Abstract

THE EFFECT OF THE FISHER PRICE POWERTOUCH™ SYSTEM ON THE EMERGENT LITERACY SKILLS OF SPANISH-SPEAKING PRESCHOOLERS

By Sara A. Michelucci Vondracek

Due to a variety of factors in Hispanic homes: low literacy support, late entrance into the educational system, low socioeconomic levels, as well as lack of exposure to English, Hispanic children are at a much greater risk for not gaining emerging literacy skills in English or Spanish. The use of interactive technology to support the formation of mental models and increase exposure to English phonemes and vocabulary at an appropriate rate for each child may help reduce the achievement gap for Hispanics by creating a strong foundation for literacy development at an early age. The PowerTouch™ Learning System was hypothesized to support the acquisition of emergent literacy skills for primarily Spanish-speaking preschool subjects. Observations were recorded during experimental sessions and utilized to elucidate outcomes. The Results of the research were mixed. The hypothesized increase in time spent in the technology condition over the books only condition was supported. Additionally, post hoc analyses were conducted to determine the impact of experimental condition on Reading Act complexity as well as subgroup performance on Subtest I of the TERA-3.
THE EFFECT OF THE FISHER PRICE POWERTOUCH™ SYSTEM ON THE EMERGENT
LITERACY SKILLS OF SPANISH-SPEAKING PRESCHOOLERS

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Chapter I: Introduction

Hispanic students have traditionally performed academically at levels below their Caucasian and African American peers (Sable & Stennett, 1998; U.S. Department of Education, 2001). One of the strongest predictors of academic success is reading proficiency (Sable & Stennett, 1998) and in preschoolers, emergent literacy (Haager & Windmueller, 2001; Stanovich, 1986). This is an area of unique challenge to the non-native English-speaker who is trying to succeed in an English-speaking educational system. Due to a variety of factors in Hispanic homes: low literacy support, late entrance into the educational system, low socioeconomic levels, as well as lack of exposure to English, Hispanic children are at a much greater risk for not gaining emerging literacy skills in English or Spanish (Hammer, Miccio, & Wagstaff, 2003; Sable & Stennett, 1998; Snow, Burns, & Griffin, 1998).

The use of interactive technology to support the formation of mental models and increase exposure to English phonemes and vocabulary at an appropriate rate for each child may help reduce the achievement gap for Hispanics by creating a strong foundation for literacy development at an early age (Davis & Shade, 1999; De Jong, & Bus, 2002; Lewin, 1997).

Hypotheses

Primarily English- and Spanish-speaking Headstart students comprised the sample utilized for this research. The PowerTouch™ Learning System was hypothesized to support the acquisition of emergent literacy skills for primarily Spanish-speaking preschool subjects. Additionally, subjects using the PowerTouch™ Learning System were expected to show greater interest in participating in the literacy activities provided by the researchers. It was also hypothesized that subjects who had spent greater periods of time on PowerTouch™ literacy activities would have higher test scores on the TERA-3 than those who had spent less. The frequency of literacy events in the home and primary language usage were assessed through the use of a questionnaire. Increased performance on the TERA-3 was expected for subjects with greater occurrences of literacy events in the home as well as greater amounts of English spoken in the home. Observations were recorded during experimental sessions and utilized to elucidate outcomes.

Results and Limitations

The Results of the research were mixed. The hypothesized increase in time spent in the technology condition over the books only condition was supported. Additionally, post hoc
analyses were conducted to determine the impact of experimental condition on Reading Act complexity as well as subgroup performance on Subtest I of the TERA-3. A high attrition rate due to loss of transportation and poor internal validity of the independent variable are included in the research limitations. Results are reported and discussed with a focus on recommendations for future research.
Chapter II: Literature Review

The process of learning to read is complex and ever increasing in importance in today’s highly educated society. The difficulties faced by young children learning to read in a language other than their native or at-home language are compound. English as a second language is becoming more prevalent in our classrooms as the Hispanic population in the United States increases (Sable & Stennett, 1998; U.S. Department of Education, 2001). The services provided by our educational institutions are growing to encompass these changing needs, but the academic performance of Hispanic students as a whole still lags behind that of Caucasians and African Americans (Sable & Stennett, 1998; Meier & Stewart, 1991; Sable & Stennett, 1998; U.S. Department of Education, 2001). Emergent literacy skills have been shown to be related to future academic achievement (Haager & Windmüller, 2001; Stanovich, 1986). A child’s early success in reading can help to ensure the basic skills necessary to gain more knowledge in a variety of subjects (August & Hakuta, 1997).

There are factors other than language which contribute to poor literacy, and they remain true for all races and ethnicities. Family, home, and community influences and experiences play important roles in children’s emerging literacy. Low socioeconomic level, minimal exposure to literacy in the home and community, and minimal one-on-one time reading with adults are all at-risk factors contributing to poor literacy (Hammer, Miccio, & Wagstaff, 2003; Snow, Burns, & Griffin, 1998).

Proven methods for increasing literacy skills and emergent literacy skills are interactive tasks (e.g., Collier, 1995; Whitehurst, Epstein, Angell, Payne, Crone, & Fischel, 1994), discovery learning (e.g., Collier, 1995; Genisio, & Drecktrah, 1999), visual and auditory support (e.g., DeJong & Bus, 2002; Sharp, Bransford, Goldman, Risko, Kinzer, & Vye, 1995), one-on-one literacy interactions (e.g., Collier, 1995; Salomon, Globerson, & Guterman, 1989; Whitehurst et al., 1994; Vygotsky, 1978), the availability of choices to increase interest (e.g., Genisio, & Drecktrah, 1999), and individualization of academic program (e.g., Whitehurst et al., 1994). Computer technology offers a variety of opportunities for dynamic and individualized multimedia learning experiences that may enhance learning while adding valuable one-on-one interactions to the child’s experience (De Jong & Bus, 2002; Hetzroni, & Schanin, 2002; Lewin, 1997); but there has been little research on technology approaches at the preschool level. This review of literature will address: the prevalence of English as a second language, the academic
performance of Hispanic students, the relationship between emerging literacy skills and children’s academic achievement, risk factors in the family, home, and environment, methods for increasing emergent literacy skills, and technology and its potential in assisting the development of emergent literacy skills.

Prevalence of English as a second language in the United States

The number of five to twenty-four year olds speaking a language other than English at home has more than doubled since 1979 (U.S. Department of Education, 2003). More and more children are arriving in the preschool classroom with few, if any, skills in the English language. Not only is it more challenging for these children to acquire literacy at rates similar to their English proficient peers, but consequently their abilities to learn other academic skills are also reduced.

The language most frequently spoken in non-English speaking homes in the United States is Spanish (72%). Of the people in non-English speaking homes who speak English with difficulty, 78% are presently from Spanish-speaking homes (U.S. Department of Education, 2003). The Hispanic population is currently growing more rapidly than any other segment of the population of the United States. Statistical predictions posit that by 2020, more than 20% of the school-age children in the United States will be Hispanic (Sable & Stennett, 1998; U.S. Department of Education, 2001). It should be noted that while most research refers to the Hispanic population as a homogeneous group, Hispanics fall into a variety of sub-groupings. These subgroups are concentrated in different parts of the United States and vary in circumstance and culture. Because data for various subgroups are limited, this literature review reports overall trends for Hispanics in the United States.

Academic performance of Hispanic students

The academic performance of Hispanic students in the United States is consistently reported as being lower than that of their monolingual peers (Sable & Stennett, 1998; U.S. Department of Education, 2001). Hispanic students are disproportionately over-represented in special education and under-represented in gifted and college oriented programs (Meier & Stewart, 1991). At 9, 13, and 17 years of age, the average Hispanic student’s reading proficiency score on the National Assessment of Educational Progress (NAEP) Test is below that of the average Caucasian student by approximately 25-30 points. This discrepancy occurs despite the fact that Hispanic students whose English proficiency is judged not to be appropriate for the test
are excluded from taking the test (Sable & Stennett, 1998). Prior to 1996, this judgement was made at the sole discretion of the student’s teachers and administrators and due to lack of available accommodations or Spanish language versions of the test (U.S. Department of Education, National Center for Education Statistics, 1996). The NAEP writing, math, and science proficiency scores for Hispanic and Caucasian students show gaps similar to those evidenced in the reading scores (Sable & Stennett, 1998). An examination of the size of the proficiency gap between Caucasian and Hispanic students at all three age levels indicates the Hispanic students are making gains similar to the yearly academic gains made by their Caucasian peers. The fact that this discrepancy gap is stable suggests that had their initial deficits, especially in language and literacy, been remediated at an early age, they would be performing at levels closer to the average at later ages.

Sable and Stennett (1998) point out Hispanic students are much less likely to finish high school than their non-Hispanic Caucasian counterparts; in fact, the rates for not completing high school are highest among Hispanic immigrants, especially those with limited English skills. Spanish-speaking children are more likely to drop out of high school than either non-Hispanic Caucasians or African Americans (Federal Interagency Forum on Child and Family Statistics, 2002). Additionally, within this population, the drop-out rate for children from homes in which parents speak Spanish as the primary language is almost twice as high for those children with poor English skills as it is for similar children who do speak English well (Sable & Stennett, 1998). These issues affect other areas beyond the academic success of Hispanic children, including their overall ability to compete in today’s society (Alexander, 1996; Hammer, Miccio, & Wagstaff, 2003; Lyon & Chhabra, 1996).

