Can computer games enhance the acquisition of cognitive skill in preschoolers with developmental delays?

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Can Computer Games Enhance the Acquisition of a Cognitive Skill in Preschoolers With Developmental Delays?

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Special Project
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Accepted by the Graduate Faculty, Indiana University-Purdue University Fort Wayne, in partial fulfillment of the requirements for the degree of Master of Science in Education with a major in Special Education.

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Abstract

Technology is becoming an important part of education. It is used at every grade level from preschool to grade 12 in the public school systems. It is utilized in post-secondary education and is a life-long skill. This project's purpose is to show how cognitive skills can be enriched and focus on task can be enhanced within the classroom through the use of computers. The final product is a handbook for parents and educators to use composed of on-line computer games focusing on specific educational skills. These games can be used to possibly enhance skill acquisition in preschool aged children with or without developmental delays.
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CHAPTER 1

Introduction

Most school districts in a Midwestern state have computer labs available for classroom use and classrooms have several individual computer stations within the rooms. Is this enough to keep up with the technological demand of the new millennium? Many jobs require the use of computers or knowledge of specific technology. Checkout clerks at grocery stores, department stores, or fast food restaurants must use cash registers, which are forms of computers, to do their jobs. Many telephones purchased by consumers have computer capabilities built into them with downloadable applications and can complete similar tasks as efficiently as a home computer. This is amazing technology for those households where it exists.

With computers available to many households, where does this leave public schools in regard to their commitment to student education for those who do not have this technology at home? The current job market requires the use of technology by many workers. It is realistic to assume that the future job market will require an even greater use of technology at even the basic entry level job. Are students with disabilities being educated with the proper technology in schools so they will be ready for the current and future job markets?

Terms

1:1 Technology Initiative. 1:1 Technology Initiative means refers to providing each student within a school district, in designated grades, technology to use individually within the classroom or at home.
Technology. Technology refers to machines, equipment, and systems considered as a unit (Encarta Dictionary: English (North America), 2010).

Expressive Letter Knowledge. Expressive letter knowledge is the letters from the alphabet that a person can name using vocal language.

Developmental Delay. Developmental delay is a category of eligibility listed in IDEA referring to a young child, ages three to five or three to nine (age range determined by state), who has exhibited significant delays in two or more areas of development or who has a severe delay in one area of development.

Statement of the Problem

A small rural school district in a Midwestern state adopted a 1:1 curriculum related to technology. Depending upon the grade level, each student in the district enrolled in grades K-12, will receive a piece of technology equipment to enhance learning within and/or outside of the classroom. Students enrolled in grades K-2 will be assigned an iTouch©, those in grades 3-4 will be assigned an iPad©, those students in grades 5-12 will be assigned a laptop computer, and those students assigned to special education classes separate from general education will be assigned an iPad© or laptop as deemed appropriate by the Teacher of Record. Preschool students with special needs will utilize desktop computers within the classroom. This technology will be part of book rental for the 2011-12 school year and beyond. This is a firm commitment to technology education within this rural school district. With this commitment to the use of current technology with students in grades K-12, where does that leave
preschoolers who have disabilities? Can these preschoolers learn educational skills using a desktop computer while also learning to navigate the equipment and software?

**Significance of Topic**

More and more schools districts are looking to enhance technology education to meet the National Educational Technology Standards and Performance Indicators for Students (International Society for Technology in Education, 2007); the addition and use of computers and other equipment within the school setting is essential for this purpose. A 1:1 technology initiative is bold and necessary to compete in today’s technological world. Specific research on the use of computer hardware and software with preschoolers who have developmental delays is not prevalent. Is a student whose age is three to five years old capable of understanding the abstract concepts involved with the use of a computer with a mouse and a keyboard? Can computer technology be used to assist preschoolers with developmental delays in the acquisition of particular skills?

The literature review and the studies completed by the researcher, concerning preschoolers with developmental delays using on-line computer games, attempt to answer these questions. A handbook of free on-line computer games has been developed to assist parents and teachers of children aged three to six in finding appropriate games for their children or students which may enhance the acquisition of specific skills.
Research Approach

This research utilized the quantitative method to determine the answer to the question, “Can computer alphabet games enhance the acquisition of cognitive skills in preschoolers with developmental delays?” Two studies were conducted, one in May-June, 2011 and one in August-September, 2011. A control group and a test group of students were randomly chosen for each of the studies from a group of preschoolers with developmental delays. The size of the groups was dependent upon the enrollment of preschoolers with a developmental delay in the researcher’s preschool classes. Groups ranged in size of three to four students. The cognitive skill of expressive letter knowledge was chosen by the researcher to examine the question posed. A pretest and posttest of expressive letter knowledge was given to all participants.

The control groups received the preschool education afforded all preschoolers with developmental delays through programs designed specifically to increase skills individually identified as deficits. This education included use of educational computer games, which focused on a variety of science, problem solving, language and math skills, for ten minute sessions, three days per week. The test groups were afforded this same individualized education including ten minute periods, three days a week, of computer games focused on language and letter skills that were print rich. These interventions took place during the unstructured time of the school day. The unstructured portion of the day consisted of students utilizing center-based learning throughout the room. They chose to paint; play in sand, water, or play dough; draw, color, cut and paste to
create art; dress up and utilize the dramatic play area; etc. Study I, May-June, 2011, lasted for six weeks. This time period was chosen because typical interventions require six weeks of implementation to determine effectiveness. Study II, August-September, 2011, lasted for three weeks. The time for the implementation of this study was shortened due to the time constraints of the researcher.

Data were analyzed to determine the amount of expressive letter knowledge gained by both groups. The results of the action research was used to develop a handbook for teachers and parents that addressed the utilization of computer software games to enhance the acquisition of cognitive skills in a variety of skill areas determined by the Department of Education (DOE) State Standards for kindergarteners and the Foundations for Young Children developed by the DOE in a Midwestern state.

**Delimitation and Assumption of Studies.**

1. The populations of these studies are limited to preschoolers, randomly selected, between the ages of three to five years who have been identified as having a developmental delay and who are receiving special needs services through a small rural Midwestern school district within the public education classroom.

2. Participation of the students is voluntary, though they will be verbally encouraged to participate in the research and may
receive a tangible reward upon completion of computer work time.

3. Findings rely on the participation of the students selected for the research.
CHAPTER 2

Literature Review

Research about the specific use of on-line computer games with preschool children who have developmental delays is limited. Is a student whose age is three to five years old capable of understanding the abstract concepts involved with the use of a computer with a mouse and a keyboard? Can computer technology be used to assist preschoolers with developmental delays in the acquisition of particular skills? This literature review will attempt to answer these questions.

Computer Use with Preschool Age Children

Many households have computers for home use. Atkins and Li (2004) stated that in those households with young children, 70% of responders have purchased educational software for the use of their children. However, the majority of these computers are located in homes with a family income less than $25,000. Where does that leave the approximate 25% of the population in a Midwestern state without a home computer or telephone with such capabilities? It is the job of public schools to prepare students to enter the workforce or a school of higher education and become productive members of society. Can school districts in this state do this without providing students with a hands-on education in the use of technology?

The number of households with home computers in the Midwestern state has been on the rise each year for almost two decades. In 1984, 6,980 out of 87,073 households, or 8.2% of the population, reported having a home computer.
In 2003 (when responders were last asked about computer ownership), 69,912 out of 113,126 households, or 61.8% of the population, reported having a home computer. Internet usage at households increased from 18.0% in 1997 (when responders were first asked about internet usage) to 68.7% in 2009 (U.S. Census Bureau, Population Division, Education & Social Stratification Branch, 2010). Within these homes that have educational software, it is undetermined how much practice those children aged three to five years have on these computers. Atkins and Li (2004) stated that preschool children with home computers accessed them at least once a week. The children that do access these computers at home, a day care, a relative’s home, and the library may be using them in a variety of ways and not just to enhance educational skills (Atkins & Li, 2004). There is not a large body of evidence that supports computer usage for preschoolers, nor evidence that disproves its value. According to Atkins and Li (2004), conflicting evidence reveals that some studies have shown computer use enhances many language, math, and motor skills in preschoolers and other studies have shown no effect on computer use and the enhancement of these skills. Both sides of the evidence will be presented with the research.

Proper Technology

Among research conducted on the use of computers with preschoolers, some themes seem to resonate. Computer software which is user friendly, provides immediate feedback, and is presented with imbedded support is essential for preschoolers. Programs that are confusing or difficult to maneuver may not hold the attention of a preschooler. If the child does not attend, learning
does not typically occur. Chen and Couse (2010) found in their review of research that motivation is essential to learning, as it promotes extended engagement in the learning process. The majority of research conducted seven or more years ago with preschoolers and technology involves the use of desktop computers with touch screens or a mouse to manipulate the programs.

Matthews and Seow (2007) wrote that 15 years ago electronic paint programs were operated using mouse-driven technology. Learning how to manipulate the mouse in order to make a mark appear on the screen, being able to use fine motor muscles to continuously depress the correct button on the mouse, and understanding that the movement of the mouse hardware on a separate surface apart from the screen would create a mark were things a child had to consider when creating artwork on a computer. Although this process was very involved, children as young as two to six years of age were able to create artwork (as cited from Jessel & Matthews, 1993).

