August 2017

The Feasibility of Assessing Parent and Child Letter Knowledge in At-Rrisk Families Within a Museum Enrichment Setting

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by

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A Thesis Submitted in

Partial Fulfillment of the

Requirements for the Degree of

Master of Science

in Communication Sciences and Disorders

at

The University of Wisconsin-Milwaukee

August 2017

ABSTRACT

THE FEASIBILITY OF ASSESSING PARENT AND CHILD LETTER KNOWLEDGE IN AT-RISK FAMILIES WITHIN A MUSEUM ENRICHMENT SETTING

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The University of Wisconsin-Milwaukee, 2017
Under the Supervision of Professor John Heilmann

Purpose. This study addressed alphabet knowledge with children/parents who may be at-risk using a museum environment. The purpose of this study was to investigate whether the parent- and child-level assessments developed were appropriate to measure letter knowledge and children's home literacy environment (HLE) from at-risk families and implement a museum enrichment program for the children/parents within a museum experience.

Methods. Fourteen parent-child dyads from the Family Focus program of the Betty Brinn's Children's museum (BBCM) participated in this study. Each participating child was between 2;6 and 4;0 years of age. The participating parent-child dyads were randomly assigned to either the treatment or control. Both the treatment and control families completed a total of four visits to the museum. The treatment group parents were asked to implement a letter learning experience with their child in a natural way while exploring the museum. Whereas the control group parents were instructed to interact with their child at the museum as they normally would. Data was collected during the family's first (baseline data) and fourth (post-treatment) museum visits. Two parent-level tests (which included background information questionnaire and parent interview questionnaire) and three child-level tests (which included the Upper-Case Alphabet Recognition subtest of the Phonological Awareness Literacy Screening for Preschool (PALS-PreK) test), an informal letter-recognition and letter-sound relationship task) were administered during the

family's first and fourth museum visits. Families were periodically called and emailed to follow up on their visits and experience at the museum.

Results. This study followed a descriptive and experimental design. The descriptive design described the overall performance of the participants in parent-level and child-level tasks and to determine if the measures used for the study was developmentally appropriate for families who are at risk. The experimental design analyzed the presence or absence of significant differences between the treatment and control group families at the baseline and to compare the change in performances across the two groups over time with treatment.

Conclusion. Based on the overall statistical analysis of the baseline data, the parent-level measures developed for the study were found to be appropriate for examining parent's use of strategies and the child's HLE among the at-risk families. Similarly, the baseline child level-measures were found to be appropriate for examining the letter knowledge skills of children from at-risk families. Additionally, the comparison between the baseline and post-treatment, parent- and child-level scores revealed no significant change in the scores of the control group families over time, with the implementation of the enrichment program.

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ACKNOWLEDGEMENTS

First and foremost, I would like to thank God Almighty for giving me the strength, knowledge, and opportunity to undertake this research study and to complete it satisfactorily. My sincerest gratitude goes to my professor and thesis advisor, Dr. John Heilmann, for giving me the chance to be a part of this research, and for his guidance, patience, and encouragement throughout my graduate studies. I thank him for all his time and instruction during this project. I learned more than I ever thought I could about emergent literacy, reading and writing development, and language development because of his positive attitude and support. My thanks also go to the members of my thesis committee, Dr. Paula Rhyner, Dr. Christopher Lawson, and Dr. Moyle Maura for their valuable input, advice, and support throughout the study.

My deepest appreciation goes to BBCM's staff for their time and assistance throughout the study. I also sincerely thank and appreciate all the Family Focus parents and children who participated in this study. Their willingness and timely contribution have helped to make this study possible. I gratefully acknowledge the cooperation and contributions of my research team members especially Ala and Octavia for their absolute dedication and support throughout the study. I am most grateful to my friends and the UWM Communications Sciences and Disorders Graduate Class of 2017 especially Tianz, Kate, and Rachel for always encouraging me and helping me with my editions.

Most of all, I would not have been able to complete my thesis without the love and support of my family. I thank my parents and siblings (Samu and Jeena) for their unconditional trust, prayerful encouragement, and endless patience. It was their love that raised me up again when I got weary. I also thank my fiancé, Steive and his family for always encouraging me to be my best and supporting me in the most positive way.

Introduction

Emergent Literacy

The term "emergent literacy" was first used by Marie Clay in 1966, to describe young children's understanding of reading and writing skills that develop before they are taught to read and write (Rhyner, Haebig, & West, 2009; Whitehurst & Lonigan, 1998). Emergent literacy develops early in a child's life before the child begins school or formal instruction (Whitehurst & Lonigan, 1998). Emergent literacy then becomes a developmental continuum for later literacy and oral language skills (Rhyner et al., 2009). Moreover, children's oral language development, which includes the areas of semantics, syntax, phonology, and pragmatics, is crucial for emergent literacy development (Rhyner et al., 2009).

Generally, children acquire emergent literacy skills incidentally and gradually within the preschool period (Justice & Ezell, 2001). Previously, learning to read was not thought to start until children were provided with formal instruction in school. However, the literature on emergent literacy has now made it clear that learning to read begins before preschool and children arrive at school having acquired early literacy skills. Children's emergent literacy abilities form the foundation for their entry into conventional formal literacy instruction. Preschoolers who are delayed in attaining the requisite emergent literacy skills will exhibit difficulties in meeting the demands of formal literacy instruction (Justice & Ezell, 2001). Therefore, preschool years are crucial for the development of emergent literacy skills that can enable children to transition smoothly to formal reading. Extensive research has been conducted to define emergent literacy, how literacy skills develop, and the potential causal mechanisms of emergent literacy (see Rhyner et al., 2009, for a summary). While some scholars have taken the approach of providing a detailed description of which skills develop throughout the emergent

literacy stage (e.g., Goodman, 1986; McCormick & Mason, 1986; Strommen & Mates, 1997; van Kleeck, 1998), others have focused on identifying the various subcomponents of emergent literacy (e.g., Storch & Whitehurst, 2002; van Kleeck, 2003). A third line of research has focused more on the child and environmental influences on emergent literacy (e.g., McNaughton, 1995; Wasik & Hendrickson, 2004). While numerous studies have not established a single set of emergent literacy knowledge, there are some commonalities related to children's later reading and writing skills (Rhyner et al., 2009; Whitehurst & Lonigan, 1998). These common skills include awareness of print and its function, phonological awareness, and letter knowledge. Each of these skills are discussed in detail below.

Awareness of print and its function. One of the key elements of emergent literacy development is print awareness and the knowledge of its function (Justice & Ezell, 2001). Given that print is ever-present in their environment, children are constantly exposed to forms of print from an early age. Therefore, the likelihood of young children learning about print is high (Hiebert, 1981). Some examples of print forms that children see in their day-to-day environment include billboards, street signs, store signs, television commercials, television programs, restaurant logos, and illustrations in books. Print awareness refers to a child's ability to learn and perceive these print forms and determine their functions from the environment and media. As children are exposed to more written forms of discourse such as books, magazines, and newspapers, they are more readily able to determine the function of a piece of print (Justice & Ezell, 2001; Goodman, 1986; Heibert, 1981). Print function refers to children's understanding that print has a function and that meaningful words can be represented in printed form (McCormick & Mason, 1986). Comprehension of print meanings usually begins at infancy and

continues to develop between three to five years of age as children recognize that printed text or written language has a purpose and conveys meaning (Justice & Ezell, 2001; van Kleeck, 1998).

Development of print awareness. Children begin to develop print awareness at a very young age as they carry out literacy-based interaction with adults. Snow, Burns, and Griffin (1998) found that children as young as eight months of age could begin to handle books, turn pages, and even babble in a "reading-like" manner with active participation with adults using age appropriate print-focused interactions. An earlier study by Heibert (1981) also suggested that the development of print awareness begins very early in life. Heibert (1981) aimed to examine the different patterns and inter-relationships in the development of print awareness in 60 preschool children aged three to five. In this study, Heibert (1981) showed that preschool children as young as three years old demonstrated some proficiency in the auditory discrimination tasks of print awareness, as well as some understanding of the processes and purposes of using print. Furthermore, there was a significant increase in the knowledge from the beginning until the end of the preschool period. Based on studies by Heibert (1981) and others, the early preschool period is an active time for print-related learning.

Gilliam and Johnston (1985) studied the development of print awareness and related oral language skills in both children with language impairments and typically developing preschoolers. Two groups with ten chronologically, age-matched participants per group were presented with an environmental print awareness task and an oral labeling task. They found that preschoolers with language impairment performed more poorly on the print awareness tasks than typically developing preschoolers. Furthermore, typically developing children were able to respond meaningfully to the print settings with reduced non-print cues while children with language impairment could not. The authors concluded that children with language impairments

fall behind their typically developing peers in the development of literacy even before starting formal written language instruction.

***Print awareness and reading*.** According to Scarborough, Neuman, and Dickinson (2009), print awareness helps the child to become familiar with the mechanics and purposes of book reading. In order to become a skilled reader, children need to recognize that information can be accurately and efficiently extracted from printed text (Scarborough et al., 2009). The development of print awareness illustrates that printed text can be matched to the stored information about spoken words in a mental lexicon (Scarborough et al., 2009).

Phonological awareness. Another emergent literacy skill crucial for children's later reading and writing development is phonological awareness. The study of the underlying sound structure of a language is referred to as phonology (van Kleeck, 2006). Phonological awareness is a specific phonological skill that enables children to recognize individual letter sounds that comprise spoken words (McGee & Richgels, 2003; Rhyner et al., 2009). Phonological awareness enables young children to identify and manipulate the sounds of a language (Justice & Ezell, 2001). As children develop, they learn that each letter of the alphabet corresponds to a particular sound or phoneme which is referred to as grapheme-phoneme correspondence (McGee & Richgels, 2003). Phonological awareness skills are distinguished by the sound unit in various tasks. These tasks are designed to further develop phonological awareness in children (Anthony & Francis, 2005; Stahl & Murray, 1994). Examples of phonological awareness tasks include rhymes (e.g. does bat rhyme with cat?), phoneme-to-word matching (e.g. does bat begin with /b/?), segmenting single phonemes from words (e.g. what is the first sound in bat?), blending phonemes to form words (e.g. what does /b-æ-t/ say?), removing phonemes (e.g. say bat without /b/), and other complex phoneme manipulations.

Development of phonological awareness. As children develop, they gain more experience with language and learn to associate sounds with meanings (Hester & Hodson, 2004). Phonological awareness is considered as one of the strongest predictors of a child's later reading skill and is said to advance in an ordered manner (Lerner & Lonigan, 2016; Næss, 2016; Pullen & Justice, 2003). Hester and Hodson (2004) suggested that the development of phonological awareness does not occur in a simple, quick, or unilateral manner. Younger children tend to show more global phonological perceptual abilities than older children. For example, very young infants can better detect the subtle differences between two phonemes such as a dental and retroflex variations in alveolar stops and aspiration variations than the older infants (Hester & Hodson, 2004). However, as children are more exposed to their primary language, they begin to draw the phonemic boundaries of that language and lose the ability to identify the subtle differences between phonemes in other languages (Hester & Hodson, 2004).

In terms of progression, phonological awareness in a typically developing child appears to move from larger units such as phrases and words to smaller units such as syllables and finally to phonemes (Hester & Hodson, 2004). Initially, children exhibit a rudimentary awareness of sounds within words. Children demonstrate this awareness as they learn to detect and manipulate larger sound units (e.g. syllables, onsets, and rhymes). As they develop, children then learn to detect and manipulate smaller units of sounds (e.g. phonemes), which contributes to the sophisticated awareness of sounds (Lerner & Lonigan, 2016). A major source of difficulty seen for children with reading impairment is the ability to acquire accurate and fluent word reading skills. A lack of phonological awareness skill in children hinders this ability (Pullen & Justice, 2003).

Components of phonological awareness. The components of phonological awareness include syllables, rhymes, and phonemes. These phonological awareness skills are considered to be separate processes that have distinct effects on children's reading achievement (Mann & Foy, 2003).

Syllables. Syllabification is the process used by preschoolers to analyze a word. Children learn to divide words into sounds or phonemes after they are exposed to the writing experience (Bauman-Waengler, 2016). A syllable structure is made up of three main components: peak, onset, and coda. According to Bauman-Waengler (2016), 'peak' is known to be the most acoustically intense part of the syllable, 'onset' comprises the phoneme segments prior to the peak (also known as syllable releasing sounds), and 'coda' includes the phoneme segments that comes after the peak (also known as syllable arresting sounds). Since vowels tend to be more acoustically intense than consonants, they are more prevalent as syllabic peaks than consonants. However, when consonants are included as peaks, they are referred to as 'syllabics.' For onset and coda, the number of phonemic segments to be included depends on the rules of the language. In Standard American English, syllables can contain one to three phonemic segments (tell, smell, straw) in an onset and one to four phonemic segments (as in bit, bits, fifth, sixths) in a coda (Bauman-Waengler, 2016). For example, in the word "deep," the vowel /i/, which is the most intense section of the syllable is the peak, /d/ is the onset as it appears before the peak and /p/ is the coda as it comes after the peak.

Rhymes. Regarding syllable structure, the peak and coda together are referred to as the 'rhyme' (Bauman-Waengler, 2016). For example, in the word "ten," /t/ is the onset and /ɛn/ is the rhyme. The words /tɛn/, /dɛn/, and /pɛn/ have the same rhyme /ɛn/. Therefore, these words are considered as rhyming words. According to Maclean, Bryant, and Bradley (1987), children

tend to show an interest in rhymes and make up their own even from a younger age. For example, singing nursery rhymes and playing rhyming games are typically seen in 3 to 4-year-olds. The recognition and production of rhymes are definite examples of phonological skills (Maclean et al., 1987).

Phonemes. A phoneme is the smallest linguistic unit which when combined with other such units can differentiate and identify word meanings (Bauman-Waengler, 2016). For example, "cat" has three phonemes /k/, /æ/, and /t/ as seen in Standard American English. These phonemes when combined, form the word "cat" and is meaningful. However, if another phoneme such as /b/ is used instead of /k/ in the previous combination, changes to the word to /bæt/ which differs from /kæt/ in meaning and one phoneme: /k/ versus /b/.

Phonological awareness and reading. Earlier correlational studies have shown a strong predictive relationship between phonological awareness and reading success. For example, in her study, Juel (1988) found that first graders who had difficulty with phonological awareness tasks such as blending phonemes to make words, segmenting words into phonemes, and manipulating initial and final phonemes, were poor readers even by the end of fourth grade and remained in the bottom quartile of their class for reading. A study by Maclean et al. (1987) suggested that children's familiarity with nursery rhymes at three years of age strongly predicted their later phonological development and early reading skills. In their study, Mann and Foy (2003) documented that rhyme awareness was more closely associated with natural language skills whereas phoneme awareness was associated more closely with exposure to literacy. Preliterate measures of phonological awareness (such as phoneme segmentation) and picture and color naming had high predictive validity on reading acquisition than many other common correlates of school achievement, including IQ scores, age, and measures of socioeconomic status (Share,

Jorm, Maclean, & Matthews, 1984). All of these studies demonstrate that the general relationship between phonological awareness and early reading are well established.

Letter knowledge. Letter knowledge refers to children's ability to identify individual letters and sequence of letters (Rhyner et al., 2009). Although phonological awareness is critical for skilled decoding abilities in children, it is not sufficient for learning to read words. In addition to phonological awareness, children also require an understanding of letter knowledge and letter sequencing for recognizing words and decoding them (Pullen & Justice, 2003).

Development of letter knowledge. Letter-name knowledge is the ability to recognize that each letter is called by a specific name (Bradley & Jones, 2007). Letter-sound knowledge refers to the ability to recognize that each letter is represented by a specific sound (Bradley & Jones, 2007). Together, letter-name and letter-sound knowledge help children to develop phonological awareness through grapheme-phoneme correspondence (Bradley & Jones, 2007). Lonigan, Burgess, and Anthony (2000) claimed that knowing the letter names and the sounds that they represent are among the strongest single predictors of learning to read on entry into school. Additionally, earlier measures of phonological sensitivity (sensitivity to manipulate the structure of sounds in a language) and oral language composites predict letter knowledge in children. Lerner and Lonigan (2016) examined the relationship between phonological awareness and letter knowledge in preschool children. According to these authors, as children develop their phonological awareness skills (such a syllable-, rhyme-, and phoneme awareness), they learn to associate the letter name with its corresponding sound. Lerner and Lonigan (2016) concluded that there was a bidirectional relationship in which initial letter knowledge predicted faster growth in phonological awareness, and initial phonological awareness predicted faster growth in letter knowledge. These bidirectional relationships were detected for both phoneme-level items

and larger units of sound demonstrating growth in two skills, phonological awareness, and letter knowledge. Thus, phonological awareness has an effect on the acquisition of letter knowledge (Lerner & Lonigan, 2016).

Letter knowledge and reading. The progress of a child's reading skill is influenced by his/her letter-sound knowledge. Children tend to show greater progress in their reading ability once they acquire all the letter sounds (Blaiklock, 2004). Earlier research has proven letter knowledge to be a strong predictor of later reading and spelling ability in kindergarten (Catts, Fey, Zhang, & Tomblin, 2001; Caravolas, Hulme, & Snowling, 2001; Foulin, 2005; Lonigan et al., 2000; Muter, Hulme, Snowling, & Taylor, 1997). Rhyner et al. (2009) suggested that children experiment with letter-sound understanding through increased exposure to reading and inventing spellings. Early stages of reading involve decoding alphabets into their corresponding sounds and then combining these sounds to form words (Whitehurst & Lonigan, 1998). For example, a child learning to read the word "cat," will initially sound it out as /k/, /æ/ and /t/. Eventually, the child will be encouraged to blend the isolated sounds together to say the word "cat" (Whitehurst & Lonigan, 1998).

Of all emergent literacy skills, letter-sound knowledge appears to play a crucial and unique role in children's reading development. Blaiklock (2004) carried out a longitudinal, correlational study to analyze the positive association between phonological awareness and reading skills for a group of children during their first two years of school. The analysis was done by controlling extraneous variables such as ability, phonological memory, pre-existing reading skills and letter knowledge. Concurrent and predictive correlations between phonological awareness scores and later reading were significant and remained so after adjusting for verbal

ability or phonological memory. However, controlling for letter knowledge reduced most correlations to nonsignificant levels and demonstrated its importance in reading acquisition.

Leppanen, Aunola, Niemi, and Nurmi (2008) examined the predictors for reading skills among 156 school-aged children. This longitudinal study inspected to what extent phonological awareness, letter knowledge, and listening comprehension at the beginning of kindergarten would predict children's reading fluency and reading comprehension at the end of grade 4. The authors measured the reading skills of these students at the beginning of kindergarten, in first grade, and in fourth grade. Their primary conclusion was that children's letter knowledge at the beginning of kindergarten was the most powerful predictor of their reading skills at the end of grade 4.

Role of the Environment in Facilitating Emergent Literacy

One of the earliest literacy-related experiences that young children have before beginning their formal instruction is at home. HLE provides a foundation for the development of their reading and writing skills (Robins, Ghosh, Rosales, & Treiman, 2014). During the first three years of life, children are most influenced by their interactions with adults and peers. Therefore, many factors including parenting style and family literacy activities within this period strongly impact a young child’s literacy skills (Weigel, Martin, & Bennett, 2006).

General Parent Literacy Enrichment Strategies. The majority of research on HLE has addressed questions about shared book reading. Book reading is a significant home factor that contributes to emergent literacy outcomes, despite some variability in its significance (Phillips, Norris, & Anderson, 2008; Bus, van IJzendoorn, & Pellegrini, 1995; Dunning, Mason, & Stewart, 1994; Payne, Whitehurst, & Angell, 1994). Engaging in shared book reading at home has shown to improve the child’s vocabulary and oral language skills (Lonigan & Whitehurst,

1998; Whitehurst, Arnold, Epstein, Angell, Smith, & Fischel, 1994). Children receive new information and world knowledge in an interesting and enjoyable manner through books (Ezell & Justice, 2005).

Phillips and Lonigan (2009), suggested that besides shared book reading, there is a range of other HLE factors that contribute to the development of the child's emergent literacy skills and oral language. These factors may include having literacy artifacts available for the child, talking about literacy-related activities with children, using the library, encouraging and modeling engagement in reading, and positive attitudes towards reading (see also Sénéchal, Lefevre, Thomas, & Daley, 1998; Sénéchal & LeFevre, 2002; Levy, Gong, Hessels, Evans, & Jared, 2006).

Parent Strategies to Foster Letter Knowledge. Parent-child conversations about letters happen through a variety of everyday activities which influence the development of emergent literacy skills. These conversations not only happen during a direct literacy task, such as while reading books, but also in day to day tasks (Robins et al., 2013).

Engagement with Environmental Print. Engaging with environmental prints provides parents and their child the unique opportunity for spontaneous learning experiences (M. Neumann, Hood, & D. Neumann, 2009; Wood, Bruner, & Ross,1976). Many authors claim that the use of environmental print such as product labels, clothing, road signs, and advertisements, during parent-child interactions is a meaningful way to expose children to letter shapes and letter sounds (Elliot & Olliff, 2008; Kuby, Goodstadt-Killoran, Aldridge, & Kirkland, 1999). Parent-child interactions provide scaffolding to help the child achieve a goal using specific tools and techniques that are otherwise beyond his or her unassisted efforts (Neumann et al., 2009).

Furthermore, through observations of parent-child conversation patterns, multiple investigators identified that parents use informative statements to describe letters to their child (e.g., “That’s the letter B for BOY”; “The letter M makes the MMM sound”; “Both words pink and purple begin with P”; Neumann et al., 2009; Edwards, 2012). Neumann et al. (2009) provided a detailed case study describing how engagement with environmental print scaffolds letter knowledge. Initially, when the child was 2 years old, the mother introduced print to the child by exposing him to spontaneous encounters with environmental print. Additionally, the child had the opportunity to engage with the same environmental prints from week to week which facilitated his knowledge of letters and words. In this case study, Neumann and colleagues further observed that it was during this age that the mother initiated interactions with the child that focused on differentiating print from the pictures on environmental print. In one instance, the authors observed this when the mother was making chocolate milk for her child using the chocolate flavored milk powder called “Milo”. She pointed to the print on the product that read “Milo” and asked the child to first look at it before initiating interactions. The authors describe some of the dialogues that the mother employed with her child during these interactions. These instructions included: “Look that says Milo”; “Look at the ‘MMM’ for Milo, it goes up, down, up down” while she was tracing the letter M using her fingers; “There’s the letter M for Milo”; “Look there’s an ‘O’, it goes around and around like the wheels of a car” while she pointed to the letter ‘O’ in the print. Furthermore, the mother used techniques such as pointing and tracing using fingers during the interactions. According to Neumann et al. (2009), these print identification interactions between the mother and the child on a day to day basis strengthened the child’s print awareness and encouraged him to explore letters further. Kuby et al. (1999) claims that, from an early age, young children are aware that environmental prints convey

meanings. Hence, by using such environmental prints during their interactions with the child, parents can provide a meaningful way to foster their young child's literacy skills including letter shapes and sounds (Elliot & Olliff, 2008).

