Phonological Awareness Intervention for Preschoolers with Speech and Sound Disorders

Intervention pour améliorer la conscience phonologique chez les enfants d'âge préscolaire ayant des troubles de la parole et de la perception des sons

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Abstract

Phonological awareness (PA) development is related to the development of decoding and reading skills. PA can be measured in young children before the commencement of school and formal reading instruction. Compared to normally developing children, these children with speech sound disorders (SSD) are at increased risk for delayed PA. Children with poor PA, who are at-risk for developing poor decoding skills, can be identified and treated before poor PA negatively impacts their future literacy development. This intervention program was developed as a form of early intervention for preschool-aged children with delayed PA. Ten 4-year-old children with poor PA and SSD participated in the study. The program consisted of eight sessions, which included both a PA and a speech perception component. The PA portion focused on matching words that shared either the same onset or rime. The speech perception portion focused on the identification of correctly articulated or misarticulated words containing the target onset. Participants made significant improvements in their PA, raising their post-treatment test scores to the level of normally developing children. The unique and important role of speech-language pathologists in the stimulation of PA in children prior to the commencement of formal schooling is highlighted.

Abrégé

La conscience phonologique est liée au perfectionnement des aptitudes de décodage et de lecture. Il est possible de mesurer cette conscience chez les jeunes enfants avant le début de l'école et de l'apprentissage officiel de la lecture. Par comparaison avec les enfants qui se développent normalement, les enfants ayant des troubles de la parole et de la perception des sons ont un risque accru d'accuser un retard de la conscience phonologique. Il est possible de repérer les enfants qui ont une mauvaise conscience phonologique (et qui risquent par conséquent d'acquérir de faibles aptitudes de décodage), et ce, avant que ce trouble n'affecte leur capacité d'apprendre à lire et à écrire. Ce programme a été élaboré pour servir de méthode d'intervention précoce auprès des enfants d'âge préscolaire accusant un retard de la conscience phonologique. Dix enfants de 4 ans accusant un retard de la conscience phonologique et ayant des troubles de la parole et de la perception des sons ont participé à l'étude. Le programme comportait huit séances, qui comprenaient chacune un volet sur la conscience phonologique et un autre sur la perception de la parole. Le premier volet demandait aux enfants de jumeler les mots qui partagent la même attaque ou la même rime. Le second leur demandait d'identifier les mots contenant l'attaque cible qui sont bien articulés et ceux qui ne le sont pas. Les participants ont considérablement amélioré leur conscience phonologique, les résultats de leur test après le traitement ayant augmenté pour atteindre le même niveau que ceux d'enfants qui se développent normalement. Cet article fait ressortir le rôle unique et important des orthophonistes dans la simulation de la conscience phonologique chez les enfants avant qu'ils ne commencent officiellement l'école.

Key Words: phonological awareness intervention, preschoolers, phonological disorders, speech sound disorders

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What is Phonological Awareness?

Phonological awareness (PA) is the explicit knowledge that spoken words can be segmented into smaller parts. Words can be broken down into syllables, which can be divided into onsets and rimes, and divided further into individual phonemes. PA is important because of the predictive nature of the relationship between PA and prospective decoding and reading skills (Bradley & Bryant, 1983).

Phonological Awareness in Preschoolers

A variety of techniques have been used to measure PA, depending on the age and abilities of the children being tested. Test targets also vary with age, illustrating the developmental progression of PA, beginning with sensitivity to larger phonological units, such as words and syllables, progressing to smaller units, such as onsets and rimes, and finally, to phonemes (Anthony, Lonigan, Burgess, Driscoll, Phillips, & Cantor, 2002).

PA is measured in preschoolers as young as 3 years old using simple tasks. For example, Chaney (1992) demonstrated that 3-year-old children successfully performed word segmentation (i.e., segmenting the words *balloontreeshirt*), phonological play involving purposeful mispronunciation and substitution of words, and judgment and correction of phonemes (i.e., shown a picture of a *pie* and asked if it was a "*sie*."). Other techniques commonly used to measure PA in preschoolers include: clapping for each syllable in a word; identifying which word, from a group of words, does not belong (e.g., *cat, hat, soup, mat*); identifying the first sound of a word; or to judge whether or not two words "start the same". By engaging children in these types of tasks, Burt, Holm, and Dodd (1999) determined that 4-year-olds have the ability to segment words into syllables and that they demonstrate an awareness of onset and rime.

