The Effect of a Fluent Signing Narrator on Children's Behavior During Technology-Enhanced Shared Reading with Children with Hearing Loss and their Parents

Gabriela Itzel Rodriguez
University of Texas at El Paso, girodriguez2@miners.utep.edu

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THE EFFECT OF A FLUENT SIGNING NARRATOR ON CHILDREN’S
BEHAVIOR DURING TECHNOLOGY-ENHANCED SHARED READING
WITH CHILDREN WITH HEARING LOSS AND THEIR PARENTS

GABRIELA ITZEL RODRIGUEZ
Master’s Program in Speech-Language Pathology

APPROVED:

Vannesa Mueller, Ph.D., Chair

Yok Fong Paat, Ph.D.

Benigno Valles, Ph.D.

Charles Ambler, Ph.D.
Dean of the Graduate School
Dedication

Para mami poderosa, todo lo que soy es gracias a ti. Gracias por demostrarme con tu amor y ejemplo que no hay obstáculos que no se puedan superar, porque tú has superado todos. ¡Esto es para ti, lo logramos! Para mi hermana Mony, gracias por ser el mejor ejemplo de una hermana mayor, por inspirarme, por nunca dejarme sola, y por ser la gran mujer que eres. ¡Las amo con todo mi corazón! Por último, esta dedicación va hasta el cielo, para mi abuelo y mi tío Luis, se me fueron antes de ver que si valió la pena todo el esfuerzo.
THE EFFECT OF A FLUENT SIGNING NARRATOR ON CHILDREN’S BEHAVIOR DURING TECHNOLOGY-ENHANCED SHARED READING WITH CHILDREN WITH HEARING LOSS AND THEIR PARENTS

by

GABRIELA ITZEL RODRIGUEZ

THESIS

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Abstract

Shared reading plays an essential role in the language and literacy development of children who are at risk of future problems in those areas. Children with hearing loss (CHL) are a group who usually experience limited and poor quality activities that foster literacy development such as shared reading (SR). Researchers examining high quality interactions have rated child behaviors, primarily attention and initiation, during shared reading and play based activities finding positive correlations between these behaviors and the overall development in typically developing children as well as in children with other impairments such as Autism Spectrum Disorder and Down syndrome (Kim & Mahoney, 2004; Mahoney & Wheeden, 1999; Mahoney, Wheeden, & Perales, 2004; Meisels, Plunkett., Roloff., Pasick & Stiefel, 1986). The present study extends the work done by Mueller and Hurtig (2009) by using their data to examine the behaviors of four CHL while interacting with their mothers with typical hearing during technology-enhanced SR. Dyads engaged in naturalistic shared reading interactions using electronic books (e-books) that varied in the presence or the absence of a signing narrator as a supportive multimedia tool. Seven behaviors were rated throughout the different phases of the study using the Child Behavior Rating Scale (CBRS) which implements a 5-point global Likert scale. These behaviors: Persistence, attention to the activity, involvement, cooperation/compliance, initiation to activity, initiation to adult and affect are part of the CBRS and are believed to be imperative for developmental learning (Mahoney, Boyce, Fewell, Spiker, & Wheeden, 1998). The results demonstrated large effect sizes in some of the behaviors in favor of either one of the two conditions (signing and non-signing). Mother’s attitude towards shared reading as evidenced by their comments were positively linked to the child’s behaviors and vocabulary acquisition.

Key Words: Children with Hearing Loss, Child Behavior, Shared reading, Technology
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Chapter 1: Introduction

A great disparity exists in the literacy attainments of children with hearing loss (CHL) such that the average student with hearing loss graduates from high school reading at approximately a 4th grade reading level (Wang, Spychala, Harris & Oetting, 2013). Several researchers have demonstrated that children with typical hearing (CTH) outperform CHL on literacy tasks such as reading (Bulhholz, Luchs, & Boudreault, 2011; DesJardin, Ambrose, & Elsenberg, 2008; Easterbrooks, Lederberg, & Conor, 2010; Lederberg, Spencer, & Shick, 2013; Mueller & Hurtig, 2009; Stobart & Alart, 2008). This difficulty with literacy directed many to focus on different aspects of reading development. One of the earliest exposures to literacy a child receives is during shared book reading. Shared reading (SR) is usually a pleasant and interactive activity that educators, researchers and pediatricians recommend that parents and children include as a routine activity in their daily life, due to the tremendous impact it has in the overall development of children (Verhoeven, & Snow, 2001). As Vygotsky’s social interactionist theory states, children require the knowledge shared by adults during social interactions (Vygotsky, 1981). Therefore, engaging SR provides opportunities for that essential transfer. Evidence shows that CHL born to parents with typical hearing (PTH) do not experience the same pleasure (e.g. interacting in a relaxed and enjoyable atmosphere, or having an active and entertaining experience) (DesJardin, Ambrose, & Elsenberg, 2008). One reason may be, that their preferred mode of communication can differ from one another (DesJardin, Ambrose, & Elsenberg, 2008).

According to the National Institute of Deafness and Other Communication Disorders (NIDCD), more than 90% of children with hearing loss are born to PTH (Mitchell & Karchmer, 2002). Knowing the high incidence of CHL and their PTH, this becomes an issue demanding immediate attention. PTH are challenged when sharing story time with their CHL even if American Sign Language (ASL) is the mode of communication known by both parent and child, therefore limiting their exposure to activities that promote early literacy skills (Easterbrooks,
Lederberg, & Connor, 2010; Kaderavek & Pakulski, 2007). Those difficulties can occur either because parents are not fluent enough in ASL or are skeptical about the competence of the CHL and so may not challenge them with complex information (e.g. high level concepts, lexicon) presented in the books (Fung, Chow, & McBride-Chang, 2005; Kaderavek & Pakulski, 2007). Evidence exists that supports the idea that the interaction and outcomes resulting from this activity in CHL and their PTH do not result in effective informational transfer as those of CTH with their PTH or CHL born to parents with hearing loss (Berke, 2013; Bulhholz, Luchs, & Boudreault, 2011). Thus, the knowledge obtained from SR has a great impact on the child’s early literacy skills and will most likely determine their future academic performance (DesJardin, Ambrose, & Elsenberg, 2008; Nelson, 2010; Pressley, 2002; Stobart & Alart, 2008; Whitehurst & Lonigan, 1998).

During such interactions, the role of both mother and child is imperative as they each bring unique contributions to the experience. Several former studies headed by Dr. Gerald Mahoney, have focused on parent-child interactions, by implementing rating scales to look at the level of maternal responsiveness and engagement. Relevant to this topic, Dr. Mahoney innovatively incorporated in his research the identification of behaviors such as attention and initiation from the child as the primary predictors of high quality played-based activities in individuals with disabilities (Mahoney & Whedeen, 1999; Mahoney, Whedeen, & Perales, 2004). The quality of the interactions, particularly reflective of the child’s behaviors has not been investigated in depth. However, child’s attention and initiation are essential behaviors in assessing the benefits obtained from this experience. Therefore, it is possible to assume that in CHL those behaviors will lead to more valuable and interactive experiences.

A variety of techniques have been implemented in interventions (e.g. Parental training, sign language exposure and technology) as supportive tools to improve quality of SR experiences of CTH and CHL (DesJardin, 2014; Lederberg, Spencer & Schick, 2013; Stone, 2014). One of the most prominent techniques used to enhance early literacy experiences is Dialogic Reading (DR), this is a method developed as an intervention that provides strategies to
modify parental behaviors when interacting with their children, in order to increase the quality of the experience (DesJardin, Ambrose, & Elsenberg, 2008). As aforementioned, technology has been considered a supportive tool. Therefore, it is not surprising that the use of electronic books (e-books) to enhance SR has been associated with positive outcomes in language and literacy development (Almaguer & Pena, 2010; Mueller & Hurting, 2009; Stone, 2014). Multimedia technology such as e-books, offer opportunities for dynamic interactions between the adult and the child, but more importantly encourage the child’s participation and attention towards the activity (Alessi and Trollip, 2001; Salmon, 2014).

Mueller & Hurtig (2009) were pioneers in developing and demonstrating the positive effects of using technology (the Iowa signing e-books), on vocabulary acquisition resulting from the interactions between PTH and their CHL. However, evidence is necessary to evaluate the quality of the interactions as revealed by the child behaviors. As no previous study has analyzed these variables in this population using technology, it is important to determine the quality of the interaction and observe how engagement and participation from both parent and child, facilitates information transfer.

Following the initial study by Mueller & Hurtig (2009) and the results validating the importance of the quality of parent-child interaction, it is essential to determine the impact of the signing narrator embedded in the Iowa signing e-book facilitating a quality SR interaction. The focus of this paper will be specifically on the child behaviors.
Chapter 2: Literature Review

Literacy Skills in Children with Hearing Loss

Embracing and accepting the barriers that CHL have to face is not sufficient when referring to their education. Research has been conducted in this area for many years and current data supports the existing gap between literacy skills of CHL compared to CTH. Research indicates low performance levels in CHL in relation to their same age CTH in reading achievement, such that high school students with hearing loss graduate with a reading level equivalent to a 4th grader with typical hearing (Bulhholz, Luchs, & Boudreault, 2011; DesJardin, Ambrose, & Elsenberg, 2008; Easterbrooks, Lederberg, & Conor, 2010; Kaderavek & Pakulski, 2007; Kyle & Harris, 2010; Lederberg, Spencer, & Shick, 2013; Lederberg, Miller, Easterbrooks, & Connor, 2014; Mueller & Hurtig, 2009; Parault & Williams, 2009; Snow, Burns, & Griffin, 1998; Stobart & Alart, 2008; Wang, Spychala, Harris, & Oetting, 2013).

Phonological awareness, alphabetic knowledge and vocabulary acquisition have been established as skills that develop concurrently but more importantly predict reading achievement (Colin et al., 2013; Kyle & Harris, 2010; Lederberg et al., 2014). Poor performance in all domains of language has been documented in CHL and has been identified as one of the deficits that affect age appropriate reading skills (Kyle & Harris, 2010; Stobart & Alart, 2008). The ability to understand and manipulate sounds in CTH can be demonstrated through the child’s expressive vocabulary. Studies have found that children who present limited expressive skills also demonstrate problems with phonological awareness, which is later reflected when the school curriculum increases in complexity (Colin, Leybaert, Ecalle, & Muynan, 2013; DesJardin, Ambrose, & Elsenberg, 2008; Kyle & Harris, 2010; Lederberg, et al., 2013; Lederberg et al., 2014; Nelson, 2010; Pressley, 2002; Stanovich, 1986; Tapp, n.d.).

Many researchers have focused their investigations on the phonological awareness skills of school-age CHL. They found their performance to be equivalent to children younger than the ages of the CHL participating in the studies. Therefore, affecting their academic performance as
demonstrated by difficulty executing tasks such as associating word meanings from the printed text, blending syllables and phonemes (DesJardin et al., 2008). Those skills can be promoted through SR interactions.