The relationship of emerging literacy skills to academic achievement

The definition of literacy includes a variety of aspects. At one end of the spectrum, it is psycholinguistically defined as a process involving component sub processes such as letter recognition, phonological encoding, and word recognition. At the other end, literacy is considered a social practice of meaning construction with many variations determined by the social or cultural group within which it takes place (August & Hakuta, 1997). The psycholinguistic view espouses direct instruction of the various sub process skills, while the social practice view recommends exposure to books through reading and tapes and the use of other more authentic literacy means (August & Hakuta, 1997). Consequently, children who
come from literate homes, in which they have been read to and whose parents use literacy skills regularly themselves are most likely to become successful readers. Whether this finding is a result of greater social exposure to literacy or to the greater opportunity to learn literacy subprocesses is being debated (August & Hakuta, 1997). It is apparent, however, that students who have acquired these early literacy skills have the tools necessary to gain more literacy and other academic knowledge, while those who do not fall further and further behind (Haager & Windmueller, 2001; Stanovich, 1986).

**Risk factors in family and home related to emergent literacy**

To predict success or failure in emergent literacy and later reading ability, child-, school-, and family-related factors have been evaluated by a number of researchers. A home language other than English, low socioeconomic status and minimal literacy support in the home environment have been shown to be risk factors in literacy development (Hammer, Miccio, & Wagstaff, 2003; Snow, Burns, & Griffin, 1998). Children are at greater risk for low levels of academic achievement in both single parent homes and in impoverished homes (Sable & Stennett, 1998). The likelihood of living in poverty, with a single parent, and with minimal literacy support is increased among Hispanic children (Federal Interagency Forum on Child and Family Statistics, 2002; Sable & Stennett, 1998).

Sable & Stennett (1998) point out that often low literacy support occurs in the home and surrounding community of Spanish-speaking students and Spanish-speakers may have difficulty with English due to lack of exposure to English, which many Hispanic students speak only at school. Forty-two percent of Hispanic families read to their children on a daily basis compared to 64% of Caucasian families (Federal Interagency Forum on Child and Family Statistics, 2002). Hammer, Miccio, and Wagstaff (2003) cite studies showing a positive relationship between reading to children and language development and literacy abilities. However, Hispanic 3-4 year olds are less likely to participate in preschool and early literacy activities than their non-Hispanic Caucasian peers (Sable & Stennett, 1998).

**Recommended methods for increasing emergent literacy skills**

Literature has identified numerous avenues for increasing and improving emergent literacy skills. Infrequent experience with books in the home may be remedied by shared book reading and other language and literacy enhancing experiences in preschool settings. When engaging children in activities to enhance the natural progression of emergent literacy,
opportunities for active learning and for participation in decision making must be included (Genisio & Drecktrah, 1999).

Often this can be accomplished through literacy interaction. Adult-child shared picture book reading increases the rate of language development for preschoolers who speak Spanish and those with developmental disabilities, as well as most other preschoolers (Whitehurst et al., 1994). Children from low-income families need frequent one-on-one language interactions with an adult to enhance their language skills and group based interactions may not be enough in the late preschool years (Whitehurst et al., 1994). Also, research in second language acquisition shows interaction to be one of the best ways to learn. Students perform significantly better in programs that teach language through discovery and interactive learning (Collier, 1995). However, one-on-one support for preschool children in the classroom is not always realistic. Additionally, Spanish-speaking parents may not possess English literacy skills themselves and are often unable to support their children by reading together at home.

The affects of technology on emergent literacy

Technology has provided a host of new options in education. It allows students to have dynamic multidimensional interactions with information that assist them in meaningful independent learning. Dynamic visual support facilitates language comprehension when children listen to stories and may provide teachers with a tool for enhancing literacy foundations in children who might otherwise be at-risk for school failure (Sharp et al., 1995).

Auditory, visual, and interactive qualities are now combined in electronic books (computer software containing storybook text, illustrations, and games) and computer assisted learning. De Jong & Bus (2002) found the electronic book format to be superior to paper books in focusing a child’s attention on text features. These computer-based software systems allow children to activate reading of words, phrases, or pages in any order they like. They found children were able to have phrases, pictures, and passages repeated on command to clarify meaning and interactively control the story experience. Due to these features, electronic books may support internalization of written word features and stimulate word recognition. Controlled exposure to text using interactive multimedia story-telling environments creates a natural learning experience that may enhance the development of literacy (Hetzroni, & Schanin, 2002). Lewin (1997) compared 3 types of computer assisted reading for a group of eight to nine year olds in the UK: drill and practice, talking-book, and talking word processors. Computer assisted
reading drill and practice was in the form of games that supported the learning of low level skills like letter or word recognition. Talking book software replicated paper books on the screen with digitized sound and simple animation. The child could read the entire book, have it read at a child-selected pace, or choose specific words or phrases to be read aloud. Talking word processor software used synthesized sound to read individual letters, words, or phrases as keyed in by the child. It included word lists and keyboard overlays to assist children in learning new words as well as minimizing the need for keyboard abilities. Of these, the research found the talking book to be superior in facilitating literacy. Three advantages of the talking book software were: 1) feedback provided children with cross-checking information, 2) decoding strategies fostered independence, and 3) the use of color and illustrations motivated the children.

Technology also creates an opportunity for differentiated learning with minimal teacher impact, offering a realistic addition to the preschool classroom. Electronic books allow children the opportunity for read-alouds of each page independent of adults (De Jong, & Bus, 2002; Lewin, 1997). Davis and Shade (1999) found the computer to be uniquely suited for adding depth to traditional early childhood curriculum. One such usage is as a ‘scaffold’ not unlike the role played by older children and adults in Vygotsky’s zone of proximal development. According to Vygotsky (1978) social interaction or instruction is a major factor in the growth of human competence. Thinking has its basis in social activities, which are then internalized. Guided social interactions for social regulation and communication evolve into self-regulation and mental representations of information. These guided interactions allow a learner who has not yet mastered specific cognitive functions to perform at a higher cognitive level which allows them to gradually become part of the learner’s individual repertoire of skills. The difference between what a learner can do alone and with social guidance is called the zone of proximal development, and the guidance necessary to perform at the upper reaches of this zone is called scaffolding. Salomon, Globerson, and Guterman (1989) found computer tools can serve as a more capable peer in a learner’s zone of proximal development and can assist through interactive guidance in developing greater competency, specifically in reading comprehension.

The potential of the PowerTouch™ for emergent literacy

The PowerTouch™ Learning System (see Materials/Measurements) offers one solution to the possible lack, for Hispanic children, of adult-child literacy interactions found to be so valuable to the establishment of early literacy skills. As Whitehurst, et al. (1994) found, children
from both low income and non-English speaking backgrounds benefited from frequent one-on-one picture book and language interactions, also stating that in late preschool, group interactions may not be sufficient. Additionally, language and emergent literacy interactions may be among the weakest areas of current preschool practice (Whitehurst et al., 1994). The PowerTouch™ was designed to be capable of providing valuable individualized interaction for children when adult literacy interaction is unavailable.

Genisio and Drecktrah (1999) state that active learning and participation in decision-making are key ingredients for enhancing the natural progression of literacy. The PowerTouch™ offers students the opportunity to choose tasks and actively respond to questions and receive immediate feedback. They have the option of working on phonics, color identifications, reading a story, number and letter identification, and sight reading words with accompanying pictures. This variety acts to keep the student interested and engaged. Collier’s (1995) findings that students perform significantly better in programs that teach language through discovery and interactive learning, suggest the attributes of the PowerTouch™ may be beneficial to students learning language.

Lewin (1998) found that the Talking Book software (discussed previously) was successful in increasing the success of early readers and children experiencing difficulty learning to read, but found practitioners felt it could be improved by enhancing feedback through the ability to help break words into phonemes and offering hints towards decoding unknown words. The PowerTouch™ can help children to sound out unknown words as well as read portions of or entire sentences on demand.

In previous technology, the use of color and illustrations were found to motivate children (Lewin, 1997). Sharp et al. (1995) found dynamic visual support to facilitate language comprehension and enhance literacy foundations in at-risk children. The PowerTouch™ provides colorful visual support for the words, letters, and numbers displayed. Often, appropriate sound effects and verbal feedback support the integration of visual and symbolic comprehension.

The PowerTouch™ creates multidimensional interactions for children that move at the pace of the child. These interactions incorporate the methods espoused by experts for increasing emergent literacy skills and act as a scaffold for learning when one-on-one adult interaction is not available.
Purpose

Because children entering English-speaking preschools speaking a language other than English face a greater challenge in acquiring literacy skills from English speaking teachers than do their English-speaking peers, this can often lead to increased skill deficits as the English literacy gap widens over the years. Technology possesses dynamic and interactive capabilities that provide greater individualization of learning for children without the need for additional teaching support in the classroom. The use of a combination of technology, visual images, auditory stimuli, and interactive capabilities may allow for previously unavailable but now realistically individualized literacy support for these children. However, there is a need for systematic study of the effect of the integration of these factors, in new technological tools such as the PowerTouch™, on the emerging English literacy skills of Spanish-speaking preschoolers in a Head Start program.

