



Use of Articulatory Pictures and Object Pictures in Phonemic Awareness Instruction

Sesletim Resimleri ve Nesne Resimlerinin Fonemik Farkındalık Eğitiminde Kullanımı

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Öz

Fonemik farkındalık öğrencilerin kelimeleri okuma ve yazmayı öğrenmeleri için gerekli olan bir beceridir. Bu beceriye sahip olanlar, sözcükleri oluşturan fonem olarak adlandırılan en küçük ses birimlerinin nasıl manipüle edileceğini kavrarlar. Okumayı öğrenmede güçlük çeken öğrenciler özellikle fonemik farkındalık becerisinin kazanımında zorlanırlar. Bu süreci kolaylaştırmada, çeşitli çok duyuşlu öğretim yöntemlerinin etkili olduğu saptanmıştır. Bu derlemede sadece articulatory resimler ve nesne resimleri kullanılarak fonemik farkındalığın öğretildiği çalışmalar, bu metotların avantajlar ve dezavantajlarını da tartışarak dâhil edilmiştir. Articulatory resimler ağzın sesleri üretirken nasıl pozisyonlandığını gösterir. Ağzın hareketlerini resimlerle takip etmeyi öğrenmek öğrencilerin konuşulan kelimelerdeki fonemleri sırasıyla ayırt etmesine yardımcı olur. Motor Konuşma Algısı Teorisi neden ağız resimlerinin etkili olduğunu açıklamada yardımcı olmaktadır. Öte yandan nesne resimleri her sınıfta görülebilir. Mesela, /b/, /f/, ve /g/ seslerini öğretmek için balık, file ve gül çizimleri kullanılabilir. Bu gibi resimler ses ve harf arasındaki ilişkileri öğretmek için kullanılır.

Anahtar Kelimeler: Fonemik farkındalık, sesletim resimleri, nesne resimleri, Motor Konuşma Algısı Teorisi.

Abstract

Phonemic awareness is a crucial skill that students must acquire in learning to read and spell words. Those who have it understand how to manipulate the smallest sounds called phonemes in words. Children who struggle in learning to read have special difficulty acquiring phonemic awareness. Various multisensory instructional methods have been found to be effective to make this process easier. In this review, only studies that have used articulatory pictures and object pictures to teach phonemic awareness are considered by discussing the advantages and disadvantages of these two methods of teaching phonemic awareness. Articulatory pictures show how the mouth is positioned to produce spoken sounds. Learning to track mouth movements with pictures can help students distinguish the sequence of separate phonemes in spoken words. The motor theory of speech explains why mouth pictures are effective. Object pictures on the other hand are displayed in every classroom, for example, drawings of bear for /b/, fish for /f/, and girl for /g/. Such pictures are used to teach associations between phonemes and letters. Phonemic awareness is a crucial skill that students must acquire in learning to read and spell words. Those who this skill understand how to manipulate the smallest sounds called phonemes in words. Children who struggle in learning to read have special difficulty acquiring phonemic awareness. Various multisensory instructional methods have been found to be effective to make this process easier. In this review, only studies that have used articulatory pictures and object pictures to teach phonemic awareness are considered by discussing the advantages and disadvantages of these two methods of teaching phonemic awareness. Articulatory pictures show how the mouth is positioned to produce spoken sounds. Learning to track mouth movements with pictures can help

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students distinguish the sequence of separate phonemes in spoken words. The motor theory of speech explains why mouth pictures are effective. Object pictures on the other hand are displayed in every classroom, for example, drawings of bear for /b/, fish for /f/, and girl for /g/. Such pictures are used to teach associations between phonemes and letters. Advantages and disadvantages of both methods are discussed.

Keywords: Phonemic awareness, articulatory pictures, object pictures, Motor Theory of Speech.

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1. Introduction

Phonemic awareness, which is a subset of phonological awareness, is the ability to identify and manipulate individual sounds in spoken words (Walsh, 2009; Ehri, 2004). On the other hand, phonological awareness covers a broader range of metalinguistic skills that enable thinking about language as separate and distinct from meaning (Keeseey, Konrad, & Joseph, 2014; Schuele & Boudreau, 2008).