Multi-sensory engagement with letters. In Neumann et al.'s (2009) comprehensive case study, the authors also observed that the child's mother used a multi-sensory approach to teaching letters. Moats and Farrell (2005) described how a child can retain and process language knowledge more efficiently when using a multisensory approach. In the case study (Neumann et al., 2009) the mother used the child's tactile (having the child trace out the letter with his fingers on the environmental print), visual (having the child look at the print while pointing at the label), auditory (having the child listen to her saying the word and making the first letter such as "That's the letter M for MILK. The letter M makes a MMM sound"), and kinesthetic senses (having the child move his hands in the shape of the letter by verbally guiding him, for example, "M goes up, down, up, down") in the learning process. The authors observed that the mother encouraged the child to say the word, the letter name and also to make its sound. Consequently, the mother then started to talk about other words that began with the same letter to further improve her child's letter name knowledge (e.g., "M is also for Mouse and Moon").

Teaching letters through play. As the study progressed, the authors further observed that the mother-child interactions which began with environmental print now transferred to playtime context (Neumann et al., 2009). The mother encouraged the child to form letter shapes when playing with play dough. The authors observed that the child now self-initiated many letter forming activities on his own when playing with household items or using food items. Some examples that the authors described are as follows: the child broke a donut in half and claimed that he was making a C for cat; he made a round O using some old string; and the child made a V

using fallen tree branches while in the garden. Neumann et al. (2009) claimed that the child was motivated during the joint parent-child interactions, and he extended these interactions into his own play employing the same speech that his mother used before with him. The authors evaluated the child's letter name and sound knowledge at different intervals using an informal naming task in which the child was asked to name and sound the letter that the mother pointed to using a printed list of capital letters.

Socioeconomic Status (SES) And Emergent Literacy

In general, children from low SES backgrounds appear to be less prepared for literacy instruction, which causes them to perform less well in school when compared to children from higher SES backgrounds (Duncan, Yeung, Brooks-Gunn, & Smith, 1998; McLoyd, 1998). Parents from lower SES backgrounds tend to read less to their children at home (Roberts, Jergens, & Burchinal, 2005). Furthermore, if reading occurred in families from low SES, there were differences in the quality of parent behaviors (Phillips & Lonigan, 2009; Whitehurst & Lonigan, 1998). Children in families with low SES status were less likely to be engaged in literacy activities at home when compared to children living above the poverty line (Weigel et al., 2006). For example, Smith and Dixon (1995) explored the differences observed in the early literacy skills of preschoolers from different SES background. Of the sixty-four preschoolers, 33 were from low SES and 31 from middle SES background. All of the children were assessed within the first four weeks of school and questionnaires were given to the parents to determine the frequency and quality of literacy activities with which the parents and children interacted. The authors concluded that most children from low SES homes were at a disadvantage even as early as 48 months of age when compared to their middle-class peers in understanding written language.

Letter knowledge as a function of SES. As suggested by Hart and Risley (1995), children tend to be impersonators of their parents in terms of vocabulary use, language, and interaction styles. However, families with a low SES status appeared to carry out less conversation, use more direct demands, and ask fewer questions (Hart & Risley, 1995). The general differences between parent-child conversational patterns in families with different SES help to determine if these patterns influence how the parents talk to their child about letters. Parents with high SES were more likely to elicit conversations from their child, and parents with low SES were more likely to talk about directing their child's behavior (Hart & Risley, 1995).

Robins et al. (2014) tested the similarities and differences in parent-child conversations on letter knowledge as a function of SES and concluded that families from both upper and lower SES backgrounds indeed talk about letters. However, there was a difference in the nature of these conversations. Families from lower SES backgrounds asked fewer questions about letters when compared to the families from upper SES backgrounds and were more likely to say letters in isolation rather than in sequences. In addition, families with lower SES were more likely to limit the letters they contextualized to the letters within their child's names. Robins et al. (2014) found no SES differences in the factors that influenced the use of particular letter names, but there were SES differences in two-letter sequences.

Assessment of Emergent Literacy skills

Children show varying levels of early literacy skills when they first arrive at preschool. Depending on where they start, their HLE, and the classroom curriculum, most children successfully transition to learning to read after they leave preschool. However, some children will not be able to acquire these well-established emergent literacy skills with just the typical classroom support. They may require an additional level of instructional support and practices.

Although the traditional preschool instructions and practices are adequate for the development of emergent literacy skills, it is unlikely that early childhood educators have the sufficient time to provide this level of extra support and instruction for all their children in their classrooms (Lonigan, Allan, & Lerner, 2011). Therefore, it is important to early identify those preschool children who may be at-risk in developing the well-established emergent literacy skills before they transition to learning to read.

Parental involvement is a major factor that influences the development of a young child's emergent literacy skills (Dearing, Kreider, Simkins & Weiss, 2006). Parenting styles and family literacy activities during the first three years of the child's life contribute heavily to the child's development of letters and letter sound knowledge (Robins et al., 2014; Weigel et al., 2006). Therefore, it is also important to assess the parent's use of literacy based strategies that can influence the preschooler's emergent literacy skills.

Museum Based Intervention

Museums are institutions used by the public for personal learning and to satisfy their learning needs. The unique nature of learning that occurs in museums is a free-choice type of learning. In free-choice learning, the learner is personally motivated to learn and makes choices as to when, where, and what to learn (Falk & Dierking, 2000). Museums are increasingly now used to promote literacy-related experiences, especially children's museums. Children's museums are considered to provide a unique focus on facilitating family literacy and are used as a setting to explore the world by providing families with an enriched environment to implement literacy (Amsel & Goodwin, 2004). One way to differentiate children's museums from traditional museums is the focus on direct, hands-on interaction with exhibits employed in children's museums (Puchner, Rapoport, & Gaskins, 2001). Children's museums aim to generate

contexts in which parents and children can engage in dialogues about museum exhibits using family literacy techniques such as storytelling, pretend play, problem-solving, and using art and music activities. This allows parents or caregivers to share and help children to read and explore the world (Amsel & Goodwin, 2004).

Research has shown that parents or caregivers play a critical role in children's learning in the museums (Amsel & Goodwin, 2004; Puchner et al., 2001). While children can explore the exhibits in a museum without adults, the involvement of a parent or caregiver in this process makes the learning experience richer (Amsel & Goodwin, 2004). Children's museums play an essential role in helping parents mediate their child's experience at the museum. Amsel and Goodwin (2004) describe a model of learning employed in children's museums. This triangular model aims to explain the relationship among the child, exhibit, and caregiver and how they play critical roles in promoting literacy-learning experience. Exhibits aim to engage the child in an experimental activity and a social interaction. The exhibits are used not only to engage children in fun activities but also to engage parents/caregivers to mediate the child's learning experiences. The parent/caregiver is then involved to promote children's interactions with these exhibits by asking questions, directing actions, exchanging goals, engaging in discussions, and so on. The model further emphasizes the role of social interaction carried out as dialogues between parents or caregivers and children in the process of learning.

In another study, Puchner et al. (2001) explored what children learned and what conditions facilitated this learning as they interacted with the different exhibits at the children's museum using naturalistic observations. This study suggests that learning did occur when children interacted with the exhibits in the museum. Additionally, children learned more when there was adult interaction regarding the exhibits in the museum, indicating that

parents/caregivers must be actively involved both verbally and physically with the child while exploring the exhibits in the museum to influence child's learning.

Summary and Rationale

Emergent literacy plays a crucial role in the development of a child's later reading, writing, listening, and speaking skills (Rhyner et al., 2009), which form the foundation for a child's readiness for school. Children who are delayed in attaining these emergent literacy skills will exhibit difficulties in meeting the school demands and requirements for learning (Justice & Ezell, 2001). Hence, the development of a child's emergent literacy skills (which include print awareness, phonological awareness, and letter knowledge) must be considered significant. Among the many emergent literacy skills, letter knowledge is considered to be a strong predictor of later reading and spelling abilities in children entering school (Catts et al., 2001; Caravolas et al., 2001; Foulin, 2005; Lonigan et al., 2000; Muter et al., 1997). Letter knowledge is a strong predictor of later skills because the early stages of reading involve decoding the letters into their corresponding sounds and then learning to combine these sounds to form words (Whitehurst & Lonigan, 1998). When young children are exposed to reading and inventing spelling activities, they learn to experiment with their letter-sound knowledge (Rhyner et al., 2009).

An excellent way to encourage the development of emergent literacy skills is parent-child interactions (Neumann et al., 2009). Parents/caregivers play an important role in nurturing positive early learning opportunities which impact the development of a child's emergent literacy skills including letter knowledge (Neumann et al., 2009). As discussed earlier, the 'home environment' is one of the earliest literacy experiences that a young child is exposed to before entering school. Hence, HLE plays a significant role in the development of a young child's letter knowledge skills (Robins et al., 2014). Children from low SES families tend to perform less well

in school when compared to children from higher SES families (Duncan et al., 1998; McLoyd, 1998). The major reason is that there tend to be fewer parent-child literacy-based interactions that occur in families with low SES when compared to families with higher SES (Philips & Lonigan, 2009; Weigel et al., 2006; Whitehurst & Lonigan, 1998). Although families with both lower and higher SES talk about letters, there is a difference in the nature of the parent-child interactions. For example, parents from low SES backgrounds tend to carry out fewer conversations, use more direct demands, and ask fewer questions about letters to their children when compared to parents from higher SES backgrounds (Hart & Risley, 1995; Robbins et al., 2014). This evidence supports the conclusion that children from low SES backgrounds are at-risk for delayed emergent literacy skills. Therefore, providing parents with information on simple literacy-based strategies and activities on promoting letter knowledge can encourage positive literacy-based interactions with their children and help foster confidence to implement these strategies at home and in other environments. This would, in turn, foster the development of their children's literacy skills (Neumann et al., 2009).

Children's museums are good environments for parents and children to learn together. A valuable way in which museums can support family literacy is by making literacy learning a natural part of an exhibit and of the museum environment (Amsel & Goodwin, 2004). Museum experiences are a natural way for both parents/caregivers and children to interact in an environment that provides opportunities for learning new skills, including emergent literacy skills. Embedding emergent literacy activities into a museum environment will help children to gain important academic skills. Additionally, embedding these activities will help parents extend the learning beyond the museum experience and empower them to take an active role in the child's learning.

The purpose of the current study was to address alphabet knowledge with at-risk children/parents within the museum experience. Specific research questions included:

1. Are the parent- and child-level measures developed appropriate for at-risk families?
    a. If so, do these measures contain extreme values ?
    b. Are the scores from these measures normally distributed across the sample?
2. Are there significant differences between treatment and control group data with respect to the baseline measures?
3. Does parent instruction within the museum experience on letter teaching strategies exhibit a change in performance of the children over time?

Methods

Context

The study was conducted at BBCM located in Milwaukee, Wisconsin, in collaboration with the museum's Family Focus program. The program provides free parenting education, museum membership, and transportation assistance to families that are struggling to raise a young child, including families with low SES, teen parents, foster families, families with a disabled child, at-risk fathers, and many others whose circumstances often limit their access to resources that can build a young child's skills, shape their values and develop their lifelong capacity to learn (Family Focus Free Membership, n.d.). Furthermore, the Family Focus program highlights the importance of play in developing children's general knowledge and cognition, language development and communication, health and physical development, social and emotional development, and approach to learning (Family Focus Free Membership, n.d.).

Participants

The participants for the study were a total of 14 parent-child dyads. The children recruited were between the ages of 2;6 (years; months) and 4:0. In selecting the age range, I aimed to identify the developmental stage where children are amenable to beginning learning letters, but are not likely to have an overly large inventory of letters known. Around three years of age, most children are able to name several letters. Worden and Boettcher (1990) tested children's ability to name letters through the preschool years and found that children, on average, named four, 14, and 22 letters at ages three, four, and five, respectively. While three-year-old children know, on average, four letters, there is considerable heterogeneity. For example, the child in the case study described in Neumann et al. (2009) could name 16 letters at 3;6. Therefore, recruiting children between 2;6 and 4:0 allowed me to identify participants who are ready to learn letters and be responsive to the proposed intervention, yet will not likely know more than a handful of letters. There were equal number of male and female children among the 14 participants. Families from a range of cultural and ethnic groups were recruited which included: 36% Hispanic families, 29% African-American families, 29% Caucasian families, and 6% from a mixed race.

Selection criteria. To be eligible for the study, the parents were required to meet the following three inclusionary criteria: the parent who brings the child to the museum must spend a minimum of 15 hours per week at home with the child; the parent must converse with their child in English at home for at least 50% of the time; and the same parent must bring the child for each museum visit throughout the study. Each participating child was also required to meet the following two criteria to be eligible for study: the child must be between the ages of 2;6 and 4;0 and have had no history of identified or suspected delays or disorders in speech, language,

hearing, or other developmental areas. Additionally, the child may or may not be enrolled in early education.

Procedure

Participant recruitment. The University of Wisconsin - Milwaukee (UWM) research team consisted of a graduate student and five volunteer undergraduate research assistants. The UWM research team worked with the BBCM staff to recruit the participants. Initially, members of the research team attended informational meetings held at the BBCM for families interested in joining the museum's Family Focus program. During the meetings, research team members described the study and collected contact information for families interested in participating in the study. After receiving the list of names of the potential participant families, the UWM research team called each parent in the list to determine if they met the minimum criteria as specified by the selection criteria for participating in the study (see selection criteria for further details). This information was collected using the initial screening questionnaire available in Appendix A. After passing the initial screening via phone call, a member from the UWM research team assigned a participant ID to the parent-child dyad and further called the parent to schedule the initial face-to-face meeting which took place at the museum. Families who did not pass the initial screening were also called and informed about their ineligibility and thanked for their interest in the study.

Group assignment. The selected parent-child dyad with a participant ID was next randomly assigned to two groups: control and treatment. There were three treatment group families for every one control group family. Multiple children from the same family were placed in the same condition (either treatment or control). Both the control and treatment group families were required to complete a total of four visits to the museum. The treatment group parents were

asked to implement a letter learning experience with their child in a natural way while exploring the museum (see treatment protocol for further details). The control group parents were instructed to interact with their child at the museum as they normally would. The control group dyads had no access to the treatment materials until they completed all four visits to the museum. At the end of their fourth visit, parents in the control group received a debriefing letter (see Appendix B) that explained the implemented treatment for the study and the treatment materials which included the instructional handout (see Appendix C) and the letter cutouts (see Appendix D).

Initial museum visit. Both the control and treatment group parent-child dyads attended an initial face-to-face meeting at the museum with a member from the UWM research team. During this meeting, the research team member collected the consent from the parent, completed testing on parent and the child, taught parents in the treatment group the strategies that they had to use during their museum visit, and informed parents in the control group to explore the museum as they normally would.

During this initial face-to-face meeting, the parents were first asked to read and complete the informed consent (see Appendix E and Appendix F). The written informed consent from the parent of the child accepted into the study was obtained through a consent process and forms approved by the UWM Institutional Review Board (IRB). Additionally, the parents from both groups were briefly explained about the study, time commitment, and the expected parent's role. They were also informed that they would receive books at the end of each session, in addition to a $20 gift card on completion of the study.

After the informed consent was signed, the research team member completed testing on the parent and child. The parent was asked to complete the parent interview questionnaire (see

Appendix G). This 16-question form provided insights about the use of language and literacy strategies at home in the first six questions and the child's HLE in the final ten questions. The team member also collected the demographic information of the parent and the child using the background information questionnaire available in Appendix H. Demographic information included the following: the parent's full name, parent's relationship to the child, ethnicity, parent's education status, parent's employment status, annual family income, child's age and gender, and child's schooling information. Finally, the child was tested using the Upper-Case Alphabet Recognition section of the Phonological Awareness Literacy Screening for Preschool (PALS-PreK) assessment tool (see Appendix I), an informal letter recognition task (see Appendix J), and letter-sound relationship activity (see Appendix K).

After all testing was completed, the treatment group parents were taught a basic intervention (described under treatment protocol) to impact their ability to help their children learn new letters. The parents were instructed to use these basic strategies to help their child learn four new letters during their four museum visits. The four new letters were selected based on the child's performance on the formal test and the informal activities. An instructional handout and letter cutouts were provided to the treatment group parents to help them implement the strategies instructed and modeled to them. The control group parents had no access to the intervention plan and the materials. They were instructed to explore the museum with their child as they would do normally. However, they were given four tickets that they could turn in at the museum front desk after each visit to receive their prize and keep track of their museum visits.

Second, third, and final museum visit. Following the first museum visit, the families attended two more visits to the museum on their own. During the second and third visit, the treatment group parents picked up their assigned letter cut outs from the museum front desk and

explored the museum to find objects beginning with that letter. The parents used the strategies taught to them to teach letter names to their child within the museum. At the end of each session, the treatment group parents turned in their letter cut outs at the museum front desk to receive their prize. On the other hand, the control group parents explored the museum with their child as they would normally do for their second and third visit. At the end of each museum visit, they turned in their respective visit ticket at the museum front desk to receive their prize.

A member of the research team from UWM periodically called or emailed to follow-up on these visits with the parent. During the follow-up phone calls and emails, the parents were thanked for their participation, asked if they had any issues during their museum visits, inquired when was the last time they went to the museum, confirmed the number of times they went to the museum, and asked when they think would go to the museum again. Parents were encouraged to visit the museum at least once per week. Additionally, the treatment group parents were reminded of the strategies and encouraged to work on letters at home. They were also reminded the letter that they should get during their next museum visit.

If the families completed three visits to the museum, then the fourth final visit was scheduled at a time when one of the research team members at the museum. During the final visit, both the parent and child testing were repeated to collect the post-treatment data. After the testing, the treatment group parents were reminded of the strategies and encouraged to use them at home. The control group families were instructed on these strategies. During their final visit, the control group families received a debriefing letter that explained the implemented treatment for the study. Additionally, they were also given the materials used for the treatment, which included the instructional handout and the letter cutouts.

Treatment protocol. The purpose of the current study was to implement a basic intervention that can have a significant impact on parents/caregivers' ability to help their children (from low SES backgrounds) learn new letters using a museum-based approach. The emergent literacy skills targeted for the study were letter knowledge and letter-sound relationships. During the initial visit, parents in the treatment group were given instruction regarding the general strategies used for teaching letter knowledge and letter-sound relationships to their child at the museum.

Selection of treatment letters. The first task was to choose a set of letters that would be targeted during the intervention and used with all children to maintain consistency. Studies of letter acquisition have revealed that the strongest predictor of letter knowledge is the presence of that letter in the child's first name (Justice, Pence, Bowles, & Wiggins, 2006). The second set of letters that are learned early by children includes "A," "B," and "O" (Phillips, Piasta, Anthony, Lonigan, & Francis, 2012). Phillips et al. (2012) concluded that these letters are early developing because "A" and "B" are the first letters of the alphabet and because there is a direct relationship between the letter "O" and lip shape when producing the vowel sound. The final class of letters that tend to be learned earlier than other letters are those that have the phoneme produced unambiguously in the letter name, either as a consonant + vowel (e.g. B, D, J, K, P, T, V, Z) or vowel + consonant (e.g. F, L, M, N, S) combination (Evans, Bell, Shaw, Moretti, & Page, 2006; Huang & Invernizzi, 2014; Justice et al., 2006; Treiman, Tincoff, Rodriguez, Mouzaki, & Francis, 1998). This class of letters is thought to be easier for children because the phoneme produced in the letter is paired with the letter itself. In their analysis, Justice et al. (2006) concluded that children were more likely to learn letters with the consonant + vowel combinations prior to the vowel + consonant letters. Therefore, for the present study, the

research team provided opportunities for parents to learn a series of both consonant + vowel and vowel + consonant combinations, which was developmentally appropriate for the children. Furthermore, stimulation on these letters also provided children with input on the sound-letter relationship. Eight letters were chosen for the study which included B, D, F, L, M, P, S, and T. Each treatment group family was assigned four letters out of the eight, based on the child's performance on the formal test and two informal activities. Therefore, the four letters chosen were the ones that the child did not know. One out of the 14 children knew all -eight treatment letters, hence the child was given a set of four letters from the eight chosen at random, with the aim to strengthen the child's existing letter knowledge skills. The parent taught one letter per visit to their child.

Letter Teaching Strategies. The three major strategies used for the intervention was modeling, repetition, and naming. As discussed earlier, the aim of using these strategies were to employ a multi-sensory approach of physically formed letter cutouts (provided to the parents as part of the museum experience), which helped to facilitate the child's letter-learning process (Bodrova & Leong's, 1998; Neumann et al., 2009). In addition, parents were encouraged to promote environmental engagement with print by using the target letters in context with objects that start with the target letter. As noted by Robbin et al. (2013), when parents interact with their young children, they view letters as items that are associated with words. This provided the child with general information about the link between letters and words. Robbins et al. (2013) reported that, children are likely to associate letters with words that are highly influenced and guided by parents following specific feedback from the parents such as "That's right! A is for apple." Furthermore, research has shown that parents and children most often focus on those letter-word

associations that are particularly important for the child, including objects seen in the child's surrounding (Aram & Levin, 2004; Robins et al., 2013).

When engaging with print, parents were instructed to produce the sound with the letter (for example, the letter "D" makes the "duh" sound). Evans et al. (2006) reported that in young children, letter-sound knowledge has an overall predictive and developmental relationship with letter-name knowledge. According to Huang, Tortorelli, and Invernizzi (2014), among all the letter-knowledge concepts (which includes letter recognition, letter-name knowledge, letter-sound knowledge, and letter production) letter-sound knowledge has the firmest relationship with decoding skills. This means the child's ability to provide the sound associated with a particular letter is closely related to his or her ability to sound out words.