Hypotheses

The expectation was that the interactive and dynamic qualities of such a system will allow children to work independently, at their own rate, on the emergent skills and vocabulary acquisition necessary for their success with literacy.

1. The performance of Spanish-speaking preschoolers on standardized tests will be greater after regular use of PowerTouch™ books in conjunction with the interactive PowerTouch™ Learning System, than that of similar students using PowerTouch™ books without the use of the interactive system.

2. The performance of Spanish-speaking preschoolers will be related to the occurrence in their homes of: larger percentages of English spoken, a caregiver whose primary language is English, larger percentages of literacy events, and/or larger percentages of literacy events occurring in English.

3. There will be a relationship between the amount of time spent on PowerTouch™ activities and the post-test scores.

4. The time participants choose to spend on activities will be greater for the interactive PowerTouch™ condition than for the PowerTouch™ book condition.
Chapter III: Method

Participants

The initial sample of 20 Spanish-speaking children was recruited, with teacher assistance, from federally funded preschool classrooms in the Head Start program in Butler County in southwestern Ohio (see Appendix A). These children were recruited as part of a larger sample of 63 students including both English and Spanish-speaking children to participate in an overarching research project with two other researchers. The children’s ages ranged from three to five years. This sub-sample of children came from predominantly Spanish-speaking homes while all subjects came from families whose socioeconomic status made them eligible for Head Start. By the end of the study, the sub-sample was reduced to 13 children and the overarching sample was reduced to 41.

Informed consent was gained from the parents of the participants as well as verbal assent from the participants themselves (see Appendices B and C). After consent, an experimental method was used, and each participant randomly assigned to an experimental condition stratified to maintain equivalency of gender and classroom membership between conditions. This research is part of a larger study examining the relationship of the PowerTouch™ Learning system on emergent literacy skills.

Materials/Measurements

Fisher-Price PowerTouch™. Twenty Fisher Price PowerTouch™ interactive literacy toys were used with the interactive condition. Each technologically enhanced system comes with four storybooks including School Skills, Ernie’s Neighborhood, Clifford, and Blues Clues. The PowerTouch™ systems are battery operated and self-contained. The user has the ability to either work on alphabet skills without utilizing any of the accompanying books by touching the letters on the toy itself or with the insertion of a book they access other possibilities for using the system. With the book, the user may choose to work with phonemes, word recognition, or reading functions. The user need only touch the page of the book or the letters on the system itself to activate interactive play. At the conclusion of the study, these toys were donated to the participating Head Start classrooms.

Non-interactive Literacy Books. Non-interactive literacy books were presented to the non-interactive condition for the same duration that the interactive toy was presented to the interactive condition. These children were presented with the books that are included with the
PowerTouch™ system, including School Skills, Ernie’s Neighborhood, Clifford, and Blues Clues. The books were without the interactive base system, providing no interactive technology.  

TERA-3. To assess literacy skills, the Test of Early Reading Ability-Third Edition (TERA-3) was used. Participants were administered the TERA-3 as pre- and post-test for both conditions. Although a Spanish version of the TERA-3 is available, it was administered in English to all participants, as the skills being assessed were related to performance in an English-speaking environment.

The TERA-3 is a direct measure of the reading and emergent literacy skills of young children. It assesses mastery of the alphabet, the conventions of print, and the construction of meaning from print. The TERA-3 is appropriate for use with children 3.6 to 8.6 years of age. The TERA-3 is generally used to identify candidates for early reading intervention, identify strengths and weaknesses, and monitor changes in performance due to intervention. The test was last normed in 2000 (n=875) and stratified by age relative to geography, gender, race, residence, and ethnicity. New studies have shown the absence of gender, racial, disability, and ethnicity bias (Reid, Hresko, & Hammill, 2001). Reliability coefficients in 30 of the 32 coefficients calculated are consistently high, all exceeding .90. New items have been added to this edition to reduce floor and ceiling effects for the upper and lower ages and abilities. According to the test publisher, the TERA-3 has validity for the general population as well as a variety of subgroups. Concurrent validity, assessed using the Basic School Skills Inventory (BSSI), was found to be in the range of .55. The test requires individual administration and takes approximately twenty minutes to complete. There are currently two forms for this test.

*Teacher Letter.* A letter to the Head Start teachers was distributed to explain the study. The teachers assisted in recruitment of preschool children by sharing information about the study with parents (see Appendix A).

*Parent Questionnaire.* In conjunction with the informed consent form and parent letter (see Appendices B and C), a parent questionnaire was distributed to parents of children in the sample population. The questionnaire inquired as to the reading experiences of the participants at home, their access to technologically enhanced interactive literacy toys, and their developmental history. Parents were also asked the relative amounts of English and Spanish spoken in the home and the primary language of the parent. Questionnaires were sent in both Spanish and English (see Appendix D).
Protocol. The experimenters, to ensure the reliability and validity of results, used protocols. These protocols included standardized instructions that were read to the participants as well as appropriate responses to participant questions, break requests, and requests to end the session early (see Appendix E).

Observation Sheet/Fidelity Checklist. The experimenters, to support consistent and operationally defined session observations, used an observation-coding sheet. Information regarding the duration of the session, specific books used, and other detailed behaviors was recorded. This form was used as a fidelity checklist to ensure standardization of procedures (see Appendix F).

Procedures

Approval was received from the Parent Advisory Council for the Head Start program, and the participants were recruited from classroom groups within Butler County. Consent was then obtained from parents and guardians and the sample finalized. Human Subjects were protected during all phases of this research. The parents were asked to complete the questionnaire regarding home literacy, literacy toys, and primary home language. The subjects were randomly assigned, within each classroom, to the interactive and non-interactive conditions. The TERA-3 was administered to all subjects as a pre-test of their literacy skills.

The primary experimenters were three graduate students previously trained in the protection of human subjects. They completed training sessions on protocol use and observation coding. In order to enhance standardization of procedures, all three experimenters observed together during the first week of research. The observation sheet/fidelity checklist was completed for every session. Additional undergraduate student assistance was needed. They were trained similarly on protocol use and observation recording. They attended IRB training and used the methods outlined in this proposal.

During the exposure phase, participants in the interactive condition had controlled access to the PowerTouch™, beginning with a training session and including five minutes of maintenance training at the beginning of each subsequent session. Each participant was removed from his/her classroom for one twenty-five minute session once or twice a week for six weeks. After the five-minute maintenance training, the participant interacted with the PowerTouch™ while the experimenter observed and responded briefly to any questions. Protocol will be followed in responding to all participant questions. If the participant chose to stop playing with
the toy and end the session, the experimenter provided one prompt suggesting further play. If the subject still wished to end the session, s/he will be returned to the classroom.

Participants in the non-interactive condition were exposed to PowerTouch™ books without the PowerTouch™ Learning system for the same number of twenty-five minute sessions. There was a training session and five minutes of maintenance training at the beginning of each session followed by twenty minutes of solitary play with the books while experimenters observe. A similar protocol and procedures were used.

At the end of the six-week exposure period, the TERA-3 was readministered to all participants as a post-test.

Data Analysis

The pre- and post-test data results were compared, using an ANCOVA or a t-test after final sample size and homogeneity were established, to examine the differences in the mean performance on the TERA-3 post-test between experimental groups. Observation results were quantified and analyzed through ANCOVA and descriptive statistic comparisons. Probability was set at the .05 significance level.
Chapter IV: Results

The expectation was that the interactive and dynamic qualities of the PowerTouch™ Learning System would allow children to work independently, at their own rate, on the emergent skills and vocabulary acquisition necessary for their success with literacy. The pre-and post-test data results were compared using a series of ANCOVA analyses after final sample size and homogeneity were established, to examine the differences in the mean performance on the TERA-3 post-test between experimental groups. Probability was set at the .05 significance level.

Hypothesis one: Improved test scores for technology group

The performance of Spanish-speaking preschoolers (SSPs) on standardized tests was expected to be greater after regular use of PowerTouch™ books in conjunction with the interactive PowerTouch™ Learning System, than that of similar students using PowerTouch™ books without the use of the interactive system. No significant differences were found between the performance of students in the technology condition and students in the books only condition on a standardized test of early literacy skills at the end of the study ($M_{technology}=87.60; M_{books only}=85.38$), $F(1,12)=0.56, p=.583$. Although the results were not significant, the means for the two groups did differ with the books only condition having a much greater variation in scores than the technology condition (See Figure 4.1). This variation combined with the higher average suggests the possibility of a statistical outlier at the high end of the scores for the books only condition both pre- and post- test. That taken into account, the difference between the pre- and post-test TERA-3 Reading Quotient score means was still greater for the technology condition than for the books only condition.