Chen and Couse (2010) propose that a tablet computer may increase a child’s interest in writing and drawing. With increase in interest, there is also an increase in motivation, attention, and focus. Now with the use of a tablet computer and a stylus, children are able to create work that uses similar motor skills as pencil and paper method. The ability to write directly onto the surface of the tablet makes the work more interesting and enjoyable due to its ease of use. The availability of a full palate of colors from which to mix and design opens up a new learning experience for the young writer and artist. A stylus can make wide, thin, light or heavy marks on the tablet screen, changing the appearance of the
picture being drawn. Erasing becomes permanent with no residue left behind; it is new, fun and exciting (Matthews & Seow, 2007). Preschoolers working with the stylus and a tablet computer in Chen and Couse’s (2010) research indicated “the colors were brighter, you don’t run out of ink, and you don’t have to rinse off your brush” as compared to traditional forms of writing and artwork (p. 95). Teachers of those participating students indicated the technology motivated students who did not usually choose to write to do so, perceiving the interest value as high. Children took more time and care to develop their pictures and were still highly interested in the use of the tablets for the remaining two months of school.

**Child Development and Computer Use**

There are conflicting bodies of research on child development that debate the constructive use of computers with children ages three to five (Atkins, Li & Stanton, 2006). Some researchers state that, according to Piaget’s theory of development, children do not reach the concrete operational stage until around seven years of age, so the use of a computer would be beyond the developmental capability of preschoolers (as cited in Brady & Hill, 1984 and Elkind, 1987). However, Atkins et al. (2006) proposed the following concerning their interpretation of research (as cited by Clements and Nastasi, 1992, and Clements, Nastasi, and Swaminathan, 1993), that “children as young as preschoolers can appropriately use computer programs... (because) what is ‘concrete’ to the child may have more to do with meaningful and manipulable than with physical characteristics” (p. 241). In addition, Vygotsky’s theory of
cognitive development can be used to determine that children develop understandings and learn through the use of cultural tools, such as the use of a computer. This tool, the computer, could help provide the support needed to increase many skills in a preschool child (Atkins, et al., 2006).

**Cognitive Skills Acquisition**

Preschoolers learn in a variety of ways. Gardner, Kornhaber, and Moran (2006) suggest that everyone learns through a variety of intelligences that are innate. Learners can show strengths in the ability to learn through several of these intelligences. Intelligences proposed by Gardner are linguistic, logical-mathematical, musical, spatial, bodily-kinesthetic, naturalist, interpersonal, intrapersonal, and existential. Many of these intelligences include the senses. A multi-sensory approach to learning and the ability to experience and practice through a variety of media are most beneficial to young children. Gardner’s original work, *Frames of mind: The theory of multiple intelligences* (1983), was not developed for educational purposes according to Hopper and Hurry (2000), and stated by Gardner himself (Gardner, et al., 2006). However, using the knowledge of the theory to develop learning experiences in which children can use many senses and intelligences to gain skills is beneficial to all. The use of computer programs to stimulate a child at a multi-sensory level would utilize many of Gardner’s intelligences, thus providing experience and practice that may benefit the acquisition of cognitive skills.

Many researchers posit that letter knowledge is one of the fundamental skills required to successfully begin the process of reading (Bowles, Justice,
Computer Games and Preschoolers

Skibbe, Turnbull, & Wiggins, 2010; Berg, C., Berg, S, Beswick, Modglin, Molfese, Molnar, et al., 2006; Leitner, et al.). How children learn to recognize letters can be debated. Children typically learn uppercase letters before lowercase letters as noted by Bowles, et al. (2010). How do children learn lowercase letters? It is most likely through a combination of ways according to several theoretical explanations of the process (Bowles et al., 2010). Bowles et al. (2010) tested four hypotheses concerning the acquisition of letter knowledge, particularly concerning the probability that children would know specific lowercase letters. These four hypotheses researched by Bowles et al. (2010) were as follows:

1. Uppercase familiarity hypothesis - students recognize lowercase letters corresponding to familiar uppercase letters (Worden & Boettcher, 1990)

2. Uppercase-lowercase similarity hypothesis – students recognize lowercase letters which resemble uppercase counterparts (Treiman & Kessler, 2004)

3. Own-name advantage hypothesis – students recognize lowercase letters occurring in their own names (Bowles, Justice, Pence, & Wiggins, 2006)

4. Frequency in printed English hypothesis – students recognize those lowercase letters occurring most often in printed English (Koda & Wang, 2005; Bode, Marquis, Oetting, Pae, & Rice, 2005; Hoff & Naigles, 2002; Hoff-Ginsberg & Naigles, 1998)

Based on Bowles’ et al. (2010) testing of 461 children, the uppercase familiarity hypothesis was supported. Students’ recognition of lowercase letters corresponded with their knowledge of uppercase letters. The uppercase-
lowercase similarity hypothesis was also supported. Lowercase letters most similar to their uppercase counterparts in shape were more likely to be known. The own-name advantage hypothesis was not supported as the children tested were not more likely to know a lowercase letter that corresponded to the initial uppercase letter of their name. The frequency in printed English hypothesis was supported for lowercase letters; however the interaction between frequency and uppercase letter knowledge was not significant.

Computer games can utilize many of these hypotheses concerning the acquisition of letter knowledge. With the repeated presentation of uppercase and lowercase letters, the names of the letters being stated, immediate feedback as scaffolding, and the utilization of a multi-sensory approach, computers may enhance the acquisition of letter knowledge, thus possibly increasing the probability of becoming a successful reader.

Teaching Strategies: DI, TAI, CAI, Scaffolding

Because preschoolers with developmental delays learn in a variety of ways, teachers and parents must use many strategies when instructing these children. Direct instruction (DI) given by the teacher or parent directly to a student or students and Teacher-Assisted instruction (TAI) given in a supportive manner when students are becoming independent learners are commonly used. Also used with students are the strategies of scaffolding (providing only the amount of support needed by a specific student) and Computer-Assisted instruction (CAI).
Chute, John, Miksad, and Rosalyn (1997) explained Vygotsky’s (1978) teaching strategy of scaffolding as “…instructional assistance that enables someone to solve a problem, carry out a task, or achieve a goal that the person could not accomplish alone” (as cited by Paris, Wixson, & Palincsar, 1986, p. 109). Scaffolding provides a level of assistance appropriate to the learner that is required when the learner is acquiring skills. The level of assistance varies from full demonstration with hand-over-hand assistance to limited assistance with just verbal prompts. Support begins at the greatest amount needed by the learner to begin to acquire a skill and is decreased as the learner acquires the skill. It is individualized to each learner and changes at varying rates. Computer programs can provide this scaffolding support to learners as they acquire new skills. Many times this scaffolding is provided by teachers or teaching assistants as they monitor the use of the computer by each student.

DI and TAI have been used to teach general education students and special education students for years. Hitchcock and Noonan (2000) suggest that CAI is showing promise as an intervention in special education. According to their research, CAI, along with a time delay response from the computer program, proved to be superior to TAI in the ability of preschoolers to build skills in the area of shape, color, and number recognition. Within their reflection upon researched articles, however, Hitchcock and Noonan (2000) did report that DI and TAI remained the most important ways in which instruction should occur. This is due to the fact that children performed better at CAI when a teacher was actively mediating the learning and providing the amount of support needed.
Leitner, Mioduser, and Tur-Kaspa (2000) noted significant improvement on test scores when 16 students in kindergarten with special needs were taught phonological awareness, word recognition and letter naming using computer software along with printed materials from a special reading program (experimental group 1). This was in comparison to 15 students who were taught only with printed materials from the special reading program (experimental group 2) and 15 students taught with regular special education program materials (control group 3). See Table 1.

Table 1
Mean, SD, % improvement and F-values for the three groups in the tests, Leitner et al. (2000, p.58)

<table>
<thead>
<tr>
<th>Groups</th>
<th>printed + computer (n=16)</th>
<th>printed without computer (n=15)</th>
<th>control group (n=15)</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>mean/(sd) %</td>
<td>mean/(sd) %</td>
<td>mean/(sd) %</td>
<td></td>
</tr>
<tr>
<td><strong>Letter</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1&gt;2&gt;3 naming</td>
<td>5.75 26.1</td>
<td>2.93 13.3</td>
<td>0.50 2.3</td>
<td>25.67</td>
</tr>
<tr>
<td></td>
<td>(2.67)</td>
<td>(1.91)</td>
<td>(0.94)</td>
<td>**</td>
</tr>
<tr>
<td><strong>Word</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1&gt;2&gt;3 recognition</td>
<td>3.94 32.8</td>
<td>2.73 22.8</td>
<td>0.36 3.0</td>
<td>18.85</td>
</tr>
<tr>
<td></td>
<td>(1.24)</td>
<td>(1.94)</td>
<td>(1.55)</td>
<td>**</td>
</tr>
<tr>
<td><strong>Phonological</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1&gt;2&gt;3 awareness</td>
<td>28.31 23.2</td>
<td>17.07 14.0</td>
<td>5.86 4.8</td>
<td>49.30</td>
</tr>
<tr>
<td></td>
<td>(8.25)</td>
<td>(4.82)</td>
<td>(4.47)</td>
<td>**</td>
</tr>
</tbody>
</table>

As seen in Table 1, the computer group scored significantly higher than the other two groups in all three language areas. In the area of Letter Naming group 1 showed an increase in performance of 26.1%, group 2 showed an increase in performance of 13.3% and group 3 an increase of 2.3%. In Word Recognition,
group 1 showed an increase in performance of 32.8%, group 2 showed an increase in performance of 22.8%, and group 3 an increase of 3.0%. In Phonological Awareness, group 1 showed an increase in performance of 23.2%, compared to an increase of 14% in group 2 and 4.8% in group 3. Within the 11 sub-tasks recorded in the phonological area, group 1 scored significantly higher on six out of the eleven tested. These subtasks were initial phoneme recognition; final phoneme recognition; identical, initial phoneme recognition in two words; identical, final phoneme recognition in two words; rhythmical rhyme identification; unrhythmical rhyme identification; and rhyme formation. No significant differences in performance were noted in the subtasks of initial and final phoneme isolation or deletion, or in the subtask of rhyme formation. The computer software used by the experimental group 1 was developmentally appropriate and interrelated with the printed materials used in both experimental groups 1 and 2. This software included the use of sound to instruct and provide immediate feedback to the users, utilizing scaffolding needed for each learner (Leitner et al., 2000).