DesJardin et al. (2008) examined the relationship between phonological awareness and reading in children with hearing deficits using cochlear implants. This longitudinal study looked at the relationship between expressive-receptive language and the child’s phonological skills compared to the results reported in a previous study. The study also considered facilitative techniques implemented by the mothers during SR with their children and the effects that it had on phonological awareness and reading. Sixteen mothers and their CHL (who had already participated in a previous study) were involved. The participants were videotaped during SR interaction for 20 min. A Phonological Awareness Test (PAT) was used to measure the child’s skills in different phonemic awareness tasks such as rhyming, blending, segmentation, substitution, deletion, isolation, decoding, and graphemes (Robertson & Sattler, 1997). They found that phonological awareness was strongly related to the mother’s use of “high level” techniques like open-ended questions. Phonological awareness and reading were associated to the types of techniques the mothers used during SR, thus highlighting the importance of high quality early literacy experiences at home.

Colin et al. (2013) followed up on a previous study that looked at very detailed tasks such as phonology reading, spelling and vocabulary in order to examine phonological awareness and its relationship to the acquisition of literacy skills in children exposed to Cued Speech. The participants were 18 CHL, plus the control group, which was comprised of 18 CTH. This longitudinal study assessed both groups 3 times throughout 3 years, from Kindergarten to second grade. The variables considered were: phonological awareness, word recognition, sentence comprehension, word spelling and vocabulary. Findings suggested that phonological skills and reading are related in both CTH and CHL but contrary to outcomes reported by other studies, results did not suggest a relationship between CHL and phonological awareness problems. However, it is important to note that school curriculum at the 2nd grade will not be as challenging
as in upcoming school years. Kyle and Harris (2010) also found this to be true, 2nd graders with hearing loss in their study did not show differences in reading performance, but they considered the second year of school to be the point of divergence of the reading trajectories of CHL and CTH. Therefore, it is not surprising that the literature reveals low reading achievement in CHL graduating high school, as expectations and complexity considerably increase during these years. This also reveals the importance of early intervention for CHL in order to prepare them for their future academic life.

**Mode of Communication and Literacy Skills.** Exposure to American Sign Language (ASL) and its implementation as the primary mode of communication, has been previously analyzed and demonstrated to positively influence early literacy skills in CHL. It is suspected that the use of ASL as a communication modality for CHL can be the precursor of spoken language and therefore it will affect development of early literacy skills. The body of literature is composed of studies supporting the use of ASL as a medium of communication for children, as there is evidence confirming improvements on the child’s communication skills (Lederberg, Spencer and Shick, 2013; Moses, Golos & Bennett, 2015; Mueller & Hurting, 2009). However, according to the questionnaire administered by Stobbart and Alant, (2008), sign language is not the ideal communication method identified by parents of CHL. Parental attitude towards the use of ASL also plays an imperative role. Learning a new language is a long and difficult process that requires much time and effort. As presented by Mueller and Hurtig (2009), this situation was also true in some of the mothers who participated in their study of which this present paper is following up. Rejection also comes in the way of isolation; parents might feel this will exclude their children because few others communicate in ASL the same way as their family does (Stobbart & Alant, 2008).

Evidence supports the use of a total communication approach for those families that feel uncomfortable changing their mode of communication with their children exclusively to sign language. A total communication approach promotes the use of any and all methods of communication or assistive devices available, based on what the child requires and his/her
abilities (Marschark & Specer, 2005). Lederberg, Spencer and Shick (2013) suggest that for CHL, learning more than one language or modality to communicate is not detrimental to the development of their verbal skills. In the present study, ASL and verbal communication are both utilized by the child participants to initiate communication interactions but also by parents to promote language development during SR.

Reports from PTH about their CHL show the priority of language and communication development over literacy skills (Stobbart & Alant, 2008). However, we cannot ignore the fact that early literacy skills are as important because they are related to overall language development, as reading is a language based ability (Lederberg, Spencer and Schick, 2013; Stobbart & Alant, 2008). Hence, by supporting those early literacy skills at home we will enhance communication, language and literacy development simultaneously. Despite this, CHL with PTH are not exposed to as much SR because of the evident communication mismatch (Stobbart & Alant, 2008; Trussell & Easterbrooks, 2013). Parents might not be fluent in ASL and thus might not provide a rich language interaction, or it can even be caused by parental underestimation of language abilities and needs of their CHL (Easterbrooks & Baker, 2002). It is important to reiterate and emphasize that the development of reading skills initiates at home and as aforementioned, is as necessary as language development in general, due to its strong influence in the future academic and professional success of those CHL (Lederberg et al., 2014). The purpose of this study is to increase awareness on the effect of technology on SR interactions, SR will be discussed more in depth in the next section.

**Shared Reading**

The belief that education starts in school is one of the most erroneous disadvantages for children, even more so for the ones who need early assistance like CHL. Initiating an activity at home that most parents think should start in school, encourages the child’s development and prepares them for their academic life (Jimenez, Filippini, & Gerber, 2006). In fact, observations lead to the conclusion that the language techniques used by parents during SR interactions have
been identified to ease and enhance acquisition of language skills (DesJardin, et al., 2008; Fung, Chow, & McBride-Chang, 2005; Pressley, 2002; Stobbart & Alant, 2008; Trussell & Easterbrooks, 2013).

SR interventions have been applied in parent-guided practices, which elicit children’s verbal communication and participation, consequently increasing the child’s grammatical complexity and vocabulary acquisition (Jimenez, Filippini, & Gerber, 2006). The quality of the interactions is also a key element identified in the linguistic gains achieved through SR (Mueller & Hurting, 2009). Jimenez, Filippini, & Gerber (2006) and Mueller & Hurtig (2009) reference to Vygotsky’s theory of children’s zone of proximal development, which reflects the adults’ adjustment of the techniques applied, in accordance to the child’s progress as they are increasing their knowledge and literacy experiences (Vygostky, 1978). This theoretical orientation is also reflected in the present study, as the basis of the research question focus on the influence of social interaction and scaffolding on the child’s attention and initiation during SR. Dialogic Reading is a widely cited reading techniques that encompasses parent guided and modified interactions which are also based on Vygotsky’s theory. This technique will be explained with more detail further in the text as it was a key method for this study.

SR has also been used as an intervention in the school setting as a strategy for those children who are at risk of future literacy problems (e.g. specific language impairment, down syndrome, and hearing impairments) (Button & Johnson, 1997; Kaderavek & Justice, 2002). Teachers provide techniques and support for the children to develop specific skills while reviewing stories or illustrations from books. Button & Johnson (1997) specified that SR allows children to participate and enjoy literacy material that they are not able to read yet, and this will positively influence their perspective towards reading. Therefore, for the purpose of this study it is important to take a detailed look into the existent literature of SR interactions of both CTH and CHL.

Shared reading with CTH. In order to recognize the nature and the magnitude of the literacy problems in CHL, it is paramount to compare their experiences to those of their peers
with typical hearing (Lederberg et al., 2014). Interaction between PTH and CTH tend to be enjoyable and it is common that both talk, label, or ask questions about the reading (Dircks and Wauters, 2015). Parental interactions in typically developing children have shown to be highly influential in the development of language and literacy skills in their children (Dexter and Stacks, 2014; Dircks and Wauters, 2015; Mol and Neuman, 2014). A study conducted by Mol and Neuman (2014) included sixty parent-child dyads, children ages ranged from 4:5-to-6:2. The participants did not present any auditory, language or visual impairments. A demographic questionnaire was provided for the parents to respond to, as one of the variables accounted for in the study was socioeconomic status (SES). Following the observation protocol from the National Institute of Child Health and Human Development (NICHD) Study of Early Child Care (Ware, Brady-Smith, O’Brien, & Berlin, 1998), which takes into account parent-child interactions during play-based and storybook tasks. The sixty dyads were videotaped and coded using parent and child constructs. The two child behaviors coded were sustained attention and initiative. The main focus of the protocol was to rate the quality of the parent-child interaction, and the purpose of the study was to observe whether extra-textual tasks had an effect on the child’s receptive and expressive language skills. The results indicated that parental extra-textual talk exposed the children to a more lexical rich environment, as well the children’s receptive and expressive language skills were predicted by parental responsiveness. Also, they concluded there is a bidirectional relation between children and parental behaviors, children influence parental behaviors and parents must be sensitive to the child behaviors, as responsiveness determines the continuing child behaviors. The assumptions stating parental responsiveness influencing not only language development but also the child’s behaviors provided the authors with an opportunity to suggest the potential benefit of reading techniques such as DR.

DR which was mentioned earlier in the text, was developed by Whitehurst (1998), and is a well-known method recognized as providing significant contributions to the positive language outcomes obtained during parent-child SR interactions (DesJardin, et al., 2008; Fung, Chow, & McBride-Chang, 2005; Pressley, 2002; Stobbart & Alant, 2008; Trussell & Easterbrooks, 2013;
Whitehurst et al., 1998). When using DR, the adult modifies reading techniques to increase the children’s attention and complexity of the task in accordance to the child responses. The PEER sequence is fundamental in DR. PEER stands for, Prompt, Evaluation, Expansion, and Repetition. Several studies with CTH who present language impairments, and who are at risk for future literacy problems such as children from low SES backgrounds have been conducted in which DR is the intervention used (DesJardin, et al., 2008; Fung, Chow, & McBride-Chang, 2005; Lonigan et al., 1999; Pressley, 2002; Trussell & Easterbrooks, 2013; Whitehurst et al., 1998). Overall, the results of children who have been exposed to DR demonstrated to increase their communication skills, the use of higher level techniques and less directive statements transformed SR into an engaging and joyful interaction (DesJardin, et al., 2008). DR created an interactive environment between parent and child, which lead to gains in receptive language. Fung et al. (2005) stated that one of the most important components of DR is that it promotes high-quality SR interactions.

Several researchers have focused on the importance of fostering SR not only at home but also in the classroom by proving its effectiveness as an intervention (Button & Johnson, 1997; DesJardin, et al., 2008; Fung, Chow, & McBride-Chang, 2005; Lonigan et al., 1999; Pressley, 2002; Stobart & Alant, 2008; Trussell & Easterbrooks, 2013; Whitehurst et al., 1998). As an example, Lonigan et al. (1999), compared two types of SR interventions versus a control group. The participants of the study were 95 low SES CTH. Participants were divided into three groups: The first group consisted of typical SR intervention and the comparison group was exposed to DR, the control group did not receive any intervention. Although both interventions revealed positive outcomes in language, listening comprehension, and phonological sensitivity compared to the control group, there were advantageous results for the dialogic reading book on language. Typical reading, on the other hand outperformed dialogic reading in listening comprehension. This study was conducted in a school setting, however, the authors suggested different results if SR interventions were held at home, perhaps conveying more generalized outcomes due to the effect of stronger parent-child interaction promoting a language rich context.
According to Snow, Burns, & Griffin (1998), literacy development in children is highly influenced by their parents. Daily life activities such as creating table conversations with their children, including them in helping with shopping lists, and shared book reading, plays a primary role in the child’s reading development. Furthermore, it is paramount that parent’s model engaged and enjoyable reading practices, as this is what will guide the children perspective and will create a rich print and reading environment at home. The aforementioned practices influence the child’s positive feelings towards reading. In the same manner, children learn the functional use of printed material by engaging in the mentioned activities with their parents, consequently reinforcing the enjoyment of literacy practices (Snow et al., pp. 142, 1998). Existent literature has also attempted to improve SR experiences of CHL, the next section will explicitly describe those efforts.