Embedding Strategies into the Museum Experience. Parents of the treatment group received both verbal and visual instruction on how to integrate these strategies into the museum experience with their child. The general plan for the parent was to engage their child in a scavenger hunt to find objects throughout the museum that begins with the assigned letter for the day and to show those objects to the child to teach the intended letter.

The instructional handout provided to the parent had information regarding the three strategies to be used to promote discussion of the four new letters while in the museum. The letter cutouts provided to the parent had suggestions for words and examples of the strategies with the words that composed the target letter for each session. The three major strategies used for the intervention were modeling, repetition, and naming. Parents used the modeling strategy when he or she would say the name of the object that began with the target letter ("I found a tree! Tree starts with the letter T"). Repetition was employed when the parent said the target letter many times while showing the letter cutout to the child ("Look! T is for tree"). The child had the

opportunity to touch and explore the letter cutout every time they spot an object that began with the target letter. Finally, naming was the strategy used when the parent asked their child to say the letter ("Now you say it! Tree starts with ___"). In addition to the four visits, a member from the UWM research team conducted phone calls with the parents to follow up on each visit and to remind the treatment group parents to carry out the strategies at home.

Data Collection

A member of the UWM research team met with each participating family during the first and the last visit at the museum, with baseline data during the first visit and the post-treatment data collected during the last visit. The same set of data was collected from both the treatment and control group parent-child dyads.

The first set of data included descriptive demographic baseline data collected from each parent-child dyad. This data was used to describe the characteristics of the sample and to identify any potential mediating demographic variables that may have had an impact on the results. The descriptive demographic category provided information on the family's SES which included the parent's highest grade level (less than high school, high school graduate or GED, 2-year degree college, undergraduate degree college, graduate degree college, or post graduate school); parent's employment status (if employed, self-employed or unemployed); annual family income (under $14,999 or above $15,000); and the child's school hours or days per week if enrolled in an early education setting including day care, head start or preschool. This information was collected using the background information questionnaire.

The second set of data consisted of parent-level data collected during the initial visit (baseline data) and the final, fourth visit (post-treatment data). This was done to learn the impact of the intervention on the participants. For the parent-level measures, the parent completed the

parent interview questionnaire that provided an understanding of whether or not the parents were using the target strategies. As mentioned earlier, the parent interview questionnaire had a total of 16 questions, in which the first six questions pertained to the parent's use of strategies. For these questions, the parents responded using a four-point rating scale which was as follows: 1-almost never, 2-few times a week, 3-daily, and 4-several times a day. Questions 7 to 16 were designed to understand the child's HLE. Parents responded to these questions using a three-point rating scale ranging from 1-never, 2-sometimes, to 3-often.

The final set of data consisted of child-level data collected during the initial visit (baseline data) and the final, fourth visit (post-treatment data). Each child was assessed using the Upper-Case Alphabet Recognition section of the PALS-PreK assessment test, an informal letter recognition task, and an informal letter-sound relationship activity. The combination of a formal assessment tool and informal activities provided a better picture of the child's letter knowledge skills. The Upper-Case Alphabet Recognition section of the PALS-Pre-K assessment examined the alphabet knowledge by having the child name upper case letters. The two informal assessments documented the child's ability to recognize the targeted letters and to recognize objects that begin with the letter using a matching task. For the letter recognition task, the child was presented with a list of four letters and was asked to identify the letter after the examiner stated the name of the target letter. The eight letters chosen for the intervention were included in this task. For this task, a total of 14 items were carried out in which the first two were trial items using pictures. Each item had four letters with one of the letters being the target letter for that item. The child could score a maximum of 12 points for this task if he or she could recognize all the 12 target letters from each item that was presented. For the letter-sound relationship task, the child was asked to match a targeted letter sound to the corresponding object that began with the

same letter sound. This task had a total of 12 items with no trial items presented. Each item had the pictures of four objects in which one of the four pictures began with the target letter sound for that item. The child could score a maximum of 12 points in this task if he or she could identify the right picture that corresponded to each letter sound that was presented in each item. The object pictures selected for the task were based on the exhibits in the museum. This provided more sensitive measures as we used the same objects, the child had explored during the intervention.

Data collected for the study were reported at the group level. Each parent-child dyad was assigned a participant ID that was linked to their name. An examiner checklist (see Appendix L) was maintained for each participating family that contained both the identifying information and the participant ID. All other documents used for data collection (initial screening questionnaire, background information questionnaire, parent interview questionnaire, Upper-Case Alphabet Recognition subtest scores from PALS-PreK assessment, letter recognition task scores, and letter-sound relationship task scores) were de-identified and contained only the participant ID. The paper examiner checklists and all de-identified data were stored in the Language Analysis Lab of the UWM Enderis Hall, room number 888, which was locked and only accessible to the research team members who have completed the CITI training. Data collected using these paper documents were transferred to a password protected electronic network that was accessible only to trained research team members.

Data Analysis

This study followed a descriptive and experimental design. The descriptive design aimed to describe the overall performance of the participants in parent-level and child-level measures and to determine if the measures used for the study was developmentally appropriate for at-risk

families. The experimental design of study aimed to analyze the presence or absence of significant differences between the treatment and control group families at the baseline and to compare the change in performances across the two groups over time with treatment.

Data analysis was categorized based on the three sets of data that were collected from the participants. The first set of data that included background information was analyzed to look for any significant differences between the two groups in terms of their descriptive demographic information. This was done by comparing the results from the background information questionnaire between the treatment and the control group families. The second set of data consisted of the parent-level measures that were collected using the parent interview questionnaire. Results from this questionnaire were analyzed using descriptive statistical measures (calculating the database mean, standard deviation (SD), coefficient of variance). Unpaired *t*-tests were done to compare the results between the treatment and control groups. The third set of data consisted of the child-level measures (which included the Upper-Case Alphabet Recognition subtest score, informal letter-recognition, and letter-sound relationship task scores) and was also analyzed using descriptive statistics, to check for significant differences between the treatment and control group families. Additionally, both the parent- and child-level data were also analyzed to check if these measures were developmentally appropriate for the at-risk families. This was determined by observing for a normal distribution pattern and floor and ceiling effects among the results.

Results

Participant Scores

The descriptive demographic profiles, parent, and child activity scores for both the treatment and control groups are summarized in Tables 1 through 11.

Descriptive demographic information. The two groups (treatment and control) were compared based on the descriptive demographic information that was provided by the participating parents using the parent interview questionnaire. Table 1 provides a comparison of the following demographic information between the control and treatment groups: the total number of participants, the number of male and female children in each group, the child's ethnicity, parent's education level, parent's current employment status, annual family income, and the child's early education status.

As shown in Table 1, a total of 14 parent-child dyads participated in the study. Treatment group families constituted the majority of participants (9 of 14). Overall, there was an equal number of female and male children recruited for the study. There were more educated parents seen in the treatment group families compared to the control group. Two out of the nine treatment group parents had completed a master's degree and a postgraduate degree. Parents in the control group had an undergraduate degree or less. As a result, higher numbers of employed parents were observed in the treatment group than the control group which also contributed to a higher average annual income among the treatment group families. Families from a range of ethnic groups were also observed. Among the total number of participants, there were 36% Hispanic families, 29% African-American families, 29% Caucasian families, and 6% from a mixed race. When compared between the two groups, there were more Hispanic and Caucasian families in the treatment group and an equal number of African American families in either group. Five out of the total 14 children were enrolled in an early education system such as the day care centers. Among the five, four of them belonged to the treatment group families. Thus,

more treatment group children were enrolled in day care than the control group children. The overall demographic information from each group accounts for the variability in the characteristics seen in at-risk families.

Table 1. Background information from control and treatment group families who participated in the study.

Background information	Control group	Treatment group
Total number of participants	5 parent-child pairs	9 parent-child pairs
Child's gender	3 female children 2 male children	4 female children 5 male children
Ethnic Group	2 Hispanic, 2 African American 1 Caucasian	3 Hispanic, 2 African American 3 Caucasian 1 Mixed race
Parent's education level	2 completed undergrad. degree 2 completed two years of college 1 is a high school graduate	1 has a post-graduate degree 1 has a graduate degree 2 completed undergrad. degree 4 completed two years of college 1 is a high school graduate
Parent' current employment status	3 unemployed 2 employed	3 unemployed 6 employed
Annual Family income	1 with $55,000 - $74,999, 2 with $35,000 - $44,999, 1 with $250000 - $34,999, 1 with $15,000 - 24,999	1 over $100,000 1 with $45,000 - $54,999, 1 with $35,000 - $44,999, 3 with $250000 - $34,999, 1 with $15,000 - 24,999 1 less than $14,999 1 did not answer
Child's early education status	4 children not enrolled in any early education 1 enrolled in a day care center for 3.5 years - 5 days a week for 9 hours a day	5 children not enrolled in any early education 4 enrolled in a day care center – 3 of them being in the center for 1 to 3 years and 1 being in the school for only 3 months.

Parent-level measures. The parent interview questionnaire was used for collecting information related to the parent activity measures. Responses from this questionnaire are summarized in Tables 2 and 3. Table 2 consists of the mean activity scores and calculated SD for each parent activity described in the parent interview questionnaire in regards to the total number of participants. Table 3 consists of the mean activity scores, calculated SD, and unpaired t-test scores matched between the control and treatment group for the parent activities mentioned in

the questionnaire. Both the control and treatment group parents were asked to complete the parent interview questionnaire during the first visit (baseline data) and during final fourth visit (post treatment data). All responses from the parent interview questionnaire were analyzed as a group. A descriptive statistical analysis (calculated mean and SD) was carried out for each parent activity. A normal distribution pattern was observed based on the calculated mean and SD for each parent activity measure among the control group, treatment group, and a total number of participants from both groups. To compare between the two independent groups (control and treatment), the unpaired *t*-test was performed. The p- and t-values were calculated using the 95% confidence interval (CI). As shown in Table 2, results from the unpaired *t*-test revealed no significant differences in the baseline scores between the control and treatment group for any of the following parent level measures: talking about letters playing with letters, naming the letters, pointing out the letters, child saying the letters, parent asking the child to say the letter, child asking the parent to read to them, parent reading to their child, child pointing to the pictures when reading, parent pointing to signs and words, playing rhyming games with the child, child seeing adults reading at home, and child being able to write his or her own name. The overall baseline parent-level measures account for the normal distribution of the scores across the sample (as seen in Table 2) and no extreme values (floor and ceiling effects) were observed for each measure (as seen in Table 3). Thus, the parent level measures developed for the study were found to be appropriate for examining parent's use of strategies and the child's HLE among the at-risk families.

Table 2. Calculated mean and SD for baseline parent-level measures from total number of participants in the study.

Parent activity	**Overall (total 14 parent-child dyads)**	
	Mean	**SD**
Talk about letters	2.35	0.97
Play with letters	2.35	0.81

Name the letters	2.57	0.97
Point out letter	2.57	0.90
Child says letters	2.85	1.05
Asked child to say the letter	2.57	0.97
Child asked parent to read to them	2.78	0.41
Parent read to child	2.85	0.34
Child points to pictures when reading	2.92	0.25
Parent points to signs and words	2.32	0.71
Play rhyming games with child	1.85	0.74
Child sees adults reading at home	2.42	0.49
Child writes own name	1.92	0.70

Table 3. Calculated mean, SD, and unpaired *t*-test scores for baseline parent-level measures from control and treatment group families who participated in the study.

Parent activity	**Control (N= 5 parent-child dyad)**	**Treatment (N= 9 parent-child dyad)**	**Unpaired *t*-test results**						
			t	**df**	**p (Two-tailed)**	**Mean Difference**	**Std. Error Difference**	**95% CI of the difference**	
								Lower	**Upper**
Talk about letters	Mean = 2.2 SD = 1.16	Mean = 2.44 SD = 0.83	0.4516	12	0.6596	0.2400	0.531	-1.3979	0.9179
Play with letters	Mean = 2.4 SD = 0.8	Mean = 2.33 SD = 0.81	0.1556	12	0.8790	0.0700	0.450	-0.9103	1.0503
Name the letters	Mean = 2.6 SD = 1.01	Mean = 2.55 SD = 0.95	0.0924	12	0.9279	0.0500	0.541	-1.1293	1.2293
Point out letter	Mean = 2.8 SD = 0.97	Mean = 2.44 SD = 0.83	0.7341	12	0.4770	0.3600	0.490	-0.7084	1.4284
Child says letters	Mean = 2.6 SD = 1.01	Mean = 3.0 SD = 1.05	0.6917	12	0.5023	-0.4000	0.578	-1.6601	0.8601
Asked child to say the letter	Mean = 2.4 SD = 0.8	Mean = 2.66 SD = 1.05	0.4787	12	0.6408	-0.2600	0.543	-1.4435	0.9235
Child asked parent to read to them	Mean = 2.8 SD = 0.4	Mean = 2.77 SD = 0.41	0.1323	12	0.8970	0.0300	0.227	-0.4642	0.5242
Parent read to child	Mean = 3.0 SD = 0	Mean = 2.77 SD = 0.41	1.2318	12	0.2416	0.2300	0.187	-0.1768	0.6368
Child points to pictures when reading	Mean = 2.8 SD = 0.4	Mean = 3.0 SD = 0	1.5526	12	0.1465	-0.200	0.129	-0.481	-0.081
Parent points to signs and words	Mean = 2.4 SD = 0.48	Mean = 2.33 SD = 0.81	0.1750	12	0.8640	0.0700	0.400	-0.8015	0.9415

Play rhyming games with child	Mean = 1.8 SD = 0.74	Mean = 1.88 SD = 0.73	0.1956	12	0.8482	-0.0800	0.409	-0.9712	0.8112
Child sees adults reading at home	Mean = 2.4 SD = 0.48	Mean = 2.44 SD = 0.49	0.1474	12	0.8853	-0.0400	0.271	-0.6315	0.5515
Child writes own name	Mean = 2.0 SD = 0.63	Mean = 1.88 SD = 0.73	0.3081	12	0.7633	0.1200	0.389	-0.7286	0.9686

Child-level measures. Each participating child from both the control and treatment groups completed the following three activities during their first and final museum visit: Upper-Case Alphabet Recognition subtest of the PALS-PreK assessment, letter recognition activity, and letter-sound relationship activity. For the Upper-Case Alphabet Recognition subtest of the PALS-PreK assessment, the child was instructed to name the upper-case letters shown on the sheet while pointing to each letter. The maximum possible score that the child could get was 26 from this test. The letter recognition activity was aimed to assess if the child could recognize the 12 upper-case letters that were chosen for the treatment (described in data collection). The child could score a maximum of 12 points for this activity if he or she could recognize all the 12 target letters. For the letter-sound relationship activity, the child was asked to match the targeted letter sound to a corresponding object picture that began with the same letter sound. This activity also had a total of 12 letter-sounds presented to the child. The child could score a maximum of 12 points in this activity if he or she could identify the right object picture that corresponded to each letter-sound that was presented in each item.

Tables 4 through 6 summarizes the individual scores achieved by the child for each of the three activities, the mean activity scores, and the calculated SD from both the control and treatment group children. The scores obtained from the three activities were analyzed as a group. A descriptive statistical analysis (calculated mean and SD) was carried out for each activity and

compared between the two groups (control and treatment). A normal distribution pattern was observed based on the calculated mean and SD for all the three activities among the participants from both groups (as shown in Table 4 for the Upper- Case Alphabet Recognition task from PALS-PreK, Table 5 for the letter recognition task, and Table 6 for the letter-sound relationship task). To compare between the two independent groups (control and treatment), the unpaired *t*-test was performed. The p- and t-values were calculated using the 95% CI. Results from the unpaired *t*-test revealed no significant difference in the baseline scores between the control and treatment group for any of the three activities. The overall baseline child level measures accounted for the normal distribution of the scores across the sample, and no extreme values (floor and ceiling effects) were observed for each measure. Thus, the child level measures developed for the study was found to be appropriate for examining the letter knowledge skills of children from at-risk families.

Table 4. Calculated mean and SD for baseline Upper-Case Alphabet Recognition subtest of PALS-PreK assessment from control and treatment group children.

Upper-Case Alphabet Recognition	Control	Treatment
Total number of participants	5 parent-child pairs	9 parent-child pairs
Individual scores for the task out of 26	5, 7, 3, 0, 21	2, 11, 4, 1, 16, 0, 3, 0 (and one did not complete)
Mean scores for the task out of 26	7.2	4.62
SD for the task out of 26	7.27	5.42
Coefficient of Variance (SD/mean)	1.00	1.17

Table 5. Calculated mean and SD for baseline letter recognition activity from control and treatment group children.

Letter-recognition task	Control	Treatment
Total number of participants	5 parent-child pairs	9 parent-child pairs
Individual scores for the task out of 12	5, 5, 3, 5, 9	3, 11, 6, 1, 4, 9, 0, 10, 3

Mean scores for the task out of 12	5.4	5.22
SD for the task out of 12	1.95	3.76
Coefficient of Variance (SD/mean)	0.36	0.72

Table 6. Calculated mean and SD for baseline letter-sound relationship activity from control and treatment group children.

Letter-sound relation-ship task	Control	Treatment
Total number of participants	5 parent-child dyads	9 parent-child pairs
Individual scores for the task out of 12	7, 0, 3, 5, 3	4, 7, 5, 5, 9, 10, 0, 4, 7
Mean scores for the task out of 12	3.6	5.66
SD for the task out of 12	2.33	2.82
Coefficient of Variance (SD/mean)	0.64	0.49

Performance over time. Both parent- and child-level measures were collected during the first (baseline data) and the final fourth museum visit (post-treatment data). Tables 7 through 11 provides a comparison between the baseline and post-treatment, parent- and child-level score. The comparison was carried out to analyze the performance over time with respect to the two control group participants.

Only two out of the 14 participating families completed their final museum visit within four months. Both of these families belonged to the control group. For each family, the baseline parent-level measures (that is, the scores from parent interview questionnaire) and child-level measures (that is, the Upper- Case Alphabet Recognition task from PALS-PreK, informal letter recognition, and letter-sound relationship task) were compared to their post-treatment data. As shown in Tables 7 through 11, the comparison revealed no significant change in the baseline and post-treatment scores.

Table 7. Baseline and post-treatment parent interview questionnaire scores from control group parent 1.

Parent activity	Baseline score	Post-treatment score
Talk about letters	3	4
Play with letters	3	4
Name the letters	3	4
Point out letter	3	4
Child says letters	3	4
Asked child to say the letter	3	4
Child asked parent to read to them	3	3
Parent read to child	3	3
Child points to pictures when reading	3	3
Parent points to signs and words	2	2
Play rhyming games with child	1	1
Child sees adults reading at home	2	2
Child writes own name	2	2

Table 8. Baseline and post-treatment parent interview questionnaire scores from control group parent 2.

Parent activity	Baseline score	Post-treatment score
Talk about letters	3	3
Play with letters	3	3
Name the letters	3	3
Point out letter	3	3
Child says letters	3	3
Asked child to say the letter	3	3
Child asked parent to read to them	3	3
Parent read to child	3	3
Child points to pictures when reading	3	3
Parent points to signs and words	3	3
Play rhyming games with child	2	2
Child sees adults reading at home	3	2
Child writes own name	3	3

Table 9. Baseline and post-treatment Upper-Case Alphabet Recognition subtest scores from two control group children.

Participant	Group	Baseline score	Post-treatment score
Child 1	Control	5	1
Child 2	Control	7	9

Table 10. Baseline and post-treatment letter recognition task scores from two control group children.

Participant	Group	Baseline score	Post-treatment score
Child 1	Control	5	5
Child 2	Control	5	10

Table 11 Baseline and post-treatment letter-sound relationship task scores from two control group children.

Participant	Group	Baseline score	Post-treatment score
Child 1	Control	7	3
Child 2	Control	0	5

Discussion

Research has shown that there is an inconsistently high number of children from low SES families with poor academic outcomes (National Institute of Literacy, 2008). A major reason for this poor performance is related to the amount of poverty observed in this population (Duncan & Murnane, 2011). As a result, researchers have been working to develop effective assessments and interventions to improve children's reading ability. Many children from low SES families enter elementary schools less prepared to learn to read due to weak emergent literacy skills. Previous literature has shown that emergent literacy skills such as awareness of print, phonological awareness, and letter knowledge, are predictive of children's later reading and writing skills (Rhyner et al., 2009; Whitehurst & Lonigan, 1998). For the most part, these skills are acquired within the preschool period (Justice & Ezell, 2001). Therefore, the first four years of the child's life are considered crucial for the development of these emergent literacy skills that enable the child to smoothly transition to formal literacy instruction (Justice & Ezell, 2001). Among all the emergent literacy skills, letter-sound knowledge appears to play a unique role in children's later reading and spelling development (Catts et al., 2001; Caravolas et al., 2001; Foulin, 2005; Lonigan et al., 2000; Muter et al., 1997). Previous research has also claimed that letter knowledge is one of the strongest single predictors of learning to read on entry into school (Catts et al., 2001; Caravolas et al., 2001; Foulin, 2005; Lonigan et al., 2000; Muter et al., 1997).

Thus, if preschool children are encouraged to know about letters and their sounds, this will contribute to their later reading and writing development and prepare them for their entry into schools.

A contributing factor influencing the development of a young child's emergent literacy skills is parental involvement (Dearing, Kreider, Simkins & Weiss, 2006). Parenting styles and family literacy activities during the first three years of the child's life contribute heavily to the child's development of letters and letter sound knowledge (Robins et al., 2014; Weigel et al., 2006). Neumann and colleagues (2009) claim that parent-child interactions are an excellent way to encourage the development of emergent literacy skills such as letter knowledge. However, traditional classroom-based education most often excludes parents from being a part of their children's education particularly in low SES populations (Booth & Dunn, 2013). Therefore, by promoting more natural and authentic ways to engage low SES parents/caregivers in their child's academic development can help to develop the child's emergent literacy skills such as letter knowledge and eventually reduce the lower academic outcomes seen among the at-risk population.

A natural way for parents to incorporate learning and interact with their children is by visiting a children's museum. Children's museums play an effective role in helping parents mediate their child's experience at the museum. Hence, the children's museum experience can be an effective method for parents and children to interact in an environment that provides opportunities for advancing early learning skills.

This study targeted assessing and teaching parents strategies to improve the at-risk child's letter knowledge skills, using a children's museum as a facilitating environment. Parents were taught to employ strategies such as naming, repetition, and modeling to teach letters and letter

sound knowledge to their preschoolers during their museum visits and to extend this learning beyond the museum experience to everyday conversations and play activities at home.