It appears that CAI can be a useful tool or intervention for preschoolers with developmental delays when appropriate computer programs are selected and monitored by teachers or staff within the classroom. Chute, John, Miksad, and Rosalyn (1997) found that improvement of cognitive skills within preschoolers could be seen in the area of specific language skills (word knowledge and verbal fluency) by using CAI. This increase could partially be attributed to the increase in attention to task when students focused to a greater
degree while using the computer rather than listening only to a teacher and when appropriate levels of scaffolding were present with the CAI (Chute et al., 1997). Therefore, computers may be used with success in preschool classrooms when appropriate programs are used and the students are assisted by staff when using the computers.

**Focused Attention – A Benefit of CAI**

The ability to focus and attend to a task is a needed skill when a student is acquiring new information or a new ability. Focusing or attending is actively directing one’s attention to the task or instruction that is currently happening. In order to do this the learner must be able to disregard any other distractions that may pull attention away from the activity. If attention is drawn away, the learner must be able to quickly recover and refocus on the task, showing persistence for learning (Cardona, Hinojosa, & Martinez, 2000). Cardona et al. (2000) noted, in their review of literature, that computers seem to capture the attention of children in a variety of ways according to a study completed by Loar (1992). This effect was also noted by Avgerinos, Tsiskari, Vernadakis, and Zachopoulou (2005) in their research on CAI with preschoolers. The use of a multi-sensory and multi-intellectual approach that the computer offers enables children to learn in a variety of modes. These include visual, auditory, tactile, and kinesthetic. The computer can actively engage the child in a variety of ways combined to create a teaching strategy from which it is hard to be distracted. Computers also offer instant feedback and gratification to reward or provide the scaffolding needed to teach a skill to a child. Cardona et al. (2000) stated that this instant feedback,
provided visually or through auditory means, is what many children with attention difficulties need (as cited by Green, 1995).

In their study, Cardona et al. (2000) found that of the five participants included in the study, all five of them showed a dramatic decrease in distractibility and an increase in visual attention while using a computer program. This ability to focus on tasks during CAI was carried over to TAI with four of the five participants, as shown by the data. Data on distractibility and visual attention were recorded in three phases, with participants completing tasks in TAI activities to establish a baseline during phase 1. During phase 2, the participants were exposed to CAI with the same distractions noted during phase 1. The data collected on distractibility showed a decrease in the number of distractions while using CAI. Visual attention increased during CAI. Distractibility while learning showed a slight increase during the withdrawal of CAI and the return to TAI for phase 3; however, the distractibility did not reach the level as noted in phase 1. One participant's distractibility remained the same as in phase 1. It was also noted during this study that visual attention increased during the CAI and also remained elevated during the return to TAI, except in one participant who remained at the same level as in phase 1. Cardona et al. (2000) discovered that “during phases 1 and 3 the participants became very agitated or captivated with (unexpected) distractions. However, when the unexpected distractions occurred during phase 2 (treatment), all participants remained focused on the computer-based visual analysis activities” (p. 53). Technology may help a child focus and attend to learning. This focus is required for any person to be able to learn new
information or acquire a new skill. The technology used can vary. It is up to the
parent or guardian and the education system to ensure that technology use is
educational for the child.

Research Topic

The literature presented suggests that students who are aged three to five
can utilize computer technology to engage in CAI in order to enhance the
acquisition of many skills, Cardona et al. (2000). The research did not indicate
whether students within this age group who have also been identified with
disabilities would benefit from using computer technology to enhance the
acquisition of specific cognitive skills. Bowles et al. (2010), Berg et al. (2006),
and Leitner, et al. (2000) posit that letter knowledge is one of the fundamental
skills required to successfully begin the process of reading. Therefore, the
purpose of the action research planned is to determine if on-line computer
alphabet games can enhance the acquisition of the cognitive skill of expressive
letter knowledge in preschoolers with developmental delays.

Rationale

The end product was in the form of a handbook. This handbook listed
various computer programs available, free and online, to educators and parents.
The handbook listed some education websites and educational computer games
currently online. It identified specific learning skills, based on the Department of
Education’s (DOE) kindergarten standards and Foundations for Young Children
from a Midwestern state. These skills may be enhanced by the use of the games
identified. Educators and parents are able to utilize the handbook to locate
games with a specific skill deficit in mind that a child may possess. Use of the games may help to enhance the acquisition of a particular skill for the child. Participating in these games may also strengthen additional cognitive skills within the child.

The Foundations for Young Children to the Academic Standards is a manual for early childhood educators or providers on understanding of the use of developmentally appropriate practices to build foundational skills. These foundations were established to make available assistance to all who work with young children to provide a developmentally appropriate environment in which to support the learning of each child within the classroom. These foundations offer a framework to support the kindergarten academic standards developed by a Midwestern state.
Chapter 3
Methodology

Introduction

The special project developed by the researcher was based on the evidence presented that the use of computers within the preschool classroom may help to increase cognitive and language skills in preschoolers. This special project was a handbook of on-line computer games separated into various skill areas. The researcher presumed that if a computer is an effective way to enhance skills in three to five year old children, it may also be effective as a means to increase a specific skill in which a child has a deficit. The computer programs presented needed to be developmentally appropriate and targeted to specific deficits of a student. The handbook that was developed listed specific skills that a child three years or older may be developing in the areas of language, math, and science. These skills were taken from the DOE state standards for kindergarten students and the DOE’s Foundations for Young Children from a Midwestern state. The websites and games chosen for the handbook were readily available to the schools and the public at large so that they can be accessed by teachers and parents. Thus, the researcher focused on websites with games that are free to use.

CITI Certification and IRB Approval

The researcher for this action research study was certified by Collaborative IRB Training Initiative (CITI), passing all of the training modules required to conduct research projects with human subjects, see Appendix A. The
action study design and plan were given Institutional Review Board (IRB) approval through an accredited Midwest university, see Appendix B. This process entailed the approval of specific details and procedures that were to be followed while introducing and completing the research proposed.

Participants and Setting

Preschool students were instructed in a language rich environment which focused upon oral language skills, social and emotional skills, receptive vocabulary, expressive vocabulary, and beginning print and writing skills. Basic number sense, basic science and social studies skills were also addressed. The students received direct and indirect instruction for one 2 ½ hour session per day for five days a week. These skills were practiced throughout the session. The use of computer games was a part of the indirect and sometimes direct instruction of the preschool students. The students were instructed in large groups (five-ten students), small groups (two-three students), and individually throughout the day. The students accessed the computer individually; they first received direct instruction and then worked independently as the scaffolding of support was removed.

During the preschool day students were immersed in center time activities for approximately 45-50 minutes. During this time students chose in what activity they wished to partake, either by themselves or with friends. The students were working on social, emotional, language, cognitive and adaptive skills during this center time depending upon which activity they chose. The students were pulled out of center time to a small table within the classroom, individually or within a
small group, to work on the individual goals they have listed within their Individualized Education Plans (IEP). They were given direct instruction at this time. During center time students may have been assigned to work, as part of their IEP goal work, on the computer which had been preloaded with an educational game from an online source. These games were language rich and may have addressed language, math, science, and social studies skills.

**Data Sources and Data Collection Process**

**Study I Participants.**

Study I was designed to take place in May-June of 2011. A control group of four students diagnosed with developmental delays was formed of randomly assigned three to five year olds from both the morning and afternoon sections of preschool. See Table 2. In order to have been found eligible for services with a developmental delay, each student was given a comprehensive, multidisciplinary evaluation. This evaluation focused on five areas of development which included cognitive, social, behavioral, physical, and adaptive. The results of this evaluation revealed a severe deficit (two or more standard deviations below the mean) in one area or moderate deficits (one standard deviation below the mean) in two or more areas evaluated.
Table 2

Student Data for Control Group, Study I, May-June, 2011

C1 was a male, four years of age, attending school in the morning.
C2 was a male, three years of age, attending school in the afternoon.
C3 was a male, five years of age, attending school in the morning.
C4 was a male, five years of age, attending school in the afternoon.

The control group, formed randomly, was assigned to work on the computer three days a week for one 10 minute session each day. They utilized a variety of computer games which targeted number sense, basic science knowledge, problem solving, and language and print knowledge. The games were all language rich. Table 2 shows information about each of the participants in the control group.

Table 3

Student Data for Test Group, Study I, May-June, 2011

T1 was a male, four years of age, attending school in the morning.
T2 was a male, five years of age, attending school in the morning.
T3 was a female, four years of age, attending school in the afternoon.
T4 was a male, four years of age, attending school in the morning.

A test group of four students diagnosed with developmental delays was formed of randomly assigned three to five year olds from both the morning and the afternoon sections of preschool classes. See Table 3. This test group was
assigned to work on the computer three days a week for one 10 minute session each day. They utilized language and print rich computer games which primarily focused on the acquisition of language and letter knowledge. Information about the test group participants can be found in Table 3.

Data Sources Study I.

A pretest was given to all participants prior to the beginning of the study. 52 flash cards of upper and lowercase letters were randomly presented to each student, see Appendix C. The researcher placed flash cards in two groups according to the accuracy of the letter named. The correct answers were then recorded on a pretest/posttest sheet with each student’s group identification and number, see Appendix D.