Figure 4.1. Tera-3 Reading Quotient results for Spanish-speaking preschoolers.

<table>
<thead>
<tr>
<th>Experimental Condition</th>
<th>Pre-Test M</th>
<th>Pre-Test SD</th>
<th>Post-Test M</th>
<th>Post-Test SD</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology</td>
<td>79.60</td>
<td>6.80</td>
<td>87.60</td>
<td>6.23</td>
<td>5</td>
</tr>
<tr>
<td>Books Only</td>
<td>84.25</td>
<td>17.34</td>
<td>85.38</td>
<td>19.40</td>
<td>8</td>
</tr>
</tbody>
</table>

Hypothesis two: Home events will affect test scores

The performance of Spanish-speaking preschoolers (SSPs) was expected to be related to the occurrence in their homes of: larger percentages of English spoken, a caregiver whose
primary language is English, larger percentages of literacy events, and/or larger percentages of literacy events occurring in English. Subjects who had more English spoken in the home, due to a caregiver whose primary language was English, were found to perform better on average than SSPs on post-test Reading Quotients (M_{English}=90.80, s.d.=12.45; M_{Spanish}= 80.89, s.d.=11.82), F(1,40)=4.593, p<.05. Minutes read at home in either language were found to have no significant relationship to the performance of SSPs on pre- and post-test Reading Quotients. Larger percentages of literacy events in English were found to have a no specific effect as stated. While time spent on literacy events was found to have no significant effect on pre- and post- test scores, which language, whether Spanish or English, was primarily spoken at home did show a difference in average post-test Reading Quotients with students from primarily English-speaking homes scoring higher (M_{English}=90.68, s.d.=12.28; M_{Spanish}= 80.12, s.d.=12.39), F(1,40)=4.80, p<.05. In both cases where mean Reading Quotient post-test scores were found to differ on average, the variation, as evidenced by the standard deviations, was extremely wide.

**Hypothesis three: Time spent on activities will affect test scores**

A relationship between the amount of time spent on PowerTouch ™ activities and the post-test scores was expected. The time participants spent over all six sessions was not significantly related to their post-test Reading Quotient scores.

**Hypothesis four: Participants will spend more time on technology activities**

The time participants chose to spend on activities was expected to be greater for the technology condition than for the books only condition. For the technology condition, the average of time spent (minutes) over the six sessions was significantly greater than the average of overall time spent for the books only condition (M_{technology}=87.28; M_{books only}= 35.96), F(1,40)=35.45, p<.001. A large effect size (.518) was found.

**Post Hoc Results: Reading Acts**

Although there were no overall differences between groups, some observational data showed insight into the results. Post hoc analyses were done for both Reading Acts and Subtest I of the TERA-3. The frequency of types of reading acts observed and recorded during the six sessions appeared to be related to experimental condition. Reading Act 1 was defined as the subject physically oriented towards the materials, turning pages, and or touching items on the system or the books. Reading Act 2 was defined as the subject pointing to and verbally naming pictures, letters, or words on the system or books. Reading Act 3 was defined as the subject
running their finger along the words of the story in the correct order, telling the story, inventing a story for the pictures while turning the pages, or in some way demonstrating an awareness of the existence of a story as it relates to a book. The term ‘Other Non-Reading Activities’ refers to any observed actions that did not fall within the descriptions of Reading Acts 1-3. Reading Act 1 is considered a more basic pre-literacy skill, Reading Acts 2 and 3 are considered to be increasingly more complex respectively. Figure 4.2 illustrates the larger percentages of higher order reading acts in the books only condition compared to the technology condition. The more frequent occurrence of reading acts two and three in the books only condition may contribute to the lack of expected effects on pre-literacy skills (as measured by the TERA-3) of the technology condition. The difference between percent of time spent engaging in Reading Act 1 due to experimental condition was found to be significant ($M_{technology}=86.45; M_{books only}= 65.55$), $F(1,40)=12.55, p<.001$. The Technology condition had a higher percentage of Reading Act 1 than the Books Only condition. The difference between percent of time spent engaging in Reading Act 2 due to experimental condition was also found to be significant ($M_{technology}=11.31; M_{books only}= 26.58$), $F(1,40)=8.97, p<.005$. No significant difference between means was found for Reading Act 3. This data will be addressed further in the discussion section.
Figure 4.2. Percent of time spent in reading acts by experimental condition.

When this data is further broken down by primary language (Refer to Figure 4.3), although no significance is found, a greater difference in means between experimental conditions within Reading Acts 1 and 2 exists within the SSP sample as compared to the ESP sample. SSP subjects in the technology condition spent 90% of each session on average engaging in Reading Act 1 while SSP subjects in the books only condition spent 64.74% of each session on average. Conversely, the ESP subjects in the technology condition spent 86.09% of each session on average engaging in Reading Act 1 while ESP subjects in the books only condition spent 66.73% of each session on average. Reading Act 2 shows a greater difference in means between subgroups. ESP subjects in the technology condition spent 12.4% of each session on average while ESP subjects in the books only condition spent 24.04% of each session on average. SSP subjects again showed a greater discrepancy than ESP subjects with the technology condition spending 8.33% and the books only condition spending 31.34% of each session on average engaged in Reading Act 2.
Figure 4.3. Percent of time spent in reading acts by experimental condition and primary language.

Post Hoc Results: Subtest I

Due to attrition to be addressed in the discussion section, the technology sample did not have any Spanish-speaking boys. This clearly limits experimental findings, but still allows for observations on the outcomes for the remaining sample. In Figure 4.4, SSP girls in the books only condition scored higher than English-speaking preschool (ESP) girls on subtest I of the TERA-3 which assesses mastery of the alphabet and letter number differentiation. SSP girls in the technology condition scored lower than ESP girls, but to a lesser degree. SSP girls in the books only condition scored highest on subtest I followed by ESP girls in the technology condition, SSP girls in the technology condition, and finally by ESP girls in the books only condition. ESP boys in the technology condition scored higher than ESP boys in the books only condition. Overall, ESP subjects in the technology condition scored higher than their
counterparts in the books only condition, while SSP girls in the books only condition scored higher than SSP girls in the technology condition.

*Figure 4.4.* Post-test standard score descriptive statistics for TERA-3, subtest I by experimental condition, gender, and primary language.

<table>
<thead>
<tr>
<th>Experimental Condition</th>
<th>Post-test TERA-3: Subtest I</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
</tr>
<tr>
<td><strong>Technology</strong></td>
<td></td>
</tr>
<tr>
<td>English-speaking boys</td>
<td>9.00</td>
</tr>
<tr>
<td>Spanish-speaking boys</td>
<td>0</td>
</tr>
<tr>
<td>English-speaking girls</td>
<td>8.83</td>
</tr>
<tr>
<td>Spanish-speaking girls</td>
<td>7.80</td>
</tr>
<tr>
<td><strong>Books Only</strong></td>
<td></td>
</tr>
<tr>
<td>English-speaking boys</td>
<td>8.00</td>
</tr>
<tr>
<td>Spanish-speaking boys</td>
<td>0</td>
</tr>
<tr>
<td>English-speaking girls</td>
<td>6.90</td>
</tr>
<tr>
<td>Spanish-speaking girls</td>
<td>9.50</td>
</tr>
</tbody>
</table>

When comparing primary language (Refer to Figure 4.5), ESP subjects in the technology condition scored highest on subtest I of the TERA-3. Overall, SSP subjects in the books only condition scored higher than SSP subjects in the technology condition. They also scored higher than ESP subjects in the books only condition. ESP subjects in the technology condition scored higher than both the ESP subjects in the books only condition as well as SSP subjects in the technology condition. While the results were not significant for this sample, these differences
suggest that the books only condition may have increased subtest scores for SSP subjects while the technology condition may have increased subtest scores for ESP subjects.

*Figure 4.5.* Tera-3 Reading Quotient results for Spanish-speaking preschoolers.

<table>
<thead>
<tr>
<th>Primary Language</th>
<th>Post-test TERA-3: Subtest I</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
</tr>
<tr>
<td>English-speaking</td>
<td></td>
</tr>
<tr>
<td>Technology</td>
<td>8.92</td>
</tr>
<tr>
<td>Books Only</td>
<td>7.27</td>
</tr>
<tr>
<td>Spanish-speaking</td>
<td></td>
</tr>
<tr>
<td>Technology</td>
<td>7.80</td>
</tr>
<tr>
<td>Books Only</td>
<td>8.00</td>
</tr>
</tbody>
</table>
Chapter V: Discussion

Study Design Based on Contemporary Literature

A review of the literature suggested primarily Spanish-speaking students score consistently lower on measures of academic achievement than their English-speaking peers. Additionally, this achievement gap begins with emergent literacy skills and widens as students progress through school. This research did not show any significant differences between the groups. However, the population of students attending Headstart programs comes primarily from low socioeconomic homes. This is not a representative cross-section of the population at large where Caucasian students are more likely to come from higher socioeconomic backgrounds than most Hispanic students. Additionally, this highlights the potential interference of the effects of low socioeconomic status on emergent literacy.