Since PA can be measured in young children, delays can be identified early. However, limited time and resources may constrain the number of children that can realistically be tested. Therefore, it is necessary to identify those children who are most at risk for delayed PA and at greatest risk for future reading difficulties through the use of simple yet effective testing.

Phonological Awareness and Speech Sound Disorders

Children with speech sound disorders (SSD) have been observed to achieve significantly lower scores on tests of PA than children with typical speech skills. The risk of PA delay is greatest when the SSD persists into school age and when there is a concomitant language delay (Nathan, Stackhouse, Goulandris, & Snowling, 2004). However, difficulties with PA have been observed even when the child's speech normalized during the preschool period (Raitano, Pennington, Tunick, Boada, & Shriberg, 2004) and in the absence of concomitant language delay (Rvachew, Ohberg, Grawburg, & Heyding, 2003).The association between speech development and PA may be an indirect one. If the relationship between these variables was direct, one would expect the severity of the SSD to predict the severity of the PA delay; however, this is not the case (Larrivee & Catts, 1999; Rvachew, et al., 2003). Furthermore, speech therapy alone has not been shown to improve PA (e.g., Gillon, 2000) and PA interventions that focus on articulatory movements do not lead to superior outcomes relative to approaches that focus on listening to sounds (Castiglioni-Spalten, & Ehri, 2003; Wise, Ring, & Olsen, 1999). In order to treat PA, it is necessary to understand the complex relationship between speech production skills and PA, and the potential contribution of other variables.

Phonological Awareness and Speech Perception

Speech perception has also been found to be related to the development of PA. Children's ability to identify different tokens of speech sounds as belonging to one speech sound category (e.g., "s") or another (e.g., "sh") improves with age as children gain experience with their native language and learn to attend to and integrate the acoustic features (Hazan & Barrett, 2000; Nittrouer, 2002).

Children with relatively poor speech perception skills have greater difficulty with PA tasks (Nittrouer, 1996). Rvachew et al. (2003) found that children with SSD and delayed PA also have significantly poorer speech perception abilities than normally developing children. They also found that good speech perception skills were necessary but not sufficient for the development of PA, illustrating the indirect nature of the relationship between these variables.

It is likely that measures of speech perception will prove useful for identifying children at risk for delayed PA given the demonstrated relationship between these two variables. Additionally, since poor speech perception is associated with poor PA, remediation of speech perception skills may be an important element in remediation of PA deficits. However, the full benefit of identifying children with delayed PA can be realized only if there is effective remediation available.

Other Phonological Awareness Intervention Programs

PA intervention has been shown to be successful for preschoolers and prereaders with SSD (Gillon, 2000; Hesketh, Adams, Nightingale, & Hall, 2000; Roth, Troia, Worthington, & Dow, 2002; van Kleeck, Gillam, & McFadden, 1998). These programs all targeted children with SSD, likely because of their susceptibility to delayed PA, but none of these programs implemented speech perception testing or teaching. Variability existed in the duration of these programs, ranging from 9 to 20 hours, and in the type and number of skills targeted, including identification, matching, and manipulation of syllables, onset, rime, and phonemes. For the most part, the design of these programs was not consistent with Ehri et al.'s (2001) recommendations for conducting PA intervention for 5 to 18 hours, while focusing on one or two specific PA skills.

Summary

The development of PA during the preschool period is related to the normal development of speech production and speech perception skills. Preschool aged children who have difficulty with the perception and production of speech sounds may demonstrate delayed development of PA skills and thus are at risk for subsequent deficits in reading ability. Intervention programs have been successfully developed to improve PA skills in children. However, none of these programs combined speech perception and PA intervention to improve PA skills of preschoolers with SSD. The purpose of this project was to determine the effectiveness of an intervention program in which speech perception and PA were directly targeted in 4- and 5-year-old preschoolers with SSD.

Method

Participants

To determine the effectiveness of the intervention program, a group of preschool children who received treatment (Treated-SSD group) was compared to two non-experimental comparison groups who did not undergo treatment. One comparison group included children with SSD who did not participate in the PA intervention (Untreated-SSD). The other consisted of children with normal speech, who also did not participate in the intervention program (Untreated-Typical).

