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# Phonological Awareness of Stress and Syllable

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PHONOLOGICAL AWARENESS OF STRESS AND SYLLABLE

by

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Bachelor of Arts, Indiana University, 1998

A Thesis

Submitted to the Graduate Faculty

of the

University of North Dakota

In partial fulfillment of the requirements

for the degree of

Master of Science

Grand Forks, North Dakota

May

2000

Approval Page

This thesis, submitted by Joshua Neil Long in partial fulfillment of the requirements for the Degree of Master of Science from the University of North Dakota, has been read by the Faculty Advisory Committee under whom the work has been done and is hereby approved.

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Date

PERMISSION

Title            Phonological Awareness of Stress and Syllable  
Department    Communication Sciences and Disorders  
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## TABLE OF CONTENTS

LIST OF ILLUSTRATIONS.....	v
LIST OF TABLES.....	vi
ABSTRACT.....	vii
CHAPTER	
I. INTRODUCTION.....	1
Statement of Purpose.....	3
Research Questions.....	3
Review of Literature.....	5
II. METHOD.....	13
Participants.....	13
Instruments.....	15
Procedures.....	15
III. RESULTS AND DISCUSSION.....	23
IV. SUMMARY AND CONCLUSIONS.....	37
REFERENCES.....	40

## LIST OF ILLUSTRATIONS

Figure	Page
1. Means and standard deviations obtained for the two-syllable portion of research question 3, which investigated the performance of the stress group versus the syllable group at the two-syllable level.....	33
2. Means and standard deviations obtained for the two-syllable portion of research question 5, which investigated the performance of the participants who did not reach criterion in the stress group versus the syllable group at the two-syllable level.....	34

## LIST OF TABLES

Table	Page
1. Pseudo-words administered to the stress group with capitalized syllables indicating the stressed syllable targets.....	16
2. Pseudo-words administered to the syllable group, the “ku” syllables were the targets.....	17
3. Number of participants who met criterion, number of participants who did not meet criterion, Chi-square analyses, and degrees of freedom obtained for research question 1.....	24
4. Means, standard deviations, t-values, degrees of freedom, and probabilities obtained for research question 2.....	26
5. Means, standard deviations, t-values, degrees of freedom, and probabilities obtained for research questions 3, 4, 5, 6.....	30
6. Means, standard deviations, t-values, degrees of freedom, and probabilities obtained for research question 7.....	32

To Amy, Miles, Kaya, and Leo

## ABSTRACT

For a number of years, researchers have studied children's intuitive knowledge of sounds and syllables because of contributions of these linguistic units to language learning, and more specifically literacy. Children learn to interpret streams of speech through the development of segmentation skills. This study investigated the abilities of preschool and school age children to locate target syllables and stressed elements in pseudo-word forms. The purpose of this study was to determine the phonological awareness knowledge of typical preschool and school age children through measurement of their performance on two-syllable, three-syllable, and four-syllable pseudo-word forms with varying stress patterns. The present study examined the participants' ability to identify targeted syllables and targeted stressed elements. That is, in one group (syllable group), participants were required to identify the location of a target syllable regardless of the stress pattern, following a training set. In the other group (stress group), participants were required to identify the location of target stressed elements following a training set. The participants were exposed to the pseudo-word forms during a pre-training, training, and experimental task. The participants demonstrated their abilities by placing tokens within a grid based on the pseudo-word that was presented. Upon completion of the collection of data, the participants were divided into a young group and an old group based on age. This comparison was made to distinguish any differences in ability based on age. The lexical stress task was less complex as compared to the syllable task at the

two-syllable level. Those participants who did not achieve criterion during the training task performed better on the lexical stress task at the two-syllable level. There was not a difference in the participants' abilities at the three-syllable level. The four-syllable task was too advanced for any of the participants to reach criterion in the training task or to perform the experimental task. There was no difference in the abilities of the participants in the young group compared to those participants in the old group at the two-syllable or the three-syllable level.



## CHAPTER 1

### INTRODUCTION AND REVIEW OF LITERATURE

The development of speech and language abilities has been investigated extensively. The general pattern of typical acquisition of these abilities has been defined in addition to the typical skills for specific age levels. Developmental norms have been generated from these investigations and are used in a variety of applications. Through many years of research, developmental norms have been supplemented with the awareness of a multitude of skills that are key to the acquisition of typical speech and language abilities. These developmental norms have led to the creation of methods used to identify children who are not at the typical levels of development, and subsequently are candidates for remediation. During remediation, professionals build upon children's strengths to fill in those skills identified as absent or deficient.

Research has focussed on determining the skills necessary for a child to acquire in order to communicate. In terms of English speaking children, they must acquire the necessary information from their environment to develop skills to receptively and expressively use the English language. As infants develop, they string together sounds that are not all English-based (Echols, 1988). Through experience and practice, infants typically begin to develop the necessary rules to decode and use speech that is representative of their native language. As infants refine their manipulation skills, they interact with the language to use and decode novel combinations.

Subsequent language skills are built on skills children begin to acquire in infancy. The following research will discuss the development of the foundations of literacy skills and other factors that are hypothesized to impact typical acquisition.

The emergence of reading skills is substantially impacted by the child's knowledge of the native sound systems. The child's phonemic system is composed of sounds and rules that govern the possible combinations of these sounds. As these rules develop, the child begins to manipulate streams of speech. The ability to manipulate sounds emerges as early as three years of age (Berko Gleason, 1993). The child's ability follows a developmental continuum that progresses from the manipulation of larger to smaller units of speech (Snider, 1995). Specifically, the child's segmentation skills progress from the dissection of speech into words, syllables, and then phonemes (Content, Kolinsky, Morais, & Betelson, 1986; Fowler, 1991; Goswami & Bryant, 1990; Liberman, Shankweiler, Fischer, & Carter, 1974; Rosner, 1979; Treiman & Zukowski, 1991). The knowledge of the phonemic structure of language is referred to as phonemic awareness, which is a part of phonological awareness (Lekowicz, 1980). Phonological awareness is a broad term that refers to an appreciation of the extensive sound structures that occur within speech (Wood & Terrell, 1998).

The ability to attend to individual sounds within a word (phonemic awareness) develops as a result of continuing metalinguistic growth within the child's cognitive system (Liberman & Shankweiler, 1985). It is difficult for children to manipulate phonemes because phonemes are abstract units of speech (Ball & Blachman, 1988). Phonemes are not separate entities; they are coarticulated in speech. The acoustic manifestation of spoken words does not have a direct correspondence to its phonological



composition. Spectrographic analysis of spoken words shows that the phones of the words overlap (Lieberman et al., 1974).

