COMPUTER BASED SPANISH PHONETIC TRANSCRIPTION TRAINING FOR

BILINGUAL SPEECH LANGUAGE PATHOLOGY STUDENTS

By

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COMPUTER BASED SPANISH PHONETIC TRANSCRIPTION TRAINING FOR

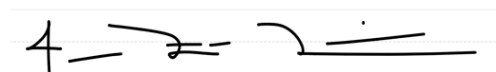BILINGUAL SPEECH LANGUAGE PATHOLOGY STUDENTS

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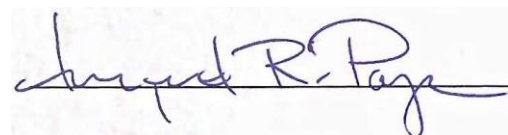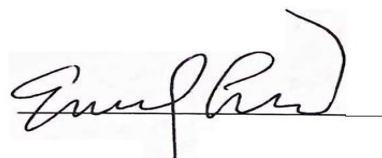
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Computer-Based Spanish Phonetic Transcription Training

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Abstract

There is a lack of bilingual speech-language pathologists and resources that train them to accurately transcribe phonetically in Spanish. Transcription accuracy is important for appropriate identification of speech-sound disorders. Bilingual, Spanish-English, speech-language pathology graduate students (n=7) were assigned to complete three online training modules to learn Spanish phonetic transcription: Syllable and Stress Patterns, IPA Symbology and Counting Sounds, and Transcription of Words and Allophonic Variations. A single-case design was used to determine if there is a functional relation between the use of a Spanish phonetic transcription training and a clinicians' accuracy in transcribing words in Spanish. Participants completed baseline data before the introduction of the training to assess prior knowledge of skills, after every module to measure skill procurement, and then after the completion of the three modules to evaluate for maintenance of acquired skills. The study found a functional relationship between the training program and participants' transcription skills, with varying effect sizes. For syllable boundaries, participants demonstrated moderate to very large size effects. For stress pattern sequences, three participants showed large to very large size effects, while the remaining four showed small or no size effect. Counting sounds showed a very large size effect for one participant, a moderate effect for another, and small or no size effect for the remaining participants. Lastly, for transcription of words and allophonic variation, three participants demonstrated very large size effects, three showed large size effects, and one exhibited a moderate effect. This study suggest that the Spanish phonetic transcription training can be used to improved transcription accuracy for the bilingual SLPs and to develop the competencies needed when assessing and treating Spanish speech-sound disorders in speaking monolingual or bilingual children.

Literature Review

Introduction

Per the American Speech-Language-Hearing Association (ASHA), under the speech pathologists' roles and responsibilities lies a commitment to provide culturally competent services that deal with being able to properly discern between a speech-language difference or disorder (ASHA, 2010). Out of the total 208,135 ASHA members, only about 5% (10,208) identified themselves as Spanish bilingual service providers (ASHA, 2020), serving an increasingly growing Hispanic population of 60.6 million (US Census, 2020). These numbers call attention to the gap between Spanish bilingual service providers and the growing Hispanic population in the US. Furthermore, adding to this discrepancy is the lack of reliable training for bilingual clinicians in providing speech and language services to the multilingual population. These issues can negatively impact the assessment and treatment of multilingual/multicultural clients. Appropriate training in transcription differences across languages can help bilingual speech-language pathologists (SLPs) develop the competencies and confidence when assessing and treating their clients.

In a field with so much more advancement needed, particularly in training for bilingual SLPs, it is essential that research addresses these discrepancies to be better-equipped professionals providing evidence-based, quality services. The purpose of this research is to explore if there is a functional relation between the use of a Spanish phonetic transcription training and a clinicians' accuracy in transcribing words in Spanish. The training focused on developing accurate transcription abilities from basic phonological awareness skills to accurately employing the International Phonetic Alphabet (IPA) transcription symbols in Spanish.

Multilingual/Multicultural Disparities in the Field

SLPs are responsible for providing culturally responsive practices to deliver appropriate services. However, it is not necessary to show proof of competency in working with culturally and linguistically diverse populations to practice as an SLP (Verdon et al., 2014). Many SLPs may undergo their educational training without treating a multilingual/multicultural client. Kritikos (2003) reported that SLPs have previously stated they have not been given sufficient information or training in assessing and treating multilingual/multicultural individuals. The questionnaire presented to SLPs by Kritios (2003) reported small numbers of SLPs receiving courses and/or training in differential assessment of bilingual versus monolingual individuals and limited assessment tools that can be used for bilingual clients. As a result, most SLPs reported low efficacy in their skills for providing bilingual assessments and in the fields' to competently provide such assessments (Kritikos, 2003). This is notable because it demonstrates the need for pre-and in-service training to provide the skills needed to support multilingual/multicultural clients.

In addition to a lack of bilingual assessment and treatment training, many English-dominant countries have demonstrated significant discrepancies between the population of multilingual individuals receiving therapy and the number of multilingual SLPs available to meet the client's needs (Verdon et al., 2014). The gap in the education for multilingual/multicultural SLPs is tied to the scarcity of those SLPs providing services due to their lack of confidence. As a result of this disparity, there is an over- and under-referral of multilingual children to speech and language services (Verdon et al., 2014). This is a critical issue because multilingual children can present with patterns of speech and language that differ from those of monolingual children. As a result, communication differences have a potential risk of being misdiagnosed as communication

disorders (McLeod et al., 2017). Over- and under-referring results in a misdiagnosis, which questions the clinician's competency and that of the field. Therefore, SLPs must be presented with the tools and skills to partake in culturally competent practices with multilingual/multicultural clients with diverse backgrounds (Verdon et al., 2014).

The need for more diverse representation in higher education and research combined with the lack of accurate materials, textbooks, and assessments have added to the problem of accurately providing linguistically appropriate assessments to Spanish speakers in the United States (Rivera-Campos et al., 2021). For instance, training materials tend to teach that phonemes are solely used in Spanish or English (Rivera-Campos et al., 2021). Materials are usually filled with conventionalisms, including the incorrect use of /r/--the symbol for the apicoalveolar trill rhotic-- by clinicians and norm-based articulation assessments for representation of the voiced alveolar approximant /ɹ/ as in the word "red" (Small, 2019). To promote a more diverse environment, proper training and reliable tools are needed to develop the skills necessary when working with multilingual/multicultural clients.

Transcription Methods

The International Phonetic Alphabet (IPA) was developed as a common language that relates every sound or phoneme with a specific symbol. SLPs use IPA to phonetically transcribe what a patient says and relate that to their intended message. Phonetic transcription allows SLPs to appropriately discern between a difference versus disorder.