Contemporary literature shows that a variety of factors in Hispanic homes: low literacy support, late entrance into the educational system, low socioeconomic levels, as well as lack of exposure to English, put Hispanic children at a much greater risk for not gaining emerging literacy skills in English or Spanish. This study found no significant differences between the SSPs and the ESPs in terms of minutes read at home. Also, all children were enrolled in preschool negating late entrance into the educational system as a factor in performance. Again, low socioeconomic levels for most children enrolled in Headstart removed one of the more common and most salient factors in the discrepancies between Hispanic and Caucasian homes and resources. Research supports that low literacy, socioeconomic levels, and resources in any home contribute to poor academic outcomes for children. In this study, these factors may have converged to have had greater impact on the subjects’ performances than lingual and cultural differences.

Computer technology offers a variety of opportunities for dynamic and individualized multimedia learning experiences that may enhance learning while adding valuable one-on-one interactions to the child’s experience. Current literature states the discovery learning, visual and auditory support, one-on-one literacy interactions, the availability of choices to increase interest, and individualization of academic program improve a student’s learning. This study did not find significant evidence that the PowerTouch™ Learning System impacted student learning in this way. In fact, data suggested that more complex reading acts occurred in the books only condition than the technology condition. The convergence of all of these qualities in one
interactive system may have interfered with the subject’s ability to gain the benefits of any one proven method for increasing academic gains.

**Review of the findings**

**Hypothesis one: Improved test scores for technology group**

While the results do not indicate a significant difference between conditions, the somewhat higher scores shown by the technology group may indicate the potential for greater effect had the limitations of the study not been so great. Small sample size (N=13) was a factor in lack of significance for all analyses. Additionally, the variation as evidenced by the large standard deviation for the Reading Quotient post-test scores for the books only condition suggests the possibility of a statistical outlier at the high end of the test score range for this group. The pre-test scores show the books only condition as starting with a higher Reading Quotient mean. Although this was addressed through the use of ANCOVA while controlling for pre-test mean differences between conditions, the presence of an outlier increases the standard deviation and decreases the possibility of significance.

Additionally, experimenter observations suggested the PowerTouch™ may have provided too much support to subjects or not offered clear enough support. The characteristics of the PowerTouch™ which contributed to the expectation of increased emergent literacy support varied from those hypothesized and supported by literature. Inconsistency of the PowerTouch™ with the definition of the independent variable will be addressed further in the Limitations section.

Although no significant difference was found between ESPs and SSPs in regards to test scores or home events as hypothesized, visual inspection does show SSPs to have fewer minutes spent on literacy events at home on average. While this does not appear to affect test scores, it should be noted.

The lack of findings for this hypothesis may be linked to the sampling population. As mentioned previously, most of the Headstart population comes from low socioeconomic backgrounds. This characteristic has been found to have greater impact on student achievement than any of the other factors measured by this study’s questionnaire. Because of this overarching equalizer, variations within the other variables between subjects may have had less impact on test scores on the TERA-3 than expected. Additionally, socioeconomic status has been tied, in the literature, to the Hispanic population as one of the factors setting it apart from the Caucasian
population and widening the achievement gap. It is of interest that given both Hispanic, Caucasian, and African American children of approximately equal socioeconomic status, the differences in resources available, time spent on literacy events in the home, and even dominant language spoken in the home do not affect test score outcomes to any significant degree.

Beyond sample limitations, the bias sometimes occurring in parent self report on the questionnaire might have been evident. Parents may have been concerned that examiners or the preschool teachers collecting the questionnaires may have judged them harshly based on their answers or apparent lack of time spent on literacy at home. Additionally, parent estimates of time spent on literacy events per day may have been less accurate than a frequency count would have been.

**Hypothesis three: Time spent on activities will affect test scores**

No relationship was found between time spent on activities and post-test Reading Quotient scores on the TERA-3. As stated in the results section for hypothesis four, subjects were found to spend more time on activities in the technology condition, than did subjects on activities in the books only condition. The utility of the PowerTouch™ in supporting increased growth of emergent literacy skills in the manner in which it was presented is clearly low. Subjects spent greater quantities of time on PowerTouch™ activites, but still showed no increased gains over the books only condition.

Additionally, because greater amounts of time were spent in the technology condition, the more complex reading acts that occurred in the books only condition were not associated with greater duration of activities. It is possible that greater amounts of time spent on activities in the books only condition may have shown greater gains on post-test scores and increased emergent literacy skills.

**Hypothesis four: Participants will spend more time on activities if technologically interactive**

The technology condition spent over twice as much time on average engaged in session activities than did the books only condition. Increased interest and motivation were solicited presumably by the interactive quality and auditory stimuli provided by the PowerTouch™. This study supports the use of interactive technology to enhance interest, motivation, and focus on task in learning environments. However, a longer period of engagement (i.e. more sessions) may be needed with novel technology so that the exploratory behavior period can be longer.

**Additional Findings**
Post hoc results indicate that participants in the books only condition engaged in more advanced “reading acts” than did the participants in the technology condition. Subjects working with the books alone engaged in more complex behaviors, indicating an awareness of a story as it relates to a book. Subjects in the technology condition were observed to interact with the system and segments of the books, but appeared less aware of the stories as overarching themes or the books as vehicles for accessing stories. This pattern of reading acts occurred with an even greater degree of disparity within the SSP sample. Subjects appeared to interact with the PowerTouch™ to identify pictures, access sounds effects and character voices, but often touched the words in the story discretely or in the incorrect order. The subjects in the books only condition did not have auditory stimuli in addition to the visual and perhaps for this reason engaged in more imaginative verbal play resulting in more complex reading acts. These differences in engagement may have contributed to the lack of expected effects on pre-literacy development (as measured by the TERA:3) of the technology condition.

Also, the exploration of a unfamiliar toy may explain the lack of more complex reading acts in the technology condition. Subjects may have needed more time to familiarize themselves with the PowerTouch™ and its capabilities before being able to focus on and utilize the literacy activities available. The increased assistance the PowerTouch™ offers users by reading words and asking questions may have also prevented the formation of story ideation. The complexity of the Reading Acts measured relies heavily on associating a book with a story or sequence of events. The technology offers users the ability to spot check words and count objects on each page, these functions are not consistent with the formation of the associations needed for complex Reading Acts.

The age of the subjects, prerequisite skills, and the modes and functioning of the PowerTouch™ may have all contributed to the lack of literacy support for subjects in the technology condition as evidenced by fewer complex reading acts. These factors will be discussed further in the Limitations section.

The SSP sample scored higher on the Subtest I post-test in the books only condition than those SSPs in the technology condition, while the reverse was true for their English-speaking counterparts. It is possible that the use of English by the PowerTouch™ in the technology condition may have interfered with the SSPs understanding the story or playing imaginatively, while the books only condition allowed them to insert their own words in English, Spanish, or a
combination of the two in order to create a story or talk about the books. This aspect of creative play as an opportunity to practice and use language was not considered during the literature review.

Limitations

The first, and most significant, limitation to this research relates to attrition of participants due to the loss of transportation. During the last week of data collection, funding for the public bussing delivering students to Headstart was discontinued. Nineteen participants from the original sample of 60 stopped attending Headstart completely. Although pre-test data and experimental data had been collected for these participants, post-test information was unable to be assessed. This drastic decrease in sample size affected the results presented in this study. Additionally, the loss of participants also contributed to an imbalance of the number of participants in each experimental condition. The SSP sample was decreased from the original 20 to thirteen including a loss of all males in the technology condition. The results for this subgroup of the population are invalidated statistically but remain of interest for discussion and future directions of research.

Another limitation within the SSP subgroup was the great variation in English proficiency among its members. This variation was not assessed nor was it accounted for in the experimental design. Within the Hispanic population, as mentioned in the review of literature, there is such variance in not only English proficiency, but also country of origin, cultural beliefs, and dialects of Spanish. This was true of the sample population as well. Although this was expected, the commonalities of bilingualism and often-low socioeconomic status within the Hispanic population were thought to have been enough to show a difference between the SSP subgroup and the ESP subgroup. The extent of the English proficiency variation as well as the previously mentioned generally low socioeconomic status of subjects in the overall sample reduced the disparity. Enrollment requirements for Head Start include a reduced income level relative to national averages. For this reason, findings from this research cannot generalize to the general preschool population. Additionally, many of the factors outlined in the literature review as being specific to the general Hispanic population, which maintains lower socioeconomic status on average than Caucasians, along with acquiring English as a second language, are not specific to the Hispanic subjects within this sample.
More than half of the subjects in the overall sample (52.3%) spent less than ten of the twenty minutes available in each session. This may have been due to a variety of factors. The experimental sessions were structured in two ways: the duration was twenty minutes and the session was offered at the convenience of the experimenter and logistics due to other subjects. The twenty-minute length may have been too long for the age of the subjects. Many of the subjects lost interest in both the books only and the technology condition after only a few minutes. The timing of the session may have interfered with subject interest and motivation to stay engaged with the materials depending upon the desirability of the activities occurring in the subject’s classroom (art, music, computer time, recess, etc.). Students may have been more or less willing to remain in the session relative to what they were missing.