1.1. Types of phonemic awareness skills

According to Daly, Chafouleas, and Skinner (2005) phonemic awareness skills develop in a hierarchical manner from the simplest to the most sophisticated. Simple levels of phonemic awareness represent an ability to isolate the initial and final phonemes of words. For example children can be taught that *book* and *ball* have the same initial phoneme which is /b/. Blending phonemes to sound out complete words (for example three phonemes /r/, /o/ and /p/ can be combined to make the word *rope*) and segmenting whole words into phonemes (for example the word *rope* can be separated into phonemes of /r/, /o/ and /p/) require more sophisticated levels of phonemic awareness.

1.2. Importance of phonemic awareness

Phonemic awareness is an important skill to be acquired along the way to become good readers. Good readers recognize words by sight and use their conscious thinking in understanding the text. According to Ehri's (2005) word learning theory, words that become sight words are stored in the long-term memory with connections that link spellings of written words to their pronunciations and meanings. To be able to perform such connection-building processes, pupils need to have knowledge of the alphabetic system. This encompasses both phonemic awareness and phonics knowledge. To be able to read words, pupils need to recognize graphemes of written words and know what phonemes correspond to those graphemes. If they lack phonemic awareness and therefore cannot blend those phonemes to form whole words, they would not be able to read words. On the other hand, to write words pupils first need to segment whole words to their phonemic constituents, then determine how to represent each phoneme with appropriate graphemes (Ehri, 2014). As it can be seen phonemic awareness is an essential skill that children should have in order to be able to decode and spell words.

1.3. Do children need to be trained for phonemic awareness?

Many children acquire phonemic awareness skills before they go to first grade or kindergarten. However, teachers who teach reading should assess all of their students for phonemic awareness and provide instruction to those who do not have adequate skills. Some children may arrive to school with limited awareness of spoken language because of limited experiences before schooling, such as reading books with lots of rhyming words or playing games that teach phonemic awareness. Some families have to deal with poverty and its consequences such as working many hours, stress, depression, etc. These conditions create difficulties for families to provide children with experiences that can help children in acquiring phonemic awareness. Therefore it becomes more important when working with children who are at risk to not assume that they have phonemic awareness skills.

Providing children with phonemic awareness activities can be helpful even for those children who may already have some phonemic awareness skills. A meta-analysis that examined 52 studies in which instruction for phonemic awareness was provided showed that all types of students, typical, at risk or children with learning difficulties, made significant gains in phonemic awareness (Ehri et al., 2001). Children not only increased their phonemic awareness

skills but also they made gains in their reading and spelling skills. The results of this meta-analysis indicate that phonemic awareness can be taught and it makes statistically significant contribution to reading acquisition.

1.4. Use of letters for phonemic awareness training

A meta-analysis that examined 52 phonemic awareness studies (Ehri et al., 2001) indicated that phonemic awareness activities that included letters, such as using plastic letters rather than blank markers to show each phoneme in a spoken word was more effective. Phonemic awareness training does not need to include alphabetical letters in order to increase the phonemic awareness skills of students (Cunningham, 1990; Fox & Routh, 1984; Lundberg, Frost & Peterson, 1988; Torneus, 1984; Treiman & Baron, 1983). However, studies that included letters in phonemic awareness instruction showed greater improvement from pretest to posttest scores of children on phonemic awareness, reading and spelling measures than did phonemic awareness training wherein children were taught phonemic awareness without manipulating letters (Ehri et al., 2001; Hohn & Ehri, 1983).

In several studies children were taught to use letters in order to mark the phonemes in words during segmentation training (Bradley & Bryant; 1983; Ehri & Wilce, 1987; Hohn & Ehri, 1983; Uhry & Shepherd, 1993). For example in Hohn and Ehri's (1983) study while one group of children were taught to represent phonemes of words with letters, another group of children were taught to show phonemes with blank markers. The results revealed that children who were taught to use letters in order to segment words demonstrated greater increases in phonemic segmentation ability than did children who were taught to use blank markers.