To understand the importance of accurate transcription in multilingual/multicultural clients, we must first describe the two types of phonetic transcription: broad and narrow. Broad transcription refers to symbols representing the phonological unit in a target pronunciation (Ball

& Rahilly, 2002). Due to its loose nature, broad transcription should be used with caution as it runs the danger of over- or underestimating a client's phonological abilities (Ball & Rahilly, 2002). Contrarily, narrow transcription deals with assigning sounds to a particular category in the target system and ignoring the differences in production at the phonetic level (Ball & Rahilly, 2002). As a result, narrow transcription demonstrates that the difference between the client's pronunciation of the sound and the target is minimal and therefore considers the differences between speakers that are not necessarily attributed to a disorder (Ball & Rahilly, 2002). The use of narrow transcription is essential to assess children from multilingual and linguistically diverse backgrounds because they produce a diverse variation in phoneme production in one language or across languages (Ball et al., 2009; McLeod et al., 2017). However, broad transcription is more commonly used in clinics and taught in educational settings (Ball & Rahilly, 2002). With appropriate transcription training SLPs can develop competence and competencies in delivering services to linguistically diverse clients by accurately distinguishing between a difference versus a disorder (Kritikos, 2003).

Computer Training & the Teach- Model- Coach- Review Approach

Professional development does not need to require much time from clinicians to result in valuable knowledge gains (Krimm & Lund, 2021). Computer trainings have been used to successfully promote knowledge in speech-language pathology when in-person training is an issue (Krimm & Lund, 2021). Krimm & Lund (2021) used online training modules to teach SLPs dialogic reading strategies and phonemic awareness, confirming that online learning modules can help effectively demonstrate evidence-based practice skills in speech and language pathology. Our study aims to use these online training approaches proven effective for adults to teach bilingual graduate clinicians basic Spanish transcription skills.

Teach-Model-Coach-Review (Roberts et al., 2014) is an instructional approach that constitutes four main components: introduction of a skill (teach), example/demonstration of the skill (model), practice on the specific skill (coach), and the evaluation of final understanding of the skill (review). Previous studies have presented the Teach-Model-Coach-Review instructional approach as effective in teaching adults certain skills. For instance, Sukonthanman (2021) proved this model to be effective by implementing it in online training modules that taught parents the use of language expansion during routine-based activities with their child with cochlear implants. Sukonthanman (2021) also indicated high levels of parent satisfaction with using the Teach-Model-Coach-Review approach. Rivera Pérez et al. (2022) used a computer program to teach parents strategies in Spanish to improve the language of their children at risk for developmental language disorders. The single-case design study found a functional relationship between the training and the strategies used by the parents. Since the Teach-Model-Coach-Review has been proven to be an effective online learning approach in teaching adults (parents and clinicians) in communication sciences and disorders, this study will utilize the approach to teach bilingual graduate clinicians the basic skills needed for accurate Spanish transcription.

The Use of Phonological Awareness Skills in Transcription

Phonetic transcription entails listening to spoken language and categorizing each speech sound into phonemic categories while keeping in mind that the articulation and acoustic nature of the sounds can vary across linguistic contexts (Robinson et al., 2011). Phonological awareness is the ability to center on sound units in spoken language apart from their overall meaning (Robinson et al., 2011). Appropriate phonological awareness skills are tied to successful phonetic transcription. Robinson et al. (2011) found that phonological awareness skills were related to learning phonetic transcription to the extent that they can predict the likelihood of a

student having difficulty phonetically transcribing words. Phonetic transcription requires having basic phonological awareness knowledge like segmentation and phoneme matching/manipulation (Robinson et al., 2011). Using this information, our study aims to teach the proper use of Spanish phonetic transcription using IPA by building upon basic phonological awareness skills in Spanish.

Purpose & Research Questions

The purpose of this research is to explore if there is a functional relation between the use of a Spanish phonetic transcription training and a clinicians' accuracy in transcribing words in Spanish. The following question guided this study:

1. Is there a functional relationship between the use of a computer-based Spanish phonetic transcription training and accuracy in Spanish transcription by bilingual graduate clinicians during their training?

2. Do the bilingual graduate clinicians maintain the use of these strategies post-intervention?

Methods

Participants

Participants were bilingual, Spanish-English, SLP graduate students (n=7) who attended Texas Christian University. All participants, except for one, were part of the Emphasis in Bilingual Speech-Language Pathology track. Participants demonstrated their Spanish proficiency by engaging in a 5-minute narrative language sample with the researchers. Analysis of the sample must have yielded less than five grammatical errors to indicate a high level of proficiency. All participants revealed a high level of Spanish proficiency. Participants also filled

out a demographic questionnaire, including questions on their Spanish language attainment/use, family background, and any notable dialects (see Table 1).

Two out of the seven participants reported Spanish to be their first language, four reported English as their first language and one participant described her first language attainment as English and Spanish simultaneously. For the participants who reported English as their first language, they learned Spanish academically, apart from one participant who learned Spanish at home. Five of the participants reported English to be their dominant language regardless of which was their first language. The other two participants reported that their dominant language switches depending on the context they find themselves in (ie. school vs home). All participants ranked Spanish proficiency in regards to the four areas of language (speaking, understanding, reading, and writing) a score of 3 or higher in a proficiency scale of 5. Four of the seven participants identified as Hispanic or Latino with three identifying with the Mexican culture and one identifying with the Nicaraguan culture.

Additionally, all participants completed the blending nonwords and segmenting nonwords sections of the Comprehensive Test of Phonological Processing-Second Edition (CTOPP-2) to assess their phonological awareness skills before the training. These skills were tested in English since this is the primary language of instruction utilized to learn phonological awareness skills by all participants. The sections of the CTOPP-2 (blending nonwords and segmenting nonwords) were chosen to eliminate the possibility of previous knowledge of real English words used in other sections. Average scores for both sections were scaled scores from 8-12. Almost all participants received average scores on the blending nonwords section of the CTOPP. Two participants received below average scores that were right at the cusp of being

average scores (see Table 2). All participants received average scores on the segmenting nonwords section of the CTOPP (see Table 3).

Participant inclusion criteria were as follows: a) graduate speech-language pathology students, b) proficient in the Spanish language regardless of dialect, and c) have not taken any Spanish transcription training before. It is important to note the last exclusion criteria as essential because we expect participants to have little to no knowledge of Spanish phonetics so that we can ensure our computer training is effective in teaching the skill of Spanish transcription. The participants agreed to volunteer for a 6-week long training.

Setting & Materials

Participants were allocated a private room in the Miller Speech and Hearing Clinic (MSHC), which they individually attended during their scheduled times across the study. The room included a chair as well as a desk with an iMac computer (Mac Retina 5K, 27-inch) and noise-isolating headphones (Sennheiser HD280PRO). The transcription training modules or the baseline/maintenance audio probe files were set up on the screen before the participant arrived. In each session, data was collected by providing the participants with a writing utensil and a printed copy of a data collection sheet. Data was collected through handwritten data collection sheets to allow for more flexibility of IPA symbols utilized by the participants. Participants were allowed to bring a personal note-taking item to record any learned information during the training modules. The participants completed the modules in person by attending the MSHC rather than taking them home to provide a controlled environment free from distractions. To ease the pressure of the study, researchers were absent in the room; however, they were available in the building to respond to any technical issues are questions about the research.