Despite the abstract components of speech, children's segmentation skills must develop accurately to ensure that they can derive meaning from their language. Children will use their segmentation skills to interact with the language, which will allow them to communicate. Researchers have identified the presence of segmentation skills typically found in children (Ball & Blachman, 1988; Nation & Hulme, 1997; Uhry & Sheperd, 1993; Williams, 1980). All children do not develop phonological awareness skills accurately, which can lead to language and/or communication deficiencies. The present study focuses on the role of lexical stress within phonological awareness, and provides a comparison to an awareness of syllables.

#### Statement of Purpose

The purpose of this study was to assess the phonological awareness abilities of typical preschool and school age children through measurement of their ability to localize syllables and stressed elements in two-syllable, three-syllable, and four-syllable pseudo-word forms.

#### Research Questions

This study answered the following research questions using a sample of preschool and school age participants.

1. As measured by the number of children, who reached criterion in the two-syllable, three-syllable, and four-syllable pseudo-word tasks, is there a significant difference in the proportion of those children in the stress group compared to the syllable group?

2. As measured by the mean number of correct responses, is there a significant difference between child identification of the position of syllables and the position of stressed elements in two-syllable, three-syllable, and four-syllable pseudo-words for those participants who reached criterion compared to those who did not reach criterion?
3. As measured by the mean number of correct responses for all participants, is there a significant difference between child identification of the position of syllables and the position of stressed elements in two-syllable, three-syllable, and four-syllable pseudo-words?
4. As measured by the mean number of correct responses, is there a significant difference between child identification of the position of syllables and the position of stressed elements in two-syllable, three-syllable, and four-syllable pseudo-words for those participants who reached criterion?
5. As measured by the mean number of correct responses, is there a significant difference between child identification of the position of syllables and the position of stressed elements in two-syllable, three-syllable, and four-syllable pseudo-words for those participants who did not reach criterion?
6. As measured by the number of training stimuli presented to those participants who met criterion, was there a significant difference in the number of training stimuli required to meet criterion for the participants in the stress group compared to the syllable group?
7. As measured by the mean number of correct responses, is there a significant difference between the combined identifications of the position of syllables and the

position of stressed elements in two-syllable, three-syllable, and four-syllable pseudo-words by older and younger preschool and school-age children?

In the present study, there were two independent variables: 1) experimental task (i.e., either position of syllables or the position of stressed elements) and 2) age of participant (younger or older preschool or school age child.) One group of participants received stimuli that required the identification of the position of a target syllable and the second group received stimuli that required the identification of the position of a stressed element in pseudo-word forms.

The dependent variables for this study were 1) the amount of stimulus trials required for participants to attain the criterion number of consecutive correct answers and 2) number of correct responses.

### Review of Literature

The present discussion of phonological awareness abilities follows the pattern of typical development in children. The sections will include a discussion of children's awareness of syllables, onsets and rimes, and phonemes followed by a rationale for the present study.

#### Syllable Segmentation

The awareness of syllables within words leads to the ability to segment syllables in speech. Children use prosodic information to aid in the detection of the occurrence of syllables.

Prosodics is a broad term that refers to metrical structures and processes used by the speaker and the listener to interpret meaning in speech (Hargrove, 1997). Pitch,



loudness, duration, and pause are stated as the most important components of prosodies (Brewster, 1989).

The use of the prosodic cues within speech is deeply rooted within the speaker's native language. English is a rhythm-based language, where a pattern consists of the appropriate sequencing of stressed and unstressed syllables within speech. There are patterns to which words and utterances within the English language often conform, namely an alternation of stressed and unstressed syllables.

Stress refers to the act of enhancing a component when compared to another component of a whole through modifications of the acoustical output (Liberman, 1967; Liberman, Harris, & Sawashima, 1970). A stressed syllable has inherently differing properties from an unstressed syllable based on the following three parameters: intensity (Liberman, 1967), fundamental frequency (Liberman, 1967), and duration (Oller, 1973).

Two prominent types of stress are lexical and emphatic stress. Lexical stress refers to stress placed within the syllabic composition of words. Emphatic stress refers to the emphasis that is placed on certain elements within the sentence. A listener's ability to detect stress will impact the interpretation of the encoded message.

The importance of the typical perception of lexical stress can be found by examining a stress-based theoretical model of word recognition. This model conceptualizes that as listeners perceive a word, they detect the stressed syllable first. Then during the weak syllables, prelexical and lexical processes interact. This model demonstrates that recognition occurs in a bottom-up fashion and not in a left to right order. Perceptually, attention is focussed on the stressed syllables (Gleitman & Warner,

1982; Grosjean & Gee, 1987). Within this model, segmentation is a process that functions in conjunction with lexical access.

Mattys and Samuel (1997) supported the stress-based model with experimental data. Through presentation of real-words and pseudo-words carrying lexical stress on the first or third syllable the research suggested that perceptual errors influence the recognition of the word. That is, if a stressed syllable is misperceived, regardless of the position, there is no lexical information to aid in detection. Conversely, if only an unstressed syllable is misperceived, regardless of the position, the detection of the stressed syllable will be used to correct the misperceived syllable. The listener can use this information from the syllable with primary stress to connect misperceived syllables that precede or follow the stressed syllable forwards and backwards within a word (Mattys & Samuel, 1997).

Wood and Terrell (1998) suggested that lexical information aids children in segmentation of streams of speech into meaning. These researchers pointed out that children are not aware of the lexical cues or of the information they provide. However, children use these cues, independently of their lexicon, to assist in segmentation. Thus, a child may not know the meaning of a word but will be able to segment the essential components of the word from a stream of speech.

Echols (1988) pointed out that without this ability to segment speech, all other linguistic information is essentially useless. An individual must be able to identify the boundaries of spoken words to interpret the appropriate meaning (Echols, 1988). There are few obvious distinctions or consistencies used to denote the boundaries between words (Cole & Jakamik, 1980; Hayes & Clark, 1970). Cues that denote the occurrence

of a stressed syllable are inherently provided within continuous speech. Listeners process shortened unstressed syllables and drops in fundamental frequency as cues to signal the approach of a stressed syllable (Cutler, 1976; Weismer & Ingrassano, 1979).

Echols (1988) theorized that if children do rely on the detection of stressed syllables to convey meaning, then this phenomenon should be evident in their first words. It is further noted that children's first words are demonstrative of this notion, in that young children produce the stressed components of the target words prior to the unstressed components (Echols, 1988). Research suggests that because of low perceptual salience of the unstressed syllables they are omitted in children's first utterances (Echols & Newport 1992; Echols, 1993).