After the six week period of computer use a posttest was given to determine whether gains had been achieved in expressive letter knowledge. The posttest was given in the same manner as the pretest with results recorded on a posttest sheet including the student’s group identification and number. The data were compiled and analyzed by the researcher.

The technology used during this study included two desktop computers with 19 inch flat screen monitors. These computers were equipped with a standard keyboard, a standard mouse, and headphones. The online games with which the participants interacted were from www.sesamestreet.org. This site has approximately 130 games that are standard and several games which vary with the seasons and holidays. The games were updated as the seasons and holidays arrived.
**Study II Participants.**

An additional study was completed in August-September of 2011. The action research was set up in much the same manner as Study I.

Table 4

Student Data for Control Group, Study II, August-September, 2011

- C1 was a male, four years of age, attending an A.M. preschool section.
- C2 was a male, four years of age, attending a P.M. preschool section.
- C3 was a female, four years of age, attending a P.M. preschool section.

A control group of three students diagnosed with developmental delays was randomly formed to work on the computer three times a week for a total of 10 minutes each session. Details of these participants can be found in Table 4. They utilized a variety of computer games which targeted number sense, basic science knowledge, problem solving, and language and print knowledge. The games were all language rich.

Table 5

Student Data for Test Group, Study II, August-September, 2011

- T1 was a male, five years of age, who attended an A.M. preschool section.
- T2 was a female, four years of age, who attended a P.M. preschool section.
- T3 was a male, four years of age, who attended an A.M. preschool section.
A test group was established of three students diagnosed with developmental delays who worked on the computer three times a week for a 10 minute session each day. The details of the participants can be found in Table 5. They utilized language and print rich computer games which primarily focused on the acquisition of language and letter knowledge. They were given the same pretest and posttest as the control group. These tests were given prior to and immediately after the three week study period.

Data Sources Study II.

A pretest was given to all participants prior to the beginning of the study. Fifty-two flash cards of upper and lowercase letters were randomly presented to each student, see Appendix C. The researcher placed flash cards in two groups according to the accuracy of the letter named. The correct answers were then recorded on a pretest sheet with each student's group identification and number, see Appendix D.

After the three week period of computer use a posttest was given to determine whether gains had been achieved in expressive letter knowledge. The posttest was given in the same manner as the pretest with results recorded on a posttest sheet including the student's group identification and number. The data were compiled and analyzed by the researcher.

The technology used during this study included two desktop computers with 19 inch flat screen monitors. These computers were equipped with a standard keyboard, a standard mouse, and headphones. The online games with which the participants interacted were from Sesamestreet.org. This site has
approximately 130 games that are standard and several games which vary with the seasons and holidays. The games are updated as the seasons and holidays arrive.
Chapter 4
Results/Research Findings

Initial Findings of Group Data

Data were taken from the results of the pretests and posttests given by the researcher. These data were compiled and visually displayed to show the gains made by the students during the action research according to the students’ group identifications and numbers. The percentage of gain was determined by subtracting the pretest score from the posttest score and dividing the difference by the pretest score.

The percentage gain was displayed for the control group and the test group in each study. The percentage of gain was also displayed across the control group and the test group, showing the rate of gain by age and by the time of attendance. The results from Study I are given, followed by the results of Study II.
Table 6

Control Group, Expressive Letter Knowledge Gained from Pretest to Posttest, Study I, May-June, 2011

Table 6 showed large gains within the control group with regard to expressive letter knowledge. C1 stands for student number 1 in the control group. C2 stands for student number 2 in the control group, etc. The control group utilized a variety of computer games which targeted number sense, basic science knowledge, problem solving, and language and print knowledge. The games were all language rich. The gains in expressive letter knowledge within the control group ranged from 15% to 110%. Each student's percentage of gain from pretest to posttest is located next to the student's number and group identification.
Table 7

Test Group, Expressive Letter Knowledge Gained from Pretest to Posttest, Study I, May-June, 2011

All test group students showed gains across the board in expressive letter knowledge ranging from 8% to 60% as shown in Table 7. T1 stands for student number one in the test group. T2 stands for student number 2 in the test group, etc. The percent of gain from pretest to posttest is visible next to the student’s group identification and number.

When the results from the two groups in Tables 6 and 7 were compared, there did not appear to be a link between the use of language and print rich computer games focused solely on the acquisition of letter knowledge and the actual acquisition of expressive letter knowledge. Both the test group and the
control group showed gains in expressive letter knowledge with no apparent correlation to the use of language and print rich only computer games.

Table 8
Control Group, Expressive Letter Knowledge Gained from Pretest to Posttest, Study II, August-September, 2011

The data from the control group in Study II, which was completed during a shorter time span than the original study, somewhat mirrored the data from the control group in Study I. The gains within the control group, from Study I, ranged from 5% to 48%. There were negligible and moderate gains in both the control groups for the two studies.
Table 9 shows the data collected from the test group in Study II with regard to expressive letter knowledge gained in a three week period of time. There were negligible and moderate gains within the test group. The gains within the test group, from Study II, ranged from 7% to 55%.

The gains in both the control group and the test group from Study II mirrored the gains made by both groups in Study I. No apparent correlation existed in regard to the specific use of language and print rich computer games focused solely on the acquisition of letter knowledge and the actual acquisition of expressive letter knowledge.

The data from both action research studies showed similar gains in the acquisition of expressive letter knowledge by the students in the test group and
students in the control group. The implementation of online computer games within the preschool setting may prove to be a useful tool to enhance the learning of many different skills in a variety of ways. During the studies, when CAI was focused on a specific skill deficit, that skill improved. When CAI was not limited to a specific skill deficit, the specific skill area of expressive letter knowledge improved with similar gains.

**Further Disaggregation of Data**

Students within both groups in Study I and Study II ranged in age from three to five years of age. Study I included one 3 year old student, four 4 year old students and three 5 year old students.

Upon disaggregating the data based upon student's age, Table 10 shows the age of the student did not have a substantial impact on the percentage of increase within either the control group or the test group. The three year old student had a moderately large gain in expressive letter acquisition of 37%. There were varying gains within the age groups of four and five year olds. Some gains were small and other gains were very large within each age group ranging from 8% to 110%.
Table 10

Percentage of Expressive Letter Knowledge Gained from Pretest to Posttest by Age, Study I, May-June, 2011

<table>
<thead>
<tr>
<th>Age</th>
<th>Child 1</th>
<th>Child 2</th>
<th>Child 3</th>
<th>Child 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 Year Olds</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Year Olds</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>5 Year Olds</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

During Study II there was one 3 year old participant, four 4 year old participants, and one 5 year old participant. Table 11 shows the results of the data by age for Study II.

The results of this data show that age of the student did not seem to have a substantial link with the percentage of gain in expressive letter knowledge. There were negligible gains at the three year old level of 5%. This may have been due to the two week time period that was needed for direct instruction and practice on the navigation and use of the computer, keyboard, and mouse. Gains in the four and five year old age groups were consistent with the wide
margins of gains found in Study I. The gains in these age groups varied from 7% to 55%.

Table 11

Percentage of Expressive Letter Knowledge Gained from Pretest to Posttest by Age, Study II, August-September, 2011

<table>
<thead>
<tr>
<th>Percentage Gain Pretest to Posttest by Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Study II</td>
</tr>
<tr>
<td>3 Year Olds</td>
</tr>
<tr>
<td>4 Year Olds</td>
</tr>
<tr>
<td>5 Year Olds</td>
</tr>
</tbody>
</table>

To determine if the time of day during which the students attended might have an effect on letter knowledge gained, data were analyzed by morning and afternoon attendance.

Table 12 shows a lack of correlation when looking at pretest and posttest gains based upon attendance in the morning session or the afternoon session for Study I. There were small and large gains in expressive letter knowledge within both the morning and afternoon sessions of preschool. The students who attended in the morning session ranged in gains from 8% to 110%. Those in the afternoon session ranged in gains from 15% to 60%.
The data from Table 13 show that there were both small and moderate gains in letter knowledge during the morning and afternoon sessions of preschool. During the morning session, gains ranged from 7% to 35%. During the afternoon session, gains ranged from 5% to 55%. The gains experienced by the morning students in Study I were higher on average by only 1%. The gains experienced by the afternoon students in Study II were higher in average by an amount of approximately 12%. Due to the fact that participant numbers for testing were small, three students per session, and the time of the intervention was brief, three weeks, this data could just be an anomaly. No correlation was shown between time of attendance and the acquisition of letter knowledge.
Table 13

Percentage of Expressive Letter Knowledge Gained from Pretest to Posttest by Time of Attendance, Study II, August-September, 2011

<table>
<thead>
<tr>
<th>Percentage Gain Pretest to Posttest by Preschool Session Time</th>
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</thead>
<tbody>
<tr>
<td>Study II</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Morning Students</td>
</tr>
<tr>
<td>Afternoon Students</td>
</tr>
</tbody>
</table>

Discussion

Both action research studies revealed varied gains of expressive letter knowledge within the participating groups of preschoolers. All participants from both studies were found eligible for special education services through the educational diagnosis of a developmental delay. The data from both action research studies showed varying gains of expressive letter knowledge throughout the control group and the test group within both studies. A moderate to large average gain could not be attributed to either the control group or the test group. No moderate to large average gain was attributed to the age of student or the time of day during which the student participated.
The implementation of online computer games within the preschool setting may prove to be a useful tool to enhance the learning of many different skills in a variety of ways. When focused on a specific skill deficit while using computer software, not only may that skill be enhanced but many other skills may be as well. Within a print rich environment, students were gaining letter knowledge in a variety of ways. The utilization of Computer Assisted Instruction (CAI) along with Direct Instruction (DI) could enhance the acquisition of many cognitive skills (Chute et al. 1997).

