Predictors of Speech Ability in Down Syndrome
Protocol
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Protocol

Eighteen children with Down Syndrome were recruited to participate in this study. Sixteen children with Down Syndrome participated in the full assessment and Speech Enrichment sessions detailed below. Two dropped out due to logistics, being unable to attend all the sessions. There were no adverse events.

<u>Assessments</u>

Participants were asked to attend assessment sessions at the beginning and again at the end of the enrollment in the study, which occurred over approximately six months. Assessments took place over 1-2 visits and lasted ~2-6 hours. Assessments were completed in a 10 X 12 room on the 10th floor of the Bill Wilkerson Center, remotely, or, if the parent wished, in their home in a quiet room at a table. The Wilkerson Center includes a standard testing room that includes a table and some chairs. Assessment sessions were audio and video recorded.

<u>Standardized tests</u>

Note: These are copyrighted tests and so items cannot be reproduced. The following synopses include links to publishers' websites so that reviewers can access the descriptions. Note that none of the tests measure psychiatric conditions, mental health, or other sensitive diagnostic categories (e.g. drug addiction) and so DO NOT include questions about violence, illegal drug use or other sensitive content. Rather, these tests include naming and pointing to pictures of common objects and actions (e.g., point to "car," point to "running," "what is this?" when presented with a picture of a house).

The following tests are part of *routine educational testing* for people with Down syndrome and were administered by a trained speech language pathologist.

Receptive One-Word Vocabulary Test-fourth edition
(https://www.pearsonassessments.com/store/usassessments/en/Store/Professional-Assessments/S peech-%26-Language/Receptive-and-Expressive-One-Word-Picture-Vocabulary-Tests-%7C-Fourth-Edition/p/100000338.html)

This test requests that the participant point to a picture from an array of four and is designed to measure comprehension of single words. Items include common nouns and verbs.

The scores for this test include number of items correct (raw score) and standard scores. The raw score is the number of correct responses out of a total of 190 items. A lower score means fewer correct responses so that a lower score means poorer performance. The raw score is used to generate a standard score, which indexes a child's performance to same age peers. Standard scores have a mean of 100 and a standard deviation of 15. A low score (e.g., 71) means relatively poorer performance as compared to same age peers, a higher score (e.g., 122) means relatively better performance relative to same age peers. A score of 85 to 115 is generally considered to be within a typical range.

Expressive One-Word Vocabulary Test-fourth edition
(https://www.pearsonassessments.com/store/usassessments/en/Store/Professional-Assessments/S peech-%26-Language/Receptive-and-Expressive-One-Word-Picture-Vocabulary-Tests-%7C-FourthEdition/p/100000338.html)

This test requests that the participants name individually presented pictures and is designed to measure production of single words (expressive vocabulary). Each picture depicts common nouns and verbs. The scores for this test include number of items correct (raw score) and standard scores. The raw score is the number of correct responses out of a total of 190 items. A lower score means fewer correct responses so that a lower score means poorer performance. The raw score is used to generate a standard score, which indexes a child's performance to same age peers. Standard scores have a mean of 100 and a standard deviation of 15. A low score (e.g., 71) means relatively poorer performance as compared to same age peers, a higher score (e.g., 122) means relatively better performance relative to same age peers. A score of 85 to 115 is generally considered to be within a typical range.

Woodcock Camarata Articulation Battery
(https://www.schoolhouseeducationalservices.com/woodcock-camarata-articulation-battery/)

This test requests that the participant name a picture of common nouns and the speech production accuracy (number of speech errors) is recorded. If they do not know the picture, the examiner names the item and asked that the child imitates the word. This standardized test measures pronunciation ability and are routinely administered to children with Down syndrome. The scores for this test include number of speech errors (raw score) and standard scores. Few errors yield a better (higher) score. The raw score is the number of correct responses. The raw score is used to generate a standard score, which indexes a child's performance to same age peers. Standard scores have a mean of 100 and a standard deviation of 15. A low score (e.g., 71) means relatively poorer performance as compared to same age peers, a higher score (e.g., 122) means relatively better performance relative to same age peers. A score of 85 to 115 is generally considered to be within a typical range.