Additionally, other factors such as subject illness, fire drills, and experimenter characteristics may have contributed to session duration. Specifically, due to graduate student availability and demographics, all experimenters were female, four were Caucasian, one was African American, and none were Hispanic or fluent in Spanish. These characteristics may have affected subject comfort or interest in remaining in session. As experimenters were purposely alternated, these effects should have been minimized as much as was possible although they could not be removed entirely.

Due to the analog nature of this research, subjects were also potentially impacted by the design of the experimental sessions. Removal from the natural environment may have created inflated novelty responses due to researchers and toys not typically existing in the classroom. The lack of choice in the timing of sessions may also have altered the interest level, motivation, and comfort level of the participants.

The independent variable, as conceptualized by this study, was found to be somewhat inconsistent with the operationalization of the PowerTouch™. For the overall sample, the interactive aspects of the activities available were often complex, requiring a more developed attention span and a basic understanding how to manipulate the system. The interactive base provided letter naming and other pre-literacy based features, however when books were added, numerous games and other activities were offered. The existence of these games and activities along with the manner in which they were to be played may have been overwhelming and confusing for the participants in the study. Some of the activities in the PowerTouch™ may require pre-literacy skills not yet developed in the sample population due to the young age and
fewer literacy experiences of subjects. Potentially, kindergarten or older subjects may better understand the games and features included on the PowerTouch™ and therefore be more successful in accessing the expected literacy supports and possible benefits to learning. Additionally, the speed and accuracy with which subjects touched the words on the pages also added difficulty in accessing the story. So, the degree of fine motor control a subject possessed may have also interfered with their ability to do so.

For the SSP sample, many of the characteristics of the conceptualized technology were expected to support the acquisition of language according to current literature. Particularly, the ability to access new vocabulary by touching pictures and words and hearing them named or read aloud. When operationalized, this feature did not deliver the information in a format useful for language acquisition by non-English speakers. For example, on a page with a variety of items like a red ball and a number of different colored paint cans. When the red ball is touched, the word “red” is vocalized, when the purple paint can is touched, the word “purple” is vocalized. For a Spanish-speaker, there is no way to know that the word vocalized represents a characteristic of the item touched, rather than the item itself. Potentially, they may erroneously learn that “red” means “ball.”

Also, the feature that allows the subject to ‘finger point’ the words to follow the story aloud did not align with the proposed scaffolding and proven effects of technologically enhanced literacy toys and talking books. Primarily, there were a number of words on the pages beyond just the words for the story. For individuals without a clear concept of the conventions of print in a paper-based book, touching all the words would seem to be the way to access the story. The lack of correspondence between these additional words and the ongoing storyline added confusion and distracted from the ‘reading’ of the book inserts.

Recommendations for Future Research

This research, although not intended as such, has become an excellent pilot study on this area of the field. Errors in defining the independent variable as well as in the selection of subjects have been identified. A future project conducting a similar study with a larger sample would be well informed by this research. Ideally, replication would yield more definitive results.

When conducting similar research with preschool children, adjusting the structure of the experimental sessions may assist in engaging preschool participants for longer overall amounts
of time. As mentioned before, the duration of the experimental sessions may have contributed to
the abbreviated engagement of the participants. Having 12 or more, ten-minute sessions rather
than six, twenty-minute sessions may extend the total amount of time subjects remain engaged.
Additionally, structuring the sessions to occur at the same time of the day may eliminate
variation in subject interest relative to what they would be missing from their daily classroom
routines.

The age of subjects was a limitation in the use of the PowerTouch™. For ideal
exploration of the potential of the PowerTouch™ to scaffold literacy learning for children,
slightly older subjects could be sampled. Kindergarten and first grade students would be ideal
for mastering the functions and capabilities of the PowerTouch™ system, while being of the
appropriate age to reap the benefits of increased emergent literacy skills. In training these
subjects to use the PowerTouch™, greater attention would be paid to instructing subjects in
accessing the various games and functions as well as allowing a brief exploratory period. Free
exploration time would be limited to prevent the loss of natural novelty and the attendant
motivation inherent in controlled use of technology in the classroom.

The sample itself would be taken from a variety of preschool or classroom environments
to better represent a true cross-section of the population. Additionally, a larger sample would be
used to optimize significance and effect size where differences between groups exist.

For future work with Spanish-speaking subjects, two major changes to the current
research would be necessary. The use of a talking book or technologically-enhanced literacy
tool that more closely aligned with the conceptualization identified in the literature review of this
study would be paramount. The characteristics defined by current literature as being most
important in second language acquisition and emergent literacy skills would need to be
operationalized appropriately. Secondly, a clearer guideline would need to be set for
qualification as a primarily Spanish-speaking subject. An assessment of English proficiency
would be done and either proficient students would be excluded from the Spanish-speaking
portion of the sample, or proficiency would need to be quantified and utilized as a variable in
examining and analyzing the data.

Summary and Conclusions

This study evaluated the use of the PowerTouch™ learning system in supporting an
increase in emergent literacy skills in English for Spanish-speaking subjects in Head Start
preschool classrooms as measured by the TERA-3. Study purpose and design were consistent with current literature. Data was collected as proposed. Characteristics of the sample, alignment of proposed materials and conceptualizations based on literature, and attrition of sample due to loss of bussing were found to limit possible results. Although many data analyses and subsequent results of the study related to proposed hypotheses were not found to be significant, subjects were found to choose to spend more time with activities in the technology condition than the books only condition. Additionally, post-hoc analyses showed greater complexity of reading acts accompanied the books only condition.

The discovery of the limitations of this study illuminate future research and make clear contributions to the advancement of understanding the possible benefits and drawbacks of technology as an aid to early learning. The findings of this study contribute to the breadth and depth of knowledge regarding emergent literacy skill development and second language acquisition.
References


Teachers:

Hello! We are second year school psychology graduate students at Miami University in Oxford, Ohio. We are writing to inform you of a research study that we are conducting for our theses and ask for your assistance in this study.

About the Study

The study is entitled “The Effect of the PowerTouch™ Learning System on Emergent Literacy Skills”. The purpose of the study is to determine if the use of the PowerTouch™ Learning system impacts emergent literacy skills in preschool children. The study will examine if using the PowerTouch™ Learning system will increase letter knowledge, print awareness, and language acquisition in 60 typically developing preschool children.

The study will be conducted in from September 2004 through February 2005 in three phases: pretest (where children with signed parental consent are administered the TERA-3), individual sessions (where the children are given the PowerTouch™ Learning system or PowerTouch™ books alone and interactions are observed), and the post-test (where the TERA-3 is readministered). It will be primarily conducted by three School Psychology graduate students. Approximately twice a week, for twelve sessions at 25 minutes each, the researchers will present the PowerTouch™ Learning system or books to the child and observe the child’s interactions with it. The researchers will be observing and recording the child’s engagement in the literacy activities provided by the PowerTouch™

Why you should help?

Emergent literacy skills can serve as predictors of later reading ability. Technology enhanced toys are often being promoted as literacy tools. This study is valuable because it will provide educators with information regarding the effect of technology enhanced toys on the promotion of greater early literacy skills. The knowledge gained from this study will also be helpful in determining useful literacy tools for children and their families at home. In addition, all participating classrooms will receive a PowerTouch™ Learning System upon completion of the study.

How you can help?

Please inform families about the study and its importance. You will be given parent forms for children’s participation in the study. When a parent/caregiver is interested, have the parent read the parent letter, complete the Parent Questionnaire, and sign the permission form. Finally, please submit both completed forms to us by placing them in _____________ mailbox.

Thank you for your time. If you have any questions, please contact us at (513) 529-8051 or at wilsonj8@muohio.edu or Dr. Doris Bergen at Miami University at bergend@muohio.edu. For questions regarding this study’s compliance with the protection of human subjects and participant rights, you can contact the Office for the Advancement of Research and Scholarship: (513) 529-3734. We appreciate your willingness and look forward to working with you.

Sincerely,
Judith Wilson, M.S., Deanna Strigens, M.S., Sara Michelucci Vondracek, M.S.
Dear Parent:

The Fisher Price toy company, which makes the PowerTouch™ Learning System, has donated 20 PowerTouch™ toys to us to do a study on early reading skills in Head Start children. The PowerTouch™ is a toy with books to insert, so a child can touch the pages, and the toy “reads” the words and sounds out loud. This means preschool children can learn about reading by reading a book on their own.

We want to find out more about how these toys can help young children learn to read. We hope you allow your child to join this study because it will help us to learn more about how these types of toys might help children get the strong base in reading that they need to succeed.

If you agree to let your child join the study, you will also be asked to answer some questions about your child’s reading and use of reading toys at home. The questionnaire will also ask about the main language spoken in your home. A reading skills test will be given to your child before and after the study. This test will allow us to see what reading skills your child has gained during the study. Your child may work with the PowerTouch™ toy and books or with PowerTouch™ books alone.