Data from the results of the research from within any set of students show no conclusive evidence that the use of specific print-based computer games directly caused a marked increase in the acquisition of expressive letter knowledge among preschoolers. The gains across the board within both groups may have suggested that basic computer use, with its multi-sensory, scaffolded, and language rich approach enhanced the acquisition of a variety of skills within the preschool classroom. An environment which was inherently language and print rich provided the students with many opportunities to acquire letter knowledge skills.

Data which initially appeared inconclusive may actually have shown that an environment which was language and print rich provided the foundation needed for all students with developmental delays to acquire letter knowledge. The differences in gains within the two groups may be attributed to the developmental readiness of each student to acquire the expressive letter skills. The computers used within the classroom may support the acquisition of varied
knowledge by providing a focused activity to further enhance not only the skill chosen by the utilization of a specific game, but other skills as well. As noted by Cardona et al. (2000), CAI provided a highly focused activity from which a student is not easily distracted. More research in this area with, perhaps, a larger number of participants is recommended.

Preschoolers who have been found eligible for special services through developmental delays need an environment which includes many language rich activities. These activities need to be provided through a combination of DI, TAI, and CAI. Computers and appropriate software are an important part of the preschool curriculum. The product presented supports the use of computers within the preschool classroom and within the homes of preschoolers.
On-line

Computer Games

Handbook and

Guide
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Rationale

Many parents and educators understand that the computer is a useful tool when it comes to the education of children. The number of home computers within Indiana households has increased from 8.2% of households in 1984 to 61.8% of households in 2003 when responders were last asked about computer ownership by the U. S. Census Bureau (U. S. Census Bureau, Population Division, Education & Social Stratification Branch, 2010). It is sometimes hard to determine how each child should use the computer. If a child is having difficulty with a certain academic skill, what game might help the child enhance that particular skill while possibly increasing knowledge of subsequent skills along the way?

This handbook was designed to help parents and educators determine which educational and academic online computer games might be best for children to use. The handbook is divided into content areas which may correlate with the Kindergarten State Standards for school children and the Foundations for Young Children in a Midwestern state. When working on one specific content area, other skills may develop unintentionally. Cardona et al. (2000) noted the ability to focus and attend to a task was shown to improve with the use of a computer for short periods of time. The instant feedback and gratification many online games provide ensures that a support system, or scaffolding, is present to continuously infuse children with the desire to continue learning. The multi-sensory approach that computer games utilize lends itself to enable practically every child to glean knowledge of some sort from the experience. Computer
Assisted instruction (CAI) is best utilized when joined with Direct instruction (DI) or Teacher-Assisted instruction (TAI) especially when introducing the concept of computer use or introducing a new game.

Use of computers or other electronic devices is an expected skill in the current field of education. In order to meet the National Educational Technology Standards and Performance Indicators for Students (International Society for Technology in Education, 2007), students are required to use technology to locate information, learn new skills, acquire knowledge, prepare work, and pass along information to their teachers and fellow students. These will be skills required to survive in the technological society in which we live.

In order to prepare our children for this future we must work together, parents and educators, to provide the best education possible for our children. This includes an education with practice and hands-on experience in technology. Utilizing this technology to help strengthen all skill sets will benefit each child in a variety of ways.

Reviewing online computer games to use for the action research studies completed by the researcher revealed many sites with a multitude of games. Most sites were not able to be utilized on the desktop computers at the school due to the firewall that was installed. ABCya.org was used for a short time but worked only intermittently, often freezing while the students were playing. Sesamestreet.org was the only site that the school computers were consistently and continuously able to play. This site was used for the games during the research studies.
This handbook can be used by any adult working with a preschool child regardless of the presence of a developmental delay. This handbook is comprised, in part, of a description of the foundations for young children as determined by a Midwestern state. These foundations were written to support the kindergarten academic standards for that state. Following the description of each standard is a list of skills and activities that you can expect a preschool child, with or without developmental delays, to be exploring. These skills are directly recommended by the Foundations for Young Children manual. Many of these skills can be supported by a parent at home or an educator at school through play and game activities. Children playing with peers learn many of these skills together; however, when the guidance and support of an adult is present at the time of play, children may learn and absorb more because there is an emotional connection with the adult. Please play with your child or student whether on the computer or not. Have fun with your children!
**Concepts About Print**

Children begin to recognize that print has meaning and we can communicate through print. Letter knowledge is a key pre-reading skill. It is the ability to recognize that the letter symbols have meaning and that there is an association between letters and sounds. This leads to the understanding that letters put together form the words that we use to relay wishes, wants, and needs. Students also begin to learn that we can gain and emit knowledge in print format.

Children beginning to understand this foundation

~ Pretend to read a book
~ Name objects from a picture book
~ Turn pages from front to back
~ Tell something a character does
~ Distinguish print from pictures
~ Point to and name 6 letters
~ Read own writing (give meaning to own writing by ‘reading’ what it says)
~ Turn one page at a time
~ Hold book right side up
~ Identify five common signs or symbols
~ Follow printed words as story is read
~ Tell a story while holding a book
~ Name 13 uppercase letters

Games

www.sesamestreet.org

Alphabet Soup
Big Bird’s Letters
Bumper Cars

Find the Letter
Letters to Big Bird
Keyboard-o-rama
www.sesamestreet.org

Call It Macaronisaurus

What Starts With the Letter?

www.pbskids.org

Abby’s Adventures

Amazing Alphabet Match-Up

Alpha Pig – Paint by Letter

Letter of the Day

Alpha Bricks

Super Reader’s Challenge

Super Why Comic Book Game

Alpha Pig’s Lickety Letter Bingo

Dog Ears

Dog Pound

Alphabet Falls

Monkey Match

Spell with Caillou

ABCD Watermelon

Pop and Spell

The Great Word Quest

Bear’s Skateboard Park

Theo’s Puzzles

www.funschool.kaboose.com

Begins with...

Clear the Track

Coloring Fun Book

Connect the Letters

Haunted Alphabet

Letter Matching

Spot the Sign

Teach Me ABCs

www.abcya.com

Alphabet Match

Magnets

Alphabet Bingo

Alphabet Slider Puzzle

Alphabetical Order

Uppercase & Lowercase Matching

www.fisher-price.com

The ABC’s Zoo Learning Game

Little People Memory Match
Bouncing Letters  
ABC Game  
Letter Blocks  
Letter Activity  
A Maze Race  
Whack the Difference
Word Recognition

As children develop the concept of letter knowledge, they begin to understand that letters form the words we use to speak and these words can be written to express ourselves. Understanding that letters have sounds associated with them and that these letters can be used to convey those sounds on paper is the beginning of word recognition. The sounds or letters can be put together to form words. Children beginning to understand this foundation

~ Identify first letter of own name  ~ Generate sounds from letters
~ Imitate simple rhymes  ~ Sing the alphabet song
~ Recite / sing one rhyme or song  ~ Clap out syllables in word songs
~ Recognize that words that look alike may sound alike
~ Generate and blend the sounds of letter patterns into recognizable words
~ Match the sound that begins own names with the sound that begins another word or name

Games

www.sesamестreet.org
Alphabet Soup  Call it Macaronisaurus
www.funschool.kaboose.com
Animal Safari  Begins With…
Clear the Track  Fall Fever
Letter Matching  Rhyme Time
www.prongo.com
Drag and Drop Game
Word Find
www.abcya.com
Henry and the Sugarbugs
Word Search Creator
Lilly, the Wild Cat
Spelling Practice with Dolch Words
Halloween Word Search
Thanksgiving Word Search
www.learn4good.com
Mysteries of Sherlock Holmes Museum
www.fisher-price.com
Learning About Opposites
Zoo Talkers Memory Match
www.knowledgeadventure.com
Crossword Puzzle
Clueless Crossword
Jumpstart Buzz Words
Memory
Typing Monster
Word Scramble
www.pbskids.org
Super Readers Challenge
Spell With Caillou
Pop and Spell
The Great Word Quest
Word World
Between the Lions
Word Play
Martha’s Scrapbook
Murray’s Word on the Street Game
Rhyme Time Bingo
My Word Space
Power Words
Not Afraid of Dogs: Word Battle
Vocabulary Development

Building a large receptive and expressive vocabulary is an important foundation needed to enhance the beginning skills of reading, writing, and the general acquisition of knowledge in all areas. Talking with young children is vital to the growth of this vocabulary. Real life experiences help solidify the meaning of the vocabulary heard. Reading and discussing stories is vital to the development of vocabulary in children. These games can expose children to new and different vocabulary. Children beginning to understand this foundation

~ Identify the first letter of own name  ~ Recognize own name in print
~ Match like letters  ~ Match same letter in different styles
~ Generate sounds from letters  ~ Identify five common signs or symbols
~ Name objects from picture books  ~ Name sounds in the environment
~ Ask and answer simple questions  ~ Ask adult to read printed information
~ Talk about action pictures  ~ Tell simple stories from pictures/books
~ Use newly learned vocabulary  ~ Act out imaginary events

~ Pretend to do something or be someone or something else
~ Generate and blend the sounds of letter patterns into recognizable words
~ Recognize that words that look alike may sound alike
Computer Games and Preschoolers

www.funschool.kaboose.com
Geography Jumble
Letter Matching
Connect the Opposites

www.prongo.com
Drag and Drop Game

www.abcya.com
Henry and the Sugarbugs
Lilly, the Wild Cat
Learn ABCya Buttons
Take a Trip, The Food Pyramid

www.fisher-price.com
Healthy Food Hunt
Opposites

www.knowledgeadventure.com
Crossword Puzzle
Hangman
Memory

www.pbskids.org
Super Reader’s Challenge
Dog Ears
Sue Ellen’s Travel Tales

Games
Fun City
Teach Me ABCs
Animal Safari

Word Find
Word Search Creator
Find the Technology
Take a Trip

Laugh&Learn, Learning About

ABC Game
Jumpstart Buzz Words
Word Scramble

Super Why Comic Book Game
Duck’s Rhyming Party
The Great Word Quest
Computer Games and Preschoolers

www.pbskids.org

An Egg is Quiet: Vocab Game  I Sense
Skits Tricks  Pup Pals
Dog Tags  Chicken Stacker
Fuzzy Lion Ears  T-Bone's Town
Hopposites  Word Morph: How to be a Good Dog
Not Afraid of Dogs: Word Battle  Counting Koi
Word Play  Martha's Scrapbook
Switcheroo  Socks in Space

www.sesamestreet.org

Make Time to Rhyme  The Nick of Rhyme
Jumping Rhymes  Abby's Gift Rap
Reading Comprehension

Exposure to a variety of experiences and reading materials helps young children build a strong foundation for understanding the language around them. Discussing and understanding the meaning of the stories read to them and seeing the information adults gather from books, computers, phones, etc. helps children learn that knowledge comes from many sources. Exposure to different genres of books helps children develop a life-long enjoyment of reading.