Children with SSD disorders were referred by speech-language pathologists (S-LPs) working at a large children's hospital. The existence of SSD was confirmed with a score below the 16th percentile on the Goldman-Fristoe Test of Articulation-Second Edition (GFTA-2; Goldman & Fristoe, 2000). SSD describes delayed development of age-appropriate speech sounds impacting upon overall speech intelligibility, not caused by structural or functional issues or a known syndrome. The nature of the speech disorder (i.e., phonetic or phonological) was not evaluated. Clinicians were asked not to refer children with speech sound disorders in cases of significant structural problems, soft motor signs (i.e., excessive drooling), and evident dysarthria. Hospital records indicated that all children had normal hearing and oral-motor structure and function and no other known concomitant delays or disabilities.

The Untreated-Typical group was recruited from suburban preschool programs. Normal hearing and oral-motor skills was assumed for the Untreated-Typical comparison group because these children achieved age-appropriate scores on measures of speech production, speech perception, and receptive vocabulary. All of the children in all three groups spoke English as their first language.

Table 1 displays the participant characteristics by group. Each group was composed of 10 preschool children. Frequency matching was used to ensure the groups were similar with respect to age, socio-economic status, and receptive vocabulary. Socioeconomic status was based on the Blishen score (Blishen, Carroll, & Moore, 1987) and receptive vocabulary was based on scores from the Peabody Picture Vocabulary Test-Third edition (PPVT-III; Dunn & Dunn, 1997). The groups with SSD were also equated for severity of their SSD, as measured by the GFTA. All testing and intervention was conducted by the first author, who was at the time a graduate student in speech-language pathology.

Design

All three groups participated in an initial assessment to determine their receptive language and early literacy skills and their baseline PA, speech production, and speech perception skills. Within one week of the initial assessment, the Treated-SSD group commenced participation in eight weekly PA intervention sessions. Following the intervention sessions, the Treated-SSD group was reassessed in the areas of PA, speech production, and speech perception, as these were the outcome measures for determining the effectiveness of the intervention program.

Procedure

Assessment

The initial assessments took approximately 60 to 90 minutes. The following areas were measured for all groups in order to further describe the participant characteristics and measure the degree of homogeneity of the groups.

Table 1

Mean (and standard deviation) and Analysis of Variance of Participant Characteristics by Group

Participant Characteristics	Untreated-SSD	Treated-SSD	Untreated-Typical	F
SES	50.80(8.48)	51.3(7.06)	58.2(11.35)	2.05
Age	57.6(3.1)	56.7(3.3)	56.7(4.19)	.21
PPVT	103.2(9.39)	109.1(11.66)	107.9(10.25)	.89
GFTA	6.4(4.27)	5.4(4.74)	41.6(18.96)	31.87**

Note. SES = Socio-economic status (Blishen Score, Blishen, Carroll, & Moore, 1987); Age is in months; PPVT = Peabody Picture Vocabulary Test-Third Edition, standard score; GFTA-2 = Goldman-Fristoe Test of Articulation-Second Edition, percentile rank.
**The mean difference is significant at the .01 level.

Receptive Vocabulary Assessment. Receptive vocabulary was assessed using the PPVT-III (Dunn & Dunn, 1997).

Early Literacy Assessment. The children's early literacy and prereading skills were assessed using the Early Literacy Assessment, adapted from Johns (1997). The test was composed of three subtests. The first subtest, alphabet knowledge, involved asking the child to name uppercase and lowercase letters. In the second subtest, literacy knowledge, the child was shown a book and asked questions about functional reading skills (e.g., "Where do you start reading?") and questions about book structure (e.g., "Where is the title?"). The third subtest, basic word knowledge, involved asking the child to read sight words (e.g., *a, the, was*).

Standardized Articulation Assessment. Speech production was assessed using the GFTA-2 (Goldman & Fristoe, 2000).

The following tests were administered to all groups during the initial assessment and to the Treated-SSD group post-treatment in order to measure any pre-treatment to post-treatment changes that may have occurred in these areas for children participating in the intervention program.

Phonological Awareness Assessment. PA was assessed using a test developed by Bird, Bishop, & Freeman (1995). The three components of this test included rime matching, onset matching, and onset segmentation. Each section included several training items, during which corrective feedback was given when necessary. No corrective feedback was given for test items. Split-half reliability for this test has been determined to be .98 (using an odd-even split) based on 87 prior administrations in which total scores ranged from 0 to 100 percent correct.

