Webber® HearBuilder® Sequencing Efficacy Studies: Improved Sequencing Skills for At-Risk Students

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Purpose: These studies examined the effects of *HearBuilder' Sequencing*, an interactive computer program that uses a systematic approach to improving sequencing skills of students considered to be "at-risk."

Method: Two separate studies were conducted in southeastern, suburban school districts with 29 and 24 participants. The students used *HearBuilder Sequencing* for at least 8 weeks 2 times per week for 30-minute sessions *or* 3 times per week for 20-minute sessions. All students were pretested and posttested with an online screener created by Super Duper^{*} Publications and the *Story Retell* subtest of the *Emerging Literacy & Language Assessment*^{*}, which is a comprehensive, norm-referenced assessment.

Results: There was a statistically significant improvement in scores for the whole group of students in both studies from pretest to posttest.

Conclusion: The results of these research studies show that *HearBuilder Sequencing* is an effective instructional component for improving the sequencing skills of students in general and special education programs when used in a variety of settings.

Introduction

Sequencing refers to the ability to put events in a chronological or causal order. These events may be familiar (e.g., making the bed, washing hands) or unfamiliar (e.g., crossing a drawbridge, snowboarding), depending on prior knowledge. Sequencing skills are necessary for understanding and telling narratives, problem solving, performing daily routines, interacting appropriately with peers and adults, reading comprehension, and academic success. In order to sequence events correctly, a student has to understand cause and effect, make predictions, use and understand time and transition words (first, next, and last), and have knowledge of the critical elements in a story (setting, character, beginning, middle, and end, etc.). A student also needs to have adequate reasoning and planning skills. Students with specific language impairments, learning disabilities, autism, and other neurological deficits may have difficulty sequencing events and consequently retelling the events of a narrative (Candler & Hildreth, 1990; Jarvella & Lubinsky, 1975; Montgomery, 2002; Mesibov, 2004; Miles & Chapman, 2002; Singer & Bashir, 1999;

Tinaz, Schendan, Schon, & Stern 2005; Wright & Newhoff, 2001).

HearBuilder^{*} Sequencing is an interactive, theorybased approach to improving comprehension and critical thinking skills needed for sequencing. The program trains students to sequence pictures, text, and/or audio in a systematic way, beginning with simple two-step sequences and progressing to sixstep sequences. Sequencing activities benefit students by helping them to remember a process, to learn the names of the steps in a process, to know the tools used to complete the process, and to understand and use the specific vocabulary associated with a process. As well, activities that include the manipulation of pictures, words, and sentences help to build important literacy skills like reading left to right, comprehending important details, predicting, and identifying the parts of a story (Marr & Morgan, 2005).

The following studies were conducted to assess the effectiveness of *HearBuilder Sequencing* in developing/improving sequencing skills in children with and without diagnosed language and/or learning disabilities. Method

Study A – Participants

This HearBuilder Sequencing study was conducted in a southeastern, suburban school district from October of 2011 to February of 2012 in eight different elementary schools with one speechlanguage pathologist per school to administer standardized testing and oversee the implementation of HearBuilder Sequencing. Twenty-nine total students participated in this study. Sixty-two percent (62%) of the students were male and 38% were female. There were seven students in kindergarten, nine in first grade, three in second grade, five in third grade, three in fourth grade, and two in fifth grade. Sixty-two percent (62%) of the participants reportedly had Individualized Education Plans (IEPs) for special education services, with 38% of the students described as having a Learning Disability and/or a Language Impairment. Other diagnoses reported included Autism Spectrum Disorder, Articulation Disorder, and Other Health Impaired. Thirty-eight percent (38%) of the students did not have special education IEPs, although some of the students without IEPs had previously been or were currently included in a Response to Intervention (RTI) program. Parents of the participants were asked to indicate students' race/ethnicity with the following results reported: 66% White, 21% Black, 10% Hispanic, and 3% Asian. Reportedly, 34% of the sample qualified for free and reduced-priced meals. See Appendix A for specific participant information.