A total of five materials were developed to evaluate the effectiveness of this museum based enrichment program. The first material used for data collection was the background information questionnaire. This form provided information on the descriptive demographic details of the at-risk families who participated in the study. The overall analysis of this form from both control and treatment group families reflected the variability of characteristics seen in at-risk families. Some notable characteristics that aligned with low SES background were also observed. For example, among the total 14 parents, two had graduated high school; six had completed two years of college; four had an undergraduate degree; and only two had a graduate degree. Regarding employment, six out of the 14 parents were unemployed, and a majority of the families had an annual income of between $15,000 - $45,000. Furthermore, families from a range of ethnic groups were also observed. Among the 14 participants, there were 36% Hispanic families, 29% African-American families, 29% Caucasian families, and 6% from a mixed race. It was anticipated that the majority of the sample would be African-American given the high percentage of African-American families living in poverty in Milwaukee (Wisconsin Poverty Report, 2014). However, the current sample had more Hispanic families than African American families. Finally, five out of 14 children were enrolled in an early education program.

The second material used for the study was the parent interview questionnaire which was developed to keep track of the parents use of strategies and to understand the child's HLE before and after the museum enrichment. Overall analysis of the baseline parent-level measures accounted for a normal distribution of the scores across the sample and absence of extreme values, thus voiding floor and ceiling effects with the scores. Hence, the parent level measures

developed for the study was found to be appropriate for examining the parent's use of strategies and child's HLE among the at-risk families.

The final three materials contributed to the collection of child-level measures (Upper-Case Alphabet Recognition subtest of the PALS-PreK assessment, letter recognition activity, and letter-sound relationship activity) and were designed to evaluate the letter knowledge skill in at-risk children, both before and after the museum enrichment experience. Similar to the parent-level measures, the overall baseline child level measures accounted for a normal distribution of the scores across the sample, and no extreme values (floor and ceiling effects) were observed. These measures were also found to be appropriate for examining the letter knowledge skills of children from at-risk families.

However, the coefficient of variance calculated for each of three tasks revealed high variability across the participants. Several factors may have contributed to this overall high dispersion of scores across the participants. For instance, not all participants had the same research team member who conducted the activities. Each participating child had different research team member who met with the family on their scheduled appointment to carry out the tasks. Similarly, not all participants were tested on the same date. Each child was tested at different dates and times based on their scheduled appointments. Finally, some children were more cooperative than others during the testing. The variability within the sample could also be a consequence of the small sample size.

Furthermore, it was also observed that the scores obtained for the formal test (Upper-Case Alphabet Recognition subtest of the PALS-PreK assessment) had the most variability compared to the informal activities (letter recognition and letter-sound relationship tasks). For the formal test, the child had to name the 26 letters shown to them, whereas for the informal

activity, the child had to only point to the correct letter or picture as prompted by the clinician. Therefore, naming, in general is a tough task when compared to the informal letter recognition and letter-sound relationship activities that required only the comprehension ability of the child. Besides, the letters chosen for the informal activities were early developmental letters. All these factors may have caused the higher dispersion of scores across the participants with the formal test than the informal activities. Nevertheless, accounting for the normal distribution of scores and avoiding of extreme values, these measures (Upper-Case Alphabet Recognition subtest of the PALS-PreK assessment, letter recognition activity, and letter-sound relationship activity) can be considered appropriate for examining the letter knowledge skills of children from at-risk families.

Although only a very limited number of families (2 of 14) could complete the post treatment measure, the comparison between the baseline and post treatment, parent- and child-level measures for the two control group families revealed no significant change in the baseline and post-treatment scores. However, based on the baseline data received from the current 14 participants, it can be predicted that the child-level measures (which includes the Upper-Case Alphabet Recognition subtest of the PALS-PreK assessment, letter recognition scores, and letter-sound relationship scores) are more sensitive and the parent-level measure (the parent interview questionnaire scores) is less sensitive to changes with the implementation of the treatment. This is because all 14 participants appeared to be performing higher or have had higher SES than anticipated in terms of parent's scoring on the parent interview questionnaire (which assessed the parent's use of strategies at home to improve their child's emergent literacy skills and information about their child's HLE). Most parents rated '3' on the '4-point' rating scale and '2' on the '3-point' rating scale of the parent interview questionnaire, hence there is not much room

for improvement with the treatment in regards to the parent's scoring. However, the child-level measures were purely based on the child's performance on the three activities. Furthermore changes in the children's HLE may also be less likely to change within this time period. The child-level measures appeared to be more sensitive than the parent-level measures as it would reflect the impact of the treatment which is the parents' use of strategies to facilitate their child's letter knowledge skills.

Clinical Implications and Future directions

There is a significant, disproportionate achievement gap observed between children from low SES and higher SES backgrounds (National Assessment of Educational Progress). Children require strong literacy skills to access the curriculum and be successful in the information age. Early intervention to boost the at-risk child's emergent literacy skills can significantly improve the long-term academic and literacy outcomes of children, thus contributing to close the achievement gap (Ramey & Ramey, 2004).

Both the parent- and child-level measures can be used by professionals such as speech-language pathologists, early interventionists, and educators of preschool children as screening tools to early identify children from low SES who may be at risk in developing emergent literacy skills. The child-level measures were considerably easy and quick to administer. The parent interview questionnaire was self-explanatory, and parents could easily respond to each question using a four-point rating. Therefore, these measures can be used for a quick but detailed screening tool to early identify children from at-risk families.

As discussed earlier, a child's HLE plays a key role in their language and literacy accusation. As a result, the parent interview questionnaire can also be used as an assessment tool to evaluate the quality and quantity of parent-child interactions that occur among the at-risk

families. This can help to enrich the child's HLE, thus proving a strong foundation for the development of their reading and writing skills. Furthermore, the PALS-PreK assessment is being widely used by educators of preschool children to assess the child's emergent literacy factors including letter knowledge ability. The informal letter recognition and letter-sound relationship task scores can complement the results from a formal assessment such as PALS-PreK to better understand the child's letter knowledge ability.

In addition, the parent interview questionnaire can also be used as an education tool to engage parents in their child's academic development. It can be used to develop strategies to teach parents how to incorporate early literacy activities at home in everyday interactions with the child. This would contribute to improving the academic outcomes and thereby reduce the achievement gap.

To continue this line research, more number of at-risk families need to be enrolled in this study and assessed for letter knowledge skills. A larger sample of parent and child dyads may help to determine the impact of treatment by comparing the control and treatment group performances over time.

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Appendix A

INITIAL SCREENING QUETIONNAIRE

To be used during the phone call with the parent (both control and treatment group) to determine if the parent and child meets the inclusion criteria

[SCRIPT FOR THE INTERVIWER]

Dear Parent, I am calling from the Department of Communication Sciences and Disorders at the University of Wisconsin – Milwaukee. I am a part of the research team that will be conducting a study in collaboration with the Betty Brinn Children's Museum. I received your contact information from the Family- Focus program at the museum. I want to thank you for giving us the permission to contact you.

In this study, we want to simply see how parents and children learn from the museum. We will ask you to answer a few questions and observe you playing with your child. We also will ask your child some questions to see what she/he is learning. These won't take much time, so it will pretty much be like a normal visit to the museum.

For the study, we are asking families to make four visits to the museum with your child in the span of three months. We also would like the same parent or caregiver to bring the child for all the four visits. Each time you visit the museum, we will have a small prize for you and your child. Also, at the end of the study you will also receive a gift card for $XX as a thank you from our end for being a part of the study.

The purpose of today's call is to get some basic information about you and your child. After the call, the team will determine if you meet the requirements for the study and will return a call to inform you the same.

[Continued on Next Page]

INITIAL SCREENING QUETIONNAIRE

Today' Date: _____
Month Date Year

Information about the child

Participant/Child's Full Name: _____

Child's date of birth: _____
Month Date Year

Child's age: _____ *(must be between 2;6 and 4;0)*

Child's gender: ○ Female ○ Male

Does your child have any history of identified suspected delays or disorders in speech, language, hearing or other developmental areas : ○ Yes ○ No

If Yes, Please specify: _____

Information about the parent/guardian

Parent/Guardian's Name: _____

Relationship to the Child: _____

Are you the primary caregiver: ○ Yes ○ No

How many hours are you with your child each week?
○ 15 hours per week
○ Less than 15 hours per week
○ More than 15 hours per week

Percentage of time you talk in English with your child:
○ Less than 50% of the time
○ About 50% of the time
○ More than 50% of the time
○ Less than 15 hours per week

Are you able to bring your child to the museum 4 times? ○ Yes ○ No

Appendix B

DEBRIEFING LETTER FOR CONTROL GROUP FAMILIES

Dear Parent or Guardian,

Thank you for your valuable time and participation in this study. The aim of the study was to understand how the children's museum could help kids learn letter-knowledge (both letter-name and letter-sound). Letters are the building blocks of words. There are 26 letters in the English alphabet. Letters form the foundation for the development of your child's reading, writing and spelling skills. Each letter of the alphabet has two characteristics that define them. One is the letter-name and two is the letter-sound. For example, the name of the letter "B" is pronounced as "bee". And the sound made by the letter "B" is "b" as in "bat". Some letters make different sounds when they are within words. For example, the letter "G" make different sounds as in "goat" and "age" and make a whole new sound when it is combined with other letters as in the word "rough". Some letters make no sounds at all when they are within words. For example, the letter "B" at the end of a word such as "thumb" makes no sound at all. According to research, these letter-names and letter-sound knowledge are strong predictors of later reading success in young children. Preschool children who can recognize letters of the alphabet and their associated sounds have an easier time learning to read as they transition to school. Hence, the goal was to train parents to use strategies in teaching letter-names and letter-sounds to their child while visiting the museum and eventually use these strategies beyond the museum experience and at home with everyday objects.

For this study, the participants were randomly placed in two groups. The first group consisted of parents who received training on how to teach their child about letter-names and letter-sounds using the museum exhibits. And the second group consisted of parents who were asked to interact with their child as they would normally do in a museum. The first group of parents were asked to focus on teaching their child letters, one letter per visit. They received training on how to implement three specific techniques to teach the letter to their child while

exploring the museum exhibits. The techniques were ‘modeling’, ‘repetition’, and ‘naming’. Here is the description for each:

- ‘Modeling’ is a technique in which the parent would say the name of the object that starts with the given letter. For example, “I found a tree! Tree starts with the letter T”.
- ‘Repetition’ is a technique in which the parent would say the letter many times while showing the letter to the child. For example, “Look! T for tree”.
- ‘Naming’ is a technique in which the parent would ask their child to say the letter. For example, “Now you say it! Tree starts with _____.”

Both groups were asked to make four visits to the museum during which the parents completed same questionnaires about their background and home activities. Children from both groups were given the standardized test material (PALS-PreK) and the school-type tasks such as pointing to pictures and saying letters. We were particularly interested in comparing the information between the two groups to explore the following questions:

- If the training given to the parents on letter-teaching strategies change the way that parents describe letters to their children within the museum experience?
- If the training given to the parents on letter-teaching strategies improve children’s knowledge of letters and letter-sound relationships? and
- If the parent's background information and home activities impacted the above results?

Your participation is not only greatly appreciated by the researchers involved, but the data collected could help parents to teach about letters to their child in everyday life activities such as during a visit to the museum. Finally, we urge you not to discuss this study with anyone else who is currently participating or might participate at a future point in time. If you have any questions about the study, please feel free to contact one of the investigators:

- John Heilmann: 414-861-6665
- Chris Lawson: 608-335-0598
- Maura Moyle: 414-550-4900
- Jeny Thomas: 847-909-1935

Thank you!

Appendix C

INSTRUCTIONAL HANDOUT

(To be given to the treatment group parents during their visit to the museum)

[SCRIPT FOR THE INTERVIWER]

Dear Parent,

We are giving you a letter cutout to use in the museum today. If you turn the letter over, you will also find some words that begin with the same letter. You can find these words throughout the museum. So this is going to be your letter for the day. Explain to your child that you will be playing a treasure hunt game to find these objects throughout the museum. When you find an object, remember to use the three techniques described in your handout:

- *Say the name of the object that starts with the letter. For example, "I found a tree, Tree starts with the letter T"*
- *Say the letter many times to your child while showing the letter cutout. For example, "Look, T for tree"*
- *Ask your child to say the letter. For example, "Now you say it! Tree starts with _____"*

After you find an object, remember to check them off from the back of the letter cutout.

[Continued on Next Page]

Let's learn some letters!

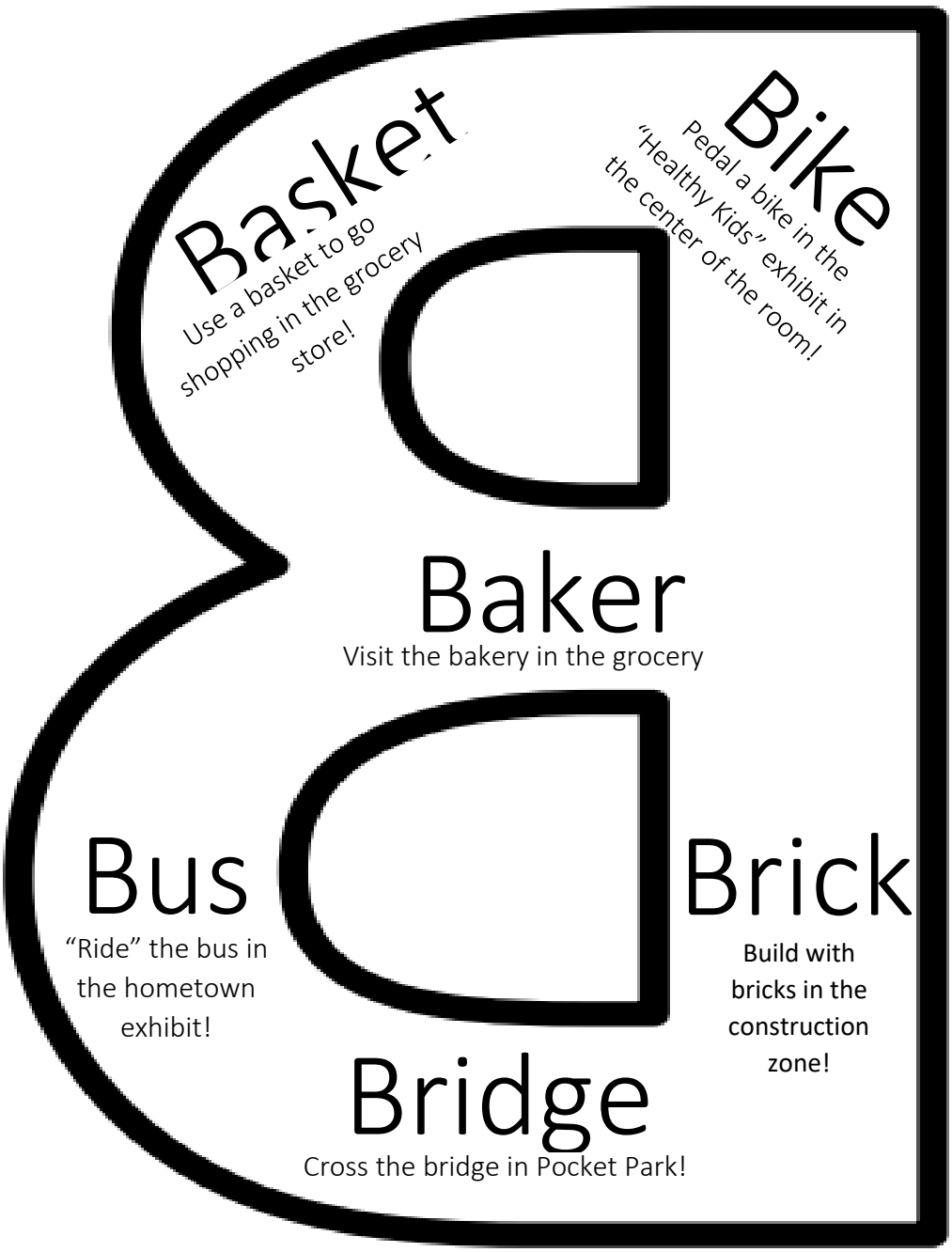
You will be given a cutout of the letter for the day. Throughout the museum, you will find the objects written on the back of the letter cutout. When you find an object remember to use the following techniques:

Technique	Description	Example
Modelling 	Say the name of the object that starts with the letter	"I found a tree! Tree starts with the letter T"
Repetition 	Say the letter many times while showing the letter	"Look! T for tree"
Naming 	Ask your child to say the letter	"Now you say it! Tree starts with _____"

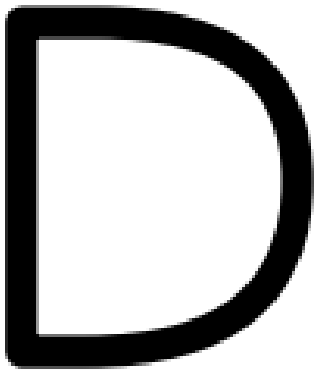
Visit 1	Visit 2	Visit 3	Visit 4

Appendix D

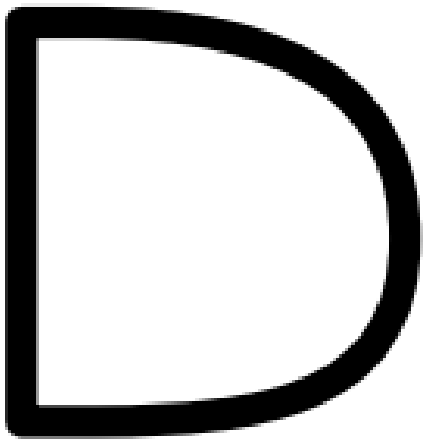
LETTER CUTOUTS



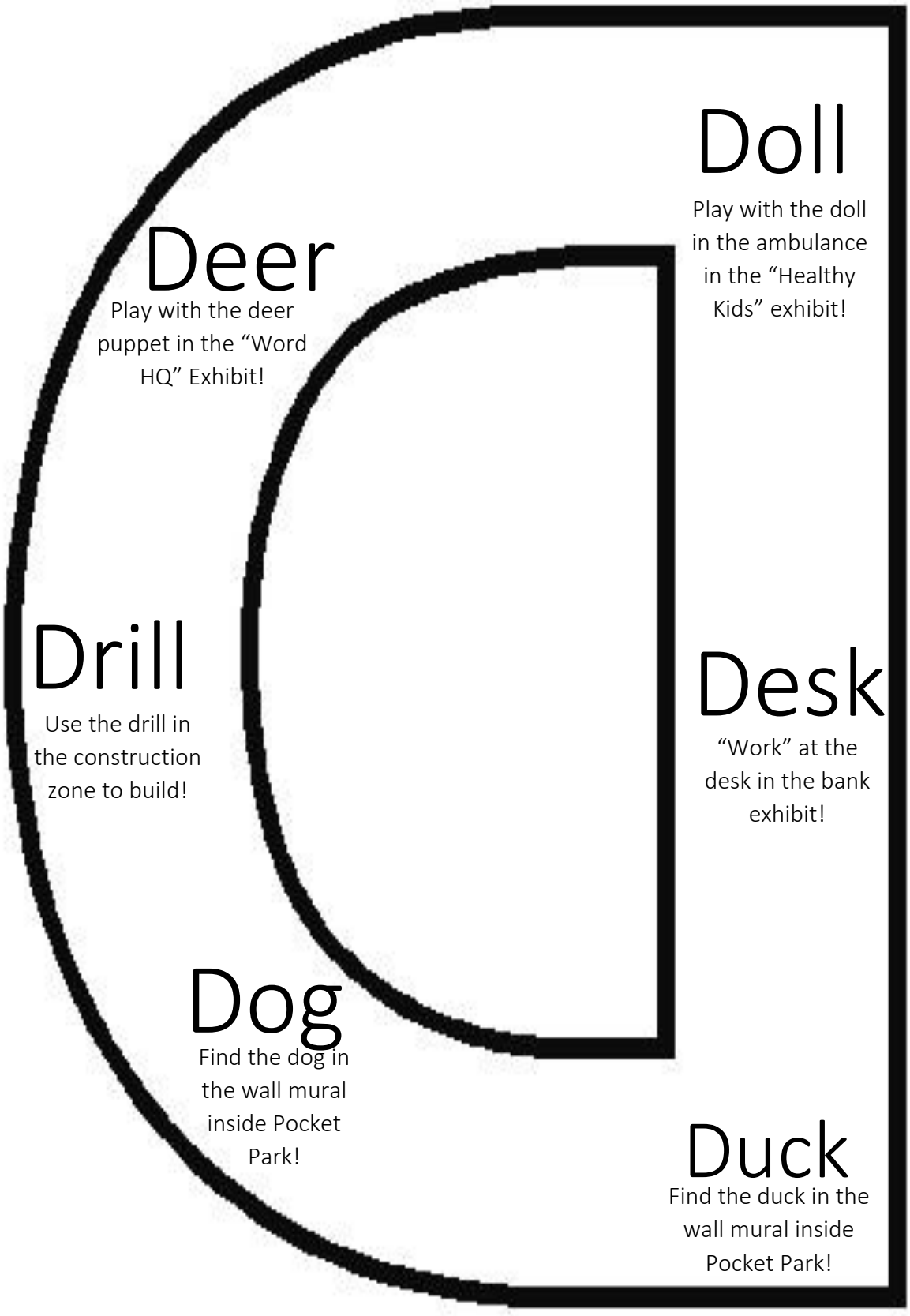
Remember to talk about any words you find that has the letter "B" in it!