Speech Perception Assessment. The Speech Assessment and Interactive Learning System (SAILS; Avaaz Innovations, 1994) was used to assess speech perception. The computer program contrasts correct and incorrect productions of the sounds /l/, /k/, /r/, and /s/ in the word initial position. For example, half of the stimuli from each block were articulated correctly, e.g., cat→[kæt], while the other half were articulated incorrectly, e.g., cat → [tæt]. Children were required to point to a picture of the item when it was spoken in the correct way or a picture of an X when it was mispronounced. Training items preceded test items to ensure task comprehension.

Articulation Probe. The articulation probe was administered to children in the Treated-SSD group prior to the first treatment session. The articulation probe included 64 items which targeted the sounds /k/, /l/, /r/, /s/, /f/, /θ/ through picture labelling and sentence repetition. These sounds were selected as targets as they are commonly misarticulated. The articulation probe was administered in order to measure any change in articulation that occurred over the treatment period.

Intervention

Each child in the Treated-SSD group participated in eight weekly PA intervention sessions, composed of four parts: (1) rime matching, (2) speech perception training, (3) onset matching, and (4) homework and review. Each part was targeted for 10 to 15 minutes per session, depending on each child's pace. The same number of responses was elicited for each participant. Therefore, each session took between 45 minutes and 1 hour, for a total of 6 to 8 hours of intervention. Homework assignments took 5 to 10 minutes to complete, resulting in additional practice time of 40 to 80 minutes over the course of the intervention period.

The weekly target items progressed from least to most difficult, encompassing both articulatory difficulty and the difficulty of the target sound contrasts. For example, the first onset targeted was /m/ which is early developing and rarely misarticulated while the remaining onset targets, /s/ and /k/, are more commonly misarticulated by young children. During the first session /m/ was contrasted with /t/, a contrast differing in place, manner, and voicing. During the second session, /m/ was contrasted with /p/, a contrast differing in only manner and voicing.

Rime Matching. Rime matching tasks involved sorting pictures of items into objects with the same rime. For instance, in the second session, the picture cards (e.g., *fan, ran, men, ten*) were sorted into either a garbage can or a plastic hen. Various techniques were used to make the rime more salient. For example, previously sorted items were re-stated or similarities were described. For example, "They have the same sound at the end." and "Those words both end with *en*."

Speech Perception Training. Each speech perception lesson targeted the same word-initial sound as the onset matching activity for the session using SAILS. The sound /m/ was targeted first for two sessions, followed by /s/ and /k/ for three consecutive sessions each. Children pointed to pictures on a computer screen corresponding to correctly articulated or misarticulated words containing the target sounds listed above (e.g., *mitt* for /m/, *Sue* for /s/, and *cat* for /k/). Corrective feedback was provided. In the case of mitt, the experimenter might say, "No, that word did not sound like *mitt.* Listen again." When a mistake was made, the word was replayed and the child was given another chance to respond.

Onset Matching. A variety of different onset matching activities were implemented, including sorting and matching activities based on similar word onset (i.e., memory, bingo, board games, etc.). Corrective feedback was provided in the form of repetition, emphasis, listing of previously sorted items, such as "*mitt, mop, man, moon, milk*" and task review. For example: "He likes to eat things that begin with the sound /m/." "*Mmmop* begins with /m/ so he likes to eat the mop." and "Listen, *mmmop* has the /m/ sound at the beginning."

Homework and review. Homework assignments included review of the target onset and rime for each week. Homework activities included rime matching and onset

identification tasks. Parents were responsible for supervising completion of homework; then assignments were reviewed by the examiner at the beginning of the next session.

Outcome Measures Reassessment

Only children in the Treated-SSD group were reassessed, following the completion of the PA intervention program. The reassessment included administration of the phonological awareness test, the articulation probe, and the SAILS test, which served as the outcome measures for the study.

Results

Pre-Treatment Analyses

The results of the ANOVA revealed a significant difference in GFTA-2 percentile rank scores between the three groups, $F(2, 27) = 31.87$, $p < .000$. Tukey's post-hoc analyses indicated that the Untreated-Typical group performed significantly better than both groups of children with SSD, while the groups of children with SSD did not differ significantly. Confirmation of appropriate group assignment to SSD versus Typical groups was achieved on the basis of significant differences in speech production despite overall homogeneity in other measures.