Study A – Participants

This *HearBuilder Sequencing* study was also conducted in a southeastern, suburban school district from October of 2011 to February of 2012 with one speech-language pathologist per school to administer standardized testing and oversee the implementation of *HearBuilder Sequencing*, but in seven different elementary schools. Twenty-four total students participated in this study. Eighty-three percent (83%) of the students were male and 17% were female. There were four students in kindergarten, ten in first grade, four in third grade, four in fourth grade, and two in fifth grade. Seventy-one percent (71%) of the participants reportedly had IEPs for special education services, with 33% of the students described as having a Learning Disability and/or a Language Impairment and another 33% of students having a diagnosis of Autism Spectrum Disorder. Also, two students were described as having an Intellectual Impairment. Twenty-nine percent (29%) of the students did not have special education IEPs, although some of the students without IEPs had previously been or were currently included in an RTI program. Parents of the participants were asked to indicate students' race/ethnicity with the following results reported: 37% Hispanic, 25% White, 21% Black, and 17% Other. Reportedly, 42% of students lived in homes where a language other than English is the primary language. Twenty-five percent (21%) of the sample were reported to qualify for free and reduced-priced meals, and 25% of the sample reportedly received Title I support. See Appendix A for specific participant information.

Studies A & B Implementation

Students used HearBuilder Sequencing for at least eight weeks 2 times per week for 30-minute sessions or 3 times per week for 20-minute sessions. The software was used in a variety of settings that included classrooms, therapy rooms, and computer labs. Students performed the software tasks independently and the speech-language pathologists were instructed to give minimal assistance. Webber HearBuilder Sequencing provided students individualized practice of sequencing two, three, four, five, and six-step sequences that target students' comprehension and critical thinking skills. See Appendix B for examples of 3-, 4-, 5, and 6-step sequences. The students were instructed to begin on Level 1 sequencing 2-step pictures in a story format (verses an instructional format) with text and audio given and no background noise. Younger or struggling students were required to first listen to the entire sequence read aloud. Students had to demonstrate 80% accuracy on each level before advancing to the next with each level containing 10 different stories for sequencing. Students who completed all levels moved to sequencing stimulus items in an instructional format with educator chosen options. See Appendix C for a list of the activity learning objectives for each level.

Studies A & B Assessment

Students were pretested and posttested using the *Emerging Literacy & Language Assessment* (ELLA^{*}) which is a comprehensive, norm-referenced

assessment designed to evaluate aspects of the foundations for literacy for students ages 4;6 to 9;11. It is divided into three sections. For these studies, only the Story Retell subtest was administered from Section 3: Memory, Retrieval, and Automaticity of the ELLA, as it evaluates the student's ability to listen to, remember the content, and reconstruct and retell a story, which corresponds with the skills that are targeted in HearBuilder' Sequencing. The Story Retell subtest of the ELLA is also now published as the HearBuilder Story Retell Test (H-SRT). For this subtest, students were read a story, varying in length and complexity based on chronological age, following along in a story book with corresponding pictures. After being read the story, the student was given the story book, using the pictures in the book to help recall content, and asked to retell everything that they could remember from the story.

Students were also pretested and posttested using an online *HearBuilder Sequencing Inventory* designed by Super Duper Publications that included three 3-step, four 4-step, and three 5-step sequences. The tasks were designed to mimic those in *HearBuilder*^{*} *Sequencing*. The pretest included the same type and number of sequences as on the posttest; however, all sequencing tasks were different from pretest to posttest. None of the sequences in the *HearBuilder Sequencing Inventory* were from the *HearBuilder Sequencing* software. See Appendix D for all sequences included on the pretest and posttest of the *HearBuilder Sequencing Inventory*.

Studies A & B Analysis

These studies employed a differential research, one-group pretest-posttest design. Data was analyzed using paired-sample t-tests in order to compare the pretest and posttest raw score totals obtained from the *Story Retell* subtest of the *Emerging Literacy & Language Assessment* and score totals obtained from the *HearBuilder Sequencing Inventory*. All analyses used a p-value of 0.05 as the criterion for identifying statistical significance.