Development of the Computer-Based Training Modules

The computer-based training modules utilized the Teach-Model-Coach-Review approach to present the content in three training modules on the following skills: syllable/stress patterns, IPA symbology/counting sounds, and transcription of words/allophonic variations.

In the teach stage of the modules, the topics were introduced and explained to the participants with examples. In the model stage, the participants were provided with more examples of the concepts using pictures, video, and audio as necessary. In the coach stage, the participants demonstrated their understanding of the concepts by answering questions and receiving immediate feedback on their responses. In the review stage of the modules, the participants were asked to assess their understanding of the concept introduced in the module and were allowed to return to any section they needed further practice with.

The prototype application was developed using Microsoft PowerPoint, incorporating visual and audio examples. A word bank of 170 infrequently used Spanish words that included multisyllabic words, consonant clusters, and words with letters that are phonetically different in Spanish, like / β /, / ɣ/, ð /, /r/, / ʝ/, / ʎ/, and / ɲ/ were audio recorded onto the computer. Fifteen random words were picked for baseline, maintenance, and training probes. Each word was repeated a total of 3 times to the participants to aid them in filling out the data collection sheet, which included a section for identifying the number of syllables in the word, the stressed syllable in the word, the number of sounds in the word and the IPA transcription of the word (see Appendix A). English was selected as the language of instruction for the training modules to reach the bilingual speakers who receive education primarily in English and help breach the content knowledge and the terms from their courses and/or practicum. Additionally, presenting the content in the training modules in English also offers an advantage for future clinical

application for those clinicians who speak English with limited to moderate Spanish proficiency and want to learn how to transcribe in Spanish.

Response Definitions & Measurement System

Baseline & Maintenance

For baseline and maintenance, participants were randomly given fifteen-word audio files from a word bank of 170 Spanish words produced by typical Spanish speakers to fill out the data collection sheet and transcribe in IPA. Each word was repeated a total of 3 times for participants to achieve their most accurate responses. Data was collected through a paper copy of the data collection sheet and a writing utensil provided to the participants to allow for flexibility in the IPA symbols used. The observers scored these probes based on the accuracy of the responses.

Training Probes

All participants were given a week to complete one module training twice. The modules introduced all the information in English but provided application examples in Spanish. All modules followed the Teach-Model-Coach-Review approach and contained probe measurements at the end, which included fifteen randomly chosen words from the 170-word bank to fill out the data collection sheet. The probe words chosen were used to measure the effect, if any, of a specific module on Spanish transcription skills before moving on to the next module. The observers scored these probes based on the accuracy of the responses.

Interobserver Agreement Procedures

Two observers, who have received prior education of Spanish phonetic transcription through an academic course, verified all participants' transcription accuracy at baseline, maintenance, and probes. All observers independently scored the participant's responses across behaviors. To measure interobserver agreement, the observers compared their scoring across all the participants for baseline, maintenance, and probe measurements. Using the interobserver agreement formula provided by Gast (Gast 2009), observers compared their results and discussed to achieve 100% agreement. If any major disagreements occur, recalibration took place by reassessing the observer's accuracy in phonological awareness and transcription skills.

Experimental Design

This study was set as a single case design. The study used a multiple baseline approach across participants to help make inferences about the effect of the training modules in Spanish transcription. Initial baseline probes increased by two across participants so that participants 1, 2 & 5 completed 5 baseline probes; participants 3 & 4 completed 7 baseline probes and participants 6 & 7 completed 9 baseline probes. All participants received a week to complete one training module twice for a total of 3 weeks to complete all three trainings twice. All participants completed 2 more probes after the trainings for maintenance measurements. In using a multiple baseline design across participants and behaviors, the researchers attempted to control external factors that could have affected the data in demonstrating changes due to the passage of time (Gast 2009). The multiple baseline design also allowed for early identification of any instrumentation errors or procedural infidelities so that the issues could be addressed to where the least amount of data was affected (Gast 2009). The research was designed to collect regular, brief, and multiple data points by using randomly chosen words from the 170-word bank to identify phonological awareness and transcription skills across participants. Additionally, this

practice ensured that the data points are free from any practice forms and that the modules seem to better the participants' skills in phonological awareness and transcription.

Experimental Procedures & Conditions

For baseline, the participants were asked to listen and fill out the data collection sheet for 15-word audio files from a bank of 170 random Spanish words. These audio files were automatically played on the computer and each word was repeated a total of 3 times. The observers, who have experience and training in Spanish IPA, assessed the participants' responses according to accuracy of their transcription per syllable. The total amount of words a participant transcribed at the end of baseline depended on how many baseline sessions they were assigned. The baseline measures were collected to gauge the participants' Spanish phonological awareness and transcription skills before the intervention.

For the training, the participants viewed a total of 3 modules that follow the Teach-Model-Coach-Review approach. The participants completed each of the modules, in their entirety, twice to ensure their understanding of the concepts. At the end of each module completion (after completing one module twice) the participants were given 15 probe words, chosen at random from the 170-word bank, to fill out the data collection sheet for a total of 45 words transcribed during training. The probes were used to determine if there were any changes present in the participants' Spanish phonological awareness and/or transcription skills overall after a specific skill was taught. The modules taught the following skills: Syllable and Stress Patterns, IPA Symbology and Counting Sounds, and Transcription of Words and Allophonic Variations.

Module 1: Syllable & Stress Patterns

Syllable identification involves segmenting words into syllables. The first section of this module provides information on the parts of a syllable like onset and rhyme. It also provides the participants with knowledge of the different characteristics of a syllable (ie. open versus closed). The module also expands on the rules of segmenting syllables in Spanish with particular focus on rules pertaining to syllable boundaries that differ from that of the English language. Stress patterns involves identifying the stressed syllable in a word. This module also explains the differences between a stressed and unstressed syllable. Through the audio examples and practice provided the participants are expected to demonstrate mastery in segmenting multisyllabic words and identifying the stressed syllable by the end of this module.

Module 2: IPA Symbology & Counting Sounds

Sound identification deals with phonological awareness, an auditory task that requires knowledge of the individual composition of each sound. This module goes through what a phoneme is and how these phonemes are represented by symbols in Spanish IPA. The module explains the differences in the Spanish consonant chart and vowel quadrilateral as they relate to IPA. This module emphasizes the use of symbols to count the number of sounds in a word. Through the audio examples and practice provided the participants are expected to be able to accurately identify the number of sounds in words by the end of this module.

Module 3: Transcription of Words & Allophonic Variations

Transcription involves being able to label sounds produced with IPA symbols. This module reviews the difference between phonemic and phonetic transcription. The module also details the Spanish specific rules in IPA including allophonic variations of sound productions

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and transcription. Through the examples and practice provided the participants are expected to properly transcribe words in Spanish by the end of this module. This skill is the key skill expected to be learned through all modules as it is an accumulation of knowing the different phonological awareness skills in Spanish and using those in alignment with the IPA specific rules.