Children beginning to understand this foundation

~ Identify a favorite story ~ Request or select a story by title
~ Tell simple stories from picture/book ~ Tell one thing that happens in a story
~ Describe place pictured in book ~ Act out imaginary event
~ Actively look for or attend to things that an adult is pointing out or sharing
~ Ask and answer questions or make comments about a story being read
~ Talk about the cover or illustrations prior to the story being read
~ Tell something a favorite character does in a story
~ Find named pictures or textures in book
~ Share own information related to a story event
~ Express what happens after the action in a picture or book
~ Follow pages that accompany a story on audiotape or CD
~ Identify the beginning, middle, and end of the story
### Games

<table>
<thead>
<tr>
<th>Website</th>
<th>Games</th>
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<tbody>
<tr>
<td></td>
<td>Super Reader's Challenge</td>
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<td>Comic Strip Capers</td>
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<td>Create a Story With Big Jake</td>
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<td>Not Afraid of Dogs</td>
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<td><a href="http://www.funschool.kaboose.com">www.funschool.kaboose.com</a></td>
<td>Bon Appetit</td>
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<td>Alphabet Soup</td>
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<td>Dinosaur Field Guide</td>
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<td>Connect the Opposites</td>
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<td>Korean Opposites</td>
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<td>Clear the Track</td>
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<td>What's My Class</td>
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<td>Family Food</td>
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<td>The Nick of Rhyme</td>
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<td>Abby's Gift Rap</td>
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Writing Processes, Applications and Conventions

Children's attainment of writing skills and processes come in different stages of development. They must first be aware that they can hold a writing utensil and make marks on a surface. As they develop their vocabulary and letter knowledge, they begin to draw pictures which represent objects and lines that represent letters. They become aware that print has meaning when written in an appropriate way following the rules of writing. They learn about page orientation and left to right progression. Witnessing the use of writing by adults helps the young child realize it is an important form of communication. Children beginning to understand this foundation

- Follow dictated writing read by adult
- Position paper for writing
- Add writing to a picture story
- Draw or write name
- Associate writing with words
- Write from left to right
- Use writing to label drawings
- Copy a vertical line
~ Copy a horizontal line  ~ Copy a circle or other shape
~ Write letters in strings  ~ Write phonetically spelled words
~ Write more than one word correctly  ~ Use correct grasp of writing tool
~ Use different combinations of letters to achieve sounds
~ Combine strokes and shapes to represent letters
~ Write using pictures, letters, and words
~ Give writing to someone as a means of communication or to share ideas
~ Scribble a message on a card or picture
~ Draw pictures and scribble to generate and express ideas
~ Draw at top or bottom of page when requested
~ Dictate something for an adult to write down
~ Give meaning to writing by 'reading what it says'

Games

www.pbskids.org
Make an E Card
Matching Game
Creating a Story With Big Jake
Paint

www.fisher-price.com
Doodle Bear Game
Pixter Scratch Board

www.knowledgeadventure.com
Shidonni
Typing Speed Fast
Typing Monster
www.prongo.com
Space World Game
www.sesamestreet.org
Big Bird's Paint Studio  Big Bird’s Crayon Studio
Picture Play
Number Sense

Developing number sense requires a child to be involved in everyday experiences within the typical family interactions of day-to-day living. This basic foundation for later math skills requires the development of the understanding of math vocabulary such as more, less, same, positional words, basic 1-1 correspondence, and rote counting of numbers. Children also build the vocabulary knowledge of shapes, colors, measurement terms, and patterns. The understanding that an amount has a symbol that stands for that amount comes after some of the basic knowledge of the vocabulary has been learned. These games help children learn math vocabulary and the symbols that stand for the numerals. Children beginning to understand this foundation

~ Sing and dance to a number song ~ Count each object only once
~ Identify first and last ~ Give ‘all’ objects when asked
~ Identify the concept of ‘less’ ~ Identify the concept of ‘none’
~ Give ‘some’ and ‘the rest’ when asked ~ Rote count to 10
~ Count backward from 10 ~ Match symbols with amounts 1-5
~ Imitate counting behavior using the names of large numbers
~ Use whole numbers up to 5 to describe objects and experiences
~ Identify objects with the same number even if the arrangement changes
~ Draw pictures or symbols to represent a spoken number
~ Apply 1-1 correspondence with objects and people
~ Identify the next number in a series of numbers up to 10
Games

www.sesamestreet.org

Big Bird's Numbers
Count Hats With Elmo and Zoe
Counting With Elmo
Find the Number
Lemonade Stand
Sleepy Bloggy

www.funschool.kaboose.com

Counting on a Cloud
Fishing For Numbers
Spot the Sign
Connect the Numbers

www.abcya.com

Magnets
Counting Fish
100 Snowballs

www.learn4good.com

Fruit Match Puzzle

www.fisher-price.com

Zoo Talkers Memory Match
Computer Games and Preschoolers

www.knowledgeadventure.com

Balloons
Candy Bags
Go Fish
Math Search

www.prongo.com

Connect the Dots

www.pbskids.com

Count Your Chickens
Juggling George
Oscar’s Trash Collection
Send in the Trolls
Number Machine
Tracey’s Matching Game
Banana 411
Bring It
Counting Koi

Connect Four
Count the Cubes
Make 15
Picture Math

How Tall
Collection Jar
Colors, Numbers, Shapes
Dish it Out
Counting Koi
Glass Palace
Pteranodon Fishing
Crossing the River
Math Computation

The foundational skills of computation include counting, sorting, classifying, and comparing objects. Children use the math vocabulary they are building to describe the interactions with the objects as they are playing. These skills can be developed at play, during clean-up, when completing chores, and at stores during typical daily household activities. Modeling these skills for children is important for adults to instill the importance of math in everyday life. Children beginning to understand this foundation

~ Count on fingers
~ Make estimations related to quantity
~ Trade several smaller items for a larger item
~ Identify and use the concepts of ‘one more’ and ‘one less’
~ Communicate that a snack is split in half
~ Make a collection of items smaller by taking away items when asked
~ Make a collection of items larger by adding items when asked
~ Describe addition situations for numbers less than five
~ Describe subtraction situations for numbers less than five
~ Break apart a whole quantity of something into a set
~ Combine a whole quantity of something (pop beads)

Games

www.abcya.com

Marble Math Addition
Take a Trip
www.abcya.com
Counting Hearts

www.knowledgeadventure.com
Math Lines
Quick Math
Connect the Stars
Math Blaster

www.prongo.com
Batter’s Up Baseball
Lemonade Larry
Mad Math Game

www.funschool.kaboose.com
Dr. Brain’s Robot
Math Popper
Addition Attack
Comets
Lunar Lander

www.pbskids.org
Day at the Beach
Measuring Up
Snack Machine Game
Dish it Out
Double the Donuts

Math Search
Addingtons
Five Dice
Picture Math
2 Player Math Game (Addition)
Farm Stand
Multiplying to 25
Farm Addition
Paint Brush Math
Cannon Math
Great Equations
Roller Monkey
Pteranodon Fishing
Roly Poly Round Up
Geyser Suprizer
Can You Fill It?
www.pbskids.org

Melvin's Make a Match
Collection Jar
Can You Fill It?
Rosita's Fiesta

Pour to Score
Estimation Contraption
Cyberolympics
Space Coupe to the Rescue
Algebra and Patterns

The ability to sort, classify, and label are beginning skills of recognizing and developing patterns. Environments rich in textures, shapes, and colors stimulate children to recognize and extend patterns with adult modeling. An environment such as this helps to develop vocabulary which the child can use to label attributes of objects. The use of these skills can be a springboard for the ability to problem solve. Basic five to 24 piece puzzles help children visualize pictures with parts missing, match colors or shapes, and develop spatial reasoning.