An English speaker detects word boundaries with the aide of stressed syllables. Segmental and suprasegmental provide information to the listener as to where the boundaries of words occurred (Cutler & Norris, 1988; Otake, Hatland, Cutler, & Mehler, 1993). An early component of phonological awareness is the ability to segment spoken words into syllables (Liberman et al., 1974). Wood and Terrell (1998) suggested that syllable awareness is required for the detection of the boundaries of words in speech. Infants must develop skills to identify the boundaries of words in order to identify meaning within streams of speech. Cutler and Norris (1988) stated that individuals process the rhythmic properties of their native language to distinguish between the boundaries of words. Preliminary segmentation research focussed on the child's awareness of syllables (Fox & Routh, 1975; Leong & Haines, 1978; Treiman & Baron, 1981). Subsequent studies indicated a positive correlation between the awareness of



syllables, and later emerging literacy skills (Lundberg, Olofsson, & Wall 1980; Mann & Liberman, 1984; Morais, Cluytens, Alegria, & Content, 1984).

Liberman et al. (1974) examined preschool (mean age = 4; 11), kindergarten (mean age = 5; 10), and first-grade (mean age = 6; 11) children's abilities to tap out the number of syllables or phonemes in stimulus words. In order to reach criterion the children were required to tap out the correct number of syllables and phonemes in six consecutive words. Through training, the ability to tap out syllables increased from 50% to 90% accuracy. Thirty percent of the children could not perform the phoneme counting task to reach criterion. This shows that the segmentation of speech into syllables is easier than the segmentation of speech into phonemes (Liberman et al., 1974).

A factor affecting the child's ability to segment speech is the size of the linguistic unit. Linguistic units have an impact on performance with different phonological awareness tasks (Liberman et al., 1974). The difficulty of the task increases when executed at the phoneme level as compared to the syllable level. This increase in complexity may be because phonemes are smaller linguistic units than syllables. Linguistic units are vehicles that provide an opportunity for segmentation abilities to be measured. As one linguistic unit is used and success is achieved, the examiner can compare that success to the performance on the more complex linguistic unit. Liberman et al. (1974) suggested a higher level of intellectual ability is required for a child to segment words into phonemes than to segment words into syllables.

#### Onset-Rime Segmentation

Some researchers have revealed that there is a step in-between an awareness of syllables and an awareness of phonemes. Treiman and Zukowski (1991) compared an

awareness of onsets and rimes with an awareness of syllables and phonemes to determine where an awareness of onsets and rimes falls in the generally accepted hierarchy of phonological awareness. The research suggested that an awareness of onsets and rimes develop after syllable awareness and before phonemic awareness (Goswami & Bryant, 1990; Treiman & Zukowski, 1991). The term onset refers to any beginning consonants, and rime refers to the vowel and any final consonants. The rime can be further divided into the vowel nucleus and the coda. The word “drop” can be used to illustrate this ability, where “dr” is the onset and “op” is the rime. The researchers also suggested that an awareness of onsets and rimes was consistent with kindergarten-aged children (Treiman & Zukowski, 1991). Goswami and Bryant (1990) suggested that an awareness of onsets and rimes precede reading abilities and phonemic awareness develops after learning to read. However, Nation and Hulme (1997) found no link of onset-rime segmentation ability to age, reading ability, or spelling ability. Ball (1993) hypothesized that rime deficits might provide a cue to later phonemic awareness deficits.

#### Phonemic/Phonological Awareness

Phonological awareness reflects the ability to make judgements on the similarities and differences between sounds. A child is used to focussing on the meaning of speech, as opposed to the form of speech. A child must comprehend this form of speech and determine the essential components to perform phonological awareness tasks (Yopp, 1992). A child who has phonemic awareness is able to detect the word “cat,” and split it into its content phonemes: “k-a-t.” Different components of phonological awareness are not mutually exclusive; thus children have varying degrees of word and syllable awareness at the same time (Jenkins & Bowen, 1994).



Phonological awareness has been directly related to success in reading (Ball & Blachman, 1988, 1991; Bradley & Bryant, 1985; Byrne & Fielding-Barnsley, 1991; Lie, 1991; Lundberg, Frost, & Petersen, 1988; Williams, 1980). Researchers have examined whether phonological awareness develops because of reading and independent of instruction, or if a child must be directly taught. If phonological awareness develops because of literacy skills, then why are these abilities found in preliterate children (Lundberg 1991, 1994)? Wood and Terrell (1998) investigated the relationship of phonological awareness to literacy through administration of phonological awareness tasks with children of an average age of 4; 4 years. Results suggested that phonological awareness could develop without training. Syllable awareness was more developed than onset-rime awareness, which was more developed than phonemic awareness (Wood & Terrell, 1998).

Individual phonological awareness activities have served as indicators of emerging language abilities. Phonemic segmentation activities have been shown to be a valid predictor of reading and spelling ability (Nation & Hulme, 1997). This segmentation ability develops as a result of continuing metalinguistic growth, which starts in infancy. Interruption of segmentation skills at any point within development may result in impaired literacy skill development.

#### Rationale for the present study

The focus on investigating the potential foundations of literacy skills is warranted. During the 1980s, the number of individuals labeled with a learning disability increased by 129% (Yseldyke & Christenson, 1988). In 1994, the U.S. Department of Special Education released a statistical analysis of those students receiving special education. Of

those receiving services, 52.4% were students with learning disabilities. Researchers have hypothesized that learning disabilities arise from reading difficulties (Yseldyke & Christenson).

Phonological awareness skills have been shown to aid in the development of reading skills (Ball & Blachman, 1988, 1991; Bradley & Bryant, 1985; Byrne & Fielding-Barnsley, 1991; Lie, 1991; Lungberg, Frost, & Petersen, 1988; Williams, 1980). As literacy research progresses, different elements are being evaluated for their presence in the hierarchy of phonological awareness. By examining different components that may or may not be a part of the hierarchy of phonological awareness, researchers can offer suggestions to be applied in remediation activities. Through remediation activities, the children may be able to develop all aspects of phonological awareness, which may have an impact on their literacy skills.

The present study was designed to demonstrate that children have a phonological awareness of lexical stress. The present study was designed to compare syllable awareness, which has been the subject of previous research, with stress awareness to determine if children have an awareness of lexical stress and whether it is more developed than their awareness of syllables. The extent of this awareness was quantified by comparing the performance of matched groups of participants who attended to either a target stress element or a target syllable.