Combining phonemic awareness instruction with explicit instruction of letter sounds has also been found to be effective for improving phonemic awareness, reading and spelling ability. Indeed, combining phonemic awareness instruction with letter sound instruction resulted in greater increases in phonemic awareness, reading and spelling than either type of training alone. (Ball & Blachman, 1991; Bradley & Bryant, 1983; Byrne & Fielding-Barnsley, 1991, 1993; Castle, Riach & Nicholson, 1994; Hatcher, Hulmes & Ellis, 1994; Ryder, Tunmer & Greaney, 2008; Santoro, Coyne & Simmons, 2006; Vadasy, Sanders & Peyton, 2006). For example, in Ball & Blachman's (1991) study the kindergarteners who were provided with phonemic awareness training (combined with letter names and letter sounds training) made significantly higher gains in reading and spelling scores, compared to the kindergarteners who were trained for letter names and sounds without phonemic awareness training. Furthermore, providing letter name and sound instruction alone did not result in significantly higher gains in phonemic awareness, reading and spelling skills compared to the control condition which was not provided with any training.

Perhaps manipulation of letters is helping children to identify each phoneme. When blank markers are used all of the phonemes are represented with the same markers. The question of interest is whether the use of pictures would show the same effect. In order for children to be instructed with letters they need to know the letters. The dilemma is that those who ended up having a reading disability are the ones who have difficulty in learning letter names and sounds. Perhaps the biggest advantage of using pictures as concrete tools for teaching phonemic awareness is the fact that teachers would not need to wait until children learn letter names and sounds. They can teach phonemic awareness to children at the same time they teach letter names and letter sounds.

1.5. Use of articulatory pictures for teaching phonemic awareness

Articulatory pictures are pictures of mouth that depict relative shape of articulatory elements such as teeth, tongue and lips during producing specific phonemes. For example the articulatory picture on the left depicts how /s/ is produced. The lips are open but there is no opening between upper and lower teeth and hissing air comes out with production of /s/.

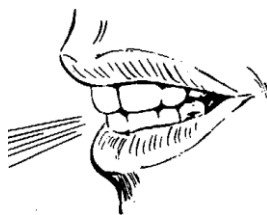


Figure 1 Articulatory pictures

1.6. Auditory Discrimination in Depth (ADD)

The use of articulatory gestures for teaching phonemic awareness was first introduced with the Auditory Discrimination in Depth program. It has been developed to help students with reading disabilities to acquire phonemic awareness (Lindamood & Lindamood, 1998). In this program students are taught to identify and monitor articulatory gestures associated with phonemes. The students' attention is directed to the position and shape of the lips and tongue. They are taught to use a hand mirror for examining their mouth while producing phonemes. For example while saying *meat*, the mouth produces three phonemes and these are reflected in three successive mouth movements: lips closing for /m/, lips opening into a smile shape for the vowel, and tongue tapping the roof of the mouth for /t/ (Ehri et al. 2001). The use of articulatory gestures and mouth pictures for teaching phonemic awareness are based on the Motor Theory of Speech Perception. The theory and relevant research is included below.

1.7. The Motor Theory of Speech Perception

Recognizing speech sounds is difficult; every consonant and vowel sound is influenced by the sounds around it, which affect the acoustic signal. This makes more difficult to isolate and identify an individual sound. This phenomenon is called co-articulation. For example, the sound of the letter 'd': depending on the context, the sound can have very different acoustic profiles. Although listeners identify all of these d's in different contexts, there is no single acoustic cue that reliably defines /d/. What all of these examples of 'd' share is the fact that when they are produced, the tongue is always placed at the roof of the mouth. Based on this observation Liberman (1999) and his colleagues suggest that the perception and production of speech are closely linked; the motoric gestures used to produce speech sounds are directly involved in perception of the speech sounds. According to Liberman's motor theory of speech perception, the necessary and sufficient features for recognizing speech are motoric. Therefore, articulatory gesture forms the basic unit of speech perception.

The discovery of mirror neurons in the 1990s provided support for the relationship between speech perception and the motor system. The discovery led researchers to look for mirror neurons for speech (Devlin, & Aydelott, 2009). Through the use of transcranial magnetic stimulation (TMS) Watkins, Strafella and Paus (2003) found increased activity in the mouth area of primary motor cortex when participants listened to speech but not to meaningful non-verbal stimuli (such as the sound of glass breaking). Furthermore, Fadiga, Craighero, Buccino, and Rizzolatti (2002) observed that when Italian speakers heard words like "terra" that involve tongue movements, there was increased activity in tongue motor cortex relative to hearing words such as "zaffo", which do not involve tongue movements. These observations show that the motor activity is specific to the muscles involved in producing particular phonemes. Further imaging studies showed that the same regions of motor cortex are used for both producing and perceiving meaningless syllables. The specific motor circuits corresponding to the lips and tongue were activated by the specific phonemes that engage those articulators. These findings support the notion that speech perception engages brain areas that are involved in speech production (Devlin, & Aydelott, 2009).