Children beginning to understand this foundation

~ Identify attributes of objects  ~ Classify categories of words
~ Give reason for placement of objects  ~ Name groups of objects
~ Follow along and imitate patterns of sounds and movement
~ Reproduce patterns of sounds and movement
~ Reproduce simple AB patterns of concrete objects
~ Represent objects / activities by drawing or selecting pictures
~ Predict what comes next when shown a simple AB pattern of concrete objects
~ Sort a group of objects by more than one way
~ Divide a set of four objects into equal parts
Games

www.pbskids.org
Work Together Puppy Puzzles
Glass Palace
Oscar’s Trash
Double the Donuts
Send in the Trolls
Jigsaw Puzzle
Stop That Creature
Flying Squirrel
Silly Sidewalk Pattern Matching

www.abcya.com
Tangrams

www.learn4good.com
Jewel City
Super Block Buster
Coball
Match the Bugz

www.fisher-price.com
Geo Trax Engine Builder

www.knowledgeadventure.com
Five Dice
Scene Memory

Roller Monkey
Colors, Numbers and Shapes
13 Ways to a Half
Disguise Combos
Crack Hacker’s Safe
Pattern Player
Tracey’s Matching Game
Boohbah Patterns
Kaleidoscope
Connect the Dots 1-10, 20, 30, 40
Fruit Match Puzzle
Spin-n-Match
Blooming Gardens
Little People Zoo Talker Puzzles
Pile of Balls
Shape Inlay
www.knowledgeadventure.com

Staries Moon Cakes

www.prongo.com

CopyCat Jack Game Hungry Caterpillar
Puzzle Game Space Jumble Game

www.funschool.kaboose.com

The Crazy Pattern Machine Animal Tracks
Boomthang Fun Science
Image Puzzler Kazounds
Motor Match Music Match-em

www.sesamestreet.org

Play Along Clap Your Hands

www.sesamestreet.org

Head, Shoulders, Knees, Toes Pat-a-cake
Where is Thumbkin? Turn on the Toys
Geometry, Fractions, and Decimals

The foundations for understanding geometry include recognizing and labeling shapes, using directional and positional words, and the development of spatial reasoning. Children can use these vocabulary words to give clues for finding a hidden object, name where an object is on a body part, or sort by one or two attributes. They can also determine when something is whole or taken apart or state when something does not belong. Children beginning to understand this foundation
~ Give clues for finding an object ~ Identify parts of an object

~ Copy a vertical and horizontal line ~ Imitate drawing a cross

~ Sort by one attribute ~ Identify ten body parts

~ Discriminate between an object that is pulled apart and one that is put together

~ Sort a group of objects by more than one way

~ Use ‘in’ and ‘out’ to indicate where things are in space

~ Use ‘on’ and ‘off’ to indicate where things are in space

~ Use ‘here’ and ‘there’ to indicate where things are in space

~ Follow instructions to place an object ‘beside’ or ‘next to’ something

~ Follow instructions to place an object ‘between’ two things

~ Copy circles, squares, triangles, and rectangles

~ Identify circles, squares, triangles, and rectangles

~ Communicate when something does not belong or should not happen

**Games**

www.pbskids.org

I Love Shapes

Colors, Numbers, Shapes

Cyberspaceship Builder

Crack Hacker’s Safe

U Fix It

Shape Search

13 Ways to a Half

Telly’s Shape Garden

Lucky Star

Collection Jar

Vortex

Point Out the View

Secret Code Shape Matching Game

Railroad Repair
Computer Games and Preschoolers

www.pbskids.org

Mission Magnetite

www.abcya.com

Take a Trip, The Food Pyramid

www.prongo.com

Colorful Shape Making Game

www.funchool.kaboose.com

Comets

Shape Racer

Frog Palace

Bobber's Farm

Percentage P.I.

www.learn4good.com

Bubble Trouble

www.sesamestreet.org

Big Bird's Shapes

Colors and Shapes

Melvin's Make a Match

Shape Cave

Action Fractions

Rescue Island

Martian Math

Check Out Cookie
Measurement

Children develop a sense of measurement by developing vocabulary related to measurement such as full, empty, tall, short, heavy, light, hot, cold, first, last, before, after, morning, afternoon, night, etc. Given the opportunities to measure using common items such as paper clips, craft sticks, paper cups, or various sized rocks allows children to develop an understanding of volume, mass, and length. Discussing daily schedules develops the understanding of before, after, and different lengths of time. Children beginning to understand this foundation

~ Follow a daily schedule
~ Order three objects by size
~ Identify things that are hot and cold
~ Tell what comes before and after

~ Follow steps in a simple routine
~ Sort objects into long and short
~ Relate time to events
~ Use measuring tools in sand/water
~ Use any descriptive word or gesture to express amount or size
~ Use common measuring tools in the correct context
~ Communicate the size of things relative to self (compare to size of finger, arm)
~ Identify similarities and differences in objects
~ Ask why something is the same or different
~ Identify when something is too heavy to lift
~ Associate events with time-related concepts
~ Tell what activity comes first and what follows in sequence
~ Tell three events in chronological order

Games

[Link to games]

www.pbskids.org
Measuring Up
How Tall?
Rosita's Fiesta
Can You Fill It?
Bike Route

www.pbskids.org
Pour to Score
Balloon Mountain Size Matching

www.funschool.kaboose.com
Potion Maker

www.sesamestreet.org
Measure That Animal
Problem Solving

When children are allowed to be a part of play and a part of adult conversation during play, they develop the ability to reason, predict, and problem solve. Children use the vocabulary they are developing to ask questions and formulate solutions to problems that arise during play and work. It is important for parents and educators to allow children the time to process situations and develop solutions on their own. They need to be given the time to take action and determine if the solution was successful. Children beginning to understand this foundation

~ Identify attributes of objects ~ Identify the missing object
~ Give clues to find an object ~ Make simple cause/effect predictions
~ Identify the missing part of object ~ Make estimations related to quantity
~ Use tools in new ways ~ Give reason for placement of object

~ Find an indirect way to obtain an object
~ Discriminate between an object that is pulled apart and one that is put together
~ Create a collection equal to objects in a collection already constructed
~ Identify similarities and differences in objects
~ Communicate when something does not belong or should not happen
~ Use a secondary strategy when the first one fails
~ Use trial and error to solve problems
~ Generalize a solution to a new situation
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<th>Game</th>
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<td>Super Bouncy Blast Off</td>
<td>How Tall?</td>
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<td>Bubble Box Music Game</td>
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<td>Jewel City</td>
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<td><a href="http://www.fisher-price.com">www.fisher-price.com</a></td>
<td>Thomas and Friends, Engine Wash</td>
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<td>Trio Builder</td>
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Computer Games and Preschoolers

www.knowledgeadventure.com

Mouse and Cat  Rubik's Cube
Shape Inlay    Balls and Boxes
Belly Bounce  Arkanoid

www.prongo.com

Hatch and Match  Checkers

www.sesamestreet.org

Elmo's Amazing Ants  Dorothy Imagines
Elmo's Playful Pets  Elmo's Classroom
Elmo's Songs  Animal Sounds With Elmo
Scientific Thinking, Sorting, Identifying

When developing the foundations for scientific thinking children need to participate in and investigate the environment around them. Using the vocabulary they are developing, they can discuss and describe the activities or games they are playing. Investigating the insides of objects or pots of dirt, examining under a rock or piece of wood, touching, observing, listening, tasting various items are a part of the learning process. Children beginning to understand this foundation

~ Observe and describe properties of objects
~ Ask and answer questions about environment
~ Choose an area with science materials as a place to explore
~ Interact with and explore a variety of objects, books, and materials
~ Develop a growing ability to ask questions and describe information
~ Make selections from the science objects and materials available
~ Use five senses to investigate the environment and to gather information
~ Participate in science experiences utilizing age appropriate equipment
~ Engage in a scientific experiment with a peer or with small groups
~ Participate in activities related to number sequencing and counting
~ Manipulate a variety of objects and tell about what is observed
~ Classify objects by different attributes
~ Apply previously learned information to new situations
~ Show a curiosity and independent interest in number related activities
~ Use familiar, nonstandard materials to measure things
~ Recognize and talk about the fact that everything has a shape
~ Observe shapes and look for objects that are the same shape
~ Recognize, copy, extend, and create patterns with objects and in drawings
~ Participate in activities using materials with a variety of shapes and patterns

Games

www.pbskids.org

Socks in Space
Oscar’s Trash Collection
Feed Gnocchi
Pogo-A-GoGo
Super Duper Antibodies
I Sense
Mix and Paint
A Twiddlebug Tool Adventure
Buster Baxter: Lung Defender
Caillou the Paleontologist
Cyberchase Squares
Balloon Mountain Size Matching

www.learn4good.com

Secret Builder’s Virtual World
www.prongo.com

8 Planets, The Solar System Game
The Outer Space Quiz Game

The Human Body Quiz Game
The Inventor’s Quiz Game

www.funschool.kaboose.com

Comets
Fall Fever
Earth Day
Fun in the Garden
Hungry Monkey
Job-O-Rama
Pet Party
Space Patrol
Space Watch
What’s the Order

Dementia 13
Food Groups
Free the Beaches
Fun Science
Incredible Edibles
Jungle Jumper
Snow Fall
Space Walk
Zoo Crew
What’s My Class?

www.sesamestreet.org

Animal Sounds
Dorothy Imagines
Snuffy’s Safari
What Doesn’t Belong: Animals
Close-up Games

Dig For Dinosaurs
Sink or Float?
Super Missions
Bert’s Bottlecaps
Super Grover: Super Missions
**Physical Environment: Matter, Energy, Forces, Physics**

Young children begin to discover that physical environments can be different. Many things are found outside at the park that you would not find inside the house or school. Children make observations and discoveries, and comparisons, show curiosity, identify and label items, and count and record findings as they play in these different environments. They investigate and explore the environment and begin to ask questions about water, the sky, weather, stars, textures, and just about everything. Children beginning to understand this foundation