For maintenance probes, similar to baseline probes, the participants were asked to listen to and transcribe, using IPA, 15-word audio files from a bank of 170 random Spanish words. These audio files were automatically played on the computer and each word was repeated a total of 3 times. The observers, who have experience and training in Spanish IPA, assessed the participants' responses according to accuracy of their transcription per syllable. The total amount of words a participant transcribes at the end of maintenance will vary as maintenance data will be collected at differing levels across participants. The maintenance data was used to identify if the participants' Spanish transcription skills are generalized and maintained after the training.

Procedural Fidelity Data Collection

During the study, observers diligently followed a procedural checklist to ensure consistent execution and maintain procedural fidelity of over 90%. The checklist encompassed various tasks, including welcoming and setting up participants, temporarily leaving the room, and returning to collect and score the paper data collection sheets after the participants had departed. Observers adhered to the checklist for each participant they were assigned to, regardless of experimental condition, to guarantee procedural fidelity across all participants.

Data collection relied on written sheets submitted by the participants, which observers subsequently scored. If any significant discrepancies emerged across participants' results,

researchers reassessed the observers' performance using the interobserver agreement formula previously detailed. Furthermore, researchers routinely monitored procedural fidelity by confirming that observers strictly adhered to the checklists for all participants.

Results

Visual Analysis

Visual analysis consists in inspecting trend, level, variability, and consistency of the data to identify patterns (Kratochwill et al, 2010). These results were plotted using a line graph across modules for each participant to identify any improvements that can be attributed to the skills taught by the training modules.

Tau-U

A non-parametric statistical analysis was performed using the Tau-U effect size to provide additional evidence. To interpret these findings, we will be utilizing the Vannest and Ninci (2015) effect size criteria. An effect size of less than 0.20 is considered small, 0.20 to 0.60 is moderate, 0.60 to 0.80 is large, and greater than 0.80 is very large.

Syllable Boundaries

Visual analysis of the data indicated a functional relation between the training program and the learning of syllable boundaries for participant 4 as demonstrated by a positive trend in the training and maintenance phases (See Figure 4). Participant 6 demonstrated variable trends with a more stable gain during maintenance (See Figure 6). Participant 1 displayed a positive trend in the maintenance condition (See Figure 1). Participant 2 had a variability in trend across

training and maintenance conditions (See Figure 2). Participant 3 demonstrated a variability in trend during training and a positive trend for maintenance (See Figure 3). Participant 5 displayed a positive trend during training and variability in the maintenance phase (See Figure 5). Participant 7 demonstrated a stable gain in training and maintenance gains when compared to baseline (See Figure 7).

To supplement the visual analysis, a non-parametric statistical analysis of effect size Tau-U yields the following results, which are significant at $p < .05$. Participant 4 (effect size estimate: 1.04) demonstrated a very large size effect. Participant 6 (effect size estimate: 0.65) demonstrated a large size effect. Participant 1 (effect size estimate: 0.42), participant 2 (effect size estimate: 0.53), participant 3 (effect size estimate: 0.27), participant 5 (effect size estimate: 0.57), and participant 7 (effect size estimate: 0.58) demonstrated a moderate size effect.

Stress Pattern Sequence

Visual analysis of the data indicated a functional relation between the training program and the learning of stress sequence for participant 1 (See Figure 8), participant 2 (See Figure 9), and participant 6 (See Figure 13) as demonstrated by a positive trend during the training and maintenance conditions. Participant 3 (See Figure 10), participant 4 (See Figure 11), participant 5 (See Figure 12), and participant 7 (See Figure 14) demonstrated no effect.

To supplement the visual analysis, a non-parametric statistical analysis of effect size Tau-U yields the following results, which are significant at $p < .05$. Participant 1 (effect size estimate: 0.95) demonstrated a very large size effect. Participant 2 (effect size estimate: 0.72) and participant 6 (effect size estimate: 0.75) demonstrated a large size effect. Participant 3 (effect

size estimate: -0.18), participant 4 (effect size estimate: 0.14), participant 5 (effect size estimate: -0.05), and participant 7 (effect size estimate: 0.15) demonstrated a small or no size effect.

Counting Sounds

Visual analysis of the data indicated a functional relation between the training program and the learning of number of sounds for participant 1 (See Figure 15), some positive trend for participant 4 (See Figure 18), and no effect for participant 2 (See Figure 16), participant 3 (See Figure 17), participant 5 (See Figure 19), participant 6 (See Figure 20) and participant 7 (See Figure 21).

To supplement the visual analysis, a non-parametric statistical analysis of effect size Tau-U yields the following results, which are significant at $p < .05$. Participant 1 (effect size estimate 0.82) demonstrated a very large size effect. Participant 4 (effect size 0.56) demonstrated a moderate effect. Participant 2 (effect size estimate 0.22), participant 3 (effect size estimate 0.35), participant 5 (effect size estimate: 0.07), participant 6 (effect size estimate: -0.29) and participant 7 (effect size estimate: -0.23) demonstrated a small or no size effect.

Transcription of Words & Allophonic Variation

To facilitate analysis for IPA transcription, we established a syllable cut-off of 39 syllables, which was determined by selecting the minimum number of syllables among all 15-word probes, considering the variability in syllable count across the probes. Visual analysis of the data indicated a functional relation between the training program and the learning of Spanish transcription for participant 2 (See Figure 23), participant 4 (See Figure 25), participant 7 (See Figure 28), participant 3 (See Figure 24) participant 5 (See Figure 26) and participant 6 (See

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Figure 27). There was a less robust effect for participant 1 (See Figure 22). To supplement the visual analysis, a non-parametric statistical analysis of effect size Tau-U yields the following results, which are significant at $p< .05$. Participant 2 (effect size estimate: 0.88), participant 4 (effect size estimate: 0.98), and participant 7 (effect size estimate: 1.00) demonstrated a very large size effect. Participant 3 (effect size estimate: 0.61), participant 5 (effect size estimate: 0.76), and participant 6 (effect size estimate: 0.64), demonstrated a large size effect. A moderate effect was found for participant 1 (effect size estimate: 0.45).

Discussion

The purpose of this research is to explore if there is a functional relation between the use of a Spanish phonetic transcription training and a clinicians' accuracy in transcribing words in Spanish. The results demonstrated varied effects across the different participants, suggesting that the training program was more beneficial for some participants, but not as effective for others. The results for the appropriate transcription of words demonstrated a functional relation between the training program and the learning of Spanish transcription for most participants. Ultimately, the data suggests that the training program was effective in improving the accuracy of transcription in Spanish for a majority of the participants. The findings indicated a functional relation between the training program and the learning of syllable boundaries, stress pattern sequence, and counting sounds for some participants. However, there was a less robust effect for others.