Furthermore, two recent studies demonstrate that motor activity directly influences speech perception. Meister, Wilson, Deblieck and Wu (2007) assessed participants' ability to discriminate phonemes embedded in white noise either before or after repetitive transcranial magnetic stimulation (TMS), which was used to suppress activity in the premotor cortex. Performance on the phoneme discrimination task was significantly impaired; however, it was still well above chance following TMS. This result suggests that the premotor cortex contributes to recognizing speech signals.

In another study, D'Ausilio (2009) and his colleagues used double pulses of TMS to enhance activity in either the lip or tongue area of primary motor cortex while participants performed a phoneme discrimination task. Subjects were faster to detect sounds produced on the lips (/b/ or /p/) than those produced by the tongue (/d/ or /t/) when TMS was delivered to the lip motor cortex, and the opposite was observed for stimulation of the tongue motor cortex. This shows that increasing the excitability of neurons within the primary motor cortex directly affects phoneme perception and critically; this occurs in a somatotopic fashion with a clear double dissociation between two classes of phonemes that rely on different articulators (Devlin, & Aydelott, 2009). These TMS studies provide the strongest evidence to date that the motor system is not only activated during speech perception, but this activation also plays a role in discriminating specific phonemes.

The aforementioned studies support Liberman's theory that articulatory motor patterns are involved in speech recognition. Therefore, the idea that teaching children how phonemes are produced would help them perceive each phoneme in a spoken word is supported by The Motor Theory of Speech. Furthermore, TMS studies provide biological evidence for the theory (Liberman, 1999).

While the Motor Theory of Speech provides theoretical support for combining articulation training with phonemic awareness instruction, extant experimental studies displayed conflicting results as to the effectiveness of combining the two types of instruction (Boyer & Ehri, 2011). In several studies groups of students were provided with phonemic awareness instruction (that either included or not included articulation training) in order to examine whether the inclusion of articulation training increases learning. The results revealed that the addition of articulation training did not result in significant gains in scores of phonemic awareness and reading measures (Olson, Wise, Ring, & Johnson, 1997; Wise, Ring, & Olson, 1999; Wise, Ring, Sessions, & Olson, 1997). In these studies older children (2nd to 5th grade) with reading disabilities were included as participants. Furthermore, training in these studies included a variety of instructional elements. Therefore, conclusions about the effectiveness of adding articulation training to phonemic awareness instruction cannot be drawn based on the results of these studies.

On the other hand, in studies that included younger typically developing children (preschool and kindergarten students) researchers found combining phonemic awareness instruction with articulation training as effective (Boyer & Ehri, 2011; Castiglioni-Spalten & Ehri, 2003; Ehri & Sweet, 1991). For example, Ehri and Sweet (1991) used articulatory pictures to teach kindergarteners to segment words into phonemes. The results of the study indicated that the articulation training increased children's phonemic awareness ability.

In a similar study Castiglioni-Spalten and Ehri (2003) trained kindergarteners for phonemic segmentation. One group was taught to place appropriate mouth pictures to represent the phonemes and the other group used an ear picture to represent each phoneme of words. There was no significant difference between the two groups on posttests measuring the amount of learning in phoneme segmentation. However, there was a significant difference between the two groups in measures of learning to read words, even though the letters were not used during training. It seems that adding mouth pictures enhanced processes that enabled children to read words. The researchers of the study interpreted this result as awareness of articulatory gestures facilitated the activation of grapho-phonemic connections that helped children identify written words and secure them in memory.

Following up with this study, Boyer and Ehri (2011) tested whether the addition of manipulation with letters along with mouth pictures would be more beneficial. One group of preschoolers were taught to segment words into phonemes with only letters, while another group was taught to segment words into phonemes with mouth pictures plus letters. The results of posttests revealed that letter plus mouth picture training was significantly more effective than letter only training for teaching phoneme segmentation and spelling, and for enhancing children's ability to learn to read words from memory by sight and to decode non-words. Boyer and Ehri (2011) suggested that learning to segment words into phonemes with articulation pictures improved children's access to phonemic constituents of pronunciations stored in memory, and that resulted in letters becoming more securely attached to the phonemic constituents and this in turn facilitated reading and spelling.