The ANOVA also revealed significant differences between the three groups on the PA test, $F(2, 27) = 8.357$, $p < .001$. The average PA test score for normally developing 4-year-olds is 21 and the lower limit of average performance is approximately 15 (Rvachew et al., 2003). Tukey's post-hoc comparisons indicated that the Untreated-Typical group performed significantly better on the PA test than either of the SSD groups with a mean score of 18.8 and scores ranging from 10 to 24. The Treated-SSD group had a mean score of 12.8 with scores ranging from 8 to 19. The Untreated-SSD group had a mean score of 13.0 with a range of 8 to 18. The Treated-SSD group and the Untreated-SSD group did not differ significantly in PA. These findings indicate that these two groups of children with SSDs had significantly lower PA than normally developing children.

Post-Treatment Analyses

The pre-treatment and post-treatment results for the Treated-SSD group are displayed in Figure 1. A paired samples t-test was used to determine if the Treated-SSD group's PA had changed significantly as a result of treatment. The increase in PA test score from 12.8 to 18.7 was statistically significant, $t(9) = -3.93$, $p < .003$.

Speech perception and speech production were also reassessed following participation in the treatment program. The mean scores on The Speech Assessment and Interactive Learning System increased significantly from 69.9% to 80.3%, $t(9) = -3.16$, $p < .011$. The mean scores on the articulation probe increased from 21.6 to 25.9. This change was not significant. These results indicate that the intervention program was successful in making a significant improvement in both skills targeted, PA and speech perception, compared to the pre-treatment levels.

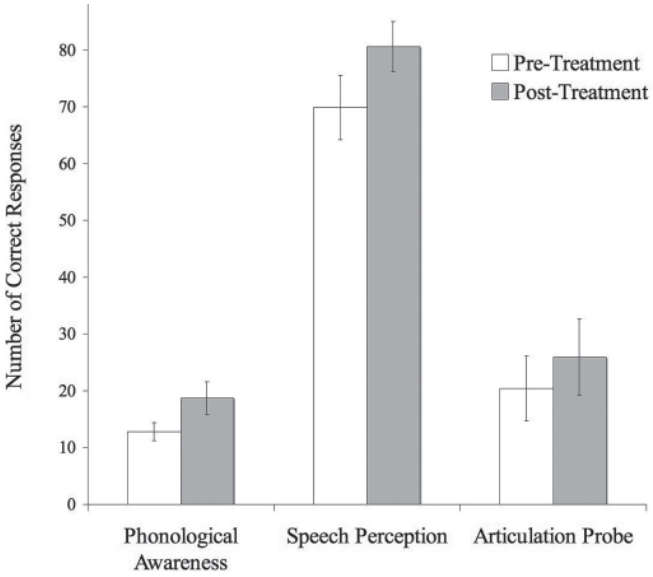

Figure 1. Mean pre-treatment and post-treatment scores for the treated-SSD group on measures of phonological awareness (PA raw score), speech perception (SAILS percent correct), and speech production skills (articulation probe raw score). Standard error bars are shown. The mean difference for phonological awareness is significant at the 0.01 level. For speech perception, the mean difference is significant at the 0.01 level. The mean difference in articulation is not significant.

Articulation skills, as measured by the articulation probe, did not change significantly.

Post-Treatment Group Comparisons

The Untreated-SSD and Untreated-Typical comparison groups participated in only the initial assessments and not the post-treatment measures. Therefore, post-treatment scores from the Treated-SSD group were compared to initial assessment scores from both comparison groups. An ANOVA confirmed that there were significant differences between the groups on the PA test, $F(2, 27) = 5.064$, $p < .014$. A Tukey's post-hoc analysis indicated that the Treated-SSD group performed significantly better on the PA posttest than the Untreated-SSD group performed on the initial PA test. The difference between the post-treatment test scores of the Treated-SSD group and the initial scores of the Untreated-Typical group were not statistically significant. Figure 2 illustrates these results.