<u>Results</u>

Study A

There was a statistically significant improvement in scores for the whole group of students (N=25) that participated in the study from pretest (M=4.08, SD=2.55) to posttest (M=6.20, SD=2.92) and completed the Story Retell subtest of the ELLA; t(24)=-4.89, p<.001. As well, statistically significant results were found for the entire the group of students (N=23) who took the HearBuilder Sequencing *Inventory* from pretest (*M*=4.30, *SD*=3.18) to posttest (*M*=6.17, *SD*=2.69); *t*(22)=-3.10, *p*=.005. These results suggest that the use of HearBuilder Sequencing had an overall significant impact on the students' sequencing skills as shown by pretest and posttest scores obtained from the Story Retell subtest of the ELLA and the HearBuilder Sequencing Inventory (see Figures 1 and 2). In addition, Figures 3 through 7 depict the pretest and posttest data derived from the Story Retell raw score averages and/or the HearBuilder Sequencing Inventory scores for specific subgroups, including students in grades kindergarten through fifth; considered to be White, Black, or Hispanic; and with/ without IEPs. Also, p-values are shown for groupings of students with an *n* greater than nine.

Study B

There was a statistically significant improvement in scores for the whole group of students (N=24)that participated in the study from pretest (M=3.08, SD=2.38) to posttest (M=5.71, SD=3.54) using the *Story Retell* subtest of the *ELLA*; t(23) = -5.01, p < .001. As well, statistically significant results were found for the entire the group of students (N=24) given the HearBuilder Sequencing Inventory from pretest (*M*=3.17, *SD*=2.14) to posttest (*M*=5.50, *SD*=2.96); t(23)=-5.58, p<.001. These results suggest that the use of HearBuilder Sequencing had an overall significant impact on the students' sequencing skills as shown by pretest and posttest scores obtained from the Story Retell subtest of the ELLA and the HearBuilder Sequencing Inventory (see Figures 8 and 9). In addition, Figures 10 through 14 depict the pretest and posttest data derived from the Story Retell raw score averages and/or the HearBuilder Sequencing Inventory scores for specific subgroups, including students in grades kindergarten through fifth; considered to be White, Black, Hispanic, or other; and with/without IEPs. Also, p-values are shown for groupings of students with an *n* greater than nine.



Figure 1. Statistically significant pretest and posttest data based on Story Retell raw scores representing improvement in sequencing skills for all students in Study A.



Figure 2. Statistically significant pretest and posttest data based on HearBuilder[®] Sequencing Inventory *raw scores representing improvement in sequencing skills for all students in Study A.*



Figure 3. Pretest and posttest data displaying Story Retell *raw score averages based on grade with* n *representing number of students in each group in Study A.*



Figure 4. Pretest and posttest data displaying HearBuilder^{*} Sequencing Inventory *raw score averages based on grade with* n *representing number of students in each group in Study A.*



Figure 5. Pretest and posttest data displaying Story Retell *raw score averages based on race with* n *representing number of students in each group in Study A.*



Figure 6. Pretest and posttest data displaying Story Retell *raw score averages based on students with and without IEPs with* n *representing number of students in each group in Study A.*



Figure 7. Pretest and posttest data displaying HearBuilder[®] Sequencing Inventory *raw score averages based on students with and without IEPs with* n *representing number of students in each group in Study A.*



Figure 8. Statistically significant pretest and posttest data based on Story Retell raw scores representing improvement in sequencing skills for all students in Study B.