1.8. Use of Object Pictures

The use of pictures in reading instruction is very common. In almost every primary classroom pictures of objects accompany letters of the alphabet displayed on the walls. A great deal of research focused on the use of pictures in teaching letters of the alphabet or sounds. Providing the picture as embedded in letters rather than as a separate entity seemed to work better; in this way, children were able to make connections between how the letters look and how they sound without dividing their attention between two different elements (Ehri, Deffner, & Wilce, 1984; Shmidman, & Ehri, 2010). Pictures have been used a lot for teaching phonemic awareness, but often researchers did

not look at its specific effects on training. In addition, pictures have been used only for teaching the initial and final sounds of words. There is almost no study, as of today, that looked the effects of using pictures in a segmentation task. There is only one exception: Larson (2011) in a dissertation used manipulatives called alphabetic blocks. These blocks had different pictures on each side. Also, there were buttons available on each side. When children pressed those buttons they heard the target phonemes spoken. The pictures were reflecting the words that start with specific phonemes. Larson created different alphabetic blocks for different conditions of the study: 1-no picture, no sound, 2-picture but no sound, 3-picture and sound. The third condition that utilized both picture and sound performed better compared to the other two groups in segmenting words into phonemes. This study provides some support that object pictures can be used for phoneme segmentation training successfully.

Bradley and Bryant (1983) also used pictures in training children with an intervention that they named sound categorization. One group was taught to categorize pictures on the basis of common sounds; for example *hen* might have been grouped with *hot* and *hop* because initial phonemes are common. The second group was also trained with sound categorizations, but in addition they were taught to represent common speech sounds with letters. The third group categorized pictures by semantic categories. There was another group who did not receive any training. The children who received sound categorization scored higher in spelling and reading than the other groups. However, the children who received additional letter training were the most successful. Bradley and Bryant pointed at an important advantage of using object pictures. They can be utilized to manipulate phonemes without saying the phoneme which is really hard especially for non-continuous consonants such as /k/, /b/ and /p/. It is almost impossible to say these phonemes without adding a schwa sound.

Ball and Blachman (1988) used a similar activity in their intervention with kindergarteners. Children were presented with four pictures and asked to select the one that did not belong to the group: The three pictures were referring to the words either with the same initial sound or final sound. The control group had a variety of language experiences such as learning vocabulary, listening to stories, and making semantic categories. Both groups, also, received training for letter-sound associations. There was a true control group that did not receive any treatment. Children were trained in groups of five for 20 minutes, 4 times per week for 7 weeks. The treatment group outperformed both control groups on post-test measures of phoneme segmentation and word reading. This study provides support that pictures can be used to teach phonemic awareness. However, since this activity was combined with training in letter-sound associations, it is hard to attribute the effectiveness of the program solely to the training that included pictures.

Byrne, Fielding and Barnsley (1991) also used pictures for phonemic awareness training in their program entitled Sound Foundations. To teach each phoneme, they used two large pictorial posters; one contained many items beginning with the sound of the target consonant and one containing items ending with the sound of the consonant. For teaching vowels, they used posters containing pictures of words having beginning sounds. Also, they prepared worksheets containing outline drawings of objects. The child's task was to locate and color the picture which refers to the word that has the initial or final sound of the target phoneme. Also, children played two card games. The cards had two pictures, and children were asked to play a domino game based on the beginning and ending sounds of the words that the pictures represented. The second game was "Snap." Children placed the cards (each containing one picture) face up on a pile and say "snap" when the new card matched the top one on the pile for initial or final sound. The control groups spent the same amount of time in story reading and similar games to the experimental group but with semantic categories. The results revealed greater gains by the experimental group in comparison to the control group. Furthermore, increased levels of phonemic awareness were gained with untrained as well as trained sounds. A forced-choice word-recognition test showed that most of the children who possessed phonemic awareness and who knew the relevant letter sounds could use their knowledge to decode unfamiliar printed words. This research provides support for the use of pictures in phonemic awareness training. However, the program included other methods of teaching phonemic awareness such as reciting short jingles or poems, with the target phoneme repeated in the appropriate position. Therefore, it is hard to attribute the effectiveness of the program solely to the use of pictures. On the other hand, one important conclusion that can be drawn from this study is that in order for phonemic awareness training to be effective it does not need to be in the form of a serious instruction business, but rather it can be a combination of fun games and still be effective.