## CHAPTER 2

### METHOD

#### Participants

A total of 44 children (mean age = 4; 4 and range 3; 6 to 7; 2) participated in this project. There were 21 male participants and 22 female participants. The children were recruited from a parochial school and two daycare centers in Grand Forks, North Dakota. The children had received varied literacy instruction, ranging from no instruction to school-taught literacy skills. All boys and girls who met the criteria to participate were eligible for the study. Only those children with signed consent forms (from a parent or guardian) participated. Once each participant had met the criteria for participant selection, s/he was randomly assigned to either the syllable group or the stress group. Participants were randomly assigned to the groups using a computer generated numerical coding system. Following acceptance into the study, the participants were also divided into two groups based on age, a young group (mean age = 4; 9, s.d. 7.3 months), and an old group (mean age = 6; 1, s.d. 6.7 months). Children between the ages of 3 years, 6 months and 7 years, 11 months were eligible to participate if they met the following criteria:

1. A Peabody Picture Vocabulary Test (PPVT-III; Dunn & Dunn, 1997) standard score within 1.5 standard deviations of the mean, indicating typical receptive language abilities.



2. A Columbia Mental Maturity Scale (CMMS; Burgmeister, Blum & Lorge, 1972) score within 1.5 standard deviations from the mean, indicating typical nonverbal cognitive abilities.

The mean PPVT-III standard score obtained for all participants was 103.77 (s.d. 11.84). The mean PPVT-III standard score obtained for the stress group was 107.37 (s.d. 10.76), and 100.59 (s.d. 13.11) for the syllable group. The mean PPVT-III standard scores were 104.05 (s.d. 13.67) for the young group, and 103.43 (s.d. 11.42) for the old group.

The mean CMMS IQ equivalence score obtained for all participants was 113.76 (s.d. 11.59). The mean CMMS IQ equivalence score obtained for the stress group was 114.42 (s.d. 9.19) with 113.18 (s.d. 13.52) for the syllable group. The mean CMMS IQ equivalence score obtained for the young group was 117.5 (s.d. 11.85) with 110.19 (s.d. 10.38) for the old group. Results of t-tests for independent samples revealed no significant differences between the scores reported for the subgroups.

All of the available children at the designated age ranges participated in the study with one exception: a female kindergarten student chose to leave the testing situation prior to the completion of the task. The performances of two students were excluded as a result of a change in test protocol. The two students were the first to complete the task, and performed exceptionally well on the three-syllable segmentation task. The primary investigator chose to raise the criterion rule following their performance; therefore their data were excluded.

### Instruments

The children's receptive one-word vocabulary was assessed using the PPVT-III. The CMMS was used to assess the children's nonverbal cognitive abilities. Both instruments have been used extensively in the professions of speech-language pathology and psychology. Also, both instruments are known for their strong psychometric properties.

### Stimulus Pseudo-Word Forms

The primary researcher developed a variety of two-syllable, three-syllable and four-syllable pseudo-word forms that were used in pre-training, training, and experimental conditions of this study (see Tables 1 and 2 for a complete list of the pseudo-word forms used). All pseudo-word forms were presented digitally by a PC computer. A female computer science graduate student at the University of North Dakota, naïve to the purpose of this study, was recruited to speak all pseudo-word forms, which were recorded, and then reviewed by the primary researcher and a faculty advisory committee member for accuracy. Developmental norms were considered in the construction of the stimulus items.

### Procedures

The primary investigator and one graduate student in the Department of Communication Sciences and Disorders conducted all testing. The graduate student was trained to administer the PPVT-III and the CMMS under the direction of the primary investigator. The primary investigator was present to supervise testing with all participants. The actual testing took no longer than 20 minutes per child. Assessments occurred in a one-on-one setting in a space designated by the school where psychological

Table 1. Pseudo-words administered to the stress group with capitalized syllables indicating the stressed targets.

Pre-training	2-Syll. Training	2-Syll. Exp.	3-Syll Training	3-Syll. Exp.	4-Syll. Training	4-Syll. Exp.
kuBA	KUta	MAku	dakuDA	kuMAma	DAdadaku	maKUmama
KUba	Taku	KUma	kudaDA	mamaKU	kudaDAda	kumamaMA
BAku	kuTA	maKU	daDAku	MAkuma	dadadaKU	kuMAmama
baKU	taKU	kuMA	dadaKU	MAmaku	daDAkuda	MAmamaku
	KUda		kuDAda	maKUma	DAdakuda	maMAkuma
	DAku		daKUda	kumaMA	dakudaDA	MAmamaku
	kuDA		KUdada	maMAku	dadaKUda	mamaMAku
	PAku		DAkuda	makuMA	daKUdada	MAmakuma
	KUpa		DAdaku	KUmama	KUdadada	makuMAma
	paKU				DAkudada	makumaMA
	kuPA				dakuDAda	mamakuMA
	daKU				dadakuDA	mamaKUma
					kudadaDA	kumaMAma
					daDAdaku	mamamaKU
					dadaDAku	MAkumama
					kuDAdada	KUmamama



Table 2. Pseudo-words administered to the syllable group, the “ku” syllables were the targets.

Pre-training	2-Syll. Training	2-Syll. Exp.	3-Syll Training	3-Syll. Exp.	4-Syll. Training	4-Syll. Exp.
kuBA	Taku	kuMA	kuDada	mamaKU	daKUdada	kumamaMA
baKU	taKU	MAku	DAkuda	kuMAma	DAkudada	makuMAma
KUba	KUta	maKU	kudaDA	MAmaku	dadadaKU	KUmamama
BAku	kuTA	KUma	DAdaku	MAkuma	DAdakuda	kuMAmama
	DAku		dadaKU	makuMA	daDAkuda	mamaMAku
	daKU		daKUda	maKUma	DAdadaku	maMAkuma
	kuDA		KUdada	kumaMA	KUdadada	kumaMAma
	KUda		daDAku	maMAku	dadakuDA	mamaKUma
	paKU		dakuDA	KUmama	dakuDAda	maMAmaku
	KUpa				dadaDAku	MAmamaku
	kuPA				daDAdaku	MAkumama
	PAku				kuDAdada	MAmakuma
					dakudaDA	maKUmama
					dadaKUda	makumaMA
					kudadaDA	mamamaKU
					kudaDAda	mamakuMA

testing was frequently conducted. If a subject became upset at any time during testing, s/he was taken back to his/her classroom.

This study incorporated pre-training, training, and experimental conditions. Participants were prompted to manipulate tokens from a Connect Four game. The Connect Four game is a grid that has seven columns and six rows. The participants dropped the red and black tokens into the grid to convey their knowledge of identifying position of syllables or stressed elements in pseudo-word forms. The number of tokens provided to the participants corresponded to the number of syllables introduced in each of the pre-training, training, and experimental conditions. For example, in the pre-training condition for two-syllable pseudo-word forms, the participant was given two tokens (i.e., one red token and one black token). Respectively, three tokens (i.e., one red token and two black tokens) were given for three-syllable pseudo-word forms and four tokens (i.e., one red token and three black tokens) for four-syllable pseudo-word forms.