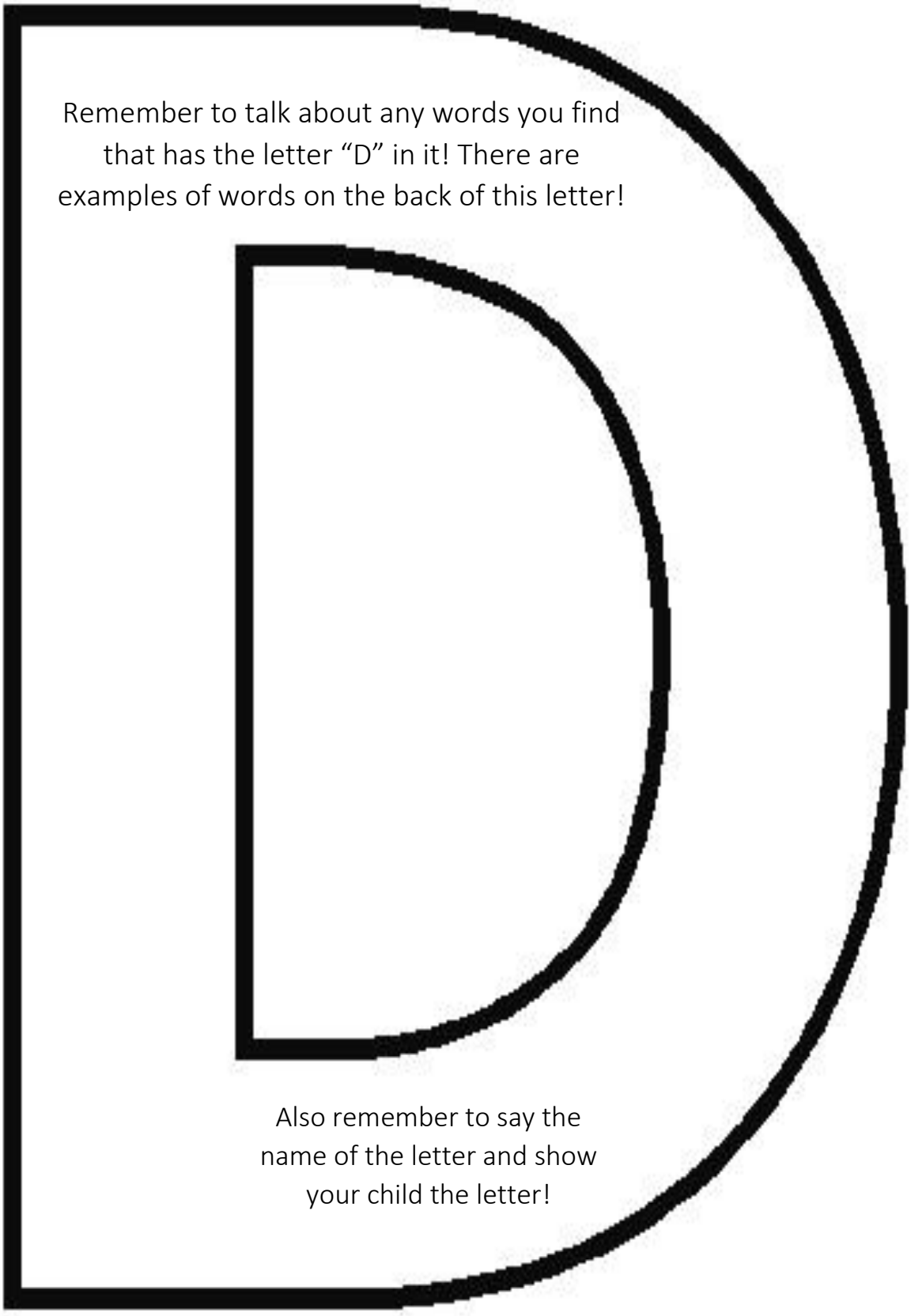
There are examples of words on the back of this letter!



Also remember to say the name of the letter and show your child the letter!


Doll
Play with the doll in the ambulance in the "Healthy Kids" exhibit!
Deer
Play with the deer puppet in the "Word HQ" Exhibit!
Drill
Use the drill in the construction zone to build!
Desk
"Work" at the desk in the bank exhibit!
Dog
Find the dog in the wall mural inside Pocket Park!
Duck
Find the duck in the wall mural inside Pocket Park!

Remember to talk about any words you find that has the letter “D” in it! There are examples of words on the back of this letter!



Also remember to say the name of the letter and show your child the letter!

Flower

Buy some flowers in the grocery store or plant some in Pocket Park!

Flag

Find the American Flag hanging up in the museum!

Freezer

Find the freezer in the Pizza Factory!

Fork

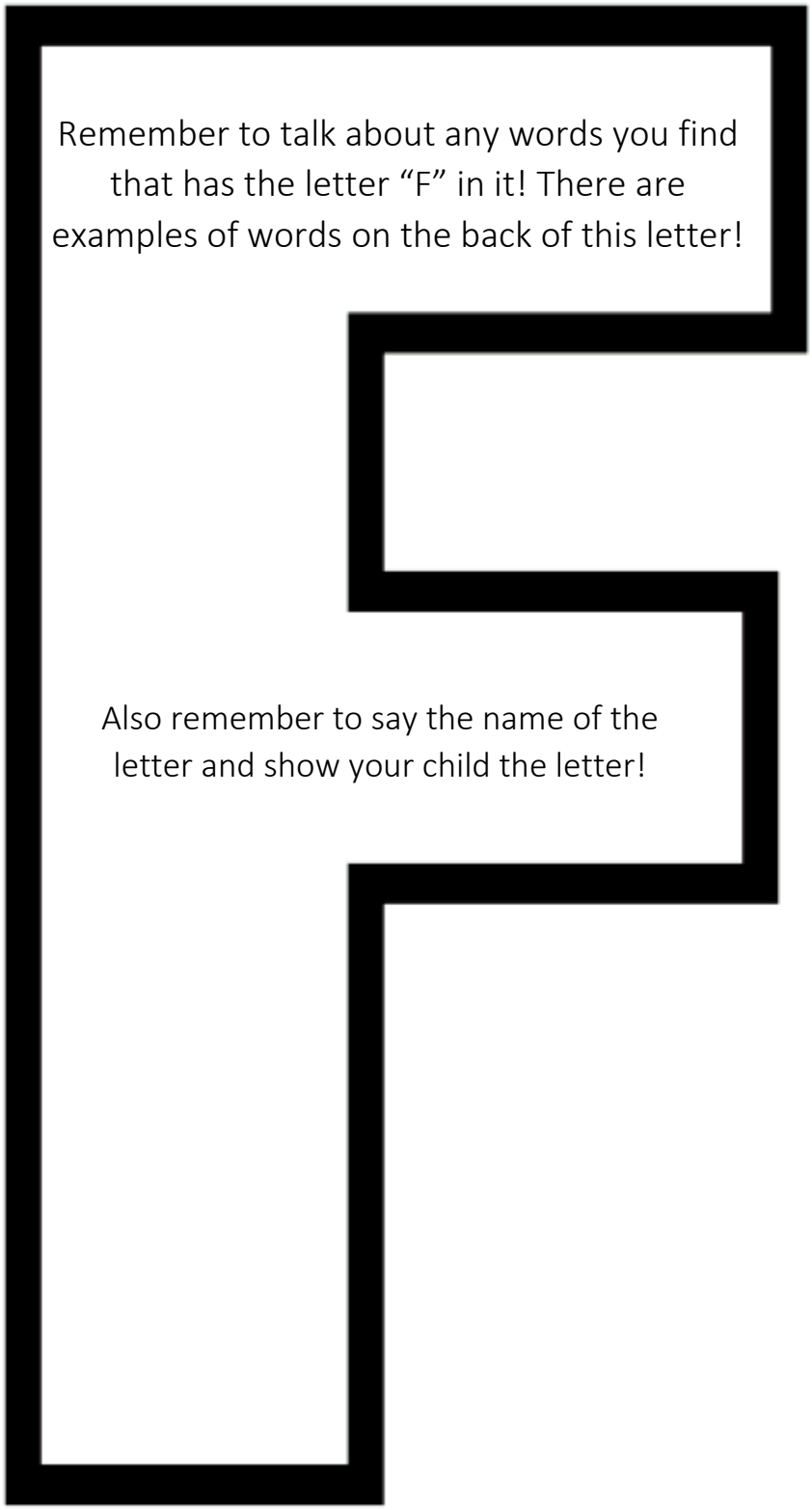
Find the fork in the "My Plate" mural on the wall in the "Healthy Kids" exhibit!

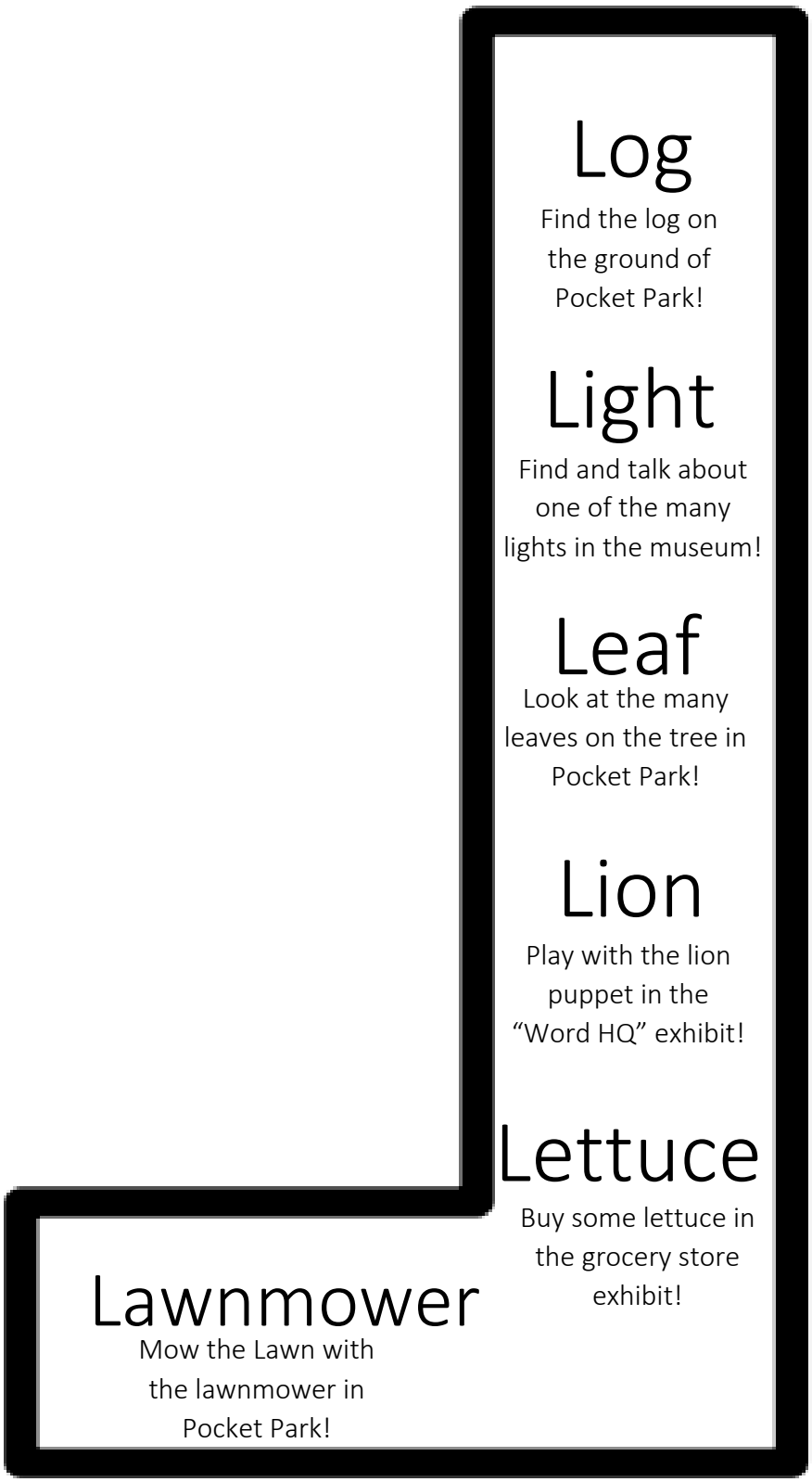
Frog

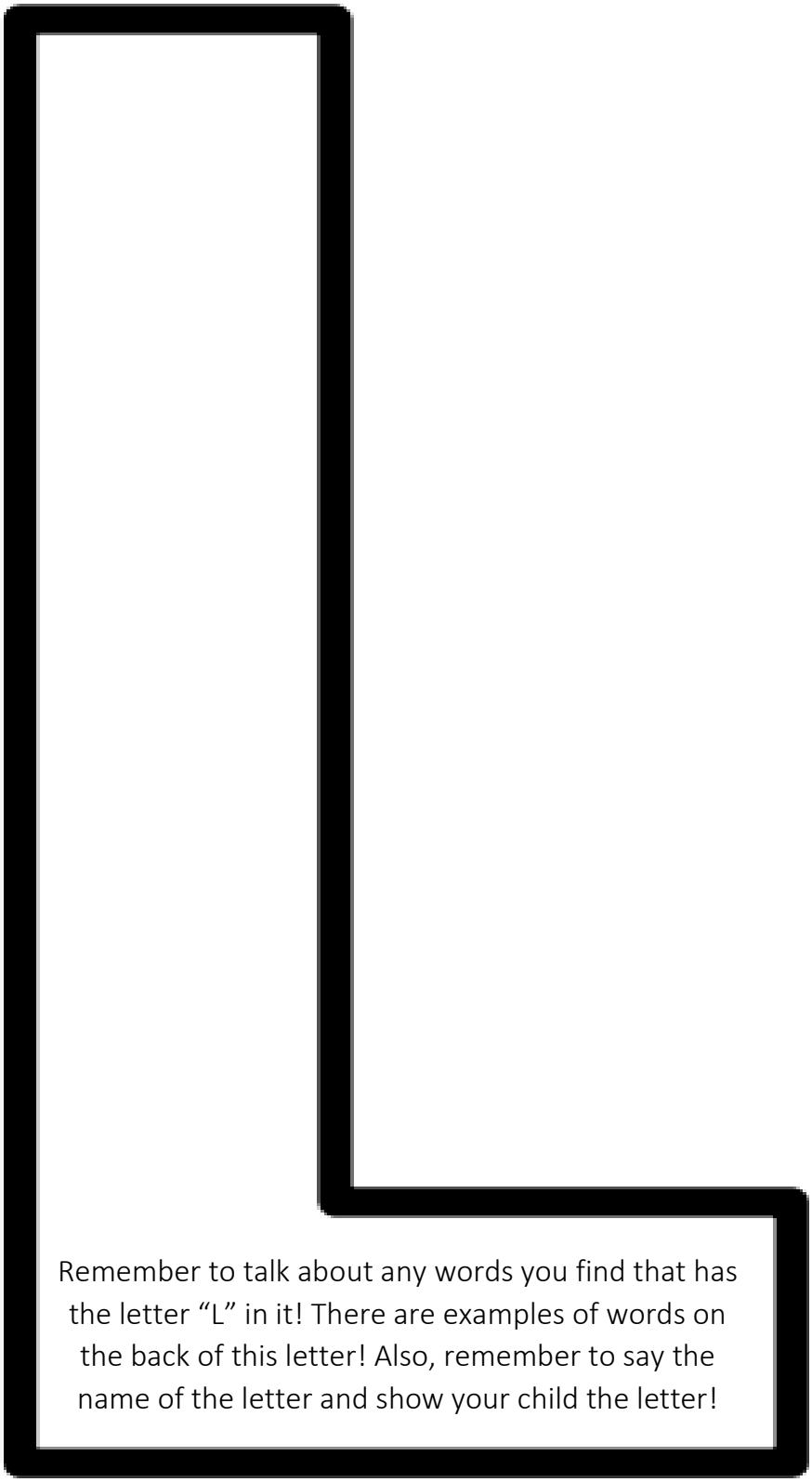
Play with the frog puppet in the "Word HQ" exhibit!

Remember to talk about any words you find that has the letter “F” in it! There are examples of words on the back of this letter!

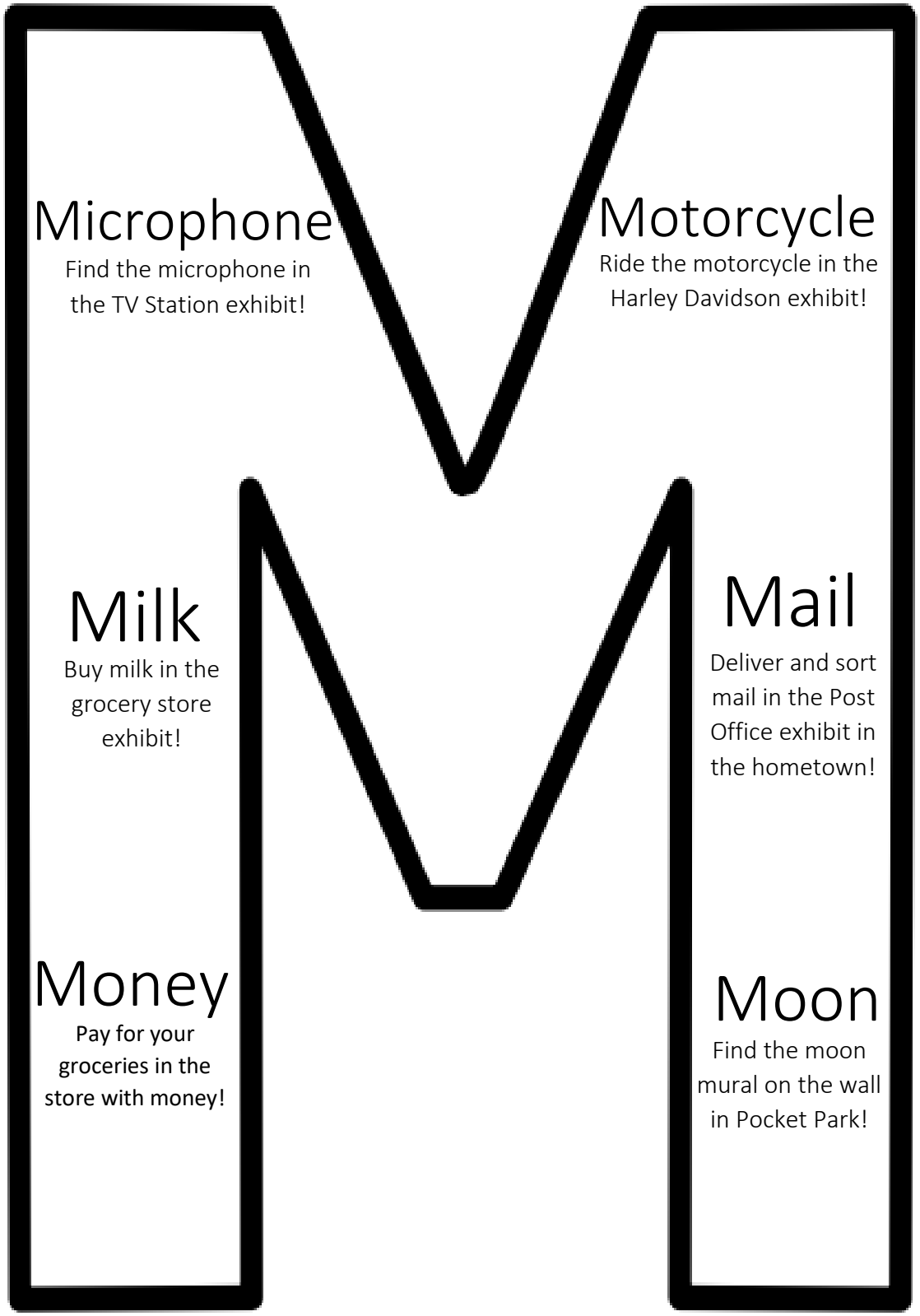
Also remember to say the name of the letter and show your child the letter!