**Shared reading with CHL.** Shared Reading has served as an effective intervention to target those skills that CHL struggle in acquiring (Trussell & Easterbrooks, 2013). As concluded by Stobbart and Alant (2008), CHL are not completely deprived of early literacy experiences. In fact they are exposed, but it is the quality and the quantity of those experiences that actually influences the gains obtained. In fact, the Principles for Reading to CHL (Schleper, 1996), present fifteen principles identified from the reading interactions of adults with hearing loss to children with hearing loss. Some of the principles stated (e.g. translating stories using ASL, following the child’s lead, making what is implied explicit, connect concepts in the story to real world, provide a positive and reinforcing environment etc.) are rarely observed in the interactions between PTH and their CHL (Schleper, 1996).

Throughout the research that has been previously conducted, the importance of finding any mode of communication in which PTH and their CHL feel comfortable interacting has been a priority. Sign Language is one of the most commonly used methods and one which has demonstrated to have successful outcomes (Buchholz, et al., 2011; Colin, et al., 2013; Lederberg, et al., 2003). Lederberg et al. (2013) focused on the success and challenges that CHL face when acquiring language and literacy skills. In the compiled information, they identify sign language
as one of the primary and valid resources for early communication in CHL. ASL provides a way to deliver the age appropriate language knowledge that the child needs to receive and prevents the language depravation that CHL usually experience. In addition, Lederberg, Spencer and Shick (2013) mentioned that vocabulary development in children who learn ASL from birth has been compared and concluded to be similar to that of CTH, thus indicating that sign language is an advantage for children who are at risk of language problems. Additionally, ASL plays an important role in the literacy development of CHL, as the child’s reading skills will be determined by their underlying language skills (Lederberg, et al., 2013).

Parental contribution to the child’s development is imperative. DR techniques have also been applied in children with hearing loss to encourage the child’s active participation and increase the opportunities for them to acquire more knowledge. A research study conducted by Fung, Chow, & McBride-Chang (2005), demonstrated the benefits of DR intervention. The study performed in Hong Kong with 28 CHL in pre-k, first or second grades, placed the children in three different conditions, DR, typical reading and the control group with CTH. Children were tested prior to beginning the interventions and re-tested after eight weeks of intervention. The DR group followed the guidelines of the shared reading project, while the typical reading group were not given any extra support as the one provided by DR intervention. The authors concluded that the DR group demonstrated significant improvements in their lexical acquisition compared to the other two groups in the study. The parents in the DR group responded a follow up questionnaire in which they expressed their satisfaction with the DR program. The conclusions of the study also strengthened the already recognized advantages of having a high quality interaction with an interactive environment.

Desjardin et al. (2014) observed parent child SR in addition to the use of parental facilitative techniques. The aim of this study was to investigate early literacy experiences in the homes of CTH and CHL and their PTH. The authors investigated the frequency of SR, parent and child behaviors related to SR and the types of facilitative language techniques used by parents. To code for parental and children behaviors they used the Responsive Adult-Child
Engagement During Joint Book Reading Scale (RACED-JBR) developed by DesJardin (2011). The RACED-JBR includes behaviors that are specifically related to language skills and is divided into five sections (e.g. engagement, adult literacy strategies, adult teacher techniques, etc.). The results from this study demonstrated that parent’s use of facilitative language techniques was related to children’s better oral language skills. As well, parents of CTH used higher level techniques when their children exhibited greater language skills. However, not much information was provided in regards to children specific behaviors during the interactions, which would be an interesting factor to look at when comparing the experiences of CTH to those of CHL. Next section, will focus on the quality of parent-child SR interactions, and the existent evidence which is the basis for the current study.

Relationship between Shared Reading and Parent-Child Interaction

Several differences can be observed on the interactions between parents with hearing loss and their CHL, and PTH and their CHL. Children with hearing loss with parents with hearing loss are exposed to more visual reinforcements (e.g. fluent ASL model, focus on visual representations) at early ages, thus increasing their relationship when communicating and empowering language learning at early ages (Dircks and Wauters, 2015; Kaderavek & Pakulski, 2007; Lederberg, Spencer and Shick., 2013). On the other hand, as already mentioned, CHL with PTH are limited from appropriate and adequate exposure to language due to late identification of the hearing impairment, or parental lack of knowledge of a manual mode of communication (Lederberg, Spencer & Schick, 2013).

CHL may face difficult and uncomfortable situations when they comment or ask questions and their PTH struggle responding to those comments (Fung et al., 2008; Mueller & Hurting, 2009). Evidence states that CHL tend to have less spontaneous communication interactions and have fewer responses to maternal requests, this can be due to inappropriate parental responses to the child’s efforts to communicate (Fung et al., 2008). Therefore, limiting interactions between parents and children. PTH with CHL are also less involved with their children in the classroom, they do not volunteer or participate in classroom events as often, in
other words they would rather observe distantly (Calderon, 2000). CHL might not be interacting as much with their parents as other children in their classroom are. Calderon (2000) hypothesized a reason, which could be that parents do not feel that they have the necessary skills to interact with other children with hearing loss. The situation exposed previously portrays real life circumstances of CHL who might not feel supported enough or comfortable interacting with their parents. Those negative feelings transmitted from the parents can have a significant effect on the child’s development.

As explained by the Matthew Effect, if parents avoid SR sessions or show discomfort while interacting, it would negatively influence the child’s perception and increase the probability that they display annoyance for those activities as well (Stanovich, 1986). Considering that parental lack of fluency in sign language might limit their ability to be a strong language model or create an adequate environment in which the child can practice their ASL skills while interacting, it is imperative to identify a supportive tool to increase the quality of those interactions (e.g. the support provided by technology) (Easterbrooks & Baker, 2002; Lederberg, Spencer and Schi, 2013). By having an additional support, CHL can increase the likelihood of experiencing pleasant communication interactions with their parents.

In fact, having a supportive literacy environment at home has been linked to reading development in children (Resee & Cox, 1999; Snow, Burns, & Griffin, pp. 121-124, 1998). As explained by Snow et. al. (1998), experiences such as story book reading and table conversations, provide rich verbal environments in which children obtain a high quantity of their language models. Basically, children’s reading education begin primarily in environments that are external to school, principally at home (Stanovich, 1986). Consequently, if CHL are limited in their exposure to activities that nurture their development, such as SR and a typical interaction between their parents, they are missing important resources to gain knowledge. Studies have shown that children behaviors direct the parent interaction towards them (Mol and Neuman, 2014; Berguin, 2001). Therefore, it is of equal importance to be attentive to both the parent and the child’s behaviors as they will influence the child’s learning experiences (Stanovich, 1986).
Actually, the influence that parental interactions have in the general development of their children is highlighted by the definition of the term Secure Attachment. Parent and child dyads who are securely attached demonstrate a strong and positive connection (Bus, et al., 1994). However, parent-child dyads who are insecurely attached demonstrated less sensitivity to what the child wants and therefore turning the activity of book reading into an unpleasant one (Bus & van IJzendoorn, 1994; Bus, et al., 1995). The statement mentioned above evidences the importance of prioritizing the child’s attitudes and behaviors toward reading activities, as early parental interactions during SR strengthen and provide optimal opportunities that empower literacy skills acquisition (Bus, et al., 1995). Also, encouraging the parents of CHL to practice SR will reinforce the relationship and increase parent-child communication (Plessow-Wolfon & Epstein, 2005).

Child behaviors have captured the attention of researchers examining children with typical hearing during play based activities, and demonstrated a correlation between parental behaviors and the children’s development (Easterbrooks, Lederberg, & Conor, 2010; Lederberg, et al., 2013). As already stated, there is a suspected bidirectional relation between parent and children behaviors.

The Shared Reading Project was developed by researchers in Gallaudet University to target and enhance the SR interactions of PTH and their CHL (Delk and Weidekamp, 2000). Through the Shared Reading Project (SRP), the use of DR facilitated language and vocabulary acquisition (DesJardin, et al., 2008). In fact, the SRP was developed based in the aforementioned Principles for Reading to Deaf Children, and modification techniques were applied in relation to those principles. The SRP provides training and support to those PTH or caregivers of CHL in order to increase the quality and the quantity of the SR interactions (Mueller & Hurtig, 2009). With this project, it was possible to observe how modification of techniques guided and encouraged the children to respond. Also, it was demonstrated that the use of higher level techniques (e.g. making inferences and asking questions beyond the story, etc.) functioned as a role model for the children that in future interactions were more likely to mimic their parent’s
actions (Plessow-Wolfon & Epstein, 2005). A constant trend is observed in research studies such as the one conducted by DesJardin, et al. (2008), in which researchers only looked at the quality of the information the child is receiving but excluding how the children react to their parent’s modified behaviors and what effect it has on the child’s knowledge acquisition.

Measuring the quality of an interaction is difficult due to the abstractness in defining a “behavior”, as well as overcoming the challenge of operationally defining those behaviors to attain a reliable measurement. However, throughout the time, researchers discovered the importance of high quality interactions and intended to measure those behaviors through different methods. Both the child and the adult’s behaviors have been the focus of previous research.

Attempts have been made to analyze and rate mother-child behaviors during SR interactions. This with the aim of improving the child’s early literacy experiences, and create intervention programs that not only look at frequency but also the quality of interactions. Those attempts at rating child behaviors are the ones which lead us to the rating scale used for this current study.

**Rating Child Behaviors**

Knowing the reactions of the children to their parent’s behaviors provides an insight on what should be modified or what has been successful. Especially for CHL, based on the limited amount of existent information, emphasis should be placed on the behaviors children demonstrate during parental and child interactions. Looking at the child behaviors will contribute to future research, and will support the idea that high quality interactions create a facilitative learning context for children who have different types of disabilities (Meisels et al., 1986; Mahoney & Wheeden, 1998; Mahoney, Wheeden, & Perales, 2004; Kim & Mahoney, 2004).

A common trend observed in current research is the focus on examining the parental responsiveness and behaviors during SR interactions (Bulhholz, Luchs, & Boudreault, 2011; Fletcher & Reese, 2005). However, few studies considered the characteristics that have an effect on the children’s behaviors during SR interactions (Fletcher & Reese, 2005). Variables that can
influence the child’s behaviors consist of the child’s interest in the book also described as engagement, as well as parental responsiveness to the child’s interactions (Berguin, 2001). Behaviors demonstrating that the child is engaged are: pointing, vocalizations and attention, thus, parents must be responsive to those behaviors (Dircks & Wauters, 2015; Fletcher & Reese, 2005). Another behavior that has thought to be essential during SR interactions is child’s initiation (Dircks & Wauters, 2015). When the child takes the lead, it allows him to be in control of the interaction and therefore increases his enjoyment and dynamic participation, creating a more valuable relationship. During shared book reading it is important to look at the behaviors of both individuals, according to Fletcher and Reese (2005) and Berke (2013) story book reading requires joint attention. Joint attention entails both children and adult to focus on the same object or event, thus the behaviors of both individuals will influence the quality of the interaction.

