A five school study of effectiveness and cost savings from the adoption of Speech Buddies®

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Abstract:
This study examined the effectiveness of an organic integration of Speech Buddies® into a typical school-based speech therapy setting at five New York City charter schools. Students ranged in age from 4:10 to 16:00 and either had articulation goals on their individual education plans (IEP) or baseline phoneme accuracy of 15% or lower on Secord Contextual Articulation Test (S-CAT) phoneme probes. 77% of students received group-based therapy, 69% also had IEP language goals, and 42% were older students with treatment-resistant residual errors. Over the course of the school year, the students were administered an average of 25.2 hours of total speech therapy (17.9 hours of articulation therapy) and the student's average accuracy on the S-CAT test increased from 23.2% to 83.3%. The average cost of therapy received per student prior to the study was $5,900 while the average cost of therapy received per student using Speech Buddies was $1,550. These results show a substantial comparative improvement over traditional articulation therapy, a significant caseload reduction for school-based SLPs, an effective administration of group therapy, and a substantial cost savings for schools and school districts.

1.0 Purpose and Hypothesis

Recent budgetary constraints have increased the need for schools to provide the most effective and efficient services for students with articulation disorders. We hypothesize that students will show improved accuracy of the /r/, /s/, /tʃ/, /ʃ/, /l/ phonemes when traditional therapy is used in conjunction with Speech Buddies®, tools that teach consistent tongue placement via intra-oral tactile biofeedback. We also hypothesize that tools will be effective with a wide variety of students in a typical school setting, yielding substantial cost savings.

2.0 Methods

2.1. Study Design and Inclusion Criteria. The study was a prospective feasibility study. 75% of subjects had articulation goals as identified by an Individual Education Program (IEP) at the start of the school year, and 25% of subjects were referred for treatment and had baseline accuracy of 15% or less on at least one phoneme-specific probe for /s/, /tʃ/, /ʃ/, /r/, /l/ of the Secord Contextual Articulation Test (S-CAT). Average phoneme baseline accuracy was 23.2%.

2.2. Population Characteristics. Twelve students were included in the study. 69% also had IEP language goals, and 92% had received therapy in the prior school year or summer. Ages ranged from 4:10 to 16:00, with the average age being 8:7. One subject had moderate bi-lateral hearing impairment with hearing-related IEP goals and one subject had enlarged adenoids which contributed to a significantly hyponasal voice.

2.3. Experimental Device. Speech Buddies® (Articulate Technologies, Inc., San Francisco, CA) provided intra-oral tactile biofeedback cues to correct production of problem phonemes by teaching proper tongue placement and movement during speech.

2.4. Methods. This IRB approved study was performed at five New York City charter schools by five speech-language pathologists (SLPs). Speech Buddies were included in therapy throughout the school year as deemed necessary by the SLP. S-CAT assessment probes were administered at baseline, at two mid-points, and during a final assessment to test phoneme accuracy at the word and sentence level. The Goldman-Fristoe Test of Articulation, 2nd Edition (G-FTA) was administered at baseline and on final assessment. Mean therapy hours administered was 25.2 administered at an average rate of 1.0 hour per week. 77% of subjects received group therapy and the average number of phonemes addressed per student was 2.3 phonemes.

3.0 Results

As shown in Figure 1 and 2, average phoneme accuracy as measured by the S-CAT probe increased from 23.2% to 83.4%. Additionally the estimated cost of therapy averaged only $1,550 per student, whereas previous therapy for the same group averaged $5,900 per student. Therapy costs were based on historical therapy records from each student, assumed an average of 3 students per group therapy session, and assumed average SLP compensation from the ASHA 2010 schools survey[1]. Therapy cost savings were a direct result of the number of hours of therapy that were administered to each student.

Figure 1: Average therapy cost per student

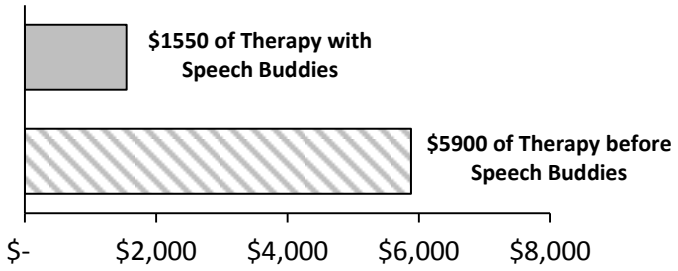


Figure 2: Average accuracy on S-CAT assessment

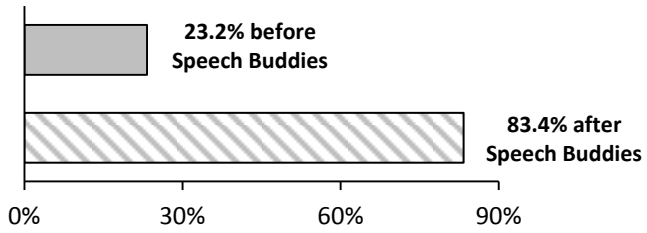
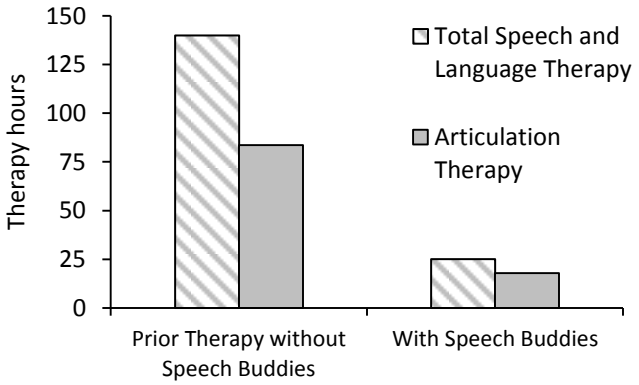


Figure 3 highlights duration of therapy administration. Mean hours administered was 25.2 with a mean of 17.9 hours focused specifically on articulation therapy. Average prior speech therapy for the group was 139.9 hours with 83.7 hours on articulation therapy. 92% of subjects received prior therapy.