Figure 9. Statistically significant pretest and posttest data based on HearBuilder[®] Sequencing Inventory *raw scores representing improvement in sequencing skills for all students in Study B.*



Figure 10. Pretest and posttest data displaying Story Retell *raw score averages based on grade with* n *representing number of students in each group in Study B.*



Figure 11. Pretest and posttest data displaying HearBuilder[®] Sequencing Inventory *raw score averages based on grade with* n *representing number of students in each group in Study B.*



Figure 12. Pretest and posttest data displaying Story Retell *raw score averages based on race with* n *representing number of students in each group in Study B.*



Figure 13. Pretest and posttest data displaying Story Retell *raw score averages based on students with and without IEPs with* n *representing number of students in each group in Study B.*



Figure 14. Pretest and posttest data displaying HearBuilder[®] Sequencing Inventory *raw score averages based on students with and without IEPs with* n *representing number of students in each group in Study B.*

Conclusion

The results of these research studies show that *HearBuilder Sequencing* is an effective instructional component in improving the sequencing and story retell abilities of students in general and special education programs when used in a variety of settings. In addition, all of the students in this study were considered to be "at-risk" based on having a diagnosed disability; enrollment in Title I/free and reduced meals program; limited English proficiency; and/or low standardized/online test scores, and in eight weeks time, as indicated by pretest/posttest scores, there was an overall significant improvement in the students' sequencing abilities.

Future research regarding *Webber HearBuilder Sequencing* should include alternate pretest and posttest assessments, control groups, greater sample sizes, and varied demographics from across the country in order to increase validity of all results obtained.

<u>References</u>

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APPENDIX A

Demographics - Study A



Total Number of Students = 29

Diagnoses - Study A



Total Number of Students = 29

Demographics - Study B



Demographics - Study B



Total Number of Students = 24

Diagnoses - Study B



Total Number of Students = 24

APPENDIX B: 3-6 Step Sequencing Examples



3-step sequence in story format

4-step sequence in instructional format



Мепи Settings **Click to Pause** • Help X **Paola's Pet Fish** Paola wanted a Paola bought a fish and all the pet fish. So she When Paola got Then she put the went to the pet supplies she home, she put the fish into the tank. store. needed. **Finally Paola fed** rocks and water into the tank. her new pet fish. Amber

5-step sequence in story format

6-step sequence in instructional format

APPENDIX C: Activity Learning Objectives

HearBuilder Sequencing features a dynamic system for creating learning objectives. The goals change based on the tasks and options choosen. The learning objectives for the default settings (*Sequence Stories, Show Pictures, Play Audio, Show Text, Background Noise Off*) are below. There are 12 objectives for any of the combinations of settings choosen. There are 28 different combinations of tasks and options.

- Level 1: Use pictures, audio, and text to arrange 2 steps in a 2-step story sequence with 80% accuracy given two attempts.
- Level 2: Use pictures, audio, and text to arrange 2 steps in a 3-step story sequence with 80% accuracy given two attempts.
- Level 3: Use pictures, audio, and text to arrange 3 steps in a 3-step story sequence with 80% accuracy given two attempts.
- Level 4: Use pictures, audio, and text to arrange 2 steps in a 4-step story sequence with 80% accuracy given two attempts.
- Level 5: Use pictures, audio, and text to arrange 3 steps in a 4-step story sequence with 80% accuracy given two attempts.
- Level 6: Use pictures, audio, and text to arrange 4 steps in a 4-step story sequence with 80% accuracy given two attempts.

- Level 7: Use pictures, audio, and text to arrange 3 steps in a 5-step story sequence with 80% accuracy given two attempts.
- Level 8: Use pictures, audio, and text to arrange 4 steps in a 5-step story sequence with 80% accuracy given two attempts.
- Level 9: Use pictures, audio, and text to arrange 5 steps in a 5-step story sequence with 80% accuracy given two attempts.
- Level 10: Use pictures, audio, and text to arrange 4 steps in a 6-step story sequence with 80% accuracy given two attempts.
- Level 11: Use pictures, audio, and text to arrange 5 steps in a 6-step story sequence with 80% accuracy given two attempts.
- Level 12: Use pictures, audio, and text to arrange 6 steps in a 6-step story sequence with 80% accuracy given two attempts.

The following are the learning objectives for each level for Sequencing Instructions with the following settings enabled: *Play Audio*, *Show Text*, and *Background Noise Level* of 5. (Note: *Show Pictures* is disabled for these objectives.)