Your child will play with the toy or books in about twelve 25 minute sessions over six to twelve weeks starting in October. During each session, they will spend some time learning how to use the PowerTouch™ toy or books, and for the rest of the time they will play on their own with the item. If you so choose, your child may be videotaped during sessions. This is to help researchers be sure they have all important information. These videotapes will not be identified by your child’s name and will be stored securely. At the end of the study, your child will take the test again.

There is no risk to your child as the sessions will involve practicing reading skills; if your child does not want to be in the study or wants to stop at any time, s/he is free to do so. Please return the questionnaire with the signed permission slip to your child’s teacher. We really hope you will let your child participate in this important study.

Anything you share about your child will be confidential and your child’s name will not be in the results Thank you for your time. If you have any questions, please contact us at (513) 529-8051 or at wilsonj8@muohio.edu or Dr. Doris Bergen at Miami University at bergend@muohio.edu. For questions regarding this study’s compliance with the protection of human subjects and participant rights, you can contact the Office for the Advancement of Research and Scholarship: (513) 529-3734. We appreciate your willingness and look forward to working with you.

Sincerely,

Deanna Strigens, M.S.
Sara Michelucci Vondracek, M.S.
Judith Wilson, M.S.

Appendix B-Spanish version
Estimados Padres:

La compañía de juguetes Fisher Price, que fabrica el sistema de aprendimiento Power Touch™, nos donó 20 juguetes Power Touch™ para hacer una investigación de la destreza de lectura de los niños en el programa Head Start. El Power Touch™ es un juguete con libros que se introducen en el juguete mismo. Un niño puede tocar la página y el juguete "lee" las palabras y los sonidos en voz alta. Esto significa que niños preescolares pueden aprender a leer usando un libro, solos y sin ayuda.

Nosotros queremos averiguar mas sobre como estos juguetes pueden ayudar los niños a aprender a leer. Esperamos que Ustedes permitan que su hijo/a participe en esta investigación porque eso nos ayudará a aprender mas sobre como este tipo de juguetes pueda ayudar los niños a desarrollar una base fuerte para leer y, por consiguiente, para tener éxito.

Si Ustedes van a permitir que su hijo/a participe en esta investigación, también le haremos a Ustedes unas preguntas sobre la costumbre de leer de su hijo/a y también sobre el uso de juguetes para leer en su casa. Además, les preguntaremos cual es el idioma hablado principalmente en su casa. Pondremos un examen de lectura a su hijo/a antes y después de la investigación. Ese examen nos permitirá a estimar la destreza de lectura que su hijo/a ganó durante la investigación. Su hijo/a trabajará con el juguete y los libros Power Touch™ o solamente con los libros Power Touch™.

Su hijo/a jugará con el juguete o los libros en dos sesiones de aproximadamente 25 minutos por semana, durante un periodo de seis a doce semanas, comenzando en Octubre. Durante cada sesión, su hijo/a pasará parte del tiempo aprendiendo a usar el juguete o los libros Power Touch™ y el resto del tiempo a jugar con el Power Touch™ solo. Si usted elige tan, su hijo/a puede ser grabado durante sesiones. Éste debe ayudar a investigadores a ser seguros que tienen toda la información importante. Estas videocintas no serán identificadas por el nombre de su niño y serán almacenadas con seguridad. Al final de la investigación, su hijo/a será examinado de nuevo.

No hay ninguno riesgo para su hijo/a. Si su hijo/a no quiere participar en la investigación o si quiere pararse cuando quiera, el (ella) es libre de hacerlo. Por favor devuelven el cuestionario y el formulario de permiso (firmado) al maestro/a de su niño. Esperamos sinceramente que Ustedes permitirán que su hijo/a participe en esta importante investigación.

Cualquier cosa que Ustedes comparten sobre su hijo/a no aparecerá en los resultados finales de la investigación Si usted tiene cualesquiera preguntas, éntrenos en contacto con por favor en (513) 529-8051 o en wilsonj8@muohio.edu o el Dr. Doris Bergen en la universidad de Miami en bergend@muohio.edu. Para las preguntas con respecto a la conformidad de este estudio con la protección de temas humanos y de las derechos del participante, usted puede entrar en contacto con la oficina para el adelanto de la investigación y de la beca: (513) 529-3734.

Apreciamos su buena voluntad y miramos adelante a trabajar con usted. Les agradecemos mucho su ayuda.

Los saludamos atentamente,
Deanna Strigens, M.S.
Sara Michelucci Vondracek, M.S.
Judith Wilson, M.S.
Appendix C

Permission Slip

I understand the purpose of the PowerTouch™ study being conducted by Deanna Strigens, Sara Michelucci Vondracek, and Judith Wilson, of Miami University and agree to let my child (name)__________________ participate in the study, if s/he is selected to participate and willing to do so. I understand that the study will be at my child’s preschool and that my child will spend twelve sessions of about 25 minutes playing with a PowerTouch™ learning system or PowerTouch™ books. I also understand that my child will be given a pre- and post-test on reading skills, and be observed at play. I agree to answer some questions about my child’s usual at home reading and language(s). I understand the study will protect my child’s privacy and nothing will be reported that will identify my child. I also know my child can choose not to be in the study or can stop at any time with no penalty for either me or my child.

Parent Signature___________________

Parent Address____________________

____________________

Parent Phone Number_______________
Child Birthdate  ___________________

I also agree to allow my child’s sessions to be videotaped for the purposes of this study. (You do not need to sign this for your child to participate, only to allow him/her to be videotaped)

Parent Signature____________________________

Student Number___________
Appendix C - Spanish version

Formulario de Permiso

Entiendo el objeto de la investigación Power Touch™ hecha por Deanna Strigens, Sara Michelucci Vondracek y Judith Wilson de la Miami University y consiento que mi hijo/a __________________ participe en la investigación, si mi hijo/a se selecciona participar y también está de acuerdo. Entiendo que la investigación tendrá lugar en la escuela de mi hijo/a y que mi hijo/a dedicará doce sesiones de aproximadamente 25 minutos a jugar con el sistema de aprendimiento Power Touch™ o con los libros Power Touch™. Entiendo también que mi hijo/a tendrá un examen sobre su destreza de lectura antes y después de las doce sesiones, y será observado mientras juega. Consiento en contestar unas preguntas sobre los típicos idiomas y lecturas usados en casa. Entiendo que la investigación protegerá la intimidad de mi hijo/a y que nada no será comunicado que podría identificarlo/a. Entiendo también que mi hijo/a puede decidir no participar en la investigación o puede terminar su participación cuando quiera sin penalidad para mi o para mi hijo/a.

Firma del padre o de la madre: ________________________________

Dirección: ___________________________

____________________________

Numero de teléfono: __________________
Fecha de Nacimiento del niño: __________

También acuerdo permitir que las sesiones de mi hijo/a sean grabadas para los propósitos de este estudio. (usted no necesita firmar esto para que su niño participe, sólo permitir que ello/a sea grabado)

De la Firma Del Padre ________________________________

Numero de Estudiante_________
Appendix D

Miami University
School Psychology Program
Judith Wilson, Deanna Strigens,
Sara Michelucci Vondracek, Principal Investigators
Phone: (513) 529-8051

Dear Parents:

We are interested in knowing about literacy activities in your home. There are no right or wrong answers. Your answers will help us to better understand the development of early literacy skills in children. Please answer all of the questions on this questionnaire.

Parent’s Name __________________________  Phone Number ____________
Child’s Name ___________________________
------------------------------------------------------------------------------------------------------------
Child’s Date of Birth _____________            Gender: ______ Male    _____Female

1. Approximately, how many times minutes per day do you or another adult at home read with your child? (Circle one)
   5  15  30  45  60  75  90  105  120  135  more than 135

2. Is the person who does most of the reading with your child:
   ___  Male   ___  Female

3. Please check any of the following that you may have in your home:
   ___  Leap Pad
   ___  Fisher Price Power Touch
   ___  Educational phonics or reading computer software
   ___  Other:  __________________
   ___  None of the above

4. Has your child used one of the toys mentioned in question 3 during the past month? 
   Yes    No
   If so, how often?
   1-2 times a week  3-5 times a week     Daily

5. What language is predominantly spoken in your home?
   Spanish  English  Other, please specify____________

6. In what language do most reading activities occur in your home?
   Spanish  English  Other, please specify _________

7. Is a second language used in your home regularly, if so, please circle?
   Spanish  English  Other, if so, please specify __________  None

8. Does your child have any known history of speech, language, or motor difficulties? If yes, please specify the difficulty.

   Thank you for completing this questionnaire.
   If you have any questions about this questionnaire, please contact us at (513) 529-8051.

   Student Number: ________
Estimados Padres:

Estamos interesadas en conocer las actividades de lectura típicas en su casa. No hay respuestas justas ni erróneas en este cuestionario. Sus respuestas nos ayudarán a entender el desarrollo temprano de la capacidad de leer de los niños. Si pudieran contestar a todas las preguntas en este cuestionario, se lo agradeceríamos mucho.