2. Conclusion and Recommendations

Phonemic awareness is a crucial skill that needs to be acquired in order for children to become readers and writers. The research reviewed in the preceding paragraphs provides support for the use of concrete tools such as articulatory

pictures and object pictures for the purpose of helping children to become aware of, identify and manipulate phonemes that underlie spoken words.

Despite the fact that numerous research studies have been conducted in the area of phonemic awareness instruction, no clear results have been obtained so far as to indicate the best method that would work for children, especially for those have learning difficulties. When words are spoken phonemes are co-articulated and spoken sounds are abstract entities. Mouth pictures can help children perceive phonemes of words by providing a medium where children can manipulate snapshots of mouth pictures that depict production of phonemes. However, extant research that examined the effects of articulatory training on phonemic awareness instruction provided mixed results. More importantly, the provision of articulatory training provided no additional benefits in reading programs developed for students with reading disabilities (Olson, Wise, Ring, & Johnson, 1997; Wise, Ring, & Olson, 1999; Wise, Ring, Sessions, & Olson, 1997). One possible explanation is that the participants of these studies were too old (2nd to 5th grade students) to benefit from articulatory training. Another possible explanation is that perhaps using other methods such as manipulation of phonemes with alphabet letters is more beneficial for children with reading disabilities.

Similarly, the extant research does not provide clear support for the use of object pictures for teaching phonemic awareness, since all the studies included this type of treatment provided some other methods of training as well. Further research that includes single elements in the instruction (such as training that includes only letters, only mouth pictures, or only object pictures and compares with other methods) is needed to understand how these elements function and how they affect the outcomes of training.

However, educators cannot wait until research clarifies which method works best. They should choose tools that are appropriate for the children they work with. If children they work with do not know letter names yet, they should not wait to teach phonemic awareness until children learn letter names. Besides teaching children letter names and letter sounds, they can train children to represent phonemes with pictures to conduct phoneme segmentation. They can use either articulatory pictures or object pictures for this purpose. The advantage of using articulatory pictures is that children can look at articulatory pictures and at the same time look in the mirror while producing phonemes. Perhaps these two ways of examination can provide children with enhanced learning of identities of phonemes. However, not all phonemes can be depicted clearly with articulatory pictures. Especially those are produced at the back of the mouth for example /g/ and /h/ cannot be displayed clearly with mouth pictures. Some phonemes are depicted with the same articulatory pictures such as /p/ and /b/, which can be confusing for some children. Furthermore, it is not very common for teachers to use mouth pictures. They may have a hard time in finding these pictures, and they may not feel at ease while using these pictures for phonemic awareness training.

On the other hand, object pictures are available in every classroom. Teachers often use object pictures for teaching letter names and letter sounds. Object pictures can easily be incorporated into activities and games that teach phonemic awareness. For example children can be taught to play word sort in which they could choose pictures that have the same initial or final phonemes. An advantage of using object pictures for phonemic awareness activities is that children can identify phonemes without saying them. For example, children can identify that *book* and *bus* have the same initial phoneme by pointing at a book picture and a bus picture without saying the phoneme /b/. When children pronounce a non-continuous phoneme for example /b/ they often sound as if there is a schwa sound next to it (instead of /b/ they may sound out the phoneme like /bah/ which may cause problems when they blend sounds to figure out the whole word). On the other hand, it could be hard to teach phonemic segmentation with object pictures as children would need to keep the spoken word that needs to be segmented in their short-term memory while figuring out object picture names that could represent each phoneme of the target spoken word. In this approach, initial phonemes of object names are used as a referent to each phoneme. For example, to show the phonemes of *map*, the first phoneme can be represented with a picture of *monkey*, the second with a picture of an *ant*, and the third phoneme with a picture of a *panda*. Although this sounds complicated, Larson's (2011) study indicates that children can manage these types of activities. Furthermore, it is reasonable to expect that children to feel at ease and have fun while learning these object names and their initial phonemes.

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