- Level 1: Use audio and text to arrange 2 steps in a 2-step instructional sequence with background noise (+5) with 80% accuracy given two attempts.
- Level 2: Use audio and text to arrange 2 steps in a 3-step instructional sequence with background noise (+5) with 80% accuracy given two attempts.
- Level 3: Use audio and text to arrange 3 steps in a 3-step instructional sequence with background noise (+5) with 80% accuracy given two attempts.
- Level 4: Use audio and text to arrange 2 steps in a 4-step instructional sequence with background noise (+5) with 80% accuracy given two attempts.
- Level 5: Use audio and text to arrange 3 steps in a 4-step instructional sequence with background noise (+5) with 80% accuracy given two attempts.
- Level 6: Use audio and text to arrange 4 steps in a 4-step instructional sequence with background noise (+5) with 80% accuracy given two attempts.

- Level 7: Use audio and text to arrange 3 steps in a 5-step instructional sequence with background noise (+5) with 80% accuracy given two attempts.
- Level 8: Use audio and text to arrange 4 steps in a 5-step instructional sequence with background noise (+5) with 80% accuracy given two attempts.
- Level 9: Use audio and text to arrange 5 steps in a 5-step instructional sequence with background noise (+5) with 80% accuracy given two attempts.

- Level 10: Use audio and text to arrange 4 steps in a 6-step instructional sequence with background noise (+5) with 80% accuracy given two attempts.
- Level 11: Use audio and text to arrange 5 steps in a 6-step instructional sequence with background noise (+5) with 80% accuracy given two attempts.
- Level 12: Use audio and text to arrange 6 steps in a 6-step instructional sequence with background noise (+5) with 80% accuracy given two attempts.

The following are the learning objectives for each level for Sequencing Instructions with the following settings enabled: *Listen to Sequence First, Show Pictures,* and *Show Text.*

- Level 1: Listen to instructions and use pictures and text to arrange 2 steps in a 2-step sequence with 80% accuracy given two attempts.
- Level 2: Listen to instructions and use pictures and text to arrange 2 steps in a 3-step sequence with 80% accuracy given two attempts.
- Level 3: Listen to instructions and use pictures and text to arrange 3 steps in a 3-step sequence with 80% accuracy given two attempts.
- Level 4: Listen to instructions and use pictures and text to arrange 2 steps in a 4-step sequence with 80% accuracy given two attempts.
- Level 5: Listen to instructions and use pictures and text to arrange 3 steps in a 4-step sequence with 80% accuracy given two attempts.
- Level 6: Listen to instructions and use pictures and text to arrange 4 steps in a 4-step sequence with 80% accuracy given two attempts.
- Level 7: Listen to instructions and use pictures and text to arrange 3 steps in a 5-step sequence with 80% accuracy given two attempts.

- Level 8: Listen to instructions and use pictures and text to arrange 4 steps in a 5-step sequence with 80% accuracy given two attempts.
- Level 9: Listen to instructions and use pictures and text to arrange 5 steps in a 5-step sequence with 80% accuracy given two attempts.
- Level 10: Listen to instructions and use pictures and text to arrange 4 steps in a 6-step sequence with 80% accuracy given two attempts.
- Level 11: Listen to instructions and use pictures and text to arrange 5 steps in a 6-step sequence with 80% accuracy given two attempts.
- Level 12: Listen to instructions and use pictures and text to arrange 6 steps in a 6-step sequence with 80% accuracy given two attempts.

APPENDIX D: HearBuilder Sequencing Inventory

Pretest Items

For pretesting and posttesting, picture sequences were presented in random order for the students to sequence. Audio was enabled allowing students to click on each card to have text read aloud. All sequences are shown in correct order below.

Taking Your Pet to the Veterinarian

Hannah's cat was due for its yearly checkup. Hannah put her cat into the carrier.

carrier into her car and drove to the veterinarian's office.

At the office, Hannah sat in the waiting room with her cat.

Later in the examination room, the veterinarian gave Hannah's cat its shots.

After the examination, Hannah left the veterinarian's office with her healthy cat.

Postest Items