The primary investigator assigned an arbitrary number to all stimuli presented during the training and experimental conditions. Once the arbitrary numbers were assigned, the primary investigator randomized the order of presentation of the pseudo-word forms for each participant. Randomization of the stimuli was performed to ensure that there was not an effect based on the order of presentation. Upon randomization of the stimuli, an answer sheet was developed for each participant. The participant's answers were recorded by making a plus or minus on the answer sheet next to the corresponding number of the presented pseudo-word form.



### Pre-training Task

The primary investigator informed the participants "Today we are going to listen to some words. I am going to play these words for you from my computer. When you hear the word, I want you to say the word back to me. Then I will give you some chips, and you can put them into the grid. First we are going to practice. Listen to the computer, and then we will put the tokens into the grid."

During the administration of the pre-training stimuli, the investigator presented the pseudo-word, said the pseudo-word, and then placed the chips within the Connect Four grid in a manner that was demonstrative of the location of the target element within the pseudo-word. The participant was informed that it was his/her turn. The investigator re-presented the pseudo-word, the participant said the pseudo-word this time, and then placed the chips in the grid. If the participant placed the chips in the correct order, the investigator said "Good job" and moved on to the next pre-training stimuli. If the participant placed the chips in error, the primary investigator re-presented the pseudo-word a third time and modeled the correct response for the participant. The participant repeated the procedure again. Regardless of the accuracy of the second attempt, the participant moved on to the next pre-training stimulus item. The format was the same for all four pre-training pseudo-word forms. After completion of the pre-training condition, the participant was informed that it was his/her turn to try it by him/herself.

### Training Task

The participants were required to score three consecutive correct responses during the two-syllable training task, three consecutive correct responses during the three-syllable training task, and two consecutive correct responses in the four-syllable training

task to move on to the respective experimental conditions. During the training task, the primary investigator presented the pseudo-word from the computer, the participant was required to say the pseudo-word back to the primary investigator, and then place the tokens into the grid. If the participant scored accurately, the primary investigator said, "Good job", removed the chips and moved on to the next stimulus item. If the participant placed the tokens into the grid in error the primary investigator removed the tokens, and told the participant "That was close, let's try it again." The primary investigator re-presented the pseudo-word from the computer, said the pseudo-word, and then placed the tokens into the grid. The primary investigator removed the tokens, and re-presented the same pseudo-word for the participant. The participant repeated the same pseudo-word back to the primary investigator, and then placed the tokens into the grid. Regardless of the accuracy of this response the primary investigator said, "Okay, let's do another one." Once the participant reached criterion, the training condition was ended, and the experimental condition began. In order to ensure that the participants benefited from the training conditions, the primary investigator presented the fixed training stimuli for two syllable pseudo-word forms and then presented the two-syllable pseudo-word forms for the experimental condition. This procedure was also implemented for the three-syllable and four-syllable pseudo-word forms. There were nine two-syllable training stimuli, and nine three-syllable training stimuli, and sixteen four-syllable training stimuli.

After completion of every fourth stimulus item during the training and experimental condition, the participant was permitted to pick an animal from the Velcro board and place it onto the jungle scene. Regardless of the response given by the

participant, s/he was permitted to pick an animal from the Velcro board and place it onto the scene.

The procedures described for the training conditions were the same for the two-syllable, three-syllable, and four-syllable conditions. The training procedures were always performed prior to the initiation of the experimental conditions for each set of stimuli.

### Experimental Task

Following the presentation of the training pseudo-words, the primary investigator began the experimental condition. The primary investigator presented the pseudo-word to the participant, and the participant placed the chips in the grid. If the participant put the chips into the grid correctly, the primary investigator said "Good job", and the next pseudo-word was played. The participant's errors were corrected as they occurred during the experimental condition. If the chips were put into the grid in error, the primary investigator removed the chips, and said "That was close let's try it again". The primary investigator re-presented the same pseudo-word, said the pseudo-word, put the chips in the correct location in the grid, and informed the participant "Now it's your turn to try a new word". The participant did not have a second chance to place the tokens into the grid during the experimental task. The primary investigator proceeded and presented the next pseudo-word. The participant was exposed to all stimuli in the particular set during the experimental condition.

If a participant achieved criterion during a set of training stimuli, following the subsequent experimental task, he/she was automatically exposed to the training stimuli for the next level of stimuli. If the participant did not reach criterion in the training task

he/she was only exposed to the corresponding experimental stimuli. Upon completion of the entire task, the participants were given their choice of two stickers supplied by the primary investigator.



## CHAPTER 3

### RESULTS AND DISCUSSION

The results are reported sequentially for each research question. It is to be noted that the four-syllable task was not used because few participants reached criterion on the three-syllable task. Therefore, no data will be reported for the four-syllable tasks in the present discussion.

The present study was designed to answer the seven research questions.

#### Research Question #1

As measured by the number of children who reached criterion in the two-syllable, three-syllable, and four-syllable pseudo-word tasks, is there a significant difference in the proportion of those children in the stress group compared to the syllable group? This research question was answered by determining the proportion of participants in each the stress and syllable groups who met criterion relative to those who did not meet criterion for progressing from the training tasks to the experimental tasks when responding to the two-syllable and three-syllable pseudo-words. The data were conceptualized in 2 X 2 contingency tables and submitted to Chi-square analysis. The stress and syllable groups did not differ significantly for either the two-syllable (Chi-square = .312;  $df = 1$ ;  $p > .05$ ) or the three-syllable (Chi-square = .051;  $df = 1$ ;  $p > .05$ ) tasks (see Table 3). From this analysis it appears that the level of difficulty in reaching the criterion for progressing from the training tasks

Table 3. Number of participants who met criterion, number of participants who did not meet criterion, Chi-square analyses, and degrees of freedom obtained for research question 1, which investigated the number of participants who met criterion relative to the number of participants who did not meet criterion in the stress group compared to the syllable group.

Research Questions	Stress Group(met/not met)	Syllable Group(met/not met)	Chi-square	df
Question 1: proportion of participants who met criterion relative to those that did not				
two-syllable	12 / 7	12 / 10	.312 *	1
three-syllable	2 / 7	2 / 9	.051 *	1

\* not significant at the  $p < .05$  level

to the experimental tasks did not differ significantly for the stress tasks versus the syllable tasks at either the two-syllable or the three-syllable levels.