Since appropriate phonological awareness skills have been tied to successful phonetic transcription (Robinson et al., 2011), the training modules provided in this study build from basic phonological awareness skills to appropriate IPA transcription in Spanish. The CTOPP-2 is a

standardized assessment used to measure phonological processing abilities in English.

Participants performance on the CTOPP-2 indicated that almost all participants had average

word blending and segmenting skills in English prior to the start of training. It is a possibility

that these phonological awareness skills in English translated well to utilizing the same skills in

Spanish. There was variability in performance on the phonological awareness skills measured

(ie. syllable boundaries, stress sequences and counting of sounds) across participants.

Participants who performed highly at baseline could have had the skill measured prior to

beginning training from their basic educational background in the Spanish language. Participants

who performed higher at training and maintenance may have acquired the skill during the

training. It is important to note that participants were encouraged to take notes during training

modules, however, were not required to. The effect of time could be a contributing factor in

retention of the information provided in the modules. Additionally, training module time was

blocked for an hour, however, participants had the flexibility to finish early or add extra time as

needed. There is a possibility participants may have rushed through the modules that could result

in missing relevant information during and after the training.

 Appropriate transcription training for SLPs is essential to develop the competence and

competencies in delivering services to linguistically diverse clients by accurately distinguishing

between a difference versus a disorder (Kritikos, 2003). The training modules provided in this

study honed in on the skill of Spanish phonetic transcription including the appropriate

symbology and allophones of the Spanish language. All participants demonstrated increased

Spanish transcription accuracy ranging from moderate to very large size effects. The participants

who tended to lean on the moderate level of skill learning could be resulting from external

factors that were out of the control for the research. For example, almost all participants were

taking part in a bilingual speech language pathology program that includes evaluating and treating bilingual clients. Participants may have been exposed to entry level knowledge of some of the IPA transcription symbols that affected their performance at baseline. This exposure could have influenced their baseline performance, making it difficult to isolate the effects of the training modules alone. Despite these potential external factors, the results still demonstrate the overall effectiveness of the training modules in improving Spanish transcription accuracy among the participants. Additionally, like the phonological awareness skills section of the training, participants were encouraged, but not required to take and use notes during the study. The content of the training modules was heavy in terms of distinguishing between symbology and the usage of allophonic variations. The effect of time and pace of information processing could have contributed to the participants performance with certain skills.

Limitations & Future Directions

This study provides important preliminary data to indicate that appropriate Spanish phonetic transcription, taught utilizing adult an adult instructional approach on a computer-based application, results in knowledge gains. However, the limitations of this study also provide opportunities for future research to further explore how explicit teaching of Spanish phonetic transcription skills can have an impact on evaluating and treating bilingual clients.

One notable limitation of this study was the selection of Spanish words for probing that were phonemically well balanced across probes to provide an accurate representation of transcription skills in Spanish. The probe words utilized in this study were randomly chosen from a word bank of 170 words and analyzed by 39 syllables per probe. This was done because scoring of appropriate transcription would not be syllabically well balanced. Meaning, some

probes contained longer words than others when measured by syllable. Additionally, the words were not phonetically balanced in the sense that different probes assessed a variety of phonemes in Spanish that were at time repeated across the probe. However, this approach lies in the attempt to maintain a certain level of ecological validity, reflecting the natural variation and unpredictability of real-world speech. By selecting words randomly and not controlling for perfect phonemic balance, the study aimed to simulate the challenges that SLPs may encounter when working with linguistically diverse clients in real-life settings. This design choice acknowledges the fact that real-world speech does not always follow a well-balanced distribution of phonemes and syllable structures. Future research, should assess a way to phonetically and syllabically balance the word bank utilized for probing so that a more accurate picture can be drawn of the knowledge being taught by the modules (ie. a balance of all the specific phonetic symbology).

Another limitation of this study was that the audio probe words provided were repeated by a researcher three times in one recording. Meaning the production of a word could have changed after the second or third production of the word. To combat this, future research should audio record the intended production of the word once and loop it two more times to get the same production a total of three times. This would provide more control on how the participants are hearing the word across the different trials and provide a more accurate representation of the transcription required from said word.

Another limitation of this study, due to the nature of it being computer based, was that there was confusion on the side of the participants in how symbols were appropriately written from the typology used in the modules. For example, many participants thought that the vowel /a/ was correct to be transcribed as /ɑ/ if that is the way they wrote that vowel with their

penmanship. A differentiation between the two was never explicitly made in the modules, therefore, credit was given for whatever version of the vowel /a/ that was given. Future research should take into consideration how typology can affect the way information is presented in the modules and explicitly instruct the differences between typology and phonetic transcription when needed. Further exploration and modification of the training program to better cater to individual needs and learning styles.

Future research could consider allowing participants to complete probe transcriptions utilizing a phonetic keyboard rather than their own penmanship to avoid any confusion of intended symbol production. This study utilized written phonetic transcription to assess skills to allow for flexibility on the IPA symbology produced by participants, however, this generated some questions when assessing the data collected. For instance, the appropriate symbol for the rhotic /r/ was explicitly taught, but several participants had difficulty drawing the symbol out. A specific IPA keyboard to help type out probe responses could aid in better assessing appropriate transcription skills.

Clinical Implications

The results presented in this study strengthens the need for continuing research in the area of education for bilingual/monolingual SLPs to better guide evaluation and treatment of multilingual/multicultural clients. The training modules in this study were effective in teaching bilingual SLPs students appropriate Spanish phonetic transcription skills. Use of this training can be generalized to bilingual SLPs and even monolingual SLPs who have a more moderate Spanish proficiency and want to learn how to transcribe in Spanish, since English was selected as the

language of instruction. Additionally, the results of this research guide further directions in teaching transcription of specific Spanish dialects and application of diacritics when transcribing in Spanish. Moreover, the development of similar training modules for other languages can help equip SLPs with the necessary skills to assess and treat clients from various linguistic backgrounds, thus fostering a more inclusive approach in speech and language therapy.

The training modules in this study were effective in teaching bilingual SLPs students appropriate Spanish phonetic transcription skills. This training allows bilingual graduate clinicians to be more confident, competent, better-equipped when providing evidence-based, quality services when attending to their Spanish speaking clients.