Nombre del Padre o de la Madre_____________________________
Numero de teléfono_______________________________________
Nombre del Niño_________________________________________
Fecha de Nacimiento del Niño_______________________________
Género: ________ Masculino ________ Femenino

1. ¿Aproximadamente cuantos minutos al día Ustedes o un otro adulto lee con su niño? (Cerquen una de las respuestas)
   0-10 11-20 21-30 31-40 mas que 40 minutos

2. La persona que lee con mas frecuencia con su niño es

   ______ Hombre _______ Mujer

3. Por favor marquen a los juguetes educativos que tienen en su casa:

   ______ Leap Pad™
   ______ Fisher Price Power Touch™
   ______ Fonética educativa (Educational Phonics) u otro "software" (paquete de programas) educativo

   ______ Otro
   ______ Ninguno de estos
3. ¿Su niño usó alguno de los juguetes indicados en la pregunta numero 3 durante las últimas cuatro semanas?
   ______ Si ______ No

   ¿Si lo hizo, con que frecuencia lo hizo?
   _____ 1-2 veces a la semana       _____ 3-5 veces a la semana
   _____ Diariamente

4. ¿Que idioma se habla principalmente en su casa?
   _____ Español _____ Inglés _____ Otro

5. ¿En qué idioma se lee principalmente en su casa?
   _____ Español _____ Inglés _____ Otro

6. Se usa un segundo idioma regularmente en su casa?
   ___ Español     ___ Inglés ___ Otro     ___ Ninguno

7. ¿Su niño ha tenido dificultades de habla, defectos de pronunciación o defectos de movimiento? Si los ha tenido, por favor describenlos:

Agradecemos mucho que completaron este cuestionario. Si tienen cualquier pregunta, por favor llamenos Sara, Deanna, o Judith al (513) 529-8051.

Numero de Estudiante________
Appendix E

Interactive Session Protocol
Possible duration 25 minutes.

1. The PowerTouch™ is turned on and opened. Stopwatch/watch ready.

2. Mark start time.

3. Give session instructions: “Today we will be reading (insert book name or offer choice of book). You can read the story using your finger to underline the words (demonstrate so child can see) like this, or you can read each word (touch word to demonstrate) like this, or you can touch things to find out their name (demonstrate) like this. You can learn letter sounds by first pressing here, then each letter (demonstrate) like this. You can read by yourself now. Let me know if you need help.”

4. Examiner may respond to questions concerning the instructions by repeating any portion of the instructions as many times as necessary.

5. Examiner may respond to other questions, personal, conversational, or other, by saying, “Right now we’re learning reading, why don’t you read more of your book?”

6. The examiner will make observations on provided observation sheet.

7. If child requests a bathroom break, examiner will mark the time, take the child, and mark the time when returned. The duration of the break will be added on to the end of the session to allow the full twenty-five minutes.

8. If the child indicates s/he is finished the examiner may prompt with, “Why don’t you spend a little more time reading the books?” If the child again indicates s/he is finished, the examiner will mark the end time and return the child to the classroom.

9. If the time reaches twenty-five minutes before the child is finished, say: “We’re all done for today. You can stop there,” and return the child to the classroom.
Non-interactive Session Protocol
Possible duration 25 minutes.

1. The book is out and opened. Stopwatch/watch ready.

2. Mark start time.

3. Give session instructions: “Today we will be reading (insert book name or offer choice of book). You can read the story using your finger to underline the words (demonstrate so child can see) like this, or you can read each word (touch word to demonstrate) like this, or you can the names of things (demonstrate) by looking here. You can also practice letter sounds (demonstrate). You can read by yourself now. Let me know if you need help.”

4. Examiner may respond to questions concerning the instructions by repeating any portion of the instructions as many times as necessary.

5. Examiner may respond to other questions, personal, conversational, or other, by saying, “Right now we’re learning reading, why don’t you work more on your PowerTouch™ book?”

6. The examiner will make observations on provided observation sheet.

7. If child requests a bathroom break, examiner will mark the time, take the child, and mark the time when returned. The duration of the break will be added on to the end of the session to allow the full twenty-five minutes.

8. If the child indicates s/he is finished the examiner may prompt with, “Why don’t you read some more?” If the child again indicates s/he is finished, the examiner will mark the end time and return the child to the classroom.

9. If the time reaches twenty-five minutes before the child is finished, say: “We’re all done for today. You can stop there,” and return the child to the classroom.
Interactive Training Session Protocol
Duration 25 minutes. Examiner introductions will occur during class time.

1. Examiner goes to classroom to retrieve student: “It’s your turn today to come with me to do some reading, okay?”

2. Explain experiment: “I am a graduate student from Miami University, and I and two others are studying how different things help kids learn to read. Would you like to help with that? ... Once or twice a week, one of us will get you from your classroom and spend about half an hour practicing reading. Today I am going to show you how we do that.”

3. Demonstrate PowerTouch™: “We’re going to use this book to help read. When you put a book in it, you can read the story using your finger to underline the words (demonstrate so child can see) like this, now you try it. You can read each word (touch word to demonstrate) like this, now you try. Or, you can touch things to find out their name (demonstrate) like this, can you do it? You can also learn letter sounds by first pressing here, then each letter (demonstrate) like this. You try. Now I’m going to let you play with it for a while. Go ahead.”

4. Examiner may respond to questions concerning the instructions by repeating any portion of the instructions as many times as necessary.

5. Examiner may respond to other questions, personal, conversational, or other, by saying, “Right now we’re learning reading, why don’t you read more with your book?”

6. If child requests a bathroom break, examiner will mark the time, take the child, and mark the time when returned. The duration of the break will be added on to the end of the session to allow the full twenty-five minutes.

7. If the child indicates s/he is finished the examiner may prompt with, “Why don’t you practice reading some more?” If the child again indicates s/he is finished, the examiner will mark the end time and return the child to the classroom.

8. If the time reaches twenty-five minutes before the child is finished, say: “We’re all done for today. You can stop there,” and return the child to the classroom.
Non-interactive Training Session Protocol
Duration 25 minutes. Examiner introductions will occur during class time.

1. Examiner goes to classroom to retrieve student: “It’s your turn today to come with me to do some reading, okay?”

2. Explain experiment: “I am a graduate student from Miami University, and I and two others are studying how different things help kids learn to read. Would you like to help with that? ... Once or twice a week, one of us will get you from your classroom and spend about half an hour practicing reading. Today I am going to show you how we do that.”

3. Demonstrate PowerTouch™ books: “We’re going to use these books to help learn to read. You can read the story using your finger to underline the words (demonstrate so child can see) like this, now you try. You can read each word (touch word to demonstrate) like this, you try. Or you can find the names of things (demonstrate) by looking here, can you see that? You can also practice letter sounds. Now I’m going to let you play with it for a while. Go ahead.”

4. Examiner may respond to questions concerning the instructions by repeating any portion of the instructions as many times as necessary.

5. Examiner may respond to other questions, personal, conversational, or other, by saying, “Right now we’re learning reading, why don’t you read more of your book?”

6. If child requests a bathroom break, examiner will mark the time, take the child, and mark the time when returned. The duration of the break will be added on to the end of the session to allow the full twenty-five minutes.

7. If the child indicates s/he is finished the examiner may prompt with, “Why don’t you practice reading some more?” If the child again indicates s/he is finished, the examiner will mark the end time and return the child to the classroom.

8. If the time reaches twenty-five minutes before the child is finished, say: “We’re all done for today. You can stop there,” and return the child to the classroom.
Appendix F
Observation Sheet/Fidelity Checklist

___Child observed is part of sample population

___Child is observed by trained observer

___Child is observed in secluded area, away from distraction

___Observer interacts with child for five minutes at the start of the session

___Observer follows protocol for any unique circumstances/questions from child

___Observer makes appropriate books available according to session #

Book Schedule
Session 1, 7 = School Skills & Ernie
Session 2, 8 = Ernie & Blues Clues
Session 3, 9 = Blues Clues & Clifford
Session 4, 10 = Clifford & School Skills
Session 5, 11 = School Skills & Ernie
Session 6, 12 = Ernie & Blues Clues

Book(s) selected by child (first=1, second=2):
  ___ School Skills
  ___ Ernie’s Neighborhood
  ___ Blues Clues
  ___ Clifford

Experimental Condition: with PowerTouch™ base without PowerTouch™ base

Subject #:________ Observer name:____________________________

Session #:________ Date:_______ Gender of child:_______

Session begin time:_______ Session end time:_______

Did the child wish to terminate the session early: yes no
If yes, what time was the first prompt given?_______
At what time was session terminated?_______

How session ended:
  ___ child selected to end session following one prompt
  ___ observer ended session due to time limit
  ___ other distraction in school ended session (fire alarm, other emergency)
     If so, what distraction ended session:____________________


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Operational Definitions:

Child engagement = Any of the following:
1-child face and body oriented toward the PowerTouch™ materials
2-child is interacting with or listening to the PowerTouch™ materials
3-child is using or participating in one of the PowerTouch™ activities

<table>
<thead>
<tr>
<th>Interval # (1 minute duration per interval)</th>
<th>Reading aloud</th>
<th>Using of book E= Ernie C=Clifford S=School Skills B=Blues Clues</th>
<th>Child engagement (Code as 1, 2, or 3)</th>
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NOTES: