed gains in intelligence, long-term memory, and problem-solving. Children using the drill and practice software showed losses in creativity.

Despite the paucity of research in this area, computers have been implemented in many early childhood education environments. Although there are those who are extremely opposed to this move (e.g., Healy, 1998), it seems to be on the basis of the cost of the technology and philosophical questions that ask whether computers are appropriate in the early childhood environment given the way that children at this age learn. However, proponents of computers in the classroom recommend that they not be used before the age of 3 and that they enhance rather than replace traditional methods (Haugland, 1999). It would seem best to use the computer as another mechanism in the learning process rather than as a replacement for current techniques. In recent discussions with early childhood educators, we heard of two different models of computer integration.

Computers were used by the children in an independent centre with many different choices of software (e.g., reading, math, and drawing) or integrated into many centres (e.g., reading software in the book centre; drawing software in the craft centre). The independent centre seems to be the most common method of implementation because most classrooms do not have enough computers to have them in many different centres.

Early childhood educators are in the unique position to provide young children with an effective introduction to computer technology. Unfortunately, most software in the early childhood environment continues to be developmentally inappropriate (i.e., drill and practice) (Haugland, 1999). It may be that these educators lack the knowledge and skill necessary to implement technology effectively in the classroom. At present, however, little is known about the level of skill, comfort or knowledge that early childhood educators have regarding
computer technology. The present study explores the needs and strengths of early childhood educators with respect to the introduction of computer technology in their centres.

In general, children seem to have a natural curiosity and enthusiasm for computers (Obrist, 1983). The fact that the fastest growing market for educational software is for children under five (Blackwell, 1999) is evidence of just how interested young children are in computer technology. One concern is that young children are gaining access to computers in places other than the early childhood classroom (e.g., home and library) without any assessment of the impact of the exposure on the early childhood education environment. One outcome of children's high level of interest and exposure to computer technology is that they may be expecting to have computers in their ECE classroom environment and be supported by a knowledgeable teacher.

Recent research in early childhood education centres, however, suggests that the ECE classroom environments and educators' knowledge about computers are not at a level that would support optimum computer learning opportunities. For example, in a survey of early childhood centres in three cities, Wood, Willoughby, and Specht (1998) found that over half of the centres surveyed did not have a computer on the premises. Of those that did, use was limited because of concerns among the staff about knowledge and familiarity regarding computers and computer software. In fact, 100% of the participants voiced concern about having sufficient knowledge about, or experience with, computers to use them effectively. This finding is discouraging given that teacher support (i.e., helpfulness and friendliness of the teacher) is a salient aspect of learning (Tobin & Fraser, 1998). If teachers cannot help children with the computer, their opportunities for facilitating learning will be diminished and, in some cases, may hinder achievement.

Because computers can be used to facilitate learning (Clements et al., 1993; Haugland, 1992), it is important that educators are familiar enough with the technology to be able to guide young children's learning. Haugland (1995) suggests that four factors are essential for computers to have a significant impact in the early childhood education environment. Three of Haugland's four factors involve the early childhood educator. Specifically, teachers must be open to technology and receptive to the placement of the computers in the classroom. They also must be aware of the potential benefits of computers and that computers can play a positive role in the classroom. To achieve this awareness, they must be trained in early childhood computer integration. Finally, computers must be available in the early childhood setting.

Once computers are available in the classroom, knowledge of and familiarity with computers is a necessary first step for promoting computer use (for a more complete review, see Berge & Mrozowski, 1999; Toci & Peck, 1998). Rosen and Weil (1995) suggest that a lack of knowledge about computers may lead to anxiety about computers. They found that over half of the elementary school teachers that they surveyed were "technophobic". In fact, the best predictor of anxiety regarding computers was past experience with computers as well as knowledge about computers. They concluded that in order to prevent "technophobia", children need to be taught by teachers who are informed, confident and comfortable with the computer technology. Similarly, Weil, Rosen, and Wugalter (1990) found that if the initial introduction of the computer was made by someone who was confident and positive about technology, less feelings of anxiety developed among the learners. In addition, Payne (1983) reports that providing teachers with hands-on experience alleviates some of the anxiety. Providing educators with computer training seems a necessary first step in implementing computers in the classroom.

Although some research has examined the needs of elementary school educators (e.g., Berge & Mrozowski, 1999; Payne, 1983; Rosen & Weil, 1995), with respect to computer knowledge, no one has identified the
unique needs of early childhood educators. Piotrowski (1992) explains that it is important to ensure that training addresses the unique needs of those participating in the training, rather than following some broad itinerary. It is for this reason that the present study surveyed early childhood educators in order to determine exactly what knowledge they have and what they are lacking. Our goal is to use the information gained to allow us to develop a framework for instruction of early childhood educators. Providing information based on a framework should allow early childhood educators to feel more confident about using computer technology in the early childhood classroom.

Method

Participants

Directors for 130 early childhood education centres were mailed a survey package. This number represented every early childhood education centre listed in the phone book for 3 mid-sized Canadian cities (excluding those that had requested not to participate in our previous research on computers). Each package contained surveys to be completed by the staff members at the centres. Of the 130 centres contacted, 52 participated. Twenty-one packages were returned because the centre was no longer in business, and 57 of the centres did not want to participate. Response rate of viable centres was 48%. The total number of participants from the centres was 196 (192 females, 4 males). The average age of the participants was 29 years (SD = 9 years, 7 months; range 20 to 61 years) with an average of 5 years and 8 months (SD = 5 years, 4 months) of teaching experience. This sample matches typical Canadian samples for workers in early child care (Goelman, Doherty, Tougas, LaGrange, & Lero, 2000). The average age of the children in the classroom was 3 years and 6 months (SD = 1 year, 7 months; median = 3.0 years). The participating centres represented the full range of commercial and non-profit facilities (i.e., nursery schools, preschools, cooperatives, and daycares). There were no outstanding differences between participating centres and those that declined. For example, with respect to computers, about ½ of the participating and non-participating centres had computers (50% vs. 45% respectively) and ½ did not (50% vs. 55%).

Materials and Procedure

One package was mailed to the director of each centre. The package contained enough copies of the survey for each staff member at the centre, consent forms for each survey and two prepaid envelopes (one for returned surveys and one for return of consent forms). In addition, one letter of introduction, addressed to the director, explained the content of the survey, procedures for returning completed materials and a request for the director to recruit staff to complete the survey. All surveys were completed anonymously with the name of the centre as the only feature identifying the source of the survey. The survey contained 20 questions. The first set of questions dealt with existing knowledge of computers. Using a 5 point scale from 1 (not at all) to 5 (a great deal), participants responded to such questions as: "How much knowledge do you feel you have about your computer operating system?" and "How much knowledge do you feel you have about the components that make up your computer (monitor, mouse, keyboard etc.)". Other questions determined tasks that the staff would require assistance to execute (e.g., connecting your computer components, turning on the computer, inserting a disk). The survey also asked participants to list the programs (both adult and child-oriented) with which they were familiar and the source(s) of their current computer knowledge (e.g., books, trial and error, retail staff). The second set of questions was designed to determine staff members' personal feelings about
computers and their attitudes toward implementation of computers in early childhood education centres. A five point rating scale was used ranging from 1 (strongly disagree) to 5 (strongly agree) for questions such as; "Computers make me nervous" and "I feel computers have a role in the ECE classroom". Finally, the survey posed the open-ended question "Do you have any concerns about implementing the computer in the classroom. If so, what are they?" A final space was left for any additional comments or questions. Open-ended questions were treated as qualitative data. Open coding procedures were used to identify major themes. The resulting themes were then used by two raters to score the responses. Inter-rater agreement between the two raters was 90%. Disagreements were resolved by discussion. Approximately one month after the surveys were mailed, follow-up phone calls were made to all directors for whom surveys had not been returned. If directors requested it, another survey package was sent.