The ANOVA also indicated that there were significant differences between groups on the Speech Assessment and Interactive Learning System, $F(2, 27) = 6.313$, $p < .006$. A Tukey's post-hoc analysis indicated that the post-treatment test scores of the Treated-SSD and initial scores of the Untreated-Typical group had significantly higher speech perception scores than the Untreated-SSD group. As in

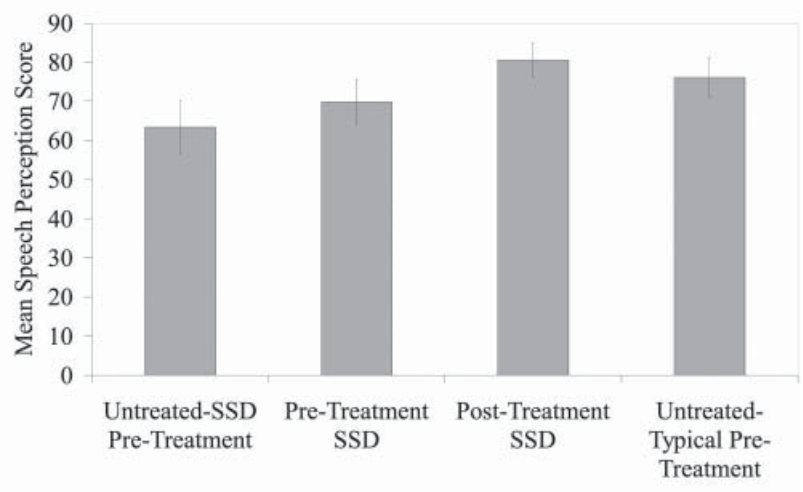

Figure 2. Mean raw scores on the phonological awareness test for the Untreated-SSD group, the Treated-SSD group Pre-Treatment and Post-Treatment, and the Untreated-Typical group. Standard error bars are shown.

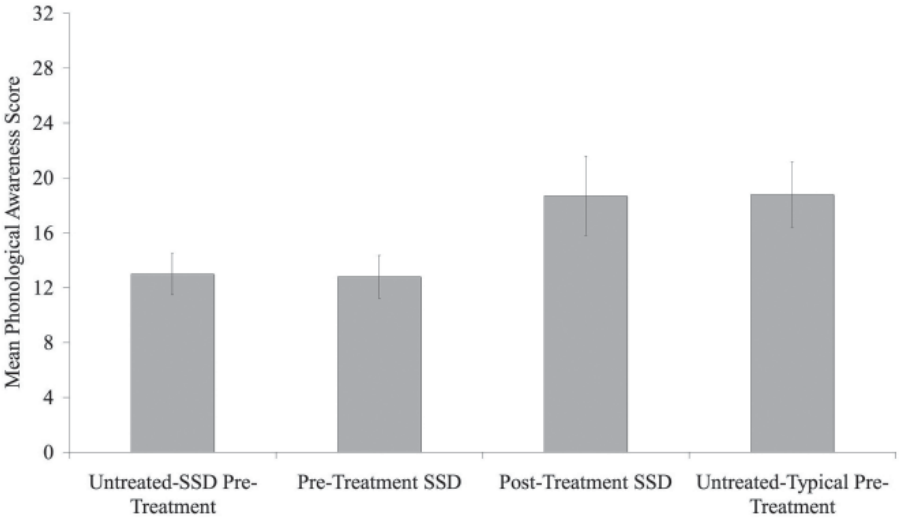

Figure 3. Mean raw scores on the Speech Assessment and Interactive Learning System for the Untreated-SSD group, the Treated-SSD group prior to treatment, the Treated-SSD after treatment, and the Untreated-Typical group. Standard error bars are shown.

the initial assessment, differences in speech perception scores between the Treated-SSD and Untreated-Typical groups were not significant. These results are displayed in Figure 3.

Discussion

The Success of the Program

In this study, 10 children with SSD participated in a PA intervention program. At study onset, both groups of children with SSD had significantly lower PA than normally developing children. After participating in the PA intervention, the mean PA of the treated group increased significantly from the pre-treatment level of other children with SSD to the level of the group mean of normally developing children. Though not all intervention participants ended up with PA skills within the average range, skills for the group moved in the direction of normal functioning. These results demonstrate that preschoolers with SSD can benefit from PA intervention.

Other researchers have also shown that PA intervention programs are successful in increasing the PA of prereaders with SSD. The studies by Gillon (2000), Hesketh et al. (2000), Roth et al. (2002), and van Kleeck et al. (1998) targeted PA in prereaders with SSD. However, the average length of intervention in these investigations was 13 hours. The children in the present study were able to make significant gains in PA in substantially less time. Bus and Ijzendoorn (1999) found that the duration of treatment was not related to the effect size, thus encouraging researchers to continue working to determine how much treatment is enough to normalize PA, while conserving valuable time and resources. Thus, this study is important in demonstrating that improvements in PA are possible with less intervention time than has been previously demonstrated.