Arizona Articulation and Phonology Scale, fourth revision (Arizona-4)
https://www.wpspublish.com/arizona-4-arizona-articulation-and-phonology-scale-fourth-revision
This test requests that the participant names, repeats or reads stimulus content. If they do not know the picture, the examiner names the item and asked that the child imitate the word. This standardized test measures pronunciation ability and are routinely administered to children with Down syndrome. For this study, the number of correct phonemes produced correctly was divided by the total number of phonemes in the test. This is the number of correct phonemes divided by the number of total phonemes divided by 100. A higher number means better speech production whereas a lower number shows poorer speech ability.

Leiter International Performance Scale-third edition. https://www.wpspublish.com/leiter-3-leiter-international-performance-scale-third-edition

This is a standardized assessment of nonverbal cognitive ability and includes picture matching, and looking at and completing a visual sequence using pictures. As am example, the examinee is

presented with a picture of a hand and another with a glove. The examiner points to each photo and then presents a picture of a foot. A set of pictures, including a shoe, a hat, and a spoon is presented. The examinee then selects the picture that goes with the foot (shoe). The scores for this test include the number of items correct (raw score) and standard scores, with a mean of 100 and a standard deviation of 15. A low score (e.g., 71) means relatively poorer performance as compared to same age peers, a higher score (e.g., 122) means relatively better performance relative to same age peers. A score of 85 to 115 is generally considered to be within a typical range.

15 Minute Spontaneous speech and language sample

This is a play-based conversation sample wherein the participant talks with the examiner about toys and picture books. The focus of the interaction is on the child's preferred activities, so the participant is allowed to select the toys and books they wish to talk about. These speech and language samples were video and audio recorded and subsequently transcribed for speech, and for length of utterance. This sampling is routinely performed by speech language pathologist as a part of standardized speech and language assessments. For this study, the number of correct phonemes produced correctly in the sample was divided by the total number of phonemes in the overall sample (which was phonetically transcribed). Percent correct was the number of correct phonemes divided by the number of total phonemes divided by 100. A higher number means better speech production whereas a lower number shows poorer speech ability.

Speech Enrichment Sessions

Setting, Materials and Activities

Participants were asked to attend speech enrichment sessions twice per week during the study, for a period of four months. Sessions were completed in a 10 X 12 room on the 10th floor of the Bill Wilkerson center, remotely, or at the participants home and were scheduled at the family's convenience. The setting at Bill Wilkerson Center is a standard room that includes a table and some chairs. Sessions at home were completed in a living room or family room of the family's choice. Speech enrichment sessions were audio and video recorded.

The materials were similar to those in the language sampling sessions and included toys and books. The activities included spontaneous verbal interactions while playing the toys and/or talking about books. These can include typical play routines and scenarios (e.g. toy school house, toy zoo) and picture books (e.g. where the wild things are, goodnight moon).

Procedures

The examiner engages the child with Down Syndrome in a play based conversation wherein the child is encouraged to talk about the toys and books. The focus of the enrichment sessions is on delivering an immediate lexical (word) response with correct phonemes to a child's production that contained incorrect phoneme production using verbal transactions. That is, a child's spontaneous or elicited production containing phonological errors was immediately followed with a clinician model that corrected the error(s) at the word level rather than the isolated

phoneme level. As an example, a speech recast of child's production of the word **bake** as [be] would be the whole lexeme **bake** [bek] rather than production drill on [k] in isolation. Clinicians were taught to use at least two speech recasts per minute (which has been feasible in previous studies with DS). A successful recast was delivered when (a) the child talks and (b) the child's intended message is understood. To enhance the probability that children would use a sufficient number of platform utterances that clinicians could sufficiently understand to provide accurate speech recasts, clinicians used verbal routines and topic-continuing questions. Verbal routines and topic-continuing questions increase child talking. In addition, the predictability of the content in spoken turns in these routines provides sufficient listener support for interpreting the child's communicative message, despite poor speech accuracy. Also, clinicians using the lexical recast intervention were trained ***not*** to use elicited imitation prompts when delivering lexical recasts during speech enrichment sessions.