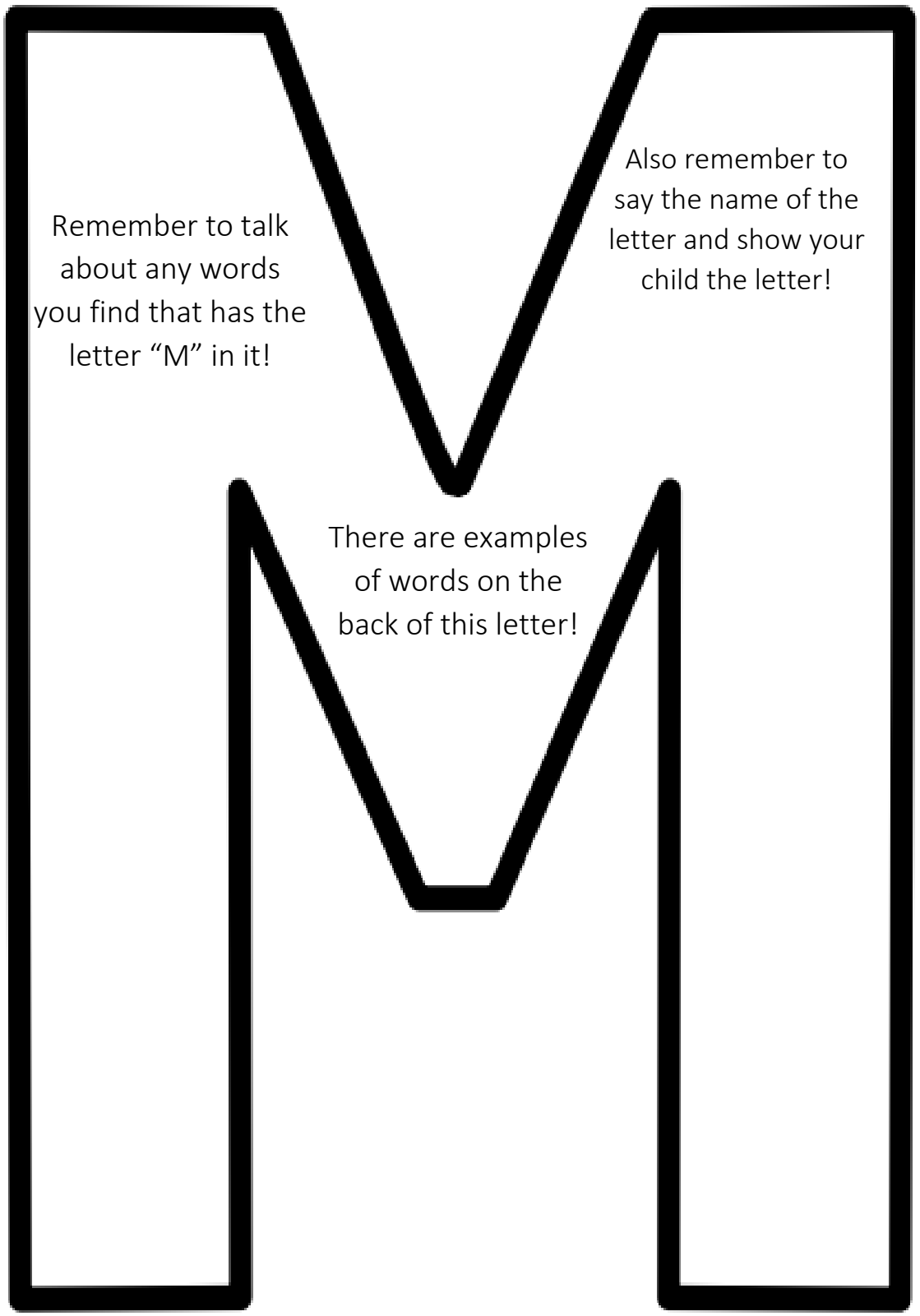


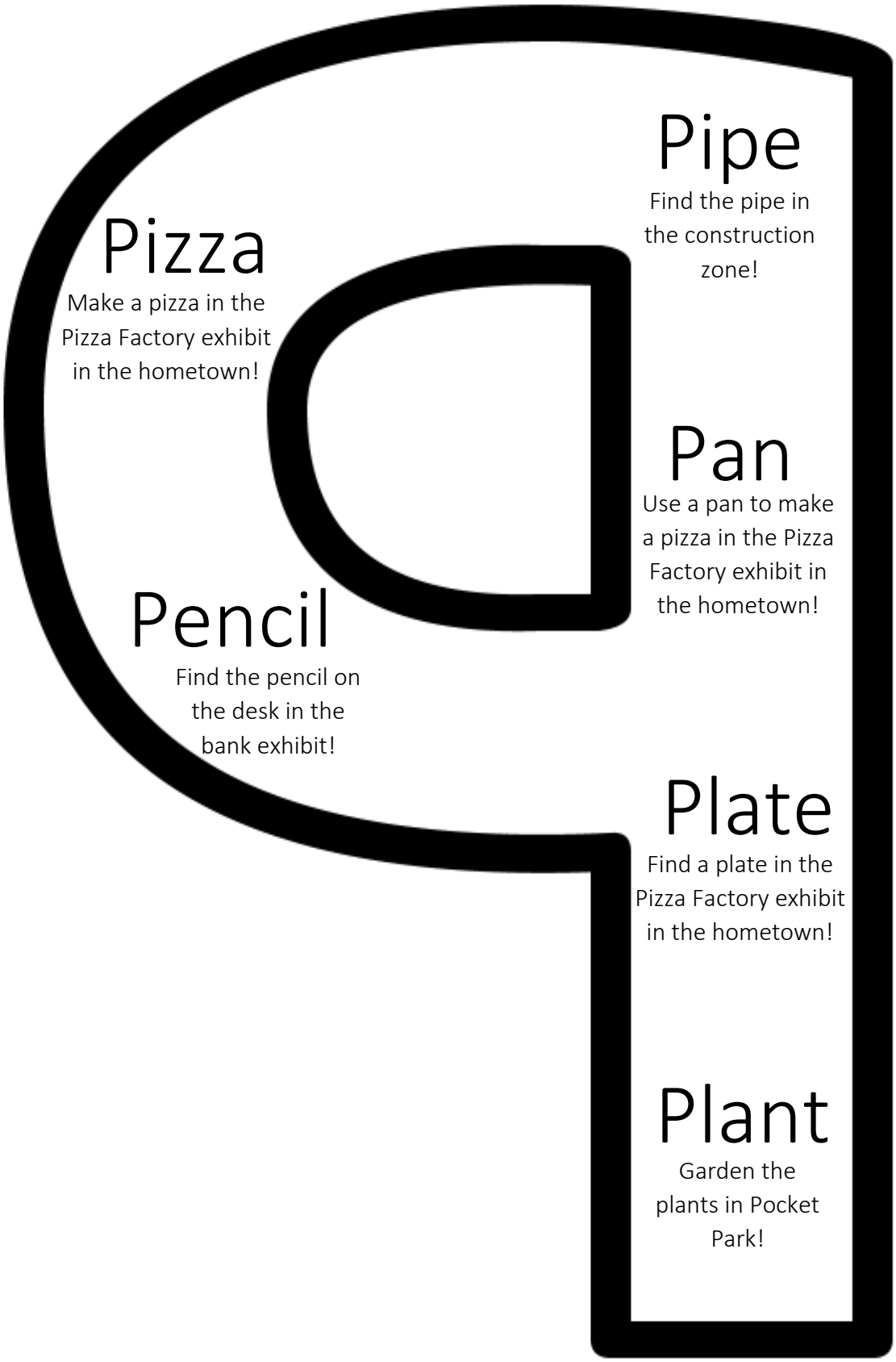

Log
Find the log on the ground of Pocket Park!
Light
Find and talk about one of the many lights in the museum!
Leaf
Look at the many leaves on the tree in Pocket Park!
Lion
Play with the lion puppet in the "Word HQ" exhibit!
Lettuce
Buy some lettuce in the grocery store exhibit!
Lawnmower
Mow the Lawn with the lawnmower in Pocket Park!



Remember to talk about any words you find that has the letter “L” in it! There are examples of words on the back of this letter! Also, remember to say the name of the letter and show your child the letter!


Microphone
Find the microphone in the TV Station exhibit!
Motorcycle
Ride the motorcycle in the Harley Davidson exhibit!
Milk
Buy milk in the grocery store exhibit!
Mail
Deliver and sort mail in the Post Office exhibit in the hometown!
Money
Pay for your groceries in the store with money!
Moon
Find the moon mural on the wall in Pocket Park!


Remember to talk about any words you find that has the letter “M” in it!
Also remember to say the name of the letter and show your child the letter!
There are examples of words on the back of this letter!



Pipe

Find the pipe in the construction zone!

Pizza

Make a pizza in the Pizza Factory exhibit in the hometown!

Pan

Use a pan to make a pizza in the Pizza Factory exhibit in the hometown!

Pencil

Find the pencil on the desk in the bank exhibit!

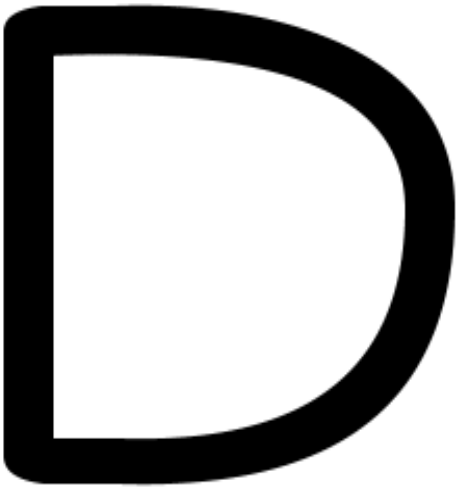
Plate

Find a plate in the Pizza Factory exhibit in the hometown!

Plant

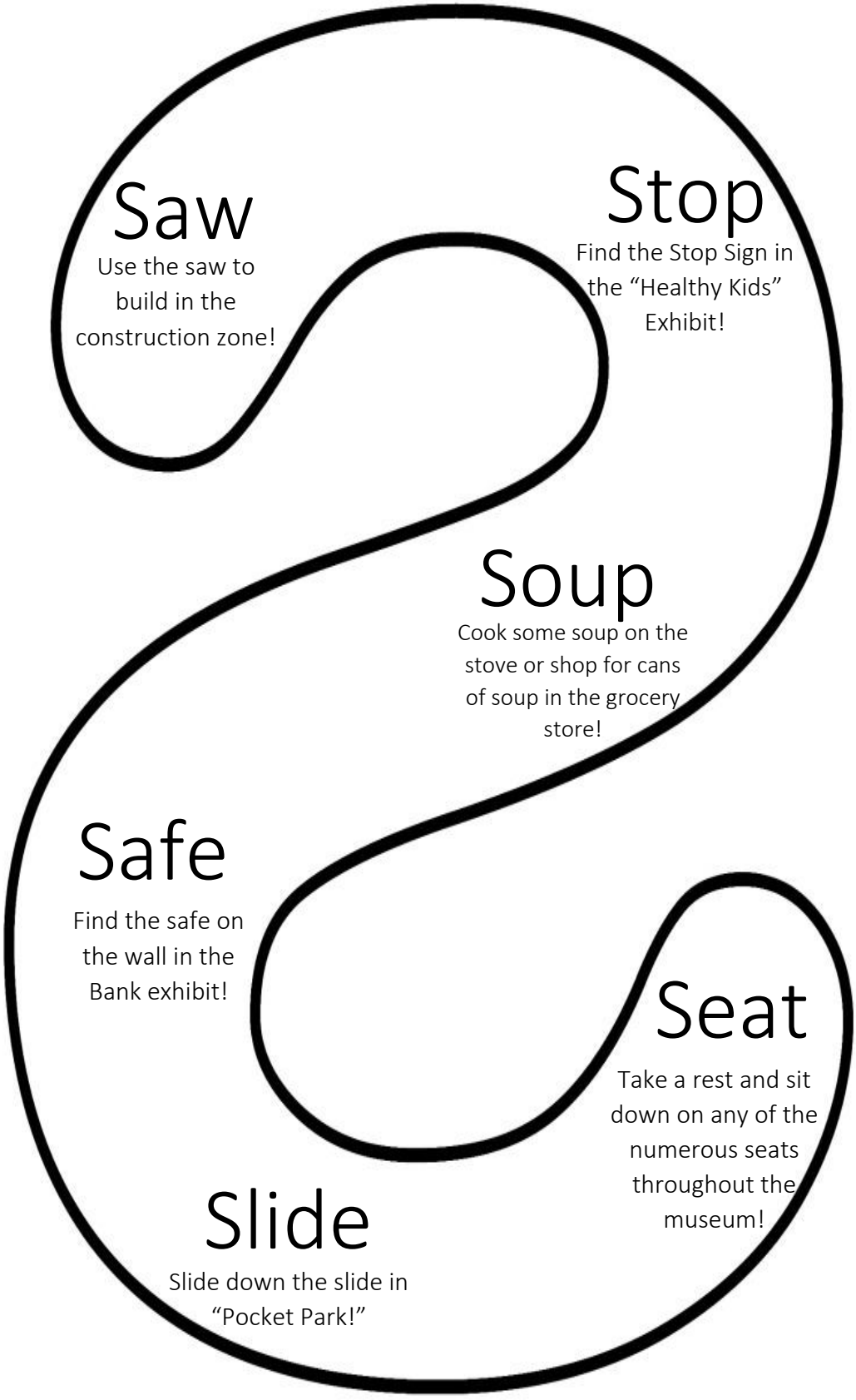
Garden the plants in Pocket Park!

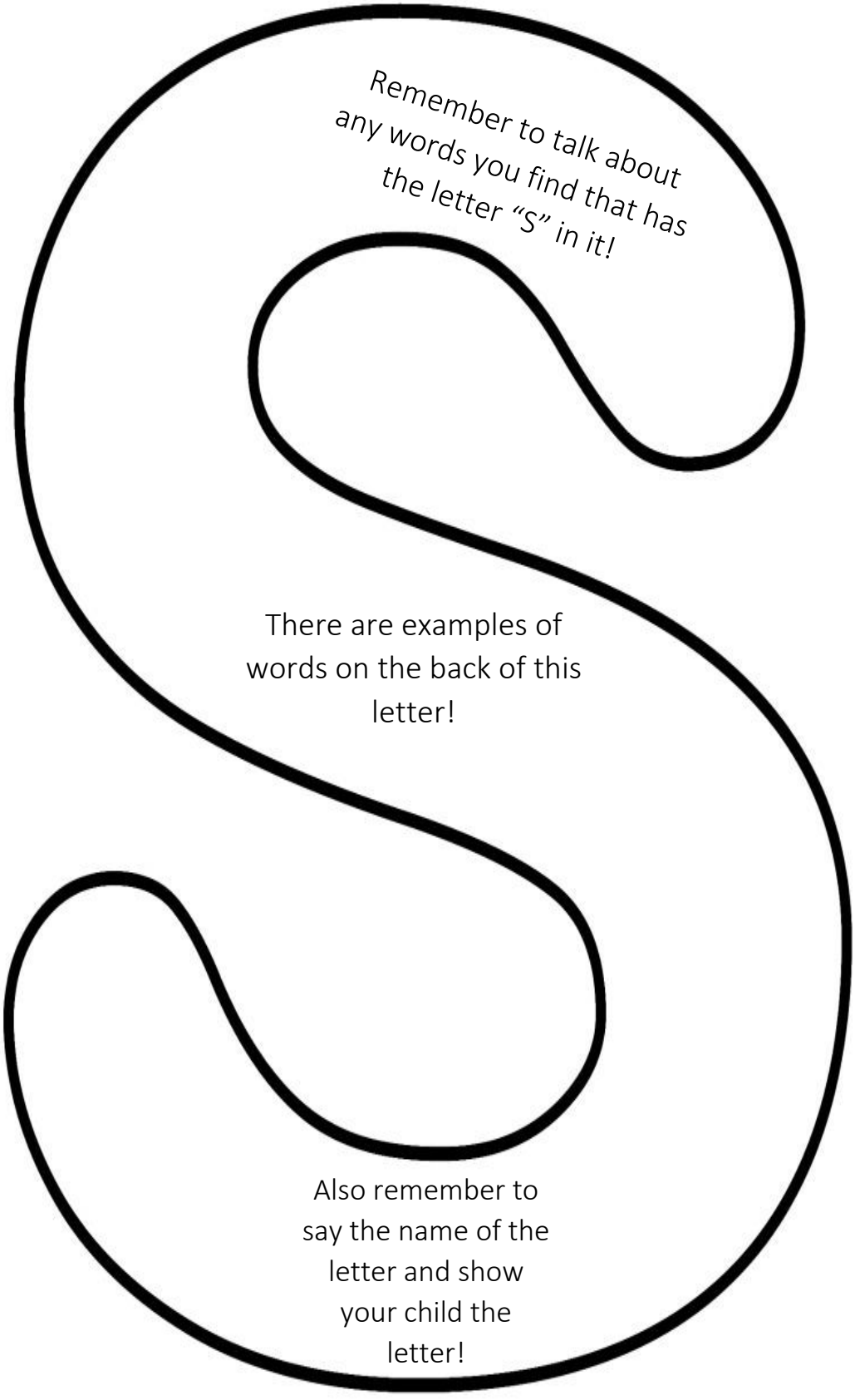
Remember to talk about any words you find that has the letter “P” in it!

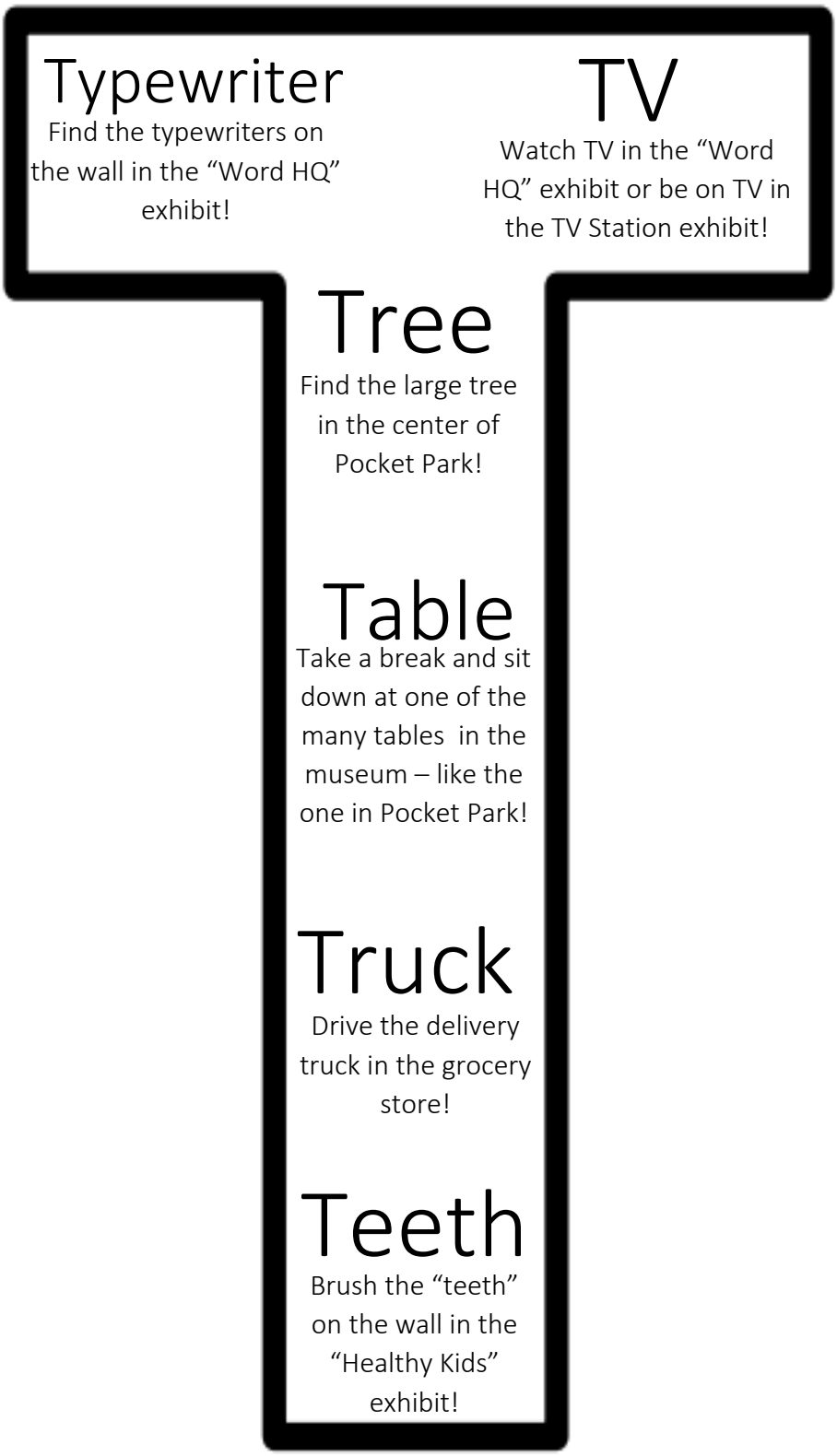


There are examples of words on the back of this letter!

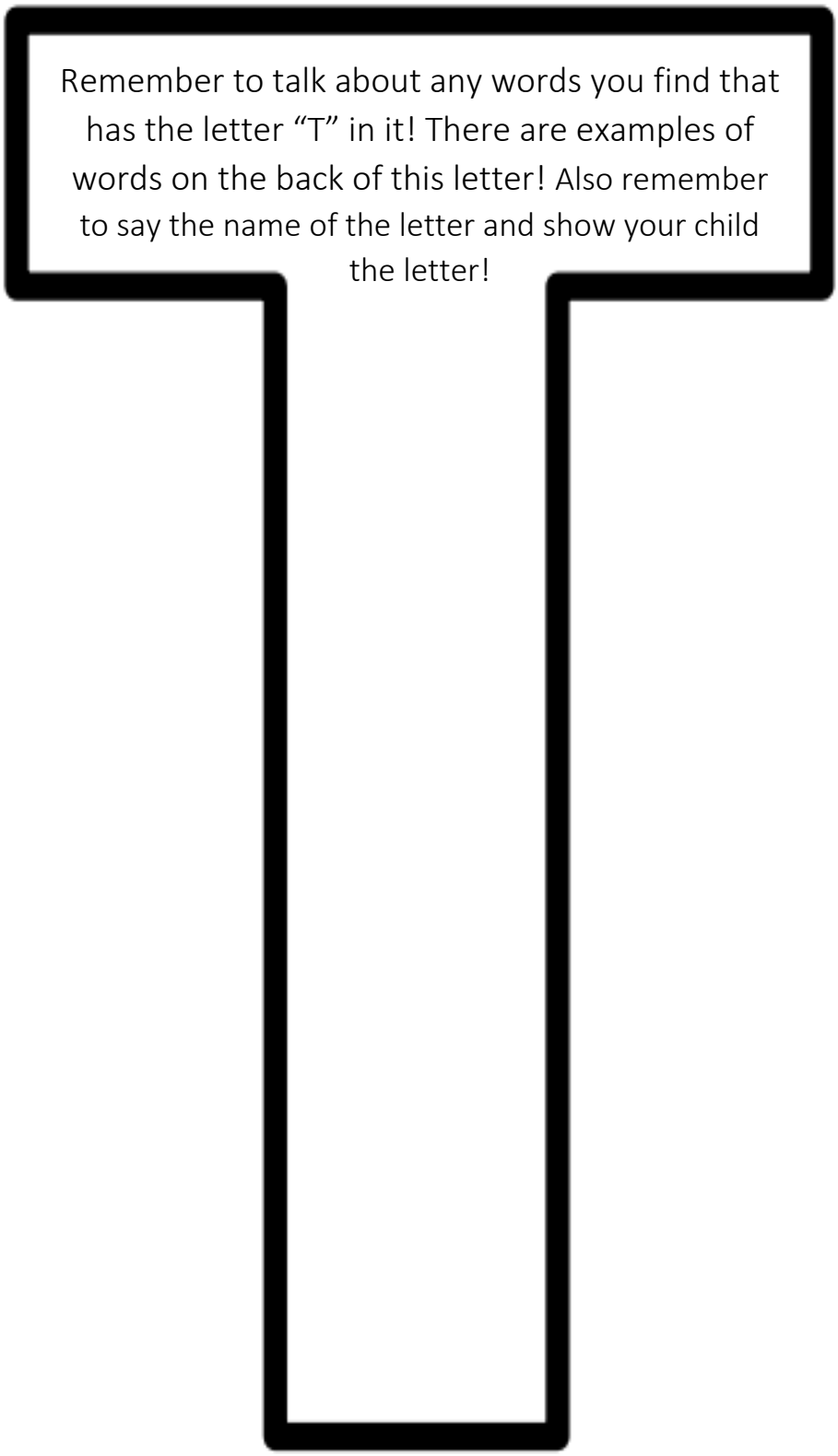
Also remember to say the name of the letter and show your child the letter!


Saw
Use the saw to build in the construction zone!
Stop
Find the Stop Sign in the "Healthy Kids" Exhibit!
Soup
Cook some soup on the stove or shop for cans of soup in the grocery store!
Safe
Find the safe on the wall in the Bank exhibit!
Seat
Take a rest and sit down on any of the numerous seats throughout the museum!
Slide
Slide down the slide in "Pocket Park!"


Remember to talk about any words you find that has the letter "S" in it!
There are examples of words on the back of this letter!
Also remember to say the name of the letter and show your child the letter!