### Research Question #2

As measured by the mean number of correct responses, is there a significant difference between child identification of the position of syllables and the position of stressed elements in two-syllable, three-syllable, and four-syllable pseudo-words for those who reached criterion compared to those participants who did not reach criterion? This research question was answered by determining the mean number of correct responses for the participants within each the stress and the syllable group when responding to the two-syllable and three-syllable pseudo-words during the experimental tasks. The responses were compared within groups to determine if there was a significant difference between those participants who achieved criterion versus those participants who did not achieve criterion. The data were analyzed using a t-test for independent samples. The performance of the participants within the stress group who achieved criterion versus those who did not achieve criterion did not differ significantly for either the two-syllable ( $t = .880$ ;  $df = 17$ ;  $p = .391$ ) or the three-syllable ( $t = .322$ ;  $df = 7$ ;  $p = .757$ ) tasks (see Table 4). From this analysis it appears that the performance of the participants in the stress group who met criterion versus those participants who did not meet criterion did not differ significantly ( $p > .05$ ) at the two-syllable or three-syllable levels. The performance of the participants within the syllable group who achieved criterion versus those who did not achieve criterion did not differ significantly for either the two-syllable ( $t = -.298$ ;  $df = 20$ ;  $p = .768$ ) or the three-syllable ( $t = .795$ ;  $df = 9$ ;  $p = .447$ ) tasks (see Table 4). From this analysis it appears that the performance of the

Table 4. Means, standard deviations, t-values, degrees of freedom, and probabilities obtained for research question 2, which investigated the performance of those participants who did not reach criterion compared to those who did within the stress and syllable groups.

Research Questions	Criterion not met	sd	Criterion met	sd	t-value	df	Probability
Question 2: correct responses for the stress group							
two-syllable	2.71	.7559	2.33	.9847	.880	17	.391 *
three-syllable	2.86	1.4639	2.50	.5000	.322	7	.757 *
correct responses for the syllable group							
two-syllable	1.70	.9487	1.83	1.1146	-.298	20	.768 *
three-syllable	3.78	2.1667	2.50	.7071	.795	9	.447 *

\* not significant at the  $p < .05$  level



participants in the syllable group who met criterion versus those participants who did not meet criterion did not differ significantly ( $p > .05$ ) at the two-syllable or three-syllable levels.

### Research Question #3

As measured by the mean number of correct responses for all participants, is there a significant difference between child identification of the position of syllables and the position of stressed elements in two-syllable, three-syllable, and four-syllable pseudo-words? This research question was answered by determining the mean number of correct responses for the participants in each the stress and the syllable group when responding to the two-syllable and three-syllable pseudo-words during the experimental tasks. The data were analyzed using a t-test for independent samples. The performance of the stress and syllable groups differed significantly for the two-syllable ( $t = 2.31$ ;  $df = 39$ ;  $p = .026$ ) task, but did not differ significantly for the three-syllable ( $t = -.98$ ;  $df = 18$ ;  $p = .338$ ) task (see Table 5). From this analysis it appears that the stress group performed significantly better (mean = 2.47) than the syllable group (mean = 1.77) at the two-syllable level. The performance of the stress group versus the syllable group did not differ significantly ( $p > .05$ ) at the three-syllable level.

### Research Question # 4

As measured by the mean number of correct responses, is there a significant difference between child identification of the position of syllables and the position of stressed elements in two-syllable, three-syllable, and four-syllable pseudo-words for those participants who reached criterion? This research question was answered by determining the mean number of correct responses for the participants in each the stress

participants in the syllable group who met criterion versus those participants who did not meet criterion did not differ significantly ( $p > .05$ ) at the two-syllable or three-syllable levels.

### Research Question #3

As measured by the mean number of correct responses for all participants, is there a significant difference between child identification of the position of syllables and the position of stressed elements in two-syllable, three-syllable, and four-syllable pseudo-words? This research question was answered by determining the mean number of correct responses for the participants in each the stress and the syllable group when responding to the two-syllable and three-syllable pseudo-words during the experimental tasks. The data were analyzed using a t-test for independent samples. The performance of the stress and syllable groups differed significantly for the two-syllable ( $t = 2.31$ ;  $df = 39$ ;  $p = .026$ ) task, but did not differ significantly for the three-syllable ( $t = -.98$ ;  $df = 18$ ;  $p = .338$ ) task (see Table 5). From this analysis it appears that the stress group performed significantly better (mean = 2.47) than the syllable group (mean = 1.77) at the two-syllable level. The performance of the stress group versus the syllable group did not differ significantly ( $p > .05$ ) at the three-syllable level.

### Research Question # 4

As measured by the mean number of correct responses, is there a significant difference between child identification of the position of syllables and the position of stressed elements in two-syllable, three-syllable, and four-syllable pseudo-words for those participants who reached criterion? This research question was answered by determining the mean number of correct responses for the participants in each the stress

and the syllable group who reached criterion when responding to the two-syllable and three-syllable pseudo-words during the experimental tasks. The data were analyzed using a t-test for independent samples. The performance of the participants in each the stress and syllable groups who achieved criterion did not differ significantly for either the two-syllable ( $t = 1.17$ ;  $df = 22$ ;  $p = .257$ ) or the three-syllable ( $t = .00$ ;  $df = 2$ ;  $p = 1.000$ ) tasks (see Table 5). From this analysis it appears that the performance of the participants who met criterion in the stress group versus the syllable group did not differ significantly ( $p > .05$ ) at the two-syllable or three-syllable levels.

#### Research Question # 5

As measured by the mean number of correct responses, is there a significant difference between child identification of the position of syllables and the position of stressed elements in two-syllable, three-syllable, and four-syllable pseudo-words for those participants who did not reach criterion? This research question was answered by determining the mean number of correct responses for the participants in each the stress and the syllable group who did not reach criterion when responding to the two-syllable and three-syllable pseudo-words during the experimental tasks. The data were analyzed using a t-test for independent samples. The performance of the participants in each the stress and syllable groups who did not achieve criterion differed significantly for the two-syllable ( $t = 2.35$ ;  $df = 15$ ;  $p = .033$ ) task, but did not differ significantly for the three-syllable ( $t = -.963$ ;  $df = 14$ ;  $p = .352$ ) task (see Table 5). From this analysis it appears that the participants who did not meet criterion in the stress group (mean = 2.71) performed significantly better than the syllable group (mean = 2.86) at the two-syllable level but did not differ significantly ( $p > .05$ ) at the three-syllable level.



Research Question #6

As measured by the number of training stimuli presented to those participants who met criterion, was there a significant difference in the number of training stimuli required to meet criterion for the participants in the stress group compared to the syllable group? This research question was answered by determining the mean number of trials necessary for the participants in each the stress and the syllable to reach criterion when responding to the two-syllable and three-syllable pseudo-words during the experimental tasks. The data were analyzed using a t-test for independent samples. The number of trials necessary to reach criterion for the participants in each the stress and syllable groups did not differ significantly for the two-syllable ( $t = .918$ ;  $df = 22$ ;  $p = .369$ ), or the three-syllable ( $t = .500$ ;  $df = 2$ ;  $p = .667$ ) tasks (see Table 5). From this analysis it appears that the number of trails necessary to reach criterion for the participants in the stress group versus the syllable group did not differ significantly ( $p > .05$ ) at the two-syllable or the three-syllable levels.

Research Question #7

As measured by the mean number of correct responses, is there a significant difference between the combined identifications of the position of syllables and the position of stressed elements in two-syllable, three-syllable, and four-syllable pseudo-words by older and younger preschool and school-age children? This research question was answered by determining the mean number of correct responses for the participants in each the young and the old group when responding to the two-syllable and three-syllable pseudo-words during the experimental tasks. The data were analyzed using a t-test for independent samples. The performance of the participants within the young



Table 5. Means, standard deviations, t-values, degrees of freedom, and probabilities obtained for research questions 3, 4, 5, 6, which investigated the performance of the stress group compared to the syllable group.

Research Questions	Stress Group	sd	Syllable Group	sd	t-value	df	Probability
Question 3: correct responses							
two-syllable	2.47	.9048	1.77	1.0204	2.31	39	.026 *
three-syllable	2.78	1.3017	3.55	2.0181	-.98	18	.338
Question 4: correct responses for those who reached criterion							
two-syllable	2.33	.9847	1.83	1.1146	1.17	22	.257
three-syllable	2.50	.7071	2.50	.7071	.00	2	1.000
Question 5: correct responses for those who did not reach criterion							
two-syllable	2.71	.7559	1.70	.9487	2.35	15	.033 *
three-syllable	2.86	1.4639	3.78	2.1667	-.963	14	.352
Question 6: number of trials required to reach criterion							
two-syllable	7.83	2.7907	6.75	2.99	.918	22	.369
three-syllable	5.00	2.8284	4.00	.0000	.500	2	.667

\* significant at the  $p < .05$  level

group versus the old group did not differ significantly for either the two-syllable ( $t = .932$ ;  $df = 39$ ;  $p = .357$ ) or the three-syllable ( $t = -1.56$ ;  $df = 18$ ;  $p = .137$ ) tasks (see Table 6). From this analysis it appears that the performance of the participants in the young group versus the old group did not differ significantly ( $p > .05$ ) at the two-syllable or three-syllable levels.

### General Discussion

The significant results obtained in the present study indicate that the participants performed the stress task at the two-syllable level better than they performed the syllable task at the two-syllable level (see Figures 1 and 2). In Figure 1, the mean total of correct responses for the stress group was significantly higher than that of the syllable group. Since the tasks and stimuli are identical except for the linguistic unit that is the focus of attention, this result indicates that an awareness of lexical stress may precede an awareness of syllables. In Figure 2, the mean total of correct responses for those participants who did not reach criterion was significantly higher for the stress group than that of the syllable group. There was not a difference between the awareness of lexical stress and the awareness of syllables for the preschool and school age children at the three-syllable or four-syllable level. The complexity of the four-syllable task was too advanced for any of the participants to reach criterion, or to perform the experimental task. There were no significant differences between the abilities of the young group when compared to that of the old group. This finding may be confounded, in that the young group and the old group were not equally distributed into the respective age ranges. There was a large standard deviation for both groups (mean age of young group = 4;9, s.d. 7.3 months, mean age of old group = 6;1, s.d. 6.7 months). From the results

Table 6. Means, standard deviations, t-values, degrees of freedom, and probabilities obtained for research question 7, which investigated the performance of the young group compared to the old group.

Research Questions	Young Group	sd	Old group	sd	t-value	df	Probability
Question 7: correct responses							
two-syllable	2.25	.8507	1.95	1.1609	.932	39	.357 *
three-syllable	2.56	.7265	3.73	2.1490	-1.56	18	.137 *

\* not significant at the  $p < .05$  level

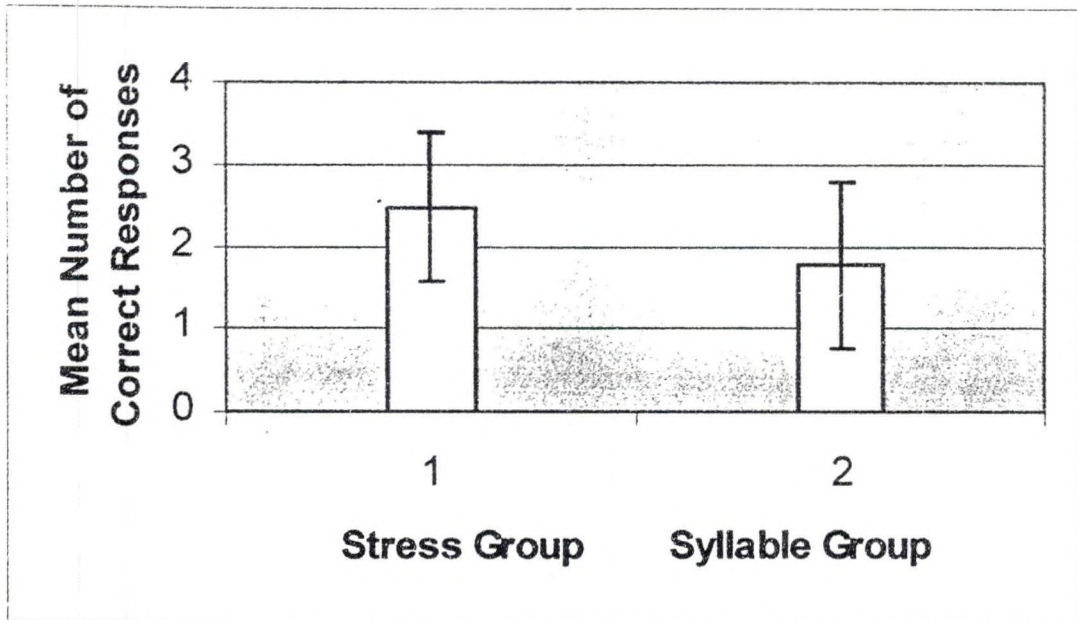


Figure 1. Means and standard deviations obtained for the two-syllable portion of research question 3, which investigated the performance of the stress group versus the syllable group at the two-syllable level.