**Results**

Given Haugland’s (1995) tenet that computers can be effective in early childhood classrooms only when educators see a need for them, it was important to assess the early childhood educators’ opinions. On a scale of 1 (strongly disagree) to 5 (strongly agree), teachers overwhelmingly supported the use of computers in the early childhood education environment (M =4.4, SD=.81), and thought that preschool children could benefit from using computers (M=4.6, SD=.67). However, based on Wood et al. (1998), we suspected that the positive attitudes toward computer technology may be tempered by early childhood educators' computer literacy skills. To assess whether skills may limit the teachers' ability to use computers efficiently, we assessed their computer knowledge.

When asked to identify their general familiarity with the computer components and how to operate these components, the teachers demonstrated some familiarity with the general components of a computer, but little familiarity with hardware or with their ability to problem solve about computer concerns. Specifically, knowledge for general components of computer (monitor, mouse, keyboard) had a mean around the midpoint of the scale (M =2.83, SD=1.01) as did general knowledge of operating systems (M =2.3, SD=1.03), with knowledge for computer applications being slightly lower (M =2.1, SD=1.02).
In comparison, low ratings were assigned for knowledge of computer hardware ($M = 1.95$, $SD = .86$) and the related ability to identify critical hardware specifications when shopping for a computer (e.g., memory, hard drive, size of screen) ($M = 2.08$, $SD = 1.11$). The ability to problem solve when the computer was not working ($M = 1.86$, $SD = .94$) received the lowest rating.

We also asked the respondents to identify tasks with which they would require assistance. Again, for items related to general/standard components of the computer, the educators did not need assistance [i.e., turning on a computer (6% require assistance), using a mouse (7% require assistance), inserting a disk (11% require assistance), and inserting a CD-ROM (25% require assistance)]. The key areas of concern seem to be setting up a computer to recognize the printer (64% require assistance), setting the mouse for speed and sensitivity (71% require assistance), and installing software (77% require assistance).

Because we had asked about the educators' knowledge of operating systems and software applications, we asked them to identify the programs with which they were familiar. Although Haugland and Shade (1994) found that the Apple computer was the most common system, very few of our respondents were familiar with a Mac Operating System (3.1%). This difference makes the point that we must know the needs of our participants. Windows95 or Windows98 seemed to be the most familiar operating system (69%). Computer games were the software programs with which they were most familiar (77%) and the more complex uses of the computer (e.g., draw programs, spreadsheets, presentations) were familiar to less than 30%.
After determining their level of knowledge and assessing the specific programs/systems with which the teachers were familiar, we asked them to identify the source of their knowledge of computers. Trial and error rated as the highest (62%), followed by family members (56%), co-workers (38%), workshops (19%), books (13%), retail staff (7%) and TV shows (2%).

Our sample indicated some anxiety about computer use. For example, about half of our sample (49%) agreed that computers made them nervous and 74% agreed at some level that while working on computers, they worried that they may do something wrong (push the wrong buttons, insert the wrong commands, and so on) that would affect the computer program. Even with these concerns, however, 95% agreed that they would like to increase their knowledge and skills on the computer. On the open-ended question, many participants reiterated their concerns regarding their own low level of knowledge. The second major theme concerned the ability to secure financial resources to purchase and maintain computers in the classroom. A few participants also identified that a workshop on computers would be beneficial.

Discussion

Overall, this survey points to the specific areas of weakness about computer technology among early childhood educators that could impact on their ability to use computers effectively in their classroom. With respect to specific knowledge about computers, we can conclude that early childhood educators have some basic knowledge of the basic components of a computer and how to operate the computer. In terms of the more complex elements, however, they are lacking information. It also is important to note that even their knowledge of the basics of the computer leaves considerable room for improvement. It is critical to note the source of their knowledge. The information that they do have seems to come from trial and error. Although trial and error may be effective sometimes, it is neither efficient nor systematic (Mayer, 1992). It is clear that these educators, at present, do not have a source of information that is reliable, systematic, and informed. If the educators lack knowledge about computers, they will not be able to facilitate computer use among their students. Relating to our knowledge of learning environments, this lack of helpfulness will hinder the perceived teacher support that is so crucial in the learning environment (Tobin & Fraser, 1998). In addition, if the teacher does not know how or what to teach, the children will resort to the trial and error approach to learning. While this may not result in "zero learning" (Fraser, 1998), it will be much less efficient than if the teacher provided systematic instruction on the use of the computer.