Typewriter
Find the typewriters on the wall in the "Word HQ" exhibit!
TV
Watch TV in the "Word HQ" exhibit or be on TV in the TV Station exhibit!
Tree
Find the large tree in the center of Pocket Park!
Table
Take a break and sit down at one of the many tables in the museum – like the one in Pocket Park!
Truck
Drive the delivery truck in the grocery store!
Teeth
Brush the "teeth" on the wall in the "Healthy Kids" exhibit!

Remember to talk about any words you find that has the letter “T” in it! There are examples of words on the back of this letter! Also remember to say the name of the letter and show your child the letter!



Appendix E

INFORMED CONSENT FOR CONTROL GROUP PARTICIPANTS

UNIVERSITY OF WISCONSIN – MILWAUKEE
PARENTAL CONSENT FOR CHILD TO PARTICIPATE IN RESEARCH

THIS CONSENT FORM HAS BEEN APPROVED BY THE IRB FOR A ONE YEAR PERIOD

1. General Information

Study title: *Museum based enrichment to promote letter knowledge skills using parent-child interactions in at-risk families*

Person in Charge of Study (Principal Investigator):

John Heilmann, PhD, CCC-SLP
Associate Professor
Department of Communication Sciences & Disorders
University of Wisconsin-Milwaukee

2. Study Description

You and your child are being asked to participate in a research study. Your participation is completely voluntary. You do not have to participate if you do not want to participate. Your participation will not affect your relationship with the museum. If you choose not to participate, you will still receive all of the benefits of the family focus program.

Study description:
The purpose of this study is to understand how the children's museum helps kids learn. We are also interested in seeing how you teach things to your child while at the museum. You are expected to make four (4) visits to the museum. In addition, we will ask you and your child some questions on your first and fourth visits. All aspects of the study will be conducted here at the museum. Overall we hope to include 50 pairs of children and guardians in this study

3. Study Procedures

What will I be asked to do if I participate in the study?
If you agree to participate, you and your child will be asked to go through the museum as you normally do. Prior to leaving the museum please find one of our researchers at the entrance of the museum. You and your child will be taken to a quiet location in the museum and will be asked to do a few things. Your child will be asked to do some school-type tasks, such as pointing to pictures and saying letters. During this time, you, the guardian, will be asked some questions about your background and about what you do at home with your child. It will take about 15 minutes to do these things.

4. Risks and Minimizing Risks

What risks will my child face by participating in this study?
There are no foreseeable risks for participating in this research study. In the unlikely event that you or your child are made to feel uncomfortable during they study, you are free to opt out from the study. You and your child's participation does not affect your relationship with the museum. If you choose not to participate, you will still receive all of the benefits of the family focus program.

5. Benefits

Will my child receive any benefit from my participation in this study?
There are no direct benefits to you.

6. Study Costs and Compensation

Will I or my child be charged anything to participate in this study?
You will not be responsible for any of the costs from taking part in this research study beyond those that are part of your typical visit to the museum. For the four visits, you will not have to pay any fee for entry to the museum.

Will I or my child be paid or given anything for being in the study?
As our way of saying "thank you" we will offer you and your child books as prizes at the end of each visit to the museum (total four visits) and a gift card with $25 after completing the study.

7. Confidentiality

What happens to the information collected?
All information collected about you during the course of this study will be kept confidential to the extent permitted by law. We may decide to present what we find to others, or publish our results in scientific journals or at scientific conferences. Information that identifies you personally will not be released without your written permission. Only the PI and members of the research team will have access to the information. However, the Betty Brinn Children's museum, the Institutional Review Board at UW-Milwaukee, or appropriate federal agencies like the Office for Human Research Protections may review this study's records.

We will record information about the age and gender of your child; however, we will not report any information on you or your child. All data will be aggregated and we will report findings related to overall groups (e.g., 4-year-olds…). Identifying information will be kept separate from the actual responses. Additionally, the primary PI will be the only person with access to all of the information. In short, we will use several measures to be sure your identity and your responses remain anonymous.

After we have coded all the data, we will destroy all personal information about you and your child. The codes will be stored in the Language Analysis Lab (Enderis 877) computer. We will retain these files beyond this particular study to inform the design of future studies on children's literacy.

8. Alternatives

Are there alternatives to participating in the study?
There are no known alternatives available to you other than not taking part in this study.

9. Voluntary Participation and Withdrawal

What happens if I decide not to allow my child to be in this study?
Your participation in this study is entirely voluntary. You may choose not to take part in this study. If you decide to take part, you can change your mind later and withdraw from the study. You are free to not answer any questions or withdraw at any time. Your decision will not change any present or future relationships with the University of Wisconsin Milwaukee or the Betty Brinn Children's museum. If you choose not to participate, you will still receive all of the benefits of the family focus program. If you choose to withdraw "We will destroy all information we collect about you". However, if you choose to withdraw from the study you will not receive an incentive for participation in this study.

10. Questions

Who do I contact for questions about this study?
For more information about the study or the study procedures or treatments, or to withdraw your child from the study, contact:

John Heilmann, PhD, CCC-SLP
Associate Professor
Department of Communication Sciences & Disorders
University of Wisconsin-Milwaukee
(414) 229-4625

Who do I contact for questions about my child's rights or complaints about my child's treatment as a research subject?
The Institutional Review Board may ask your name, but all complaints are kept in confidence.

Institutional Review Board
Human Research Protection Program
Department of University Safety and Assurances
University of Wisconsin – Milwaukee
P.O. Box 413
Milwaukee, WI 53201
(414) 229-3173

11. Signatures

Parental/Guardian Consent:

I have read or had read to me this entire consent form, including the risks and benefits. I have had all of my questions answered. I understand that I may withdraw my child from the study at any time. I am not giving up any legal rights by signing this form. I am signing below to give consent for my child to participate in this study.

_____
Printed Name of Child Participant

_____
Printed Name of Parent/Guardian

_____ _____
Signature of Parent/Guardian Date

Principal Investigator (or Designee)

I have given this research subject information on the study that is accurate and sufficient for the subject to fully understand the nature, risks and benefits of the study.

_____ _____
Printed Name of Person Obtaining Consent Study Role

_____ _____
Signature of Person Obtaining Consent Date

Appendix F

INFORMED CONSENT FOR TREATMENT GROUP PARTICIPANTS

UNIVERSITY OF WISCONSIN – MILWAUKEE
PARENTAL CONSENT FOR CHILD TO PARTICIPATE IN RESEARCH

THIS CONSENT FORM HAS BEEN APPROVED BY THE IRB FOR A ONE YEAR PERIOD

1. General Information

Study title: *Museum based enrichment to promote letter knowledge skills using parent-child interactions in at-risk families*

Person in Charge of Study (Principal Investigator):

John Heilmann, PhD, CCC-SLP
Associate Professor
Department of Communication Sciences & Disorders
University of Wisconsin-Milwaukee

2. Study Description

You and your child are being asked to participate in a research study. Your participation is completely voluntary. You do not have to participate if you do not want to participate. Your participation will not affect your relationship with the museum. If you choose not to participate, you will still receive all of the benefits of the family focus program.

Study description:
The purpose of this study is to understand how the children's museum helps kids learn. We are also interested in seeing how you teach things to your child while at the museum. We will train you to use strategies to help their children learn early academic skills. You are expected to make four (4) visits to the museum. In addition, we will ask you and your child some questions on your first and fourth visits. All aspects of the study will be conducted here at the museum. Overall we hope to include 50 pairs of children and guardians in this study.

3. Study Procedures

What will I be asked to do if I participate in the study?
If you agree to participate, you will be given a handout that will include instructions about some activities to do while you are at the museum exhibits. Prior to leaving the museum please find one of our researchers at the entrance of the museum. You and your child will be taken to a quiet location in the museum and will be asked to do a few things. Your child will be asked to do some school-type tasks, such as pointing to pictures and saying letters. You, the guardian, will

be asked some questions about your background and what you do at home with your child. It will take about 15 minutes to do these things.

4. Risks and Minimizing Risks

What risks will my child face by participating in this study?
There are no foreseeable risks for participating in this research study. In the unlikely event that you or your child are made to feel uncomfortable during they study, you are free to opt out from the study. You and your child's participation does not affect your relationship with the museum. If you choose not to participate, you will still receive all of the benefits of the family focus program.

5. Benefits

Will my child receive any benefit from my participation in this study?
The study may teach you some strategies for helping your child learn early academic tasks.

6. Study Costs and Compensation

Will I or my child be charged anything to participate in this study?
You will not be responsible for any of the costs from taking part in this research study beyond those that are part of your typical visit to the museum. For the four visits, you will not have to pay any fee for entry to the museum.

Will I or my child be paid or given anything for being in the study?
As our way of saying "thank you" we will offer you and your child small prizes at the end of each visit to the museum (total four visits) and a gift card for $25 after completing the study.

7. Confidentiality

What happens to the information collected?
All information collected about you during the course of this study will be kept confidential to the extent permitted by law. We may decide to present what we find to others, or publish our results in scientific journals or at scientific conferences. Information that identifies you personally will not be released without your written permission. Only the PI and members of the research team will have access to the information. However, the Betty Brinn Children's museum, the Institutional Review Board at UW-Milwaukee, or appropriate federal agencies like the Office for Human Research Protections may review this study's records.

We will record information about the age and gender of your child; however, we will not report any information on you or your child. All data will be aggregated and we will report findings related to overall groups (e.g., 4-year-olds…). Identifying information will be kept separate from the actual responses. Additionally, the primary PI will be the only person with access to all of the

information. In short, we will use several measures to be sure your identity and your responses remain anonymous.

After we have coded all the data, we will destroy all personal information about you and your child. The coded data will be stored in the Language Analysis Lab (Enderis 877). Dr. Heilmann and his lab staff will retain these files beyond this particular study to inform the design of future studies on children's literacy.

8. Alternatives

Are there alternatives to participating in the study?
There are no known alternatives available to you other than not taking part in this study.

9. Voluntary Participation and Withdrawal

What happens if I decide not to allow my child to be in this study?
Your participation in this study is entirely voluntary. You may choose not to take part in this study. If you decide to take part, you can change your mind later and withdraw from the study. You are free to not answer any questions or withdraw at any time. Your decision will not change any present or future relationships with the University of Wisconsin Milwaukee or the Betty Brinn Children's museum. If you choose not to participate, you will still receive all of the benefits of the family focus program. If you choose to withdraw, we will destroy all information we collect about you. However, if you choose to withdraw from the study you will not receive an incentive for participation in this study.

10. Questions

Who do I contact for questions about this study?
For more information about the study or the study procedures or treatments, or to withdraw your child from the study, contact:

John Heilmann, PhD, CCC-SLP
Associate Professor
Department of Communication Sciences & Disorders
University of Wisconsin-Milwaukee
(414) 229-4625

Who do I contact for questions about my child's rights or complaints about my child's treatment as a research subject?
The Institutional Review Board may ask your name, but all complaints are kept in confidence.

Institutional Review Board
Human Research Protection Program
Department of University Safety and Assurances
University of Wisconsin – Milwaukee
P.O. Box 413

Milwaukee, WI 53201
(414) 229-3173

11. Signatures

Parental/Guardian Consent:

I have read or had read to me this entire consent form, including the risks and benefits. I have had all of my questions answered. I understand that I may withdraw my child from the study at any time. I am not giving up any legal rights by signing this form. I am signing below to give consent for my child to participate in this study.

_____
Printed Name of Child Participant

_____
Printed Name of Parent/Guardian

_____ _____
Signature of Parent/Guardian Date

Principal Investigator (or Designee)

I have given this research subject information on the study that is accurate and sufficient for the subject to fully understand the nature, risks and benefits of the study.

_____ _____
Printed Name of Person Obtaining Consent Study Role

_____ _____
Signature of Person Obtaining Consent Date

Appendix G

PARENT INTERVIEW QUESTIONNAIRE

Examiner Name _____ Date _____Participant Code _____

***Introduction*: I'm going to ask you questions about reading, writing, and talking activities that you might be doing at home and that your child might be doing right now. Please keep in mind there are no "right" or "wrong" answers. These questions are designed to ask about a very wide range of activities and skills that caregivers and children might be doing. Asking you these questions does not mean you should be doing these things. We know that all families are different and all children grow differently. If you don't know an answer or you'd rather not answer a question just let me know. Do you have any questions for me before we start?**

For the next several questions, I will be asking you about how often you and your child do things in a typical week. The responses are "Almost Never, A few times a week, Daily, and Several times a day."

1. In an average week, how many times do you talk about letters with your child

Almost never Few times a week Daily Several Times a Day

2. In an average week, how many times do you play letter games with your child (e.g., sing ABC, read letter book, play with letters)

Almost never Few times a week Daily Several Times a Day

3. In an average week, how many times do you say the names of letters with your child?

Almost never Few times a week Daily Several Times a Day

4. In an average week, how many times do you point out a letter to your child?

Almost never Few times a week Daily Several Times a Day

5. In an average week, how many times do you hear your child say a letter?

Almost never Few times a week Daily Several Times a Day

6. In an average week, how many times do you ask your child to say a letter?

Almost never Few times a week Daily Several Times a Day

The following set of questions will ask more generally how often you and/or your child do things. The answers are never, sometimes, and often

7. Does your child ask you to read to him/her?
Never Sometimes Often

8. How often do you read to your child?
Never Sometimes Often

On average how many minutes per day? _____
Do you have a designated time for reading? _____
How many books do you usually read in one sitting? _____

9. Does your child point to pictures when you read?
Never Sometimes Often

10. Do you point out signs and words like restaurant names or street signs to your child?
Never Sometimes Often

11. Do you play rhyming games with your child?
Never Sometimes Often

12..Does your child see you or another adult read books or magazines in the house?
Never Sometimes Often

13. Does your child try to write her/his name?
Never Sometimes Often

14. Does your child watch TV and movies? Yes No

If yes, about how many hours per day?

15. At what age did you begin reading to your child? _____

16. About how many books does your child have at home?

0 1-5 6-10 10-20 >20
other_____

Appendix H

BACKGROUND INFORMATION QUESTIONNAIRE

Participant/Child's Full Name: _____

Child's gender : ○ Female ○ Male

Parent/Guardian's Name : _____

Relationship to the Child : _____

Please specify your ethnicity : _____

Please select the highest level of schooling you have completed or is currently enrolled in:

- ○ Less than High school
- ○ High school graduate or GED
- ○ College (2-year degree)
- ○ College (Undergraduate degree)
- ○ College (Graduate degree)
- ○ Post graduate school

What is your current employment status?

- ○ Employed
- ○ Self-employed
- ○ Unemployed

What is your annual family income before taxes?

- ○ Under $14,999
- ○ Between $15,000 to $24,999
- ○ Between $25,000 to $34,999
- ○ Between $35,000 to $44,999
- ○ Between $45,000 to $54,999
- ○ Between $55,000 to $74,999
- ○ Between $75,000 to $99,999
- ○ Over $100,000

Is your child enrolled in an early education setting (e.g. day care, head start, pre-school)?

○ Yes ○ No

If Yes, What is the name of the school? _____
How long has child been enrolled? _____
How many hours does your child spend at school? _____ hours
How many days per week does your child spend at school?_____ days/week

Appendix I

UPPER-CASE ALPHABET RECOGNITION SECTION OF PALS-PREK

Section II: Alphabet Knowledge

Part A: Upper-Case Alphabet Recognition

Materials

Child Packet: Upper-Case Alphabet Recognition page

Child Summary Sheet, p. 1

Upper-Case Alphabet Recognition	
Minimum Score	0
Maximum Score	26
Spring Developmental Range for four year olds	12–21

Administration Notes

- Alphabet Knowledge is divided into three parts:
  Part A: Upper-Case Alphabet Recognition → only giving Part A
  Part B: Lower-Case Alphabet Recognition
  Part C: Letter Sounds
- Use a piece of paper to show only one line at a time for those children who may be distracted by so many letters on the alphabet page. A card with a cutout square can also be used to show one letter at a time.
- Direct the child to touch the letters in the proper sequence and make sure the child does not get off track. Some children may require some assistance with pointing or you may point to the letters yourself.

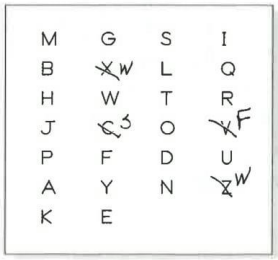
Instructions

1. Tell the child to put his or her finger on the first letter at the top of the page.
2. Say, **"I would like for you to point to each letter. As you point to the letter, tell me the name of that letter. If you come to a letter that you do not know, you may say 'I don't know' and move to the next letter. Ready? Let's begin…"**

Scoring

1. Score the child's responses on the Upper-Case Alphabet Recognition section of the Child Summary Sheet.
2. Mark a slash through each letter the child identified incorrectly or did not identify. It may be helpful to write what the child says next to the letter.
3. Self-corrections are counted as correct answers.
4. Count the number of letters that the child identified correctly. Record that number in the score box on the appropriate section of the Child Summary Sheet.
5. Only children who correctly name 16 or more upper-case letters proceed to Part B: Lower-Case Alphabet Recognition.

Upper-Case Alphabet Recognition Scoring Sample



Please mark what the child says if incorrect. Write a ? if child says s/he doesn't know the letter. ?

Upper-Case Score: 22 (26 possible)

Upper-Case Alphabet Recognition

M	G	S	I
B	X	L	Q
H	W	T	R
J	C	O	V
P	F	D	U
A	Y	N	Z
K	E		

Appendix J

LETTER RECOGNITION TASK

(To be carried out with both the control and treatment group children during their first and last visit to the museum)

SCRIPT FOR THE INTERVIWER TO THE CHILD:

General Directions for the trail items: *"We are going to look at some pictures together and I am going to check how well you know what they are called. So first I will show you four pictures, then I am going to say a word and you are going to show me the picture. Remember, to look at all the pictures before you show me. Even if you don't know, it is ok to guess the picture. Try to do your best."*

Prompt question: *"Show me a _____"* (show child the respective prompt)

If the response is incorrect: *"I don't think that looks like a _____, let me say the word again. Listen carefully. Show me a _____"*

General Directions for the test items: *"Now we are going to play the same game with letters. I am going to check how well you know your letter names. So I will show you four letters, then I am going to say the name of a letter and you are going to show me that letter. Again remember to look at all the letter before you show me. It is ok to guess, even if you don't know the letter. Try to do your best."*

Prompt question: *"Show me the letter _____"* (show child the respective prompt. No help should be given for the test items.)

INSTRUCTIONS FOR THE INTERVIEWER:

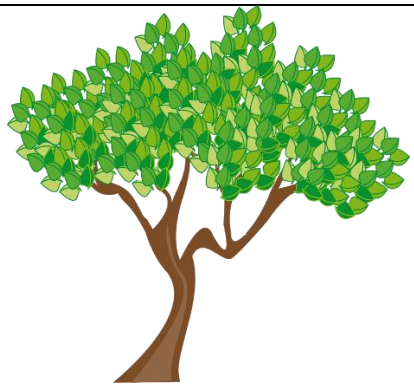
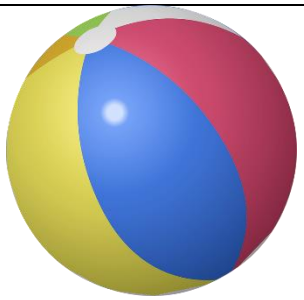
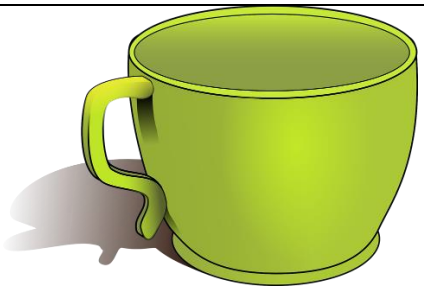
- Use the above prompt to assess if the child can identify each of the ten letters presented to them for the task.
- Carry out the trail words before starting with item 1.
- Present the items in the order described below.
- Say each letter-name and write yes/no whether the child identified the correct/incorrect letter.
- Count the total number of correct responses (out of 12) and fill in the last box.

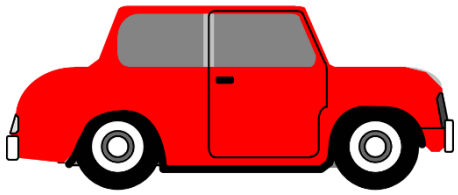
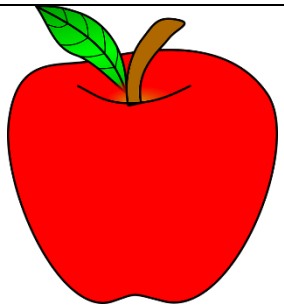
[Continued on Next Page]

Scoring Sheet:

Item #	Letter	Correct (Y/N)?
Trial 1	Ball	
Trial 2	Dog	
1	S	
2	B	
3	N	
4	P	
5	F	
6	A	
7	L	
8	T	
9	M	
10	V	
11	K	
12	D	
Total # of Yes Responses		**/ 12**

Stimulus:

Trial 1		
		

Trial 2		
		

1	A	K
	N	S

2	M	T
	B	F

3	D	K
	N	T

4	M	P
	V	F

5	F	M
	L	B

6	N	T
	V	A

7	N	P
	L	S

8	B	T
	M	V

9	S	P
	V	M

10	V	P
	M	L

11	B	L
	K	M

12	T	A
	N	D

Appendix K

LETTER-SOUND RELATIONSHIP TASK

(To be carried out with both the control and treatment group children during their first and last visit to the museum)

SCRIPT FOR THE INTERVIWER TO THE CHILD:

> **General Directions:** *"We are going to look at some pictures together and I am going to check how well you know what sounds their names begin with. So first I will show you four pictures, then I am going to say a letter sound and you are going to show me which picture begins with that letter. Remember, to look at all the pictures before you show me. Even if you don't know, it is ok to guess the picture. Try to do your best."*
>
> **Prompt question:** *"Show me the picture that begins with the sound _____"* (show child the four associated pictures)

INSTRUCTIONS FOR THE INTERVIEWER:

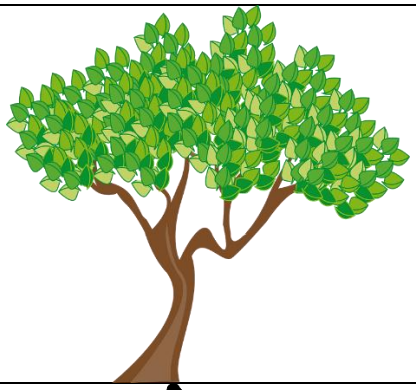
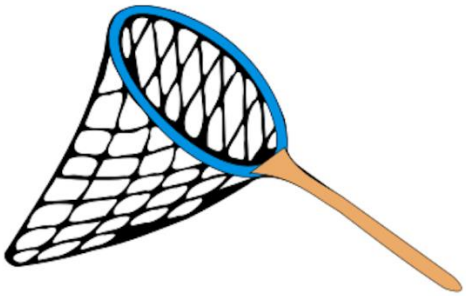
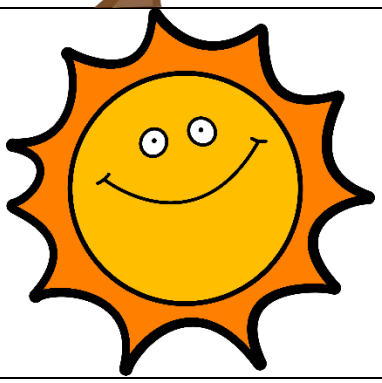
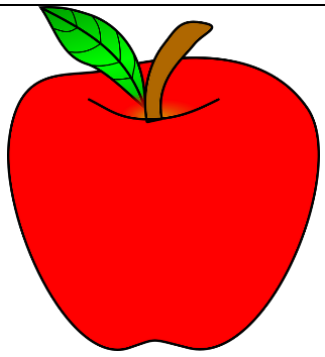
- Use the above prompt to assess if the child can identify the right picture associated with the presented letter-sound.
- Say each letter-sound, cross the picture identified by the child, and write yes/no whether the child identified the correct/incorrect letter.
- Count the total number of correct responses (out of 12) and fill in the last box.