~ Actively explore simple machines
~ Participate in activities using materials with a variety of properties
~ Investigate and talk about the characteristics of matter (liquid, solid, textures, bendable or not, temperature, etc.)
~ Investigate the physical surroundings by digging in dirt, collecting and classifying rocks, recognizing changes in weather
~ Gain a natural sense of the forces of nature by experiencing wind blowing, temperature changes, changing seasons of the year, or things falling
~ Understand that not all physical environments are the same
~ Understand that their environment expands beyond the earth and begin to ask questions or make comments about the sun, stars, planets, and clouds
~ Be aware of the fact that the physical environment affects the living environment and visa versa
Games

www.pbskids.org

Feed Gnocchi
Gabriella's Balancing Act
A Twiddlebug Tool Adventure
Gerald's Weather Wheel Dress Up
WHOAHler Coaster
Stop the Stormerator!
Pour to Score

Migration Adventure
Weather Transformer
Gerald's Fun with Friction
Move It or Luge It!
Water We Doing
Caillou the Cook
Bubbles Bursting

www.learn4good.com

Online Huje-Tower

www.adventurelearning.com

Balloons
Akita Kanto Festival

Cup Stacking
Ball Control
Living Environment

Young children are very curious about the living environment. They are just beginning to understand the difference between living and nonliving. They want to observe and examine plants, animals, rocks, branches, and everything they touch. Children start making observations, asking and answering questions, comparing objects and discriminating differences, and showing an overall curiosity in their environment. Children beginning to understand this foundation

~ Identify living and nonliving things  ~ Sort by attribute or characteristic
~ Observe and explore a variety of live plants and animals
~ Take care of familiar plants and animals
~ Identify plants and animals as living things
~ Use characteristics of living things to make finer discriminations (donkeys have shorter legs and longer ears than horses)
~ Talk about different types of plants and animals that inhabit the earth
~ Participate in activities related to preserving the environment

Games

www.pbskids.org

Hungry Hungry Herbivore  ZOOmazing
Earth Exploration  Now You See Me, Now You Don’t
Such Great Heights  Flower Finder
The Great Nocturnal Hat Hunt  Groovy Garden
Computer Games and Preschoolers

www.pbskids.org

Buster Baxter: Lung Defender

Matching

Snack Machine Game

www.abcya.com

Take a Trip, The Food Pyramid

www.fisher-price.com

Tremor Trouble

Healthy Food Hunt

www.funschool.kaboose.com

Animal Homes

Animal Spots

Wild Animals

Caillou Gardener

Where in the World

Rescue Heroes, Meteor Madness

Animal Safari

Animal Tracks

The Heart Facts
Social Studies, Geography and Historical Knowledge

Young children are just becoming aware of the sense of time and sequential order of events. They are becoming aware that all things do not revolve around them and there are others around them of whom they need to be cognizant. They become aware of the need to follow rules for safety and order and to follow a schedule on a daily basis. The foundations for these skills begin with an awareness of time of day or year, working cooperatively in a group for a common purpose, sharing, respecting the rights of others, naming buildings or destinations in the neighborhood, and identifying familiar locations. Children beginning to understand this foundation

~ Construct a sense of time
~ Put pictures in sequential order
~ Follow simple directions
~ Participate in games and follow rules
~ Recognize the U. S. and state flag
~ Move in directions on command
~ Identify and locate familiar places
~ Use a simple map
~ Make roads for toy cars and trucks
~ Learn name of own city or town
~ Draw pictures of and discuss family
~ Help clean up after activities
~ Recognize gender differences
~ Notice physical differences in people
~ Notice that some people speak differently than others
~ Realize families live in different types of housing
~ Think of grandparents and how they are different from children
~ Realize that other children are more alike than they are different
~ Use interpersonal skills of sharing and turn taking in interactions with others
~ Role play different types of family members or occupations
~ Recognize that things have to be paid for with money and sometimes you don’t have enough to buy what you want
~ Be aware that adults work in order to earn money to buy houses, food, clothing
~ Recognize that things do/do not belong in an environment (pollution)
~ Help with chores at school and at home to keep area clean
~ Pretend to care for doll by feeding and other activities
~ Determine what type of clothing to wear based on the weather
~ Identify seasons by temperature or other characteristics
~ Draw pictures representing seasonal changes
~ Realize that people live in different places for different reasons
~ Identify various natural features of land (hill, mountain, valley, lake, canyon)
~ Be aware of common community signs and symbols
~ Discuss different types and modes of transportation used in various places and why there are differences between locations and modes of transportation used
~ Match objects to the location they belong
~ Name body parts and the location of each
~ Recognize that streets and houses have names and numbers for identification
~ Point and name various rooms in the house or school
~ Recognize surroundings while traveling in the car
~ Make houses or buildings and roads with blocks
~ Recognize and understand the need for rules
~ Understand the consequences of behaviors and choices
~ Distinguish between past, present, and future

~ Recall information from the immediate past

~ Show anticipation for regularly scheduled events

Games

www.knowledgeadventure.com
World Capitals Quiz

www.prongo.com
The Earth Quiz Game
The United States Quiz Game

www.funschool.kaboose.com
Capitals
Castle Calamity
Cave Runner
Computer Whiz!
Dementia 13
DINO saurs!
Dinosaur Dig
Earth Day
Fall Fever
Flash Flags
Free the Beach
History Quest
Independence Day
My World
Stars and Stripes
Stone City
Treasure Cove
United States Puzzle
U S State Detective
Where’s That U S State?
Geography Jumble
Transmission
Trivia Archer
Winter Holidays
Additional Websites

The following websites provide games and activities that you may find beneficial for your child. They proved to be a little more difficult to navigate and possibly contained links to other sites embedded within some of the games. Please peruse these for additional games or activities that may benefit your child.
Additional Websites

Abcmouse.com
Apples4theteacher.com
Arcademicskillbuilder.com
Coolmath4kids.com
Edheads.org
Education.com
Education-games-for-kids.com
Energyville.com
Homeschooling.about.com
Ixl.com
Kidsknowit.com
Quizhub.com
Ramcogames.com
Thekidzpage.com
Whyfiles.org
REFERENCES


Appendix A

CITI Collaborative Institutional Training Initiative
Information withheld for privacy

For this Completion Report to be valid, the learner listed above must be affiliated with a CITI participating institution. Falsified information and unauthorized use of the CITI course site is unethical, and may be considered scientific misconduct by your institution.

Paul Braunschweiger Ph.D.
Professor University of Miami
To: JANE LEATHERMAN  
NF 250L  
From: RICHARD MATTES, Chair  
Social Science IRB  
Date: 04/07/2011  
Committee Action: Exemption Granted  
IRB Action Date: 03/21/2011  
IRB Protocol #: 1103010567  
Study Title: Can Computer Alphabet Games Enhance the Acquisition of Expressive Letter Knowledge in Preschoolers with Developmental Delays?

The above-referenced protocol is considered exempt after review by the Institutional Review Board pursuant to Federal regulations, 45 CFR Part 46.101(b)(1).

If you wish to revise or amend the protocol, please submit a revision request to the IRB for consideration. Please contact our office if you have any questions.

We wish you good luck with your work. Please retain copy of this letter for your records.

Below is a list of best practices that you should be aware of and keep in mind when conducting your research.

Category 1
- Written permission from preschools, primary and/or secondary schools should be obtained prior to the investigator engaging in research, such as recruitment and conducting research procedures. If the written permission was not submitted with the protocol at the time of IRB review (e.g., the school would not issue the letter without proof of IRB approval), the investigator must submit the written permission to the IRB office immediately upon receipt from the school. This is a Human Research Protection Program requirement.

Categories 2 and 3
- Surveys and data collection instruments should note that only participants 18 years of age and over are eligible to participate in the research, state that participation is voluntary and that any questions may be skipped, and include the investigator's name and contact information.
- Investigators should explain to participants the amount of time required to participate. Additionally, they should explain to participants how confidentiality will be maintained or if it will not be maintained.
- When conducting focus group research, investigators cannot guarantee that all participants in the focus group will maintain the confidentiality of other group participants. The investigator should make participants aware of this potential for breach of confidentiality.
Appendix B

- Written permission from businesses, preschools, primary and/or secondary schools should be obtained prior to the investigator engaging in research, such as recruitment and conducting research procedures. If the written permission was not submitted with the protocol at the time of IRB review (e.g., the school would not issue the letter without proof of IRB approval), the investigator must submit the written permission to the IRB office immediately upon receipt from the school. This is a Human Research Protection Program requirement.

Category 6
- Surveys and data collection instruments should note that participation is voluntary.
- Surveys and data collection instruments should note that participants may skip any questions.
- When taste testing foods which are highly allergenic (e.g., peanuts, milk, etc.) investigators should disclose the possibility of a reaction to potential subjects.

General
- To recruit from Purdue University classrooms, the instructor and all others associated with conduct of the course (e.g., teaching assistants) must not be present during announcement of the research opportunity or any recruitment activity. This may be accomplished by announcing, in advance, that class will either start later than usual or end earlier than usual so this activity may occur. It should be emphasized that attendance at the announcement and recruitment are voluntary and the students attendance and enrollment decision will not be known by those administering the course.
- When conducting human subjects research at non-Purdue colleges and universities, investigators are urged to contact that institution’s IRB to determine requirements for conducting research at that institution.
- When conducting human subjects research in places of business, investigators must obtain written permission from an appropriate authority from the business prior to engaging in research activities such as recruitment or conducting study procedures.
Appendix C
Appendix D

Expressive Letter Identification

Student Number _______  (Circle) Pre Post Assessment

Date _______________  Number of items correct _________

Use a deck of upper and lower case alphabet cards, without other images, thoroughly mixed in a random order. Show each card to the student for up to 5 seconds. Create stacks of correctly and incorrectly named letters. Circle items named correctly after administering the assessment.

A a B b C c D d E e F f

G g H h I i J j K k L l

M m N n O o P p Q q R r

S s T t U u V v W w X x

Y y Z z
Appendix E

Vita

Jacqueline S Foster

Information withheld for privacy.