Secure attachment, mentioned prior in the text, has also been related as having an influence during SR. It is suggested that children who are securely attached are more likely to be attentive, responsive, and have less disruptive behaviors than children who are not as securely attached (Bus et al., 1997; Fletcher & Reese, 2005). Bus et al. (1997), found that secure attachment has a positive and enhancing effect on the quality of the interactions, which leads to increase the frequency of occurrence of SR between parents and their children. Children who feel comfortable interacting with their parents, are more likely to enjoy SR sessions and therefore increase the probability of acquiring more knowledge out of it. The child’s interest in literacy experiences has been identified in creating a positive interactive environment which stimulates the child’s pleasure and desire to participate in reading activities (Bus, 2003). Roberts, Jurgens, & Burchinal (2005) and Dircks & Wauters (2015) also pointed out the restricted amount of research focusing on child behaviors as opposed to the more prominent body of research on quality and frequency of interactions during SR. There is not enough evidence on how child behaviors might predict the quality or the effectiveness of the interaction.

Plessow-Wolfon and Epstein (2005), attempted to predict this, by examining the child’s behaviors towards reading by using a questionnaire. The aim in using the questionnaire was to
measure: a) the quantity and satisfaction of the interaction with social support and b) general life satisfaction. With those surveys they concluded that in general, the participants were very active and enthusiastic towards the reading, this was reflected by their refusal to conclude the activity. However, no specific rating scale was used to measure the behaviors of the children to document how the quality of the interaction influenced the outcomes.

Limited research studies have focused on observing child behaviors during SR by means of rating scales. One of those studies mentioned before was conducted by DesJardin et al. (2014), used the RACED-JBR to rate videotaped interactions of CHL and their PTH, and CTH and their PTH. The RACED-JBR measures engagement, adult literacy strategies, adult teacher techniques, child/adult interactive reading and guided reading with a Likert-type scale which ranges from 0= no evidence to 3= most of the time. This rating scale has been used in other studies (Dircks and Wauters, 2015), and demonstrated high reliability, however it was too broad for the purposes of this study.

The Parenting Interactions with Children: Checklist of Observations Linked Outcomes (PICCOLO) has also been used to rate parent-child interactions with a 3 point-Likert scale in which 0= not at all and 3= very important (Roggman, Cook, Innocenti, Norman & Christiansen, 2013). This rating scale looks at parent/child’s engagement, affection, responsiveness, encouragement and teaching. It has claimed high reliability and validity, as well as the items are believed to predict positive results out of the interactions. This checklist was tested with different populations and ethnicities, exhibiting the same positive results (Roggman et al., 2013).

Another study incorporating a rating scale was conducted by Kaderavek & Pakulski (2007) who used a four-point orientation rating scale to book reading and toy play. The dependent variable was the child’s orientation to the task, which measured the child’s responsiveness and motivation while the interaction is taking place. In this study, the author’s also implemented a mother’s text modification rating scale to assess maternal participation during SR. The results demonstrated that children were more oriented in manipulative books compared to narrative books. As well, authors suggested that repeated exposure to the books
increased the child’s orientation, therefore they suggest allowing the child to explore and manipulate books in the first SR sessions is important to capture their attention. In this study, some mothers demonstrated to follow the lead of their children during the interaction, which is an important behavior during SR interactions. This was not the only study which compared child behaviors during play based activities and SR. In a study conducted by Girolametto et al. (2000) they evaluated the language that 10 pre-school teachers exposed to their typically developing preschoolers during book reading and a play activity. The results indicated that verbal output increased during the play based activity, as compared to a more restricted and simple language used during book reading. The aforementioned results expose the erroneous perspective professionals and non-professionals have of book reading. Thus, it is important to demonstrate the value of good quality SR in the learning process of the child.

Other studies identified the importance of parent-child interactions by analyzing the behaviors of CTH during parent-child play based activities, primarily on the attention and initiation of the child during the activity, as the main representation of the child’s engagement (Kim & Mahoney, 2004; Fletcher & Reese, 2005; Mahoney & Wheeden, 1999; Meisels, Plunkett., Roloff., Pasick & Stiefel, 1986; Mahoney, Wheeden, and Perales, 2004). Attention and initiation were also used as behaviors to observe in playing and story time by Mol and Neuman (2001). Although this study was conducted with CTH, the authors used behaviors such as sustained attention, initiation, and engagement in order to rate the quality of parent-child interactions.

On the same note, a study conducted by Mahoney et al. (1998) emphasized the importance of rating the interactions between parents and children. The outcomes were described based on the impact demonstrated by the “relationship focused models of intervention” on the children development. The effects of the adult responsiveness and the type of interaction the child receives were the major accomplishments exposed in this research. As a result, it was observed that affection has high implications on the child’s development as demonstrated by
their behaviors. An additional suggestion derived from this study is monitoring the behaviors of both individuals during the interaction to increase knowledge gain.

Meisels et al. (1986), developed a Mother Behavior Rating Scale (MBRS) to determine how the maternal behavior is related to the child’s development. This study focused on measuring the mother behaviors specifically, however, this rating scale served as a precursor of the child behavior rating scale. The MBRS lead to the assumption that it was of same importance to analyze the child behaviors with a rating scale, during a parent-child interaction.

Later, Mahoney and Wheeden (1999) developed a *Child Behavior Rating Scale (CBRS)* to observe and measure the children behaviors during adult- child interaction while playing. The CBRS divides the behaviors into two main categories, initiation and attention which are considered crucial for a successful interaction. The behaviors included in this rating scale are believed to be imperative for developmental learning (Kim & Mahoney, 2004). Some of the items in the CBRS are explicitly required during SR such as attention, cooperation, persistence, joint attention, interest, and affect (Kim & Mahoney, 2004).

The CBRS was the rating tool in the study conducted by Mahoney & Wheeden (1998), in which the authors investigated the effects of the teacher style on the engagement of preschool children with disabilities. The CBRS measured the global quality of the children behaviors. The authors analyzed the effect of acting in a highly directive and non-supportive way on the child’s engagement during the interaction. The study took place in the school setting, either in the classroom or in a quiet place. Child behaviors were observed in three different situations: a) alone b) child with teacher and c) free play. The CBRS was used to rate the children behaviors with a 5-point global Likert scale. Teacher behaviors were also rated using a modified MBRS. To obtain high reliability measures, the raters experienced a 40 hour training to be able to attain an 85% exact agreement. The mean exact agreement for the rating of CBRS items was 58% inter-rater agreement. The results demonstrated positive connections between the child’s engagement and the teacher’s interactive style. Responsiveness was also found to be related to
the child’s initiation. Affective environments, in which the teacher supported and stimulated the child to be involved in the activities were clearly linked to children’s initiation.

In another study, Kim and Mahoney (2004), rated maternal-child interactions of 30 dyads of Korean children and their parents while playing together. The participants of the study included children with and without disabilities. The CBRS was used to code the behaviors of each of the children. One of the relations found was between maternal responsiveness and child’s affect, the more responsive and affective parents reacted, the more active and engaged their children remained during the interaction.

Mahoney, Wheeden, and Perales (2004) also used the CBRS to measure the behaviors of children receiving special education services in relation to their teacher’s instructional approach and parental interactions. Results showed that children’s rate of development was highly correlated to the interaction with their parents and not related to the teacher’s instructional style (e.g. didactic vs naturalistic models). The authors reported a 100% within one point inter-rater agreement, demonstrating high reliability. Parental style of interaction was the only correlation found to the children’s knowledge gain. Therefore supporting the idea that parents are essential contributors during interactions with their children.

More recently, Mahoney, Perales, Wiggers, and Herman (2006) rated the behaviors of children with Down syndrome while interacting with their parents using the CBRS. The study aimed to evaluate the effectiveness of Responsive Teaching, which is a technique that addresses cognitive, language and social emotional needs of children who have developmental problems such as Down syndrome. The results concluded that parental involvement in early years is essential, as it promotes children’s development when engaging in responsive daily interactions. Identifying child behaviors while interacting with children with developmental disorders is imperative, due to the impact it has on the child’s development and social-emotional needs.

The CBRS has currently been translated to different languages such as Turkish and Japanese, and implemented in diverse situations and populations. Karaaslan and Mahoney (2013) used this rating scale to assess the effectiveness of responsive teaching in Turkish children with
Down syndrome. The translation of the CBRS into the Turkish language demonstrated high internal consistency with a Cronbach’s alpha of .89.

Similarly to play based activities, SR requires monitoring of the child behaviors in relation to their mother behaviors. During both SR and play based activities, joint attention, engagement, and responsiveness are crucial in order for the interaction to be successful (Berke, 2013; Fletcher & Reese, 2005; Meisels et al., 1986; Mahoney & Wheeden, 1998; Mahoney, Wheeden, & Perales, 2004; Kim & Mahoney, 2004). Dr. Mahoney suggested the use of the rating scale with any activity that can evoke the same behaviors and that is constant (Mahoney, Powell, & Finger, 1986). Therefore, it was ambitioned to extend the contexts in which the CBRS can be successfully adapted and use it to rate child behaviors during SR interactions of CHL using a supportive tool, technology.

**Technology in CHL**

Attempts have been made to improve the literacy experiences of CTH and CHL. Technology enhanced SR has been used to facilitate and support interactions between parent and child, but also to promote early SR interactions. As stated by Alessi and Trollip (2001), technology offers a myriad of opportunities to facilitate learning by increasing attention, motivation, active learning, and cognitive development. All of the aforementioned skills are identified to play a primary role in learning acquisition and are considered to be essential for SR.

Examples of studies that have considered technology and supported the use of e-books during SR are limited, but continue to develop, as it is a recent topic of study (Golos & Moses, 2013; Korat & Or, 2015; Moses, Golos & Bennett, 2015; Mueller & Hurting, 2009; Salmon, 2014; Stone, 2014). The small body of literature in respect to how technology and SR impact the literacy development of CHL highlights the need for more research to support or disprove use of technology to guide decision making in clinical practice. The implementation of technology to enhance SR interactions with the objective of supporting early literacy experiences of CHL is of extreme relevance to the present study, as it aims to rate the quality of the behaviors when a multimedia tool (a fluent signing narrator) is present on the e-book.
The use of technology with ASL exposure to support literacy is not limited to CHL, it has also been tested in CTH. Moses, Golos & Bennett (2015) and Golos & Moses (2013), focused on the development of language and literacy skills when using ASL and educational media in CHL and CTH. In both studies, educational DVD’s developed by the authors were used to interactively teach ASL. In the first study, Golos and Moses (2013) presented the educational videos to a group of pre-school students with hearing loss. Children’s knowledge of ASL and their literacy skills were tested prior and after the intervention. The results indicated that children in the study increased vocabulary knowledge in ASL after observing the videos. As well, children demonstrated improvement after exposure to the videos in identifying key elements of the story such as characters, setting, etc. In the most recent study, Moses, Golos and Bernnett (2015) presented the same DVDs to CTH, but this time incorporating phases in which audio was exposed simultaneously as the signed video. The results demonstrated that CTH learned signs, finger spelling, and print along with the sounds. This suggests that visual representations are alternative options to teach and enhance early literacy skills learning in children with typical hearing.