It also is clear that even though teachers perceive a need for more information and have some anxiety about using computers, they are very enthusiastic about introducing and implementing this technology in their centres. This finding is extremely important as a first step in creating a more ideal learning environment. Teachers can employ strategies to make the actual learning environment more closely resemble the preferred learning environment of young children (Fisher et al., 1995). Clearly an initial strategy to increase computer use in the classroom would be for teachers to learn how to use the computer. Although the ideal situation would be the introduction of a course in computer technology for students in the filed of early childhood education as has been suggested for K-12 teachers (e.g., Ellsworth, 1998; Rasmussen & Norman, 1998), current educators need to become familiar with computer use in the ECE environment. The present survey findings provide an outline for creating a template in order to provide this population with the knowledge and experience required for them to become more comfortable using computers. In particular, we believe that the information teachers require would be suited to a workshop presentation.
An appropriate workshop would involve hands-on learning in several skill areas. Because knowledge was generally low, the workshop for early childhood educators should spend some time orienting them to the components of the computer and explaining how to use an operating system. It may be argued that the operating system does not need to be trained because 69% stated that they were familiar with Windows95 or Windows98. However, 71% of respondents stated that they would require assistance in changing the speed of the mouse. This issue is especially relevant given that young children could have differences in dexterity, hence knowledge of features that could accommodate different needs would be beneficial. By showing educators some of the general tasks of the operating system, they will be able to tailor the computer for all of their students.

A main objective of a workshop would be to help educators feel comfortable using computers in the classroom. Hands-on experience would be necessary to learn how to manage all aspects of the computer from hardware to software. This would include a review of specific instruction about the components that make up a computer. Given restricted financial budgets mentioned by most of our centres, it is important for teachers to know enough about computer hardware and operations to select the right unit for their centres, and to be able to manage simple problems. This knowledge would diminish the need to call in external supports and avoid wasted learning opportunities. In addition, a useful workshop component would include learning how to install, run, and evaluate educational software for the children.

It is important to train teachers to choose developmentally appropriate software. Haugland and Shade's (1988) identified 10 criteria of age appropriateness in computer software. These criteria would serve as a good reference for selecting software. They include: child control, clear instructions, expanding complexity, independent exploration, process orientation, real world representation, technical features, trial and error, and visible transformations. To make these criteria clear, it would be helpful to demonstrate software that is developmentally appropriate and software that is developmentally inappropriate. Currently, there are a number of companies that provide award-winning software. Edmark produces top-rated problem solving software such as Bailey's Bookhouse, Millie's Math House, Sammy's Science House, and Thinkin' Things. The Learning Company produces quality programs such as Dr. Seuss Kindergarten and Just Grandma and Me. In choosing their software for the classroom, educators should evaluate based on Shade and Haugland's criteria and use the above mentioned software as a guide.

Finally, because educators' experience considerable anxiety about computers, as evidenced both in our study and in previous work (Payne, 1983; Weil et al., 1990), it would be important to ensure that the environment of the workshop be supportive and active to ensure practice and mastery of these basic skills.

An issue of importance that has not been addressed by the present study surrounds the pedagogy of computers in the early childhood classroom. This question is beyond the scope of the present paper, but is one that should be addressed in a workshop. In order for educators to be able to discuss the use of computers in the early childhood classroom, they need to be familiar with the spectrum of uses that the computer could have (e.g., drill and practice; problem-solving). Given the findings of the current study, however, it is clear that educators first need to be trained in the basic skills of computer use. Once they have these skills, they can then bring the computers into the classroom and integrate them into the early childhood classroom curriculum.

In summary, in order to create a positive learning environment with computers in the early childhood classroom, it is important first to teach computer skills to the educators. The result would be a classroom that would perhaps match more closely the expected learning environment of young children and would most likely
yield optimum use of computer technology.

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References


