



Using a Computer Intervention to Support Phonological Awareness Development of Nonspeaking Adults

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ABSTRACT

The present study investigates the effectiveness of a computer-based intervention to support adults with severe speech and physical impairments (SSPI) in developing their phonological awareness, an essential contributory factor to literacy acquisition. Three participants with SSPI undertook seven intervention sessions during which they were asked to play a training game on an iPad. The game was designed to enable learners to practice their phonological awareness skills independently with minimal instruction from human instructors. Preliminary results of post-intervention assessments demonstrate general positive effects of the intervention upon the phonological awareness and literacy skills of the participants. These results support the use of mainstream technologies to aid learning for individuals with disabilities.

Categories and Subject Descriptors

K.3.2 [Computer and Information Science Education]:
Literacy

General Terms

Human Factors, Languages.

Keywords

Phonological Awareness, Literacy, Severe Speech and Physical Impairments, Computer-based Intervention.

1. INTRODUCTION

It is well documented that individuals with severe speech and physical impairments (SSPI) often experience difficulties in literacy acquisition [8]. In order to develop effective literacy instructional strategies for individuals with SSPI, much research promotes the inclusion of phonological awareness interventions in literacy training [1, 5]. Phonological awareness (PA) refers to the explicit attention to the sound structure of language, reflected by the ability to identify and manipulate individual phonological units of words [4]. PA encompasses a wide range of skills, from rhyming recognition, phoneme blending, to phoneme segmentation and phoneme manipulation. These skills, especially the phoneme blending and phoneme segmentation skills, play a critical role in the development of word decoding and spelling skills and thus are essential for literacy success [4].

Most PA interventions for individuals with SSPI reported to date utilize paper-based materials, such as storybooks and picture cards [5]. Speech and language pathologists often play a central

role, having to present multiple tasks, from presenting auditory items, labeling picture cards orally, to checking the learner's answers and implementing correction procedures if needed. There is little research into how mainstream technologies can be employed to automate PA interventions for individuals with SSPI. Moreover, most studies to date have focused on evaluating the efficacy of PA interventions for children [2]. There is limited evidence on the effects of such interventions on adults with SSPI. To address these issues, the present study investigates whether mainstream computer technologies can be applied to develop PA interventions for adults with SSPI, and how these interventions influence the PA abilities and literacy skills of the target user group. It is hoped that the use of computer-based intervention with minimal instruction required from human instructors would help promote the learner's independent practice and reduce the workload imposed on the instructors.

2. STUDY DESIGN

2.1 Participants

Three cerebral palsied adults, aged from 46 to 54 years old, with SSPI and varying degrees of literacy difficulties were selected for the study. Participants' cognitive ability was assessed using the Raven's Coloured Progressive Matrices test [7]. The working memory of the participants was assessed using an adapted version of the Digit Span test from the Wechsler Adult Intelligence Scale-III [9]. Results of these tests revealed that participants 1 and 2 possibly have working memory deficits.

2.2 Materials

2.2.1 PA and Literacy Assessment Battery

An assessment battery was prepared to assess the PA and literacy skills of the participants at pre- and post- intervention. The battery consists of 8 tests, including: (1) letter name knowledge; (2) letter-sound correspondence; (3) spelling real words; (4) reading real words; (5) blending real words; (6) blending non-words; (7) phoneme analysis; (8) phoneme counting. Tests 1-3 were created by the author whilst tests 4-8 were adapted from the APAR test [3], an assessment of PA and reading skills specifically designed for adults with SSPI.

2.2.2 Intervention Software

Over the last few years, there has been a growing trend of using mainstream technologies, such as Apple's iOS platform, to provide more affordable communication support for individuals with SSPI. The intervention software was, therefore, developed on the iPad. The software allows the learner to listen to the 42 spoken phonemes introduced in the Jolly Phonics literacy learning program [6]. These phonemes are represented by

pictures and are divided into 7 groups with 6 phonemes in each group (see Figure 1.a). A 'Word Creation' game is implemented for each group to enable the learner to practice segmenting spoken words into phonemes. The learner listens to each spoken word, then drag-and-drops the correct phonemes from the bottom panel to the upper panel to create the word (see Figure 1.b). If the learner chooses an incorrect phoneme, the phoneme automatically moves back to its original position. Once the learner has selected all the required phonemes, the software repeats the phonemes in sequence, together with the target word. This emphasizes how the phonemes are blended into spoken words, thereby reinforcing the learner's phoneme blending skill.

Informal evaluation sessions were conducted with a teacher and all the participants to ensure that the software was usable to the target user group, given their speech and physical impairments.



Figure 1. The Intervention Software

2.3 Procedure

Baseline assessment of PA and literacy skills of each participant was carried out prior to the intervention phase. The assessment was conducted in two sessions, each lasted 45-60 minutes. The participants then undertook 7 intervention sessions, one per week, each lasted 30-45 minutes. Post-intervention assessment was started a week after the last intervention session.

3. RESULTS AND DISCUSSION

Table 1 shows the preliminary results of Participant 1. Participants 2 and 3 have completed the intervention phase and are currently in the process of post-intervention assessment.

Table 1. Results of Participant 1 (Percent Correct)

Assessment Tasks	Pre-intervention	Post-intervention
Letter name knowledge	84.6	88.5
Letter-sound correspondence	72.0	100.0
Spelling real words	5.0	5.0
Reading real words	72.5	80.0
Blending real words	80.0	100.0
Blending non-words	70.0	65.0
Phoneme analysis	58.3	83.3
Phoneme counting	8.3	25.0

The results demonstrate an improvement in the participant's performance for all the assessment tasks except for the spelling and the blending non-word tasks. A maximum score was reported for the blending real words task, which requires the participant to blend sequences of phonemes into whole words.

The participant achieved a noticeable improvement on the phoneme analysis task, which assesses the ability to identify individual phonemes in spoken words. The participant also performed better on the phoneme counting task, which requires the participant to count the number of phonemes in spoken words. However, this task proved to be very difficult for the participant as she only scored 25% post intervention. It is suspected that the participant's working memory deficit might partly account for this result. Although the spelling score did not increase, the participant achieved improvements in the reading and the letter-sound correspondence tasks, which was surprising considering that letters were not introduced in the intervention.

4. CONCLUSION

These results suggest that PA intervention could potentially have positive effects on the PA and literacy skills of adults with SSPI. Moreover, the highly positive feedback on the iPad intervention software obtained from all participants supports the use of mainstream technologies to develop accessible PA intervention. All participant results will be reported in full at the conference. However, further studies with a larger number of participants are needed to generalize these results.

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