Another intervention in which technology and sign language were incorporated to help CHL is the Cornerstone literacy project (Wang & Paul, 2011). This approach implemented animated videos where the focus was on print word recognition and development of background knowledge. Participants were 22 students with hearing loss and their teachers. The authors provided pre and post test results which yielded to the conclusion that multimedia stories used improved the aforementioned skills. The intervention consisted of stories with 2 weeks of instruction, objectives, lesson plans, in addition to signed videos narrating the text. 30 vocabulary words were taught for each story, and those words were presented in groups of 2 or 6 per day. For this intervention, the use of technology enhanced child’s learning.

Korat and Or (2010) compared printed books reading vs two types of e-book reading (commercial and educational). 48 kindergartens and their mothers were randomly assigned to either one of the groups. The authors followed a Vygotskian theoretical orientation and were
interested in examining mother’s mediation talk and cognitive talk, which were scored from 1 to 9. The results indicated that e-books elicited more initiations and responsiveness from the child’s. Therefore, the supportive tools of the e-books encouraged children to accept and follow their mother’s suggestions and respond to them. Educational e-books also fostered word meanings compared to the commercial e-books. Thus, specific features should be included on e-books in order for them to have a positive impact on the SR experiences of children.

In an effort to contribute to the current knowledge about technology as a supportive tool, Stone (2014) conducted a literature review based on existent research about bilingual English and ASL e-books and its use with CHL. The researcher discussed technology from the past which included CD’s, videotapes, and DVD’s, and how they evolved to the use of e-books instead. Stone aimed to provide evidence regarding whether and how e-books support literacy acquisition in CHL as evidenced by the reviews of the different research studies. He states that the precursors of the current e-books started around 2010 and have been advancing into the new tablet devices (Stone, 2014). There are several software programs that include sign-print reading such as HandsOn & Thinking Reader; in both programs, reading comprehension and vocabulary are targeted. The elements in the Thinking Reader demonstrated effects on the motivation and engagement of the children to participate in the activity and use the strategies taught (Kennedy, 2004, as cited by Stone, 2014). Mueller and Hurting (2009), and Nikolaraizi, Veikiri, and Easterbrooks (2013) are also cited by Stone (2014), as reference of studies that implemented e-books or ASL softwares. The modern bilingual e-books, constitute those created by App Store and “iBooks”. The conclusions dictated that the type of application or software used influences the nature of the engagement and the vocabulary support available. Finally, the author suggested future research on the efficacy of the e-books to develop more effective technology (Stone, 2014).

In the same year, Salmon (2014) also reviewed existent literature in an attempt to analyze which features of e-books impacted emergent literacy development. The results suggested that specific interactive features, the quality of assessment, repetition and more importantly adult
involvement were the most significant factors influencing the efficacy of e-books. The author also mentions the lack of current research about parent-child interactions using technology enhanced SR.

In 2009, Mueller and Hurting developed the Iowa Signing e-books that included the support provided by a fluent signing narrator appearing on the screen of some of the e-books. The authors used a single subject withdrawal design, where the withdrawal portion was the fluent signing narrator on the story. The purpose of the e-books was to expose the CHL, who used sign language, to early literacy experiences (Mueller & Hurting, 2009). Participants were four CHL and their mothers with typical hearing. Based on the Shared Reading Project principles, the parents received training e-books to familiarize with the story and learn some signs related to the story. The interactions were videotaped in their homes, within a natural interaction context. Although the authors were not able to establish a positive relationship between vocabulary acquisition and the use of signing e-books, vocabulary acquisition was observed in all the participants during all phases, even the ones with no signing narrator. The time spent on the different e-books with and without the presence of the signing narrators was determined by individual preferences. Some mothers stated that they used the e-books to learn signs and then practice with their children, others had negative attitudes towards it, possibly due to their lack of fluency in ASL. Mueller and Hurting (2009), not only emphasized the importance of the frequency but also the quality of the interactions to have an effect on the general language and literacy development of the children. The current study aims to examine and extend the data compiled by Mueller and Hurting (2009) in regards to the quality of parent-child interactions.

Based on the positive results, it is important to observe whether or not the quality of the interaction played an important role in the positive outcomes obtained in the aforementioned studies. The parent’s ASL fluency can play an important role during their interactions with their children, it can either make it difficult and unpleasant, or interactive and joyful (Calderon, 2000; Easterbrooks & Baker, 2002; Lederberg et al., 2013). Children who are at risk of literacy problems, or who have difficulty coping with regular reading activities might benefit from the
use of e-books, as it serves as a tool to facilitate interactions (Mueller & Hurting, et al., 2009). Therefore, it is important to identify what behaviors demonstrated greater benefits, and to investigate if the technology enhanced SR sessions had positive influences on the quality of the parent-child interactions.

**Purpose of the Study**

The current study aims to extend the work of Mueller and Hurtig (2009) by using the data previously compiled for their study to look at the behaviors of CHL during SR interaction with their mothers with typical hearing. Shared reading has been found to be an activity that enhances the development of language and early literacy skills in CT as well as in CHL. The quality of the interaction is based on the behaviors of both the parents and the children, which influence the knowledge acquisition and contributes to obtaining positive outcomes.

Moreover, incorporating e-books as a supportive tool that strengthens the language base of the children by including ASL, facilitates the communicative interactions between parents with typical hearing and their CHL. The mother’s difficulty with ASL might decrease the quality of the interaction due to interruptions or not providing a good language model for the child. The signing narrator in this case, functions as a supportive tool to increase the quality of the interaction between mother and child, by providing a good signing model and guidance. Therefore, allowing the parents to develop a meaningful activity with their CHL. By including this additional support, it can increase the child’s attention, motivation, and encourage active participation. Multimedia features also allow the child to comment, make inferences and interact naturally with their parents while talking about the story that was signed by the narrator. Analyzing the quality of the interaction can lead to important information about its influence to the child’s knowledge acquisition. However, prioritizing the children’s behaviors to identify the enjoyment and the impact of including technology tools on the quality of the interaction is crucial, as they have demonstrated to play an important role in successful interactions.

In the present study, the behaviors of the four children who participated in Mueller and Hurtig (2009) will be observed throughout the different phases of the study (e.g. presence or
absence of the fluent signing narrator on the e-books) using the Child Behavior Rating Scale developed by Mahoney and Wheeden (1999). Based on existent research and to our knowledge, there are no other studies that have considered the evaluation of child behaviors when incorporating technology enhanced SR in CHL during interactions with their PTH. As well, no study has used an explicit rating scale developed exclusively to rate the child behaviors. Therefore, this study aims to examine seven child behaviors: persistence, attention, involvement, compliance, initiation to activity, initiation to adult and affect of CHL during technology-enhanced SR. The research question intended to answer is: What is the effect of the fluent signing narrator on the child’s behaviors during the shared reading interaction?
Chapter 3: Methods

The opening of this chapter is a summary of the work published by Mueller and Hurtig (2009), the proceeding subtitles will explain the methods used for the purpose of this current study. The study conducted by Mueller and Hurtig (2009), followed an ABABA withdrawal design. For the current study, the same research design was used. However, the dependent variables were modified.

Participants

Four children (three boys and one girl) with hearing loss and their parents with typical hearing were participants in this study. The ages of the children ranged from 2-5 years old, they were part of a previous research using technology enhanced shared reading. The Inclusionary criteria as stated in Mueller and Hurtig (2009) included:

1- The children have been identified with pre-lingual hearing loss.
2- Ages between 2 to 5 years old.
3- The child has been exposed to any type of sign language
4- No report of any concomitant disorder such as autism, mental retardation, or attention deficit hyperactivity disorder.
5- Both parents must not present any kind of hearing loss.

Participant 1 pseudo-name was “Charlie” is a 4 year; 10 months old boy who was identified with moderate hearing loss at the age of 2 years and 5 months because he only produced single words that were unintelligible to unfamiliar listeners. Charlie’s hearing loss evolved into a profound hearing loss. He had a cochlear implant for a period of 10 months at the time the study was conducted. Charlie attends school in which the primary mode of communication was spoken language but the teacher used signing simultaneously (Mueller & Hurting, 2009).

Participant 2 pseudo-name was “Ivan” he was 2 years 0 months by the time the study was conducted. He was identified at birth with mild-to-moderate hearing loss, and began wearing hearing aids in both ears by 3 months of age. Ivan’s mode of communication includes a
combination of speech and signs. Mother reported that Ivan produces more words when he learns to sign it first (Mueller & Hurting, 2009).

Participant 3 “Nancy” a 2 years 3 months girl who was diagnosed with moderate hearing loss at 14 months of age, due to her mother’s concern in her lack of speech. Nancy attended group speech-language services in a clinic twice a week. At the time the study was conducted, she had worn her hearing aids for a period of 6 months. Nancy mostly uses vocalizations and some signs to communicate (Mueller & Hurting, 2009).

Participant 4 “Wayne” was 4 years 8 months old, identified with moderate-to-severe hearing loss at birth. He was exposed to sign language at 3 months and began to use hearing aids in both ears by 4 months. Wayne was attending a preschool program at a school for CHL. His means of communications is mostly speech but uses sign language to communicate with people who sign (Mueller & Hurting, 2009).

Table 1 Children information

<table>
<thead>
<tr>
<th>Name</th>
<th>Age</th>
<th>Severity of hearing loss</th>
<th>Age at amplification</th>
<th>Mode of Communication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charlie</td>
<td>4:10</td>
<td>Profound bilateral hearing loss</td>
<td>4 years</td>
<td>Combination of speech and signs</td>
</tr>
<tr>
<td>Ivan</td>
<td>2:0</td>
<td>Mild to moderate, sloping to moderate sensorineural hearing loss</td>
<td>3 months</td>
<td>Combination of speech and signs</td>
</tr>
<tr>
<td>Nancy</td>
<td>2:3</td>
<td>Bilateral moderate hearing loss</td>
<td>1 year 9 months</td>
<td>Combination of speech and signs</td>
</tr>
<tr>
<td>Wayne</td>
<td>4:8</td>
<td>Bilateral moderate sloping to severe sensorineural hearing loss</td>
<td>4 months</td>
<td>Primarily speech with signs</td>
</tr>
</tbody>
</table>

Materials

The Iowa Signing E-books, was used by the participants. These electronic books were developed by the authors of the previous study in the Assistive Devices Laboratory at the University of Iowa. The prior research was based on the Shared Reading Project and
modifications were made in accordance with Alesssi and Trollip’s (2001) model. Each e-book consisted of an interactive multimedia screen presenting clickable images and questions. Half of the e-books (signing e-books) provided to the mothers contained videos of an individual narrating the story in sign language, labeling images, signing questions related to the story, and providing feedback. The other half of the e-books (non-signing e-books) did not include the videos of the signing narrator incorporated to the story, no interactive images or feedback.

Mothers were also given a parent training e-book with each child e-book provided, they had access to them at all times, regarding of the study phase. The purpose of the parent training e-books was to offer additional support for mothers to be familiar with the story and learn how to sign words prior to interacting with their children. These e-books were comprised of three parts: the first part consisted of the child’s e-book embedded in the parent training, to allow mothers to be familiar on how to sign that specific story. The second part provided SR enhancing techniques or tips derived from the DR. Such techniques included ways to make comments related to the story, asking questions beyond the text, describing pictures, etc. The third part of the parent training e-books included the Shared Reading Principles developed in Gallaudet University, with specific examples on how to apply them during the SR interaction. Participants were videotaped during SR time using the Iowa Signing books.