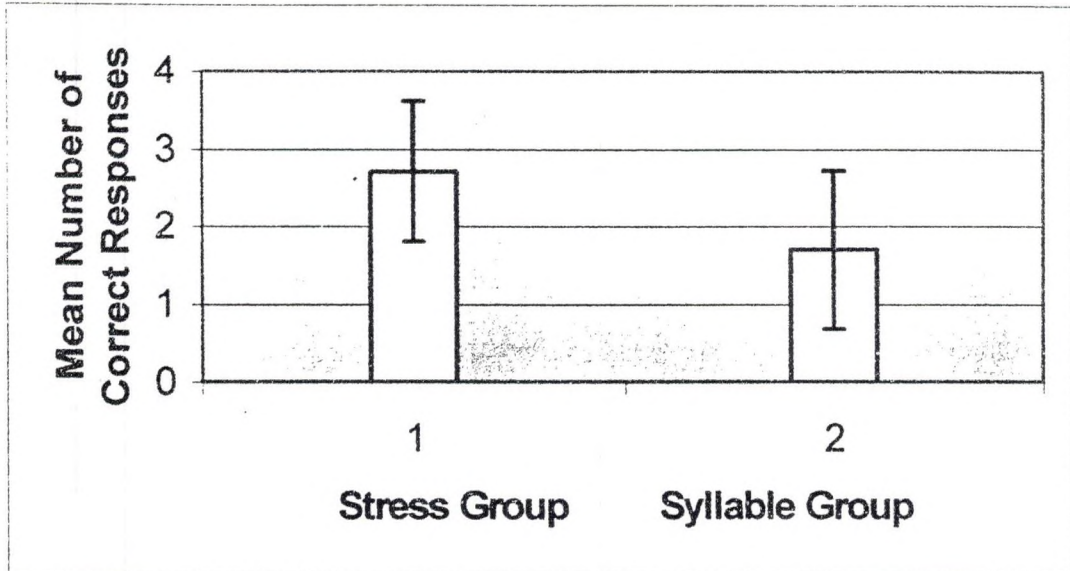


Figure 2. Means and standard deviations obtained for the two-syllable portion of research question 5, which investigated the performance of the participants who did not reach criterion in the stress group versus the syllable group at the two-syllable level.

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obtained, a definitive picture of where an awareness of lexical stress falls on the developmental continuum of phonological awareness cannot be formed. The results suggest that an awareness of lexical stress precedes an awareness of syllables, however the results are not conclusive.

A comparison of the present study to two similar research studies suggests that the current task may be too difficult. Liberman et al. (1974) examined the abilities of preschool (mean age = 4; 11), kindergarten (mean age = 5; 10), and first- grade (mean age = 6; 11) children to count the number of syllables and phonemes in stimulus words. The proportion of participants who could complete the syllable task by achieving six consecutive correct responses was 46% (preschool), 48% (kindergarten), and 90% (first-grade) (Liberman et al, 1974). Treiman and Zukowski (1991) compared the awareness of syllables, onsets and rimes, and phonemes in preschool (mean age = 5; 1), kindergarten (mean age = 5; 9), and first-grade (mean age = 7; 0) children. However, instead of a counting task, the participants were required to listen to two words presented verbally by the examiner, and make a decision to whether or not they had sounds that were the same. The sounds in common were at the syllable, onset-rime, or phoneme level. The stimuli for the syllable condition were two-syllables in length. The participants were divided into each group based on grade level. The researchers also used a puppet in the task. The participants were informed when two words shared a sound the puppet was happy, and when the two words did not share a sound the puppet was sad. For the stimuli at the syllable level, primary stress was always placed on the shared syllables. This is a major point in the methodology of this study because the researchers *combined* syllables with stress. An underlying factor in the present research study was to *compare* an awareness

of stress to an awareness of syllables. The proportion of participants who could complete the syllable task to reach criterion (six consecutive correct responses) was 100% (preschool), 90% (kindergarten), and 100% (first-grade) (Treiman & Zukowski, 1991), substantially higher than that found by Liberman et al. (1974).

The criterions used in the above-mentioned studies are stronger than the results obtained in the present study. In the present study, the participants were required to score three consecutive correct responses at the two-syllable and three-syllable levels to reach criterion. One would expect a greater proportion of participants in the present study to reach criterion as compared to the Liberman et al. (1974) and Treiman and Zukowski (1991) studies, due to the fewer number of consecutive correct responses needed to reach criterion in the present study. However, in the present study 63% of the participants in the stress group reached criterion at the two-syllable level, and 29% at the three-syllable level. In the syllable group, 55% of the participants reached criterion at the two-syllable level, and 18% reached criterion at the three-syllable level. These percentages indicate that the present task is relatively more difficult than that used by other researchers.

## CHAPTER 4

### SUMMARY AND CONCLUSIONS

The location of lexical stress awareness within the developmental hierarchy of phonological awareness is not fully understood. A thorough examination of lexical stress abilities is necessary for a complete understanding of the typical acquisition of segmentation skills. The purpose of this study was to determine the phonological awareness knowledge of typical preschool and school age children through measurement of their awareness of syllables and stressed elements in two-syllable, three-syllable, and four-syllable pseudo-word forms. The children were assigned to a stress group or a syllable group, which determined what type of task they completed. The participants in the stress group were required to identify the location of a stressed element, and the participants within the syllable group were required to identify the location of a target syllable. Upon completion of the collection of data, the participants were divided into a young group or an old group based on their age. The young versus old comparison was made to identify any differences in segmentation skills based on age.

The findings of the present study were these:

1. The mean total of correct responses was greater for those participants in the stress group compared to those participants in the syllable group at the two-syllable level.



2. The mean total of correct responses at the two-syllable level was greater for those participants in the stress group who did not achieve criterion compared to those participants in the syllable group who did not achieve criterion.
3. There was not a difference between the abilities of the participants in the stress group compared to those participants in the syllable group at the three-syllable level.
4. The complexity of the four-syllable task was too advanced for any of the participants to reach criterion or to perform the experimental task.
5. There was not a difference in the phonological awareness skills of the participants in the young group compared to those participants in the old group at the two-syllable or the three-syllable level.

From these findings it was concluded:

1. The stress task was easier compared to the syllable task for all participants at the two-syllable level. Children are aware of lexical stress, and it is a part of phonological awareness.
2. The participants in the stress group who did not achieve criterion at the two-syllable level may have benefited from the additional training stimuli which was evident in their success over the participants in the syllable group who did not achieve criterion.
3. There were no differences in the participants' abilities with an increase in the size of the linguistic units to three-syllables.
4. The cognitive demand of the four-syllable tasks exceeded the participants' abilities.

5. There were no age-based effects present in the participants' abilities at the two-syllable or the three-syllable level.

Based on the present study recommendations for further research are:

1. The number of participants in the study should be increased so that there is an adequate representation of each age-level.
2. The age ranges of the participants should be expanded so that a clear picture of when an awareness of lexical stress is typically formed.
3. The experimental tasks and/or the training tasks need to be altered so that the research design is not as cognitively demanding for the participants. The tasks need to be less complex so that the participants remain interested and attentive during the data collection.
4. The task should be designed so that the participants are inherently motivated.

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