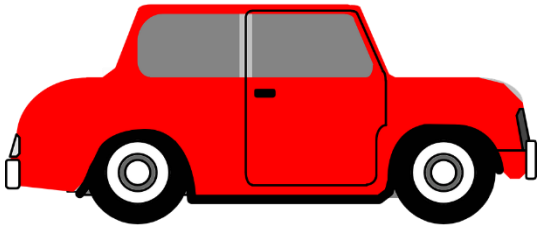
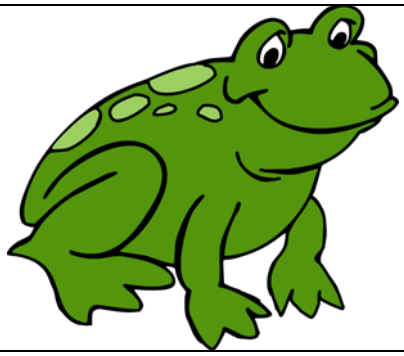
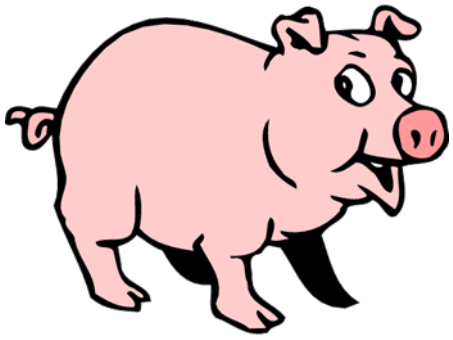
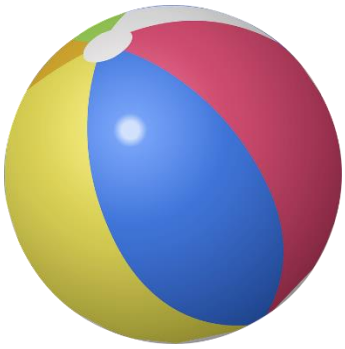
[Continued on Next Page]

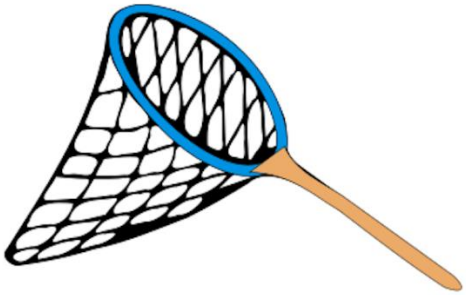
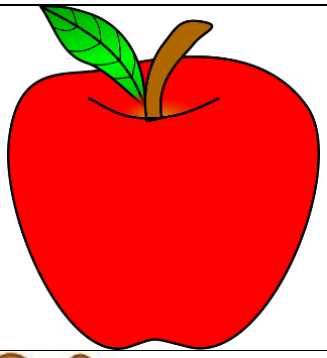
Scoring Sheet:

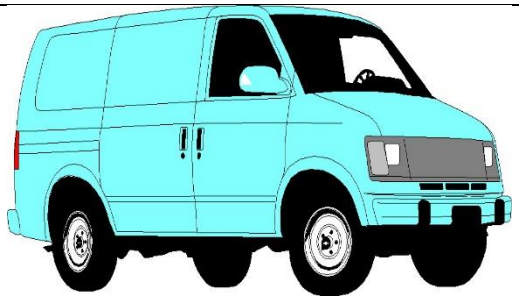
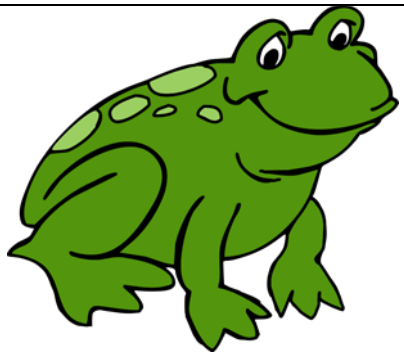
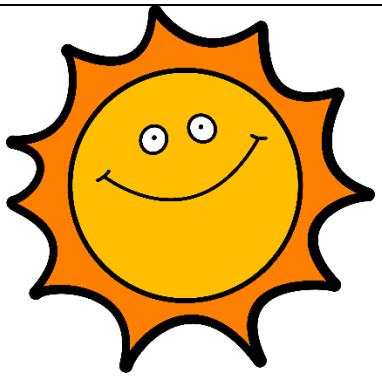
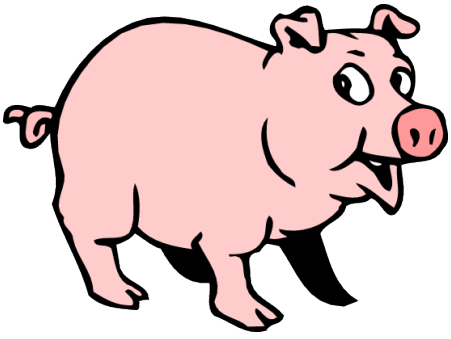
Item #	Letter	Correct (Y/N)?
1	S	
2	B	
3	N	
4	P	
5	F	
6	A	
7	L	
8	T	
9	M	
10	V	
11	K	
12	D	
Total # of Yes Responses		**/ 12**

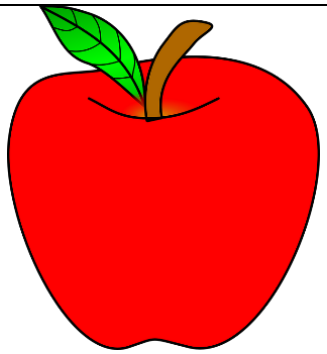
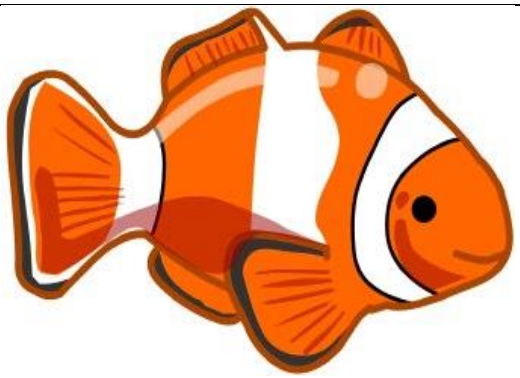
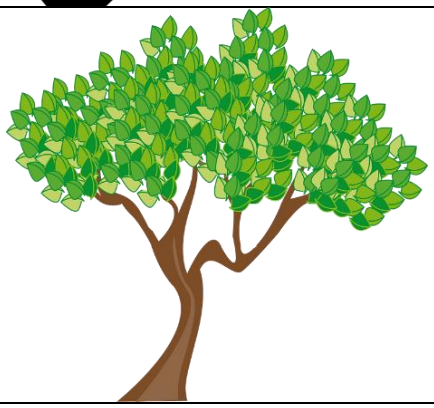
Stimulus:

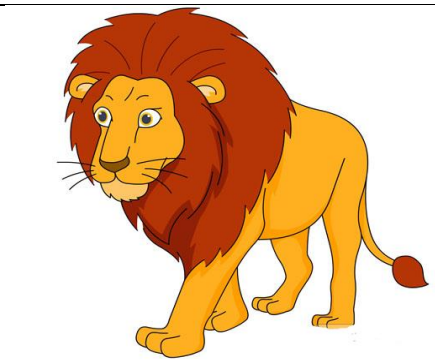
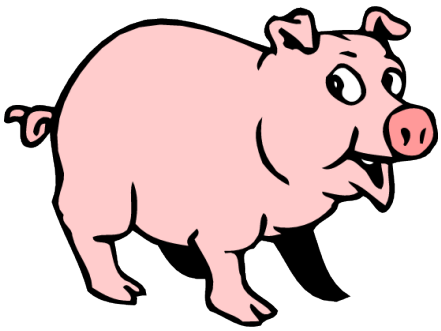
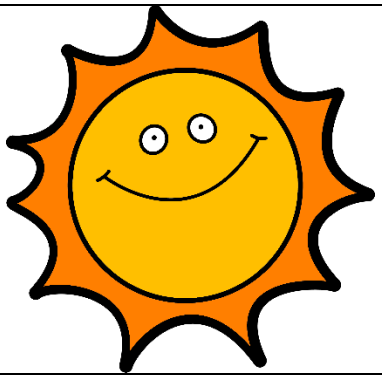
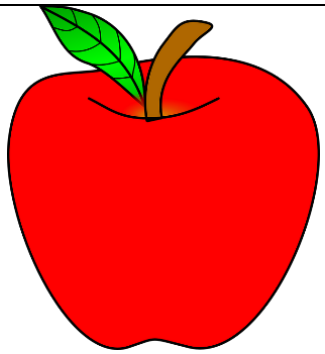
1		
		

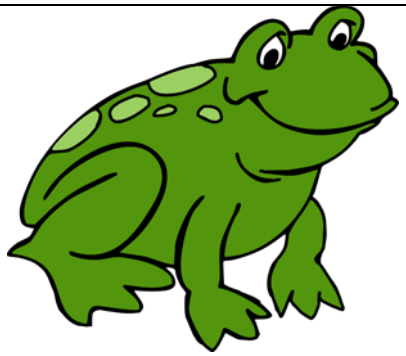
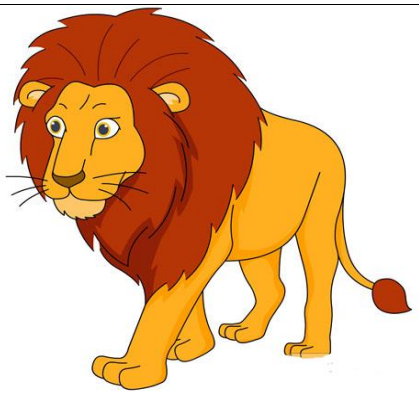
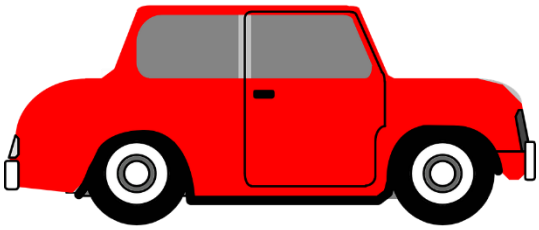
2		
		

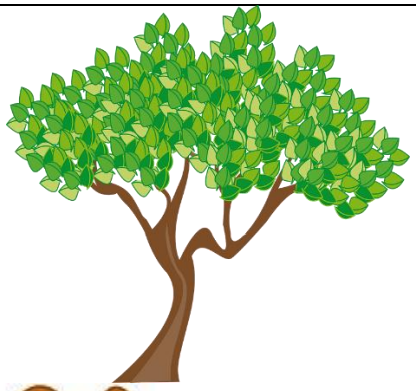
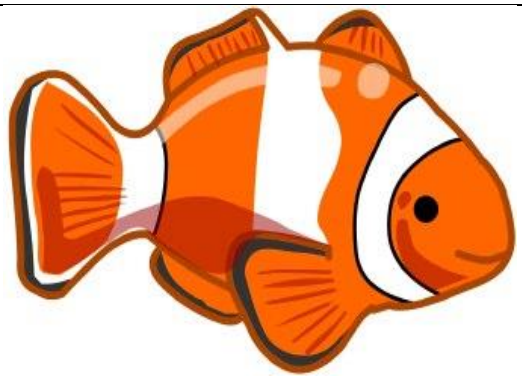
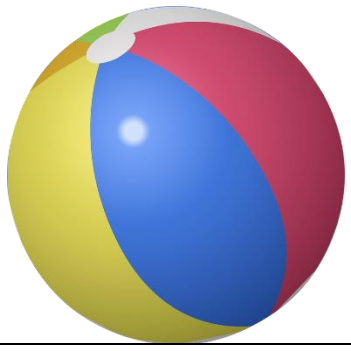
3		
		

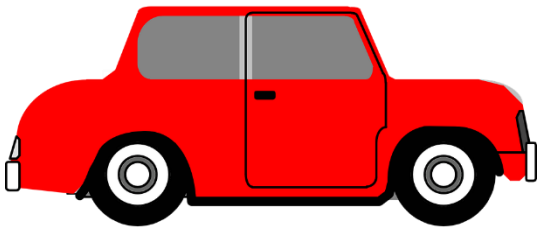
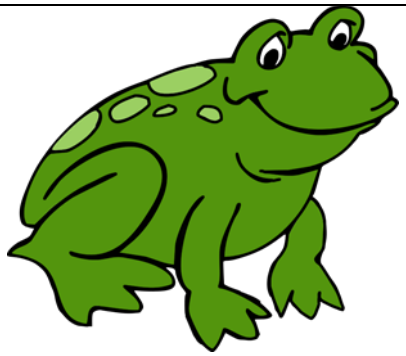
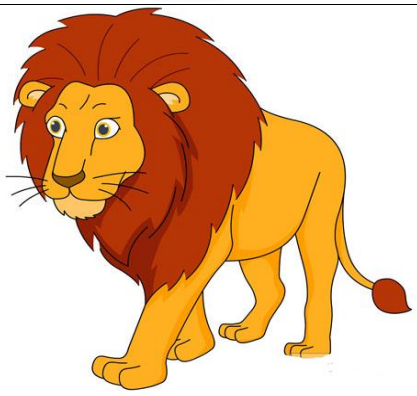
4		
		

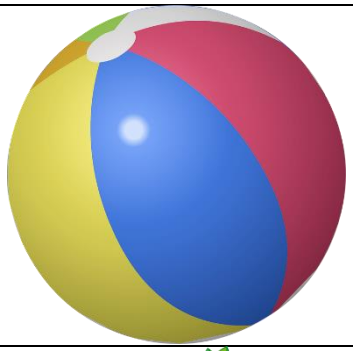
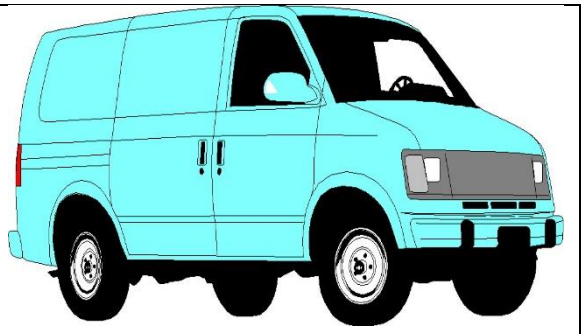
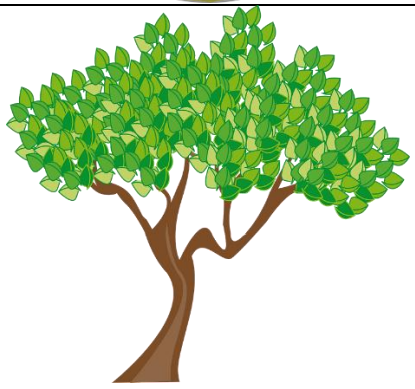
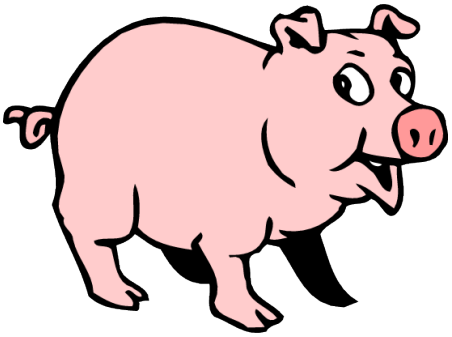
5		
		

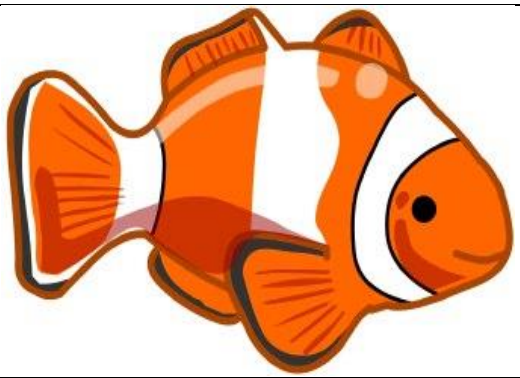
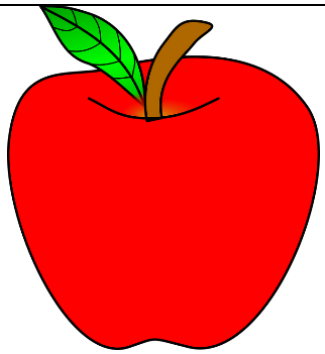
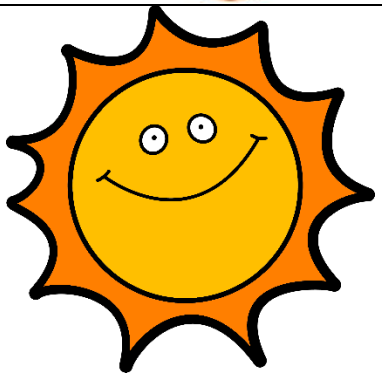
6		
		

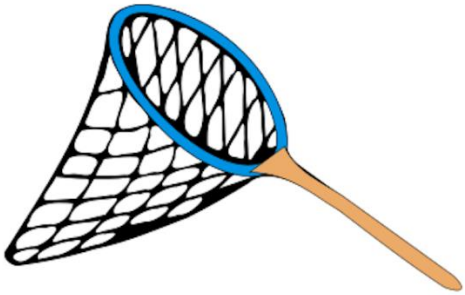
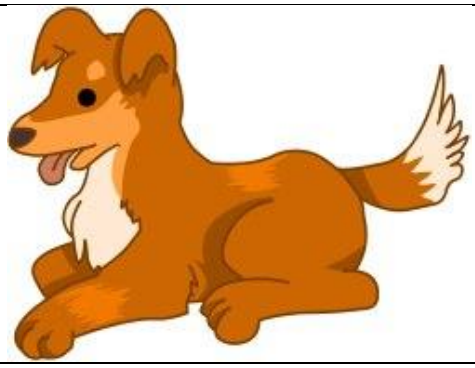
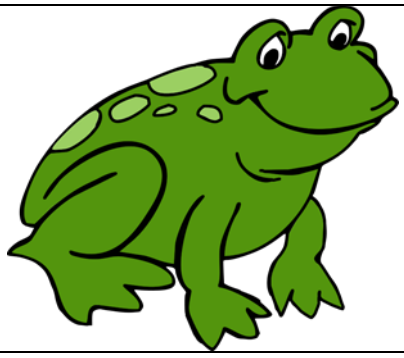
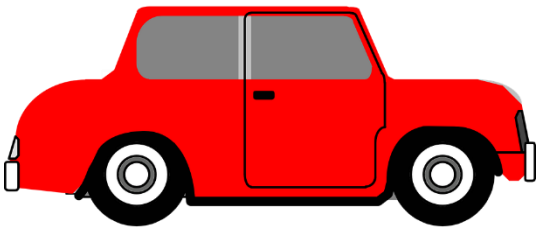
7		
		

8		
		

9		
		

10		
		

11		
		

12		
		

Appendix L

EXAMINER CHECKLIST
(To be filled out by the examiner)

Participant ID: _____ Examiner Name: _____

Group Assignment (circle one)

Control group Treatment group

Checklist for baseline data collection on the first visit:

☐ Informed consent signed by the parent

Parent-level data:

☐ Background Information Form

☐ Parent interview

Child-level data:

☐ Informal letter-recognition task

☐ Informal letter-sound relationship task

☐ 'Alphabet Knowledge' section of the PALS-PreK

Checklist during visits for *treatment group* participants:

☐ Assign letters

- Cross out the following letters that the child ***correctly*** named on the PALS-PreK

  B D K M P T V S F N L A

- Choose the first four letters (left to right) that were NOT crossed out (i.e., letters the child did NOT name)
- Circle these four letters above and write them at the bottom of the Instructional Handout Sheet with a Sharpie marker
- Tell the family that they will work on these letters during their next 4 museum visits

[Continued on Next Page]

Explain Procedure for Getting Prize

☐ Treatment Group: Turn in letter after visit

☐ Control Group: Turn in ticket (be sure to give family 4 tickets)

Follow up process

☐ Remind Family that we will contact them

Family's Preferred Contact Method (circle one and get preferred contact info)

Phone: _____ Email: _____

Checklist for post-treatment data collection on the last visit:

Parent-level data:

☐ Parent Interview

Child-level data:

☐ Informal letter-recognition task

☐ Informal letter-sound relationship task

☐ 'Alphabet Knowledge' section of the PALS-PreK

Final Tasks

☐ Give "Debriefing" document to participant (control family only)

☐ Give family $25 gift card

For any questions while completing the study, contact one of the investigators

John Heilmann: 414-861-6665
Chris Lawson: 608-335-0598
Maura Moyle: 414-550-4900
Jeny Thomas: 847-909-1935