**Child Behavior Rating Scale**

As previously stated, Mahoney and Wheeden (1998) developed the Child Behavior Rating Scale. In order to capture accurate information, a request was made directly to Dr. Gerald Mahoney for the initial rating procedure and the global scale used in the original research when the CBRS was initially developed. Dr. Mahoney shared operational definitions assigned to each item in the CBRS, each description was adapted for the purposes of the present study.

Therefore, the rating scale used for the present study is a modification of the CBRS. Reports from the use of the original rating scale on evaluating videos of mother-child interactions during played based activities, claimed high reliability between the raters (Meisels et
Mahoney stated that the MBRS could be applied to different situations as long as the behaviors observed in the interaction are constant throughout all instances (Mahoney & Wheeden, 1986). Therefore as the CBRS was developed under similar conditions as the MBRS and the interactions of this study are consistent, Mahoney’s suggestions might also be true for the CBRS. Based on the reliable and valid results that have been obtained using this rating scale under different conditions and in different languages, it was considered that this rating scale will provide the information that this study attempts to report.

The two categories in which this rating scale separates children behaviors (e.g. attention and initiation) have been examined by other researchers. As a concrete example, behaviors rated by Mol and Neuman (2014) using a global 4-point Likert scale consisted of: Sustained Attention, Engagement, and Initiative. Behaviors that overlap with the ones measured by the CBRS. In addition, attention and perception were identified as essential behaviors contributing to the process of knowledge acquisition. The aforementioned because the stimuli presented can be altered by surrounding distractors in the environment thus, diminishing the child’s attention and affecting the effectiveness of the interaction (Alessi & Trollip, 2001). Based on the relevance of those behaviors to SR interactions and to the high reliability obtained by the developers in their studies, the CBRS was considered to be the adequate rating scale for this study. Consistent to the purpose of this study, each behavior was adapted to specific situations expected during a SR interaction.

Below find examples of the descriptions for each CBRS behavior as modified by the current author:

**Measures for attention.** Include persistence, attention to activity, involvement, and compliance. Attention targets the degree to which the child is focused in the shared reading interaction.
Persistence: The degree to which the child makes an effort to participate in the reading. In addition, persistence reflects the extent to which the child produces signs and vocalizations.

Attention to activity: Assesses the extent to which the child attends to the reading. The child may or may not be actively involved in the reading but must remain in the activity for an extended duration.

Involvement: This measure reflects the intensity to which the child is involved in the reading. Involvement can be demonstrated by the child being highly motivated to engage in the reading regardless of who initiated the interaction.

Compliance/cooperation: The degree to which the child attempts to cooperate with the requests or suggestions of the adult.

**Measures for initiation.** Include initiation activity, initiation adult, and affect. These items target the child’s initiatives during the interaction but also focus on the actual responses of the child to the mother.

Initiation activity: Measures the extent to which the child initiates an activity. A child who receives a high rating frequently attempts to initiate interaction during the shared reading session. (Examples of this item include: verbal initiation, turn to the next page, touches an item on the screen, and ask for help).

Initiation/ adult: This measures the child’s intent to initiate interactions with the adult. High rating in this item might show frequent and lengthy periods of eye-contact and other sharing behaviors such as vocalizations, taking turns, requesting, gestures, or facial expressions to involve the adult in the interaction.

Affect: Demonstrates positive affect and enjoyment whether it be directed toward the adult or the reading. The child may show affect by frequently smiling, laughing, demonstrate enthusiasm or vocalizing either to the adult or during the activity.

**Procedures**

Mother-child dyads were videotaped in a naturalistic interaction at home using the *Iowa Signing E-books*. The procedures of the study consisted of weekly SR sessions, mothers were
asked to interact as they normally do with their children. Over a 5 week period, each dyad was provided with the e-books described in the previous section. Thus, the authors provided each dyad with five new and different e-books every week. A total of 25 e-books were used throughout the entire study. For each dyad, presentation of e-books was counterbalanced as a method to control for possible confounding variables. Therefore, following the ABABA withdrawal design, Mueller and Hurtig gathered baseline information and performance during condition (A) which consisted of e-books without the support of the fluent signing narrator. Treatment phases were represented with a (B), and the e-books presented incorporated the signing narrator. A detailed description of the study design can be obtained directly from the author, Dr. Vannesa Mueller.

Data collection for the current study consisted on observation of the videotaped interactions of mother-child dyads using technology enhanced SR. The purpose was to observe a segment in the middle, that constituted half of the SR session and that contained the most representative performance of the interaction. The middle segment of the session was considered to be the climax of the interaction due to the difficulty observed on the videos of the mothers engaging children at the beginning of the interaction; therefore, it was hypothesized that the middle portion was more representative of the actual interaction.

Total time in seconds was obtained and divided into two to calculate the exact seconds that were required to be observed and rated, this was done with every video of a SR session of each dyad. For example, the session lasted 6 minutes, the rater would observe a segment on the middle of the video that lasts 3 minutes. The duration of the videos varied from session to session and from individual to individual therefore, the observed time was dependent on the length of that day’s SR interaction for each of the mother-child dyads. A value was assigned to each of the behaviors described on the CBRS in accordance to the child’s general performance exclusively to the observed fragment of the video.
**Inter-rater reliability**

The CBRS (revised by Gerald Mahoney, 1998) was made available from the author and developer, this with the purpose of following the same reliability procedure applied to the original rating scale. The studies that used the CBRS claimed high reliability between the raters following Dr. Mahoney’s procedure. As an example, Mahoney & Wheeden (1999) obtained 90-100% within one point interrater agreement following training. Therefore, following Dr. Mahoney’s guidelines, in the first segment of the training, the two raters reviewed a total of 11 videos together to become familiarized with the rating scales, attain a consistent rating, and establish reliability. In total, raters participated in 14 hours of training until attaining a within one point agreement of at least 90%. In the second phase of the training, once reached an acceptable percentage of within one point agreement, the raters observed videos independently and assigned a value from one to five to each of the seven child behaviors according to 5 point global Likert scale (e.g. 5 being very high and 1 being very low). If agreement was not high, the raters discussed their perspectives and the training process was repeated, after that a new block of videos was rated separately again. For the current study, this process continued to be followed for 8 videos until 91% within one point agreement was attained. After this, the author was ready to begin with the data analysis.
Chapter 4: Results

Cohen’s $d$ scores were calculated to analyze the effect size of the 7 behaviors observed in the signing and non-signing phases of the study for each of the participants. Mean and standard deviations were also calculated for children individually. Results are reported for each of the participants:

Table 2. Depicts Charlie’s Standard Deviations, Means, and Effect Sizes for each of the seven behaviors of the CBRS.

<table>
<thead>
<tr>
<th></th>
<th>1-Persistance</th>
<th>2-Attention to Activity</th>
<th>3-Involvement</th>
<th>4.Compliance/cooperation</th>
<th>5. Initiation Activity</th>
<th>6. Initiation Adult</th>
<th>7-Affect</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>B</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>5</td>
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<td>4</td>
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<tr>
<td></td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Mean</td>
<td>4.75</td>
<td>5</td>
<td>4.75</td>
<td>4</td>
<td>4.5</td>
<td>4.5</td>
<td>4.5</td>
</tr>
<tr>
<td>SD</td>
<td>0.5</td>
<td>0</td>
<td>0.5</td>
<td>1.414214</td>
<td>0.5</td>
<td>0.707107</td>
<td>0.707107</td>
</tr>
<tr>
<td>Cohen's d</td>
<td>0.7</td>
<td>0.7</td>
<td>0.4</td>
<td>1.22</td>
<td>0.29</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

(A)= Non-signing e-books  Large effect size=+.8
(B)= Signing e-books  Medium effect size=+.5  Small effect size=-.2

“Charlie”: Charlie’s ratings were mostly 5’s for all of the behaviors, which is the optimal or highest score in the scale. The following effect sizes were found for each of the behaviors: A large effect size ($d=1.22$) resulted for compliance/cooperation in favor of the presence of the fluent signing narrator. This was the only large effect size obtained for Charlie. Thus, Charlie cooperated more with his mother’s requests when the signing narrator was on the screen. A medium effect size ($d=.07$) was found on persistence and attention to the activity, one in favor of the signing phase and another in favor of the non-signing phase, respectively. In this case, Charlie attempted to participate in the activity more often when the narrator appeared. However, he was more focused on the interaction when the signing narrator was absent. Small effect sizes were observed for involvement ($d=0.4$) in favor of the withdrawal phase and initiation to adult ($d=0.29$) in favor of the treatment condition. Charlie was slightly more engaged in the books that did not include the videos of the signing narrator, but he attempted to interact more with his mother when the signing narrator was on the screen. No effect size was seen on initiation to activity or affect.
Table 3. Depicts Ivan’s Standard Deviations, Means, and Effect Sizes for each of the seven behaviors of the CBRS.

<table>
<thead>
<tr>
<th>IM</th>
<th>1-Persistence</th>
<th>2-Attention to Activity</th>
<th>3-Involvement</th>
<th>4.Compliance/cooperation</th>
<th>5. Initiation Activity</th>
<th>6. Initiation Adult</th>
<th>7-Affect</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>2</td>
<td>3</td>
<td>5</td>
<td>4</td>
<td>2</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>B</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>A</td>
<td>2</td>
<td>3</td>
<td>5</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>B</td>
<td>3</td>
<td>3</td>
<td>5</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>A</td>
<td>2</td>
<td>3</td>
<td>5</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>B</td>
<td>3</td>
<td>3</td>
<td>5</td>
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<td>4</td>
<td>3</td>
<td>1</td>
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<tr>
<td>Mean</td>
<td>2.6</td>
<td>3</td>
<td>4.8</td>
<td>3.75</td>
<td>2.8</td>
<td>3.5</td>
<td>3.6</td>
</tr>
<tr>
<td>SD</td>
<td>0.47723</td>
<td>0.447214</td>
<td>0.957427</td>
<td>0.447214</td>
<td>0.57735</td>
<td>0.547723</td>
<td>0.6</td>
</tr>
<tr>
<td>Coohen’s d</td>
<td>1.32</td>
<td>1.4</td>
<td>1.35</td>
<td>0.19</td>
<td>1.03</td>
<td>1.23</td>
<td>0.17</td>
</tr>
</tbody>
</table>

(A)= Non-signing e-books \hspace{1cm} Large effect size=+.8
(B)= Signing e-books \hspace{1cm} Medium effect size=+.5 \hspace{1cm} Small effect size= -.2

“Ivan”: Ivan, who was the youngest of the participants demonstrated the largest effect of all the four children in most of the behaviors. Larger treatment effect was found for the behaviors of persistence \((d=1.32)\); involvement \((d=1.35)\); initiation to activity \((d=1.03)\); and initiation to adult \((d=1.23)\) all in favor of the treatment phase. Therefore, Ivan participated more in the reading, was engaged, and initiated more interactions to the adult and the e-book when the signing narrator appeared on the screen. Attention to activity also demonstrated a large treatment effect \((d=1.4)\) but in the non-signing narrator phase. Meaning that Ivan stayed more in the activity when the signing narrator was not present. Finally, a small effect size was reported for cooperation \((d=.19)\) and affect \((d=.17)\) in favor of the signing narrator. This suggesting that Ivan was more compliant and demonstrated positive affect when the signing narrator was on the screen.
Table 4. Depicts Nancy’s Standard Deviations, Means, and Effect Sizes for each of the seven behaviors of the CBRS.