Figure 3: Hours of therapy are nearly 1/5 with Speech Buddies



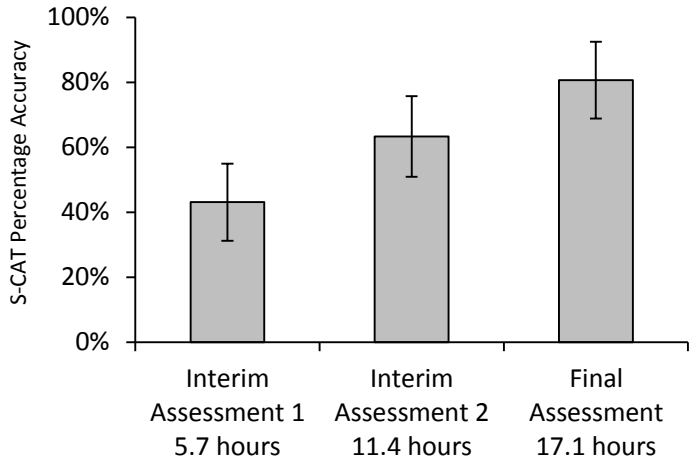
A repeated-measures mixed model was used to test the effect of Speech Buddy use on performance over time using SAS Version 9.2 (SAS Institute Inc., Cary, NC.) Initially, baseline performance, age, presence of language disorder, hours of therapy, hours of previous therapy, receipt of individual therapy, and number of problematic phonemes were the covariates. As baseline performance was the only significant covariate, a final parsimonious model was run including only baseline performance as a covariate. Baseline performance remained a significant covariate ($F(1,68)=15.87$, $p=.0002$) and participants improved over time ($F(2,20)=18.30$, $p<.0001$). Post-hoc comparisons of the predicted performance means showed participants performed significantly better at interim assessment 2 and the final assessment than at interim assessment 1, (t=2.94, p=.008, t=6.05, p<.0001, respectively) and better at the final assessment than interim assessment 2 (t=2.83, p=.01). Table 1 and Figure 4 show predicted performance accuracy with 95% confidence on the S-CAT probe, examining the time effect shown by average hours of articulation therapy.

Table 1: Predicted performance with Speech Buddies use on S-CAT accuracy percentage: least squares means

Timepoint	Predicted Performance	T	Pr>|t|	Lower %	Upper %
5.7 hours	43.12%	7.60	<.0001	31.28	54.96
11.4 hours	63.33%	10.64	<.0001	50.91	75.74
17.1 hours	80.67%	14.21	<.0001	68.82	92.51

*Degrees of Freedom=20, Standard Error 5.68%, 6.00%, 5.68% respectively

Figure 4:
Predicted outcome using Speech Buddies with 95% confidence of S-CAT accuracy over time of articulation therapy: Least square means.



Not only was a significant response with phoneme specific probes measured, but global articulation skills, as measured by the G-FTA, showed a significant improvement in age-equivalent scores using a dependent sample t-test, t(12)=4.78, p=.004.

4.0 Discussion

Through an organic integration of Speech Buddies into traditional school based therapy programs, substantial improvement of articulation was achieved in nearly 1/5 the number of therapy hours and at nearly 1/4 the cost of prior therapy.

Also of note was that gains were achieved even though 77% of the students received group speech therapy with an average of two additional classmates. This study shows how schools can achieve shorter and more consistent outcomes through group therapy for many types of students.

Therapy gains were consistent for subjects that were both new to treatment and presenting with treatment-resistant, residual articulation errors, as 42% of subjects were age 11 and older and had been in speech therapy for several years. Clark, Schwarz & Blakeley (1993) showed 160% improved learning for subjects with residual errors through the use of tactile feedback devices.[2] This data presented here point to comparable treatment gains, but via a system that is more easily deployed in a school setting.

The data also compare favorably to industry norms published by Jacoby, Lee, Kummer, Levin & Creaghead (2002) where a similar population in a non-group, clinic setting achieved comparable gains equivalent to two functional communication units of articulation.[3] Gains shown by Jacoby et al. were achieved in an average of 40.3 hours or an estimated $3,224 per student while gains with Speech Buddies in a group setting were achieved in an average of 25.2 hours at an estimated $1,550 per student. Gains were also more consistent: 92% of subjects with Speech Buddies showed some or substantial improvement vs. 76% for Jacoby et al.

These results show a substantial comparative improvement over traditional articulation therapy, a significant caseload reduction for school-based SLPs, an effective administration of group therapy, and a substantial cost savings for schools and school districts.

[1] American Speech-Language and Hearing Association, *2010 Schools Survey*, 2010, 1-7.
[2] Clark, Schwartz & Blakeley, "The Removable R-Appliance as a Practice Device to Facilitate the Correct Production of /r/" American Journal of Speech-Language Pathology (1993): 84-92.
[3] Jacoby et al. (2002), n=111 for 4, 5 and 6 year olds, gains comparable to two or more increase in functional communication units (FCU) of articulation, no improvement comparable to no FCU increase