The present study is unique in its combination of characteristics including targeting preschool-aged children with SSD, teaching PA through rime and onset matching activities, and the incorporation of speech perception activities. Other researchers have successfully improved PA in the absence of a speech perception component, even for children with SSD (e.g., Gillon, 2000; Roth, et al. 2002). Due to the demonstrated connection between PA and speech perception, it was hypothesized that the inclusion of speech perception training would improve the ability of the children in this study to benefit from PA intervention. The design of the study did not permit the isolation of the impact of speech perception training on improvements in PA, but this is an important area for future investigation.

Limitations of the Research Design

Despite the significant improvement in PA achieved through the PA intervention program, there are limitations to the study design, including a small number of participants and threats to internal and external validity. Given the small number of participants it is impossible to predict

the success of this intervention in the larger population of children with SSD.

Random assignment and the use of equivalent control groups are two components of an experimental study design which minimize threats to internal and external validity in order to ensure that the findings are the result of a true relationship between the independent and dependent variables. The quasi-experimental nature of this study design lacked both of these characteristics. Resulting threats to internal validity included maturation, testing effects, and selection bias; therefore, it is not certain that the PA intervention program alone is responsible for the increased PA scores. Threats to external validity included the Hawthorne effect, novelty effects, history, and teacher effects, bringing into question the effectiveness of the treatment program.

However, since this study was not a randomized clinical trial and occurred in a more clinically realistic fashion, some threats to external validity typically encountered when running randomized clinical trials were avoided. Randomized clinical trials run the risk of being ungeneralizable to the target population due to the irregular setting, exceptional type of treatment, or atypical participants. In this study, the clinical treatment style used is likely to be replicated by other professionals.

Additional support for the validity of these results come from other PA intervention programs which were implemented using quasi-experimental designs that lack random assignment of participants and have non-equivalent groups (e.g., Ehri et al., 2001; Lundberg, Frost, & Petersen, 1988). Ehri et al. (2001) demonstrated that poor study design did not necessarily lead to inflated effect size.

Future Research Directions

In order to control for threats to internal and external validity resulting from the quasi-experimental design of the current study, future studies should utilize a randomized clinical trial including a PA intervention group with and without speech perception training, an untreated SSD group and an untreated typically developing group. After an initial assessment, children with SSD should be matched on age, SES, PA, and receptive vocabulary and randomly assigned to one of the three conditions for children with SSD. After the completion of the intervention program or passage of the equivalent amount of time, children from all four conditions should participate in the post-treatment assessment thereby isolating the effects of PA training, speech perception training, or some combination, on improved PA. In addition, it may be desirable to further examine the type of SSD when defining groups (i.e., SSD with phonetic versus phonological origins).

Speech-Language Pathologist Involvement in Early Intervention

In order for early intervention to be successful, at-risk children must be identified and intervention implemented effectively and promptly. S-LPs have a crucial role in the identification and remediation of children who are at risk for future reading difficulties. Given their expertise in speech, language, and prereading skills, S-LPs are an important resource in both the identification and remediation of children with delayed PA. Young children referred to S-LPs often undergo a thorough assessment of their speech and language abilities. This is an opportune time for the S-LP to conduct a PA screening as it would be a natural addition to assessment batteries. PA intervention should not necessarily occur in the absence of a screening or assessment since, even though children with SSD are more likely to have below average PA than children with normally developing speech skills, it is not necessarily the case (Rvachew et al., 2003).

Generalization of the results of this study to other clinical settings is likely given that the treatment program was carried out in a clinical setting and that the program was practical in nature. Treatment changes were shown with children with SSD when both PA and speech perception components were targeted directly.

Conclusion

This intervention program was successful in improving the PA skills of children with SSD in less time than has previously shown in other studies, potentially decreasing their risk of future decoding difficulties. This study showed that PA training, which incorporated both PA and speech perception training was successful in improving PA of children with SSD, but was not designed to isolate the unique contributions of each component. Future study is needed to determine which components are essential to bringing about changes within the shortest period of time.

Participants in this intervention program are also enrolled in a longitudinal study, which will reassess all the pre-treatment measures, with the addition of decoding and reading measures, for 2 years following the treatment program. Therefore, the impact of the intervention on prospective PA, decoding, and reading skills will be measured. Additionally, a computer-based PA intervention program is currently in development utilizing many of the same design principles as this intervention program, including a focus on onset and rime matching and speech perception.

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