<table>
<thead>
<tr>
<th>NR</th>
<th>1-Persistance</th>
<th>2-Attention to Activity</th>
<th>3-Involvement</th>
<th>4.Compliance/cooperation</th>
<th>5. Initiation Activity</th>
<th>6. Initiation Adult</th>
<th>7-Affect</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>B</td>
<td>A</td>
<td>B</td>
<td>A</td>
<td>B</td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>5</td>
<td>1</td>
<td>5</td>
<td>1</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>MEAN</td>
<td>2.666667</td>
<td>2.5</td>
<td>3</td>
<td>2</td>
<td>2.666667</td>
<td>2</td>
<td>2.666667</td>
</tr>
<tr>
<td>SD</td>
<td>0.57735</td>
<td>2.12132</td>
<td>1.732051</td>
<td>1.414213562</td>
<td>2.081666</td>
<td>1.414214</td>
<td>1.154701</td>
</tr>
<tr>
<td>Cohen’s d</td>
<td>0.107</td>
<td>0.63</td>
<td>0.37</td>
<td>0.37</td>
<td>0.51</td>
<td>0.51</td>
<td>0.308</td>
</tr>
</tbody>
</table>

(A)= Non-signing e-books

(B)= Signing e-books

Large effect size=+.8
Medium effect size=+.5
Small effect size=-.2

“Nancy”: Nancy was the only child obtaining more treatment effects in favor of the non-signing phases of the study. In Nancy’s case, no large effects were found. The two medium effects were calculated for attention to activity ($d=.63$) and compliance ($d=.51$) in favor of the non-signing narrator phase. In other words, Nancy was more attentive and compliant when the signing narrator was not on the screen. Small treatment effects for persistence ($d=.10$), involvement ($d=.37$), and initiation to activity ($d=.30$) were also in favor of the withdrawal phase. Therefore Nancy attempted more communication interactions, was more involved and took initiative in the interaction more often in the phases the signing narrator was not present. Initiation to adult was the only behavior with a small effect size ($d=.33$) which favored the treatment phase. Nancy initiated more interactions with her mother when the signing narrator was present on the screen. No treatment effect was observed in the affect item.
Table 5. Depicts Wayne’s Standard Deviation, Means, and Effect Sizes for each of the seven behaviors of the CBRS.

<table>
<thead>
<tr>
<th>WS</th>
<th>1-Persistance</th>
<th>2-Attention to Activity</th>
<th>3-Involvement</th>
<th>4.Compliance/cooperation</th>
<th>5. Initiation Activity</th>
<th>6. Initiation Adult</th>
<th>7-Affect</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
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<td>4</td>
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<tr>
<td>B</td>
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<td>3</td>
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<td>B</td>
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<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>MEAN</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>SD</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Cohen's d</td>
<td>0</td>
<td>0.81</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.63</td>
<td>1.658</td>
</tr>
</tbody>
</table>

(A)= Non-signing e-books Large effect size=+.8
(B)= Signing e-books Medium effect size=+.5 Small effect size= -.2

“Wayne”: Wayne was very consistent in his behaviors throughout the phases, obtaining optimal scores of 5’s. No effect size was reported for persistence, involvement, compliance/cooperation, and initiation to the activity. On the other hand, initiation to the adult reported a medium treatment effect \((d=.33)\) in favor of the signing narrator. Wayne started more interactions with his mother when the signing narrator was present. Two other behaviors, (affect and attention to the activity) reported large \((d=1.65)\) and medium treatment effect \((d=.81)\), respectively, in favor of the non-signing narrator phase. Thus, Wayne demonstrated more affection and payed more attention when the signing narrator was not on the screen.

Overall, the behaviors of persistence and initiation to adult were the two most salient of all the 7 behaviors, which surprisingly demonstrated effects in favor of the fluent signing narrator. Other behaviors such as involvement and initiation to the activity were also positively influenced by the signing narrator, as large treatment effects were observed in favor of the treatment phase. Interestingly, attention to activity exhibited medium to large effect sizes in all of the children for the phases when the signing narrator was not on the screen. Although affect is an
important behavior during this type of interactions, it only demonstrated treatment effect in one of the children and it was in favor of the non-signing phases of the study.
Chapter 5: Discussion

Interesting results were derived from this preliminary analysis. Coinciding with other research conducted in CTH during SR interactions, behaviors such as initiation and attention seemed to separate from the other behaviors. The question posed at the beginning of this research study which was, “What is the effect of the fluent signing narrator on the child’s behavior during shared reading interactions?” will be discussed in the following section. The research question was developed based on the existent information about children’s active learning, motivation, and increased attention when using multimedia tools to support learning acquisition and to facilitate interactions with adults (Dirks & Wauters, 2015; Korat & Or, 2010).

The introduction of the fluent signing narrator was suspected to elicit more communication interactions from the child, provide an opportunity for the child to be attentive and encourage more initiations. This was true for some of the participants, who demonstrated large treatment effects when the fluent signing narrator was present. Table 6 presents the treatment effects of all four children in each of the behaviors. By looking at the table patterns can be identified. Such is the case of persistence, which demonstrated positive results in favor of the signing phase. Or attention to activity in which medium to large treatment effects were identified in favor of the non-signing condition for all 4 participants. Similar to the section in which results were presented, in this section we will also discuss and provide conclusions for each participant at a time. General conclusions, limitations and clinical implications will follow later in the text.
Table 6 Cohen’s $d$ Effect size for the Seven Behaviors on the Modified CBR

<table>
<thead>
<tr>
<th>Behavior</th>
<th>Persistence</th>
<th>Attention to activity</th>
<th>Involvement</th>
<th>Compliance/Cooperation</th>
<th>Initiation activity</th>
<th>Initiation adult</th>
<th>Affect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charlie</td>
<td>0.7*</td>
<td>0.7*</td>
<td>0.4</td>
<td>1.22**</td>
<td>0</td>
<td>0.29</td>
<td>0</td>
</tr>
<tr>
<td>Ivan</td>
<td>1.32**</td>
<td>1.4**</td>
<td>1.35**</td>
<td>0.19</td>
<td>1.03**</td>
<td>1.23**</td>
<td>0.17</td>
</tr>
<tr>
<td>Nancy</td>
<td>0.107</td>
<td>0.63*</td>
<td>0.37</td>
<td>0.51*</td>
<td>0.308</td>
<td>0.33</td>
<td>0</td>
</tr>
<tr>
<td>Wayne</td>
<td>0</td>
<td>0.81**</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>.63*</td>
<td>1.65**</td>
</tr>
</tbody>
</table>

Green = In favor of Signing phases  * = Medium treatment effect  Orange = In favor of Non-signing phases  ** = Large treatment effect

“Charlie”: In the case of Charlie, it is possible that the signing narrator encouraged Charlie to continuously try communication interactions, as he was rated high on persistence during the signing phases. Charlie was also more cooperative when the signing narrator was present, therefore suggesting that it promoted Charlie’s participation and compliance to his mother’s requests. These behaviors have been observed in other parent-child interactions, and found to be critical in order to maintain the quality of SR (Berguin, 2001). Child participation is important as it will elicit more conversations, if the child is cooperating with his mother, this can suggest both individuals are taking an active part during the interaction (Dircks & Wauters, 2015). Contrary to the previous results, Charlie demonstrated to be more attentive when the signing narrator was not present. Interestingly, Charlie was one of the two participants who acquired more vocabulary during the non-signing phases. This can signify that Charlie’s mother successfully obtained his attention and promoted more learning without the support of the signing narrator.

One factor that can be influential to the results, is the mother’s profession. She was a special education teacher (SPED), and obtaining children’s attention is an important skill that SPED teachers must have. Another factor that can explain this result is the mother’s attitude.
She reported having a positive attitude towards signing and even mentioned enjoying the signing e-books as she learned new ways of signing. Therefore, her supportive attitude towards signing was reflected on Charlie’s behaviors and high sign vocabulary acquisition.

This is not the first time a phenomenon like this has been observed, Berguin (2001), reported that maternal facilitative beliefs and positive attitudes toward reading are of great influence for positive outcomes. Charlie was also one of the participants receiving high ratings (4’s and 5’s) in most of the behaviors, despite the study phase. Congruently, his mother reported that “he enjoyed reading all the books the first 5-7 times, then he lost interest”. This connection, demonstrates that parents are sensitive to their children’s behaviors and can monitor their wants and needs to provide a positive experience for them.

“Ivan”: Ivan was the only child showing a clear pattern of treatment effect in favor of the signing e-books. The signing narrator influenced and provided support in most of Ivan’s behaviors (persistence, involvement, and initiation to activity and adult). Existent research on quality of SR interactions has identified those behaviors as essential for high quality interactions (Berguin, 2001; Korat & Or, 2010; Mol & Neuman, 2001; Salmon, 2014). The use of technology has demonstrated to increase engagement and involve children on the interaction (Dircks & Wauters, 2015). A critical behavior that appears repeatedly in the literature is initiation.

Using technology enhanced SR in CTH has demonstrated to increase the likelihood of the child taking the lead, involve the parent through initiations, making comments, pointing, vocalizing, etc (Berguin, 2001; Dircks & Wauters, 2015; Korat & Or, 2010; Salmon, 2014) Thus, the presence of the signing narrator stimulated dynamic interactions between the child and the mother while reading the book. On the other hand, Ivan similar to the other participants, was
more attentive during the non-signing e-books. Ivan was the youngest of the participants. A child’s age has been shown to play a role in the influence of technology enhanced SR, together with story format and previous SR experiences (Salmon, 2014). It is not clear how age could have played a role in this specific case. However, since he was mostly non-verbal and based on his age, some of the behaviors that were included on the operational definition of each item in the CBRS were not present yet on a child as young as Ivan (e.g. asking questions and being very involved). Thus, although not many verbal initiations were expected from Ivan due to his age, it was surprising that he was the only participant demonstrating significant differences mostly in favor of the signing e-books. This is definitely a result that should be highlighted, e-books improve and enhance SR experiences of children as young as 2 years of age.

Fascinatingly, the factor of mother’s attitude was also reflected in this dyad. Although most of the conditions favored signing exposure, he was the participant who acquired less vocabulary words throughout all phases. Mueller and Hurtig (2009) reported Ivan’s mother’s comment about not enjoying the use of sign language and difficulty accepting Ivan’s hearing loss. In this case, maternal beliefs and attitudes played a bigger role than the high quality interaction elicited by the signing narrator. This demonstrated that even with all the benefits technology offers, adult support improves learning acquisition (Salmon, 2014).

“Nancy”: The opposite situation was observed for Nancy, her results demonstrated a consistent pattern in favor of the non-signing e-books. None of the initiation behaviors demonstrated a treatment effect, suggesting that she was not taking the lead during the interaction. Results revealed that Nancy was more focused on the interaction and this increased her compliance with her mother’s comments and suggestions when the signing narrator was not present. Despite of this, Nancy was observed to be easily distracted throughout the interactions.
However, it is important to note that many distracting agents were taking place at home during SR sessions (e.g. dog running around, loud music playing, and telephone ringing). Although resulting in treatment effect in favor of the non-signing e-books, Nancy obtained the lowest treatment effect scores of all the participants on attention. Nancy’s mother was also able to notice this situation, as she reported having difficulty to get Nancy to focus during the interaction.

Researchers have suggested, that children who are not securely attach to their parents tend to be less interactive during parent-child interactions, and demonstrate more disruptive behaviors during the interactions (Berguin, 2001; Bus, et al., 1994). Nancy was the only participant who refused to read in some of the instances, this was evidenced by her crying and pushing the e-book away. This situation demonstrates the importance of individual variations in this types of interactions, as parent-child relationships prior to the study must influence the results. While Nancy only obtained treatment effects for two behaviors, possibly signaling that the interaction was not optimal, her mother’s attitude towards signing improved Nancy’s learning. Nancy was one of the two participants who acquired the highest amount of signs throughout the study (Mueller & Hurtig, 2009). Mother stated being motivated and enthusiastic in learning sign; she was enrolled in an ASL class, and looked forward to Nancy learning more signs, therefore improving learning acquisition. This is another example that children’s development is highly influenced by their mother’s support and motivation (Berguin, 2001).

“Wayne”: Wayne results also favored the non-signing phases of the study. His behaviors did not vary from phase to phase, this is evident if we observe table 6. We can see that no treatment effects were obtained for behaviors such as persistence, involvement, compliance and initiation to activity. We can also refer to table 5, in which optimal ratings (5’s) are observed throughout all phases. This results also coincided with the comment WS made to Mueller and
Hurtig, in which he stated enjoying all the books the same despite of the presence or absence of the signing narrator.

Wayne initiated more communication interactions with his mother when the fluent signing narrator was on the screen, which has also been reported in other participants and by other researchers (Berguin, 2001; Dircks and Wauters, 2015). This suggests that the presence of the fluent signing narrator could have provided the child with more background information and encouraged him to share novelties or ask his mother to expand on acquired information. As previously mentioned, there is evidence demonstrating that e-books allow children to be more involved, active participators, and encourage them to initiate more communication interactions with the adult (Korat & Or, 2010).

Wayne was observed to ask more questions, made comments and attempted to share novel experiences with his mother, thus, the CBRS was reliable in demonstrating this through the reports of the treatment effects on initiation. This was also true by Wayne continuously attempting to initiate interactions with the observer who was recording the interactions.

Although the child was taking the lead in communicating with the observer, those initiatives were not considered for the analysis, as the purpose was to only rate mother-child interactions between each other. An interesting fact, was that Wayne was the only child showing large treatment effect in favor of the non-signing e-books for affect. Affective quality of SR interactions might improve the chances of children to gain more knowledge, provoke enthusiasm, and increases the frequency of SR experiences (Berguin, 2001; Dircks & Wauters, 2015; Korat & Or, 2010). At the same time, as the child demonstrates more enthusiasm and affection, this motivates their parents to improve their own behaviors. As Dircks & Wauters (2015) stated, children are the best motivators for their parents, this taking into account that the
behavior of both individuals affect each other. In addition, we certainly cannot omit Wayne’s mother fluency in ASL and occupation, as she was a Speech Language Pathologist. Therefore, her professional training and experience provided her with the skills to maintain optimal interactions with no need of a supportive tool as the signing narrator. Once more maternal reports and results were linked, mother reported feeling as a “passive observer” when reading signing e-books.

Overall, most of the behaviors persistence, involvement, compliance, initiation to both activity and adult were positively influenced by the presence of the signing narrator. Persistence and initiation were the behaviors exhibiting higher treatment effects in favor of the fluent signing narrator. Literature has highlighted the importance of those two behaviors, as the child’s continuous attempts to take control during the interaction plays an essential role in learning but also in engaging their parents in the interaction (Berguin, 2001; Dircks & Wauters, 2015). Moreover, the fact that child’s initiation to both activity and adult was positively influenced by the signing narrator shows benefits on the use of technology, as according to Dircks & Wauters (2015), this is an essential behavior required in order to promote learning and improve SR experiences. Thus, as following the child’s lead is imperative and the child demonstrated benefits in favor of the signing phases, the use of technology enhanced SR is supported.

We cannot ignore the clear pattern observed on attention to activity during the non-signing phases. These results suggest that children were more engaged in the activity when parents were the ones signing and not the narrator embedded in the book. Although this specific result does not support our hypothesis, it is an important finding as it provides information about the significance of parents taking active part in the interaction to increase their children’s attention to the activity. However, this contradicts evidence that states multimedia features
embedded in technology should captivate and increase the child’s attention (Dirks & Wauters, 2015; Salmon, 2014). The fact that children payed more attention during the non-signing phase can also suggest that parents applied their knowledge from the parent training and DR to attract and maintain the child’s attention. Dirks & Wauters (2015) stated that implementation of signs has been widely used as a strategy to capture the attention of CHL and with other disorders.

Existent research has also shown that maternal behaviors play an important role in how the child reacts. Bergin (2001) suggested that, as mothers are less directive they reduce their children distractions, in other words increase their attention. This can also be the case of the children in this study, thus displaying the importance of observing at the behaviors of both individuals. As we know maternal attitudes and support is imperative for a successful interaction (Dircks and Wauters 2015). If children are more attentive when the signing narrator is not present, and the mothers are not supportive on sign language, this will eventually reflect the negative attitude in limiting their child’s development.

We should encourage parents to be aware of their children behaviors, follow their lead and attempt to modify them through modification of their own behavior. Taking into account the child’s interests and attitudes towards the tasks is an important contributor in SR interactions (Crowe et al., 2014). This can be possibly done perhaps by incorporating strategies to identify, monitor and modify child and self-behaviors through the parent training portion of the Iowa signing e-book.

The aforementioned lead us to the important information that can be derived from this study and how it can be applied in clinical practice. This preliminary study proposes the use of technology to improve the quality of SR interactions in CHL and their PTH. Dircks & Wauters (2015) stated “Nothing is known about the quality of storybook reading experiences with e-books
between CHL and their THP” (p. 434). Therefore, this research study intended to contribute to the existent body of literature about young CHL, as we know SR plays a greater role in early literacy development. The positive findings of this study towards the use of technology enhanced SR to increase the quality of interactions highlights the importance of developing further research in this topic and provide resources to PTH that have difficulty having meaningful interactions with their CHL.

**Limitations**

There are several factors that could have played a role during this interactions and that can be improved for future research. The first factors are confounding variables such as noises, other people in the room while the interaction was taking place, pets, phone ringing, younger siblings, etc. All of those situations were observed in the videos, and are thought to be important factors that could influence the performance of the children in this study. The second factor entails intrinsic variables of each participant, including attitudes, age, emotions, and parent-child relationships. Since all of those elements cannot be controlled for, they should be taken into account. Individual variations have been found to be important when deciding what is beneficial for each person as what works for one, might not be helpful for another. Another limitation found was the presence of the researcher in the room as the dyad recording the interaction. This might have altered the dyad’s performance during a “typical interaction”, as they were aware of the recording and thus the Hawthorn effect could have taken place. Finally, e-book specific features are also important factors that can impact reading experiences using technology (Takacs, Swart, & Bus, 2015). These were factors outside the scope of this study that definitely can be measured for future investigations.
Suggestions for Future Research

Similar to the findings of Bergin (2001) and Dexter and Stacks (2014) who conducted studies on the quality of SR interactions of parents and children with typical hearing, this preliminary research highlights the importance of SR. It provides a perspective on the value of quality which perhaps may be as important as frequency. We urge future investigators to analyze any relationship between both quality and frequency of SR on the early literacy skills of CHL, which is the ultimate goal. Bergin (2001) stated that quality of the interaction can alter the effect of frequency of SR, therefore it is of great significance to consider both.

Given that previous studies tend to focus on the role of maternal behaviors, this study draws attention to the value of child’s preferences and behaviors, as one can influence the other and vice versa. This has already been explained in other studies, in which children attitudes were taken into account.

Conclusions on the Use of Technology Enhanced SR

One of the relevant discussions in this study is whether or not the use of technology improves the quality of SH interactions. Although a definitive answer was not obtained, our results indicate that having the signing narrator on the e-book yielded to positive significant effects on children behaviors, which according to Korat and Or (2010) are essential factors when evaluating adult and child interactions.

It should also be noted that individual variations may have an impact on how effective these tools are including age, interest, previous knowledge, and interestingly their mother’s attitude (Salmon, 2014). We found a strong correlation between mother’s attitude and their children’s behaviors and vocabulary acquisition. As already mentioned, the Iowa e-book was successful in encouraging communication interactions and empowering children to interact more. This is a positive result, as there is evidence stating that active interactions where both mother and child participate result in increased language growth (Korat & Or, 2010). Although language growth and behaviors were not compared in this current study, it would be interesting to investigate those variables together.
Educating PTH is imperative in situations like this as they require additional support in order to have more comfortable and pleasant interactions with their CHL, and therefore foster the required language skills that early literacy activities provide. Parent’s patience and responsiveness has shown to enhance children’s feelings of being important part of the reading process and promotes their language development, therefore eliciting more initiations and engagement (Dircks & Wauters, 2015). This can possibly be done by incorporating strategies to identify, monitor and modify child and self-behaviors through the parent training portion of the Iowa signing e-book.

In conclusion, this preliminary study supports the use of technology enhanced SR to improve the quality of the interaction in CHL and their PTH. The data reported in the current study should be used to reduce the existent gap between the reading achievement of CHL and their same age CTH, by improving their early SR experiences. We can provide parents with resources to help in their journey to eliminate the literacy deficits in this population and implement technology as an alternative tool to support PTH overcome the challenges they encounter when interacting with their CHL.
References


Curriculum Vita

Gabriela Itzel Rodriguez graduated from Coronado High School in the spring of 2010. Continued higher education in El Paso Community College and entered The University of Texas at El Paso in the fall of 2012 as an undergraduate student with the vision of applying to the Graduate School. Throughout her undergraduate years she was on the Dean’s list from fall 2012 to spring 2014. As undergraduate student she volunteered at The Center for Therapeutic Services, and assisted in two research studies: (1)The Effects of Sign on Speech Segmentation in Infants and (2) Parental Perception of a Baby Sign Workshop on Stress and Parent-Child Interaction. In the fall of 2014 she was accepted in the Graduate School at the University of Texas at El Paso pursuing a Master’s of Science in Speech-Language Pathology with a Bilingual certificate. In her first and second year as graduate student, she was awarded with the Preparing Bilingually Certified Speech Language Pathologists (PBC) grant from the Department of Education. Together with another graduate student, they conducted a research study on the Effect of a Fluent Signing Narrator on Quality of E-book Shared Reading Interactions between Mothers with Typical Hearing and Children with Hearing Loss. She presented the research study at the Texas Speech-Language and Hearing Association annual convention in Fort Worth, Texas.

Contact Information: girodriguez2@miners.utep.edu

This thesis was typed by Gabriela Itzel Rodriguez