Tables

Table 1. *Demographic questionnaire responses as reported by participant.*

Participant	Age	Gender	Ethnicity	Level of education	Phonetics background	First language	Dialect	Dominant language	Proficiency in English (1= little proficiency; 5= highly proficient)	Proficiency in Spanish (1= little proficiency; 5= highly proficient)
P1	22	Female	Hispanic/ Latino-Mexican	Bachelor's	English, no Spanish	Spanish	None reported	Code Switches	Speaking: 5 Understanding: 5 Reading: 5 Writing: 5	Speaking: 5 Understanding: 5 Reading: 5 Writing: 4
P2	22	Female	White	Bachelor's	English, no Spanish	English	None reported	English	Speaking: 5 Understanding: 5 Reading: 5 Writing: 5	Speaking: 4 Understanding: 5 Reading: 4 Writing: 5
P3	22	Female	White, Mexican/Latino-Nicaraguan	Bachelor's	English, no Spanish	English & Spanish simultaneously	Nicaraguan	Code switches	Speaking: 5 Understanding: 5 Reading: 4 Writing: 4	Speaking: 5 Understanding: 5 Reading: 4 Writing: 4
P4	23	Female	White	Bachelor's	English, no Spanish	English	None reported	English	Speaking: 5 Understanding: 5 Reading: 5 Writing: 5	Speaking: 4 Understanding: 4 Reading: 4 Writing: 4
P5	23	Female	White	Bachelor's	English, no Spanish	English	Southern-Louisiana	English	Speaking: 5 Understanding: 5 Reading: 5 Writing: 5	Speaking: 3 Understanding: 4 Reading: 4 Writing: 3
P6	23	Female	Hispanic/Latino-Mexican	Bachelor's	English, no Spanish	English	None reported	English	Speaking: 5 Understanding: 5 Reading: 5 Writing: 5	Speaking: 3 Understanding: 5 Reading: 5 Writing: 3
P7	23	Female	Hispanic/Latino-Mexican	Bachelor's	English, no Spanish	Spanish	None reported	English	Speaking: 5 Understanding: 5 Reading: 5 Writing: 5	Speaking: 4 Understanding: 5 Reading: 4 Writing: 3

Table 2. *Results from CTOPP-2- Blending Nonwords Section*

Participant	Percentile Rank	Scaled Score	Interpretation of Scaled Score
P1	50	10	Average
P2	63	11	Average
P3	37	9	Average
P4	37	9	Average
P5	16	7	Below average
P6	63	11	Average
P7	16	7	Below average

Table 3. *Results from CTOPP-2- Segmenting Nonwords*

Participant	Percentile Rank	Scaled Score	Interpretation of Scaled Score
P1	50	10	Average
P2	50	10	Average
P3	63	11	Average
P4	63	11	Average
P5	63	11	Average
P6	50	10	Average
P7	37	9	Average

Figures

Syllable Boundaries Probe Sessions:

Figure 1. *Syllable Boundaries Probe Sessions for Participant 1.*
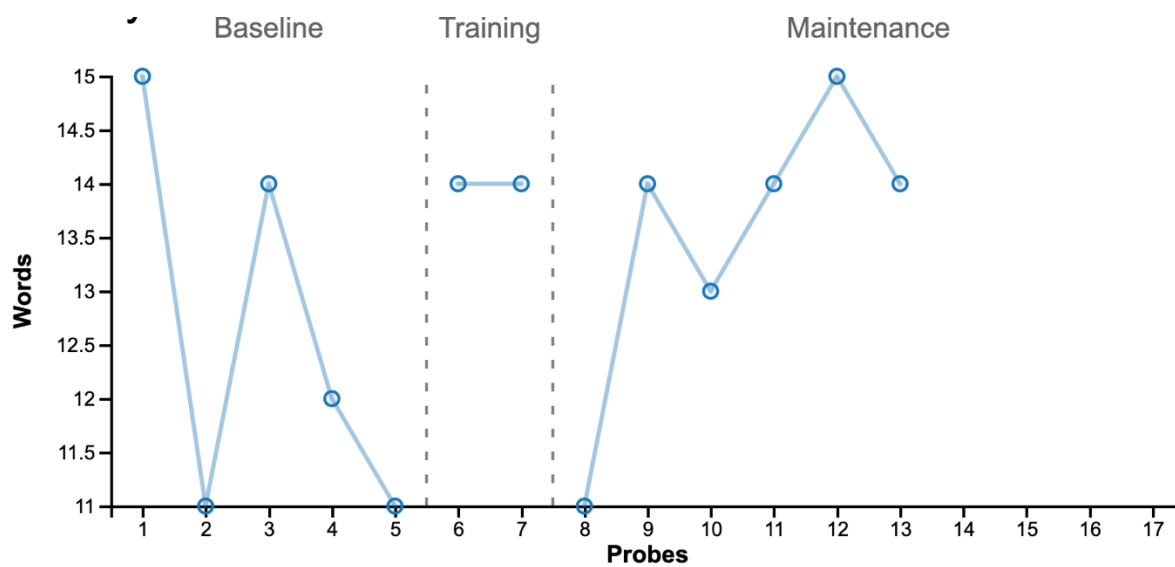
Figure 2. *Syllable Boundaries Probe Sessions for Participant 2.*
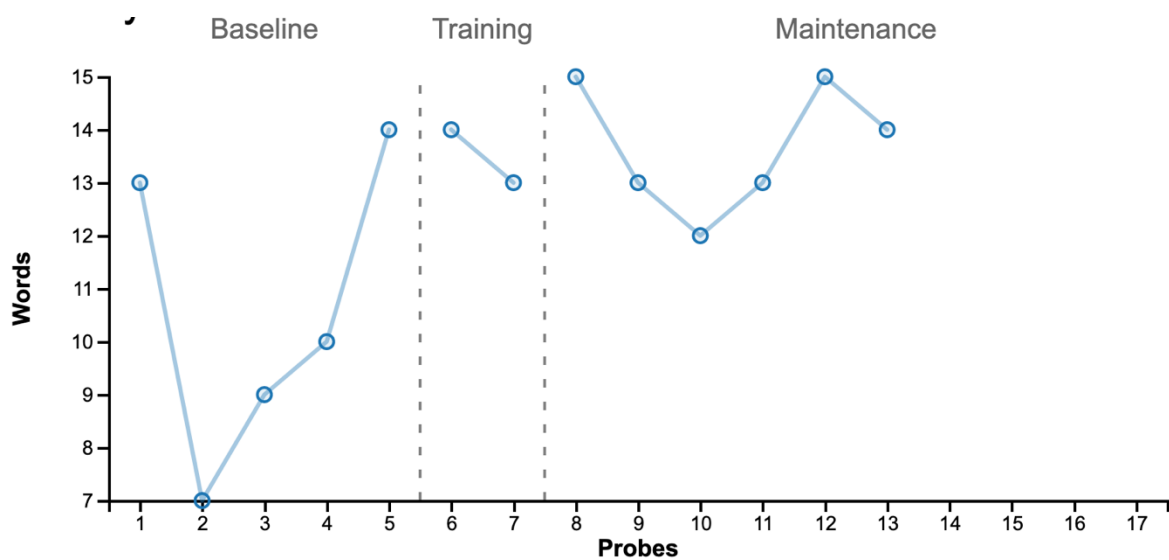
Figure 3. Syllable Boundaries Probe Sessions for Participant 3.
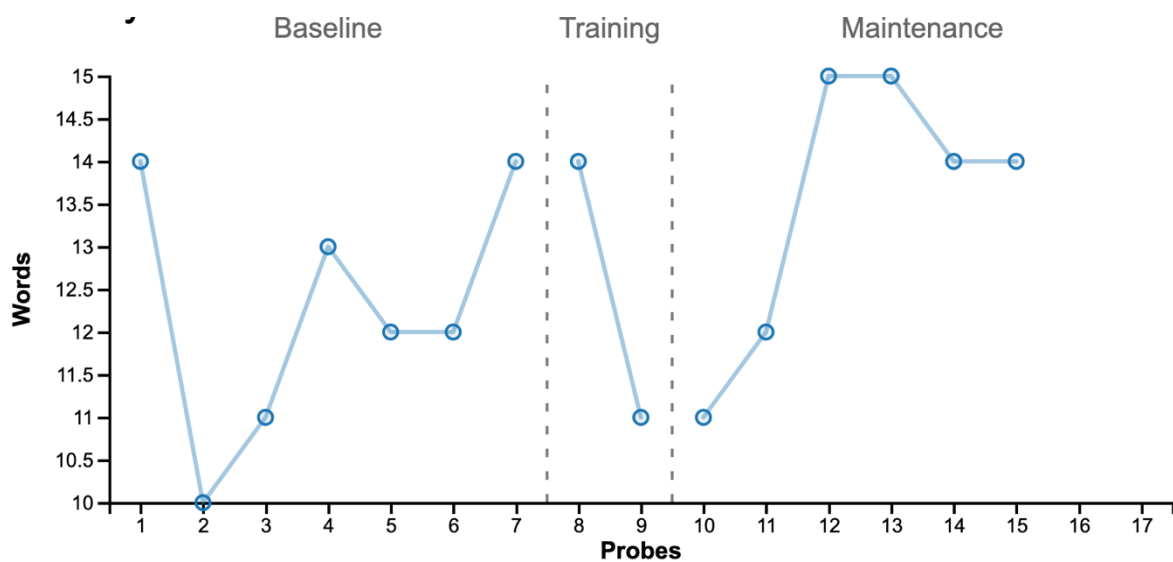
Figure 4. Syllable Boundaries Probe Sessions for Participant 4.
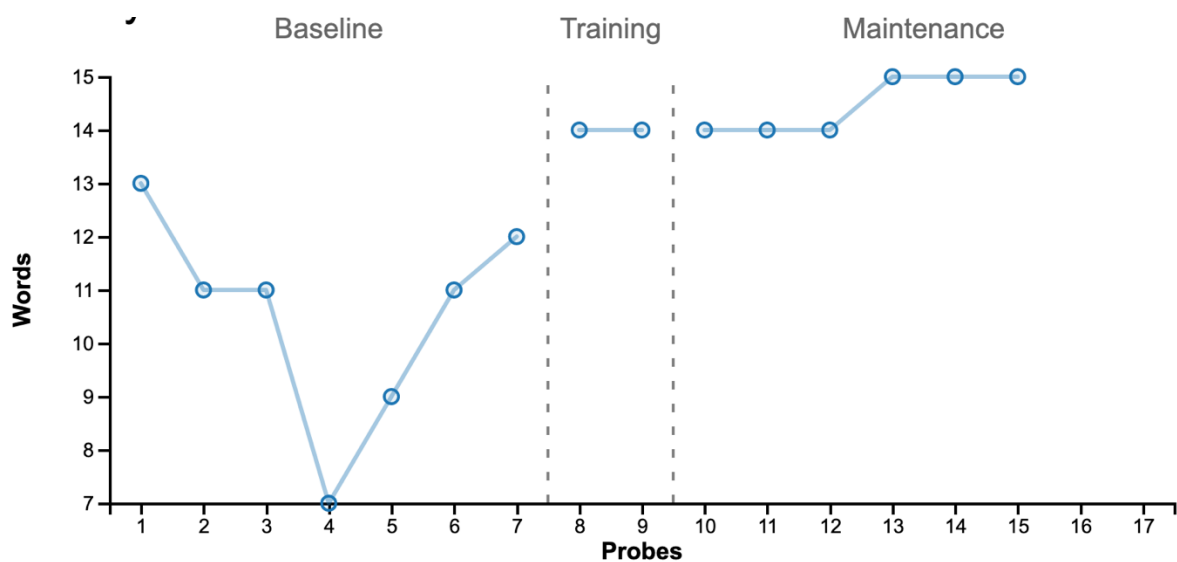
Figure 5. *Syllable Boundaries Probe Sessions for Participant 5.*
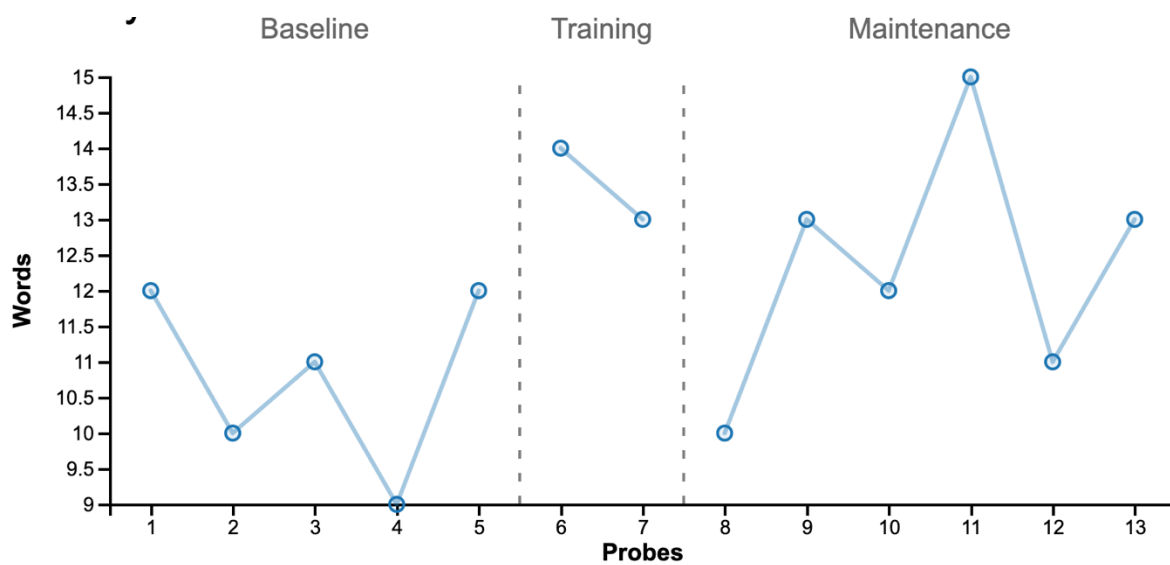
Figure 6. Syllable Boundaries Probe Sessions for Participant 6.
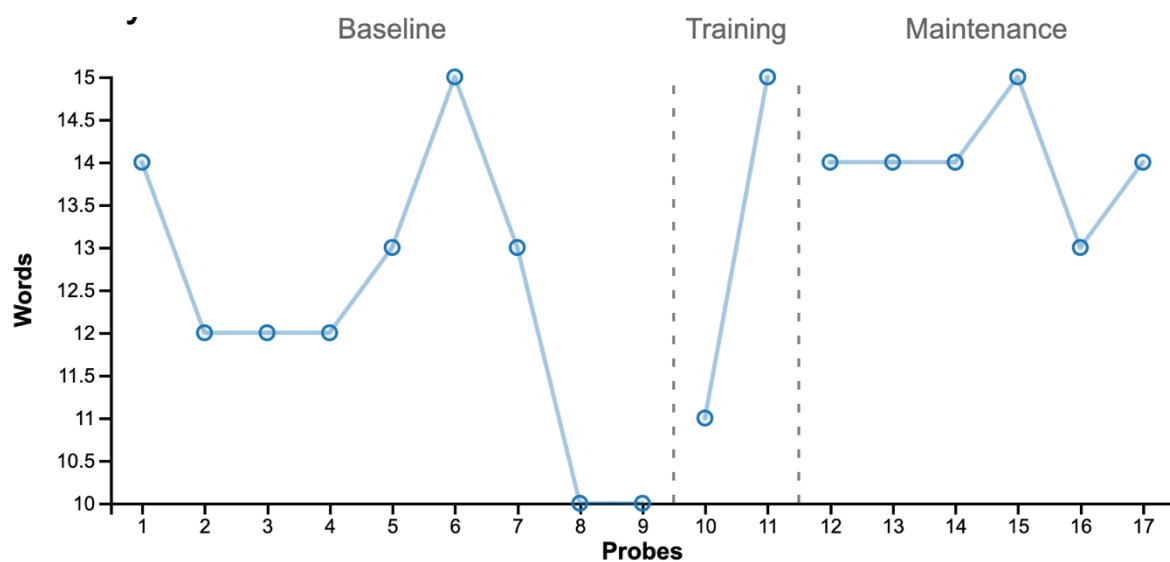
Figure 7. Syllable Boundaries Probe Sessions for Participant 7.
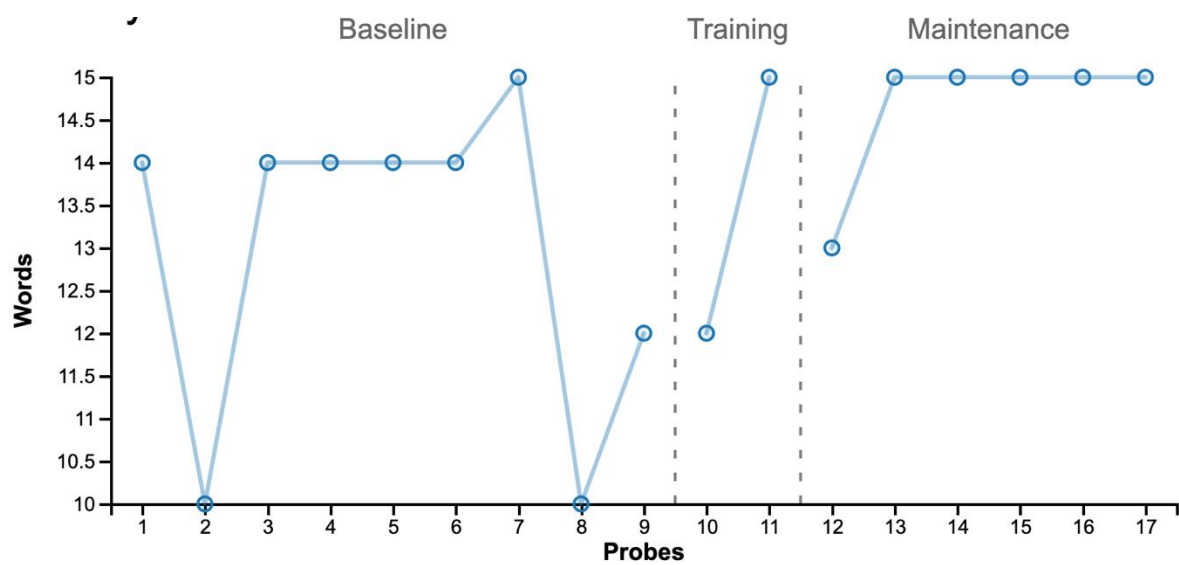
Stress Sequence Probe Sessions:

Figure 8. *Stress Sequence Probe Sessions for Participant 1.*
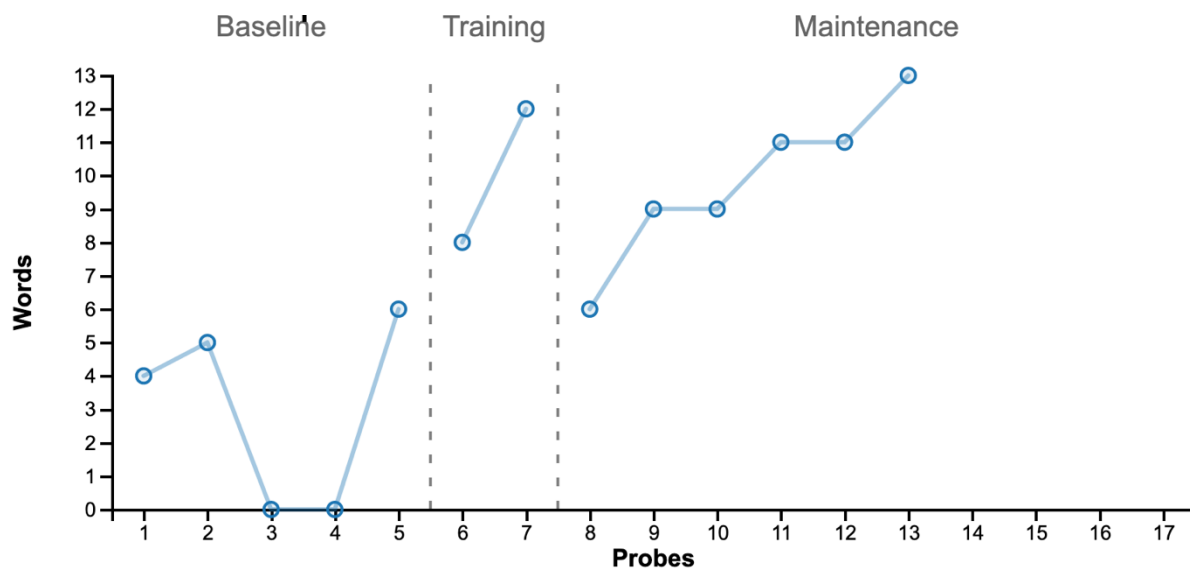
Figure 9. *Stress Sequence Probe Sessions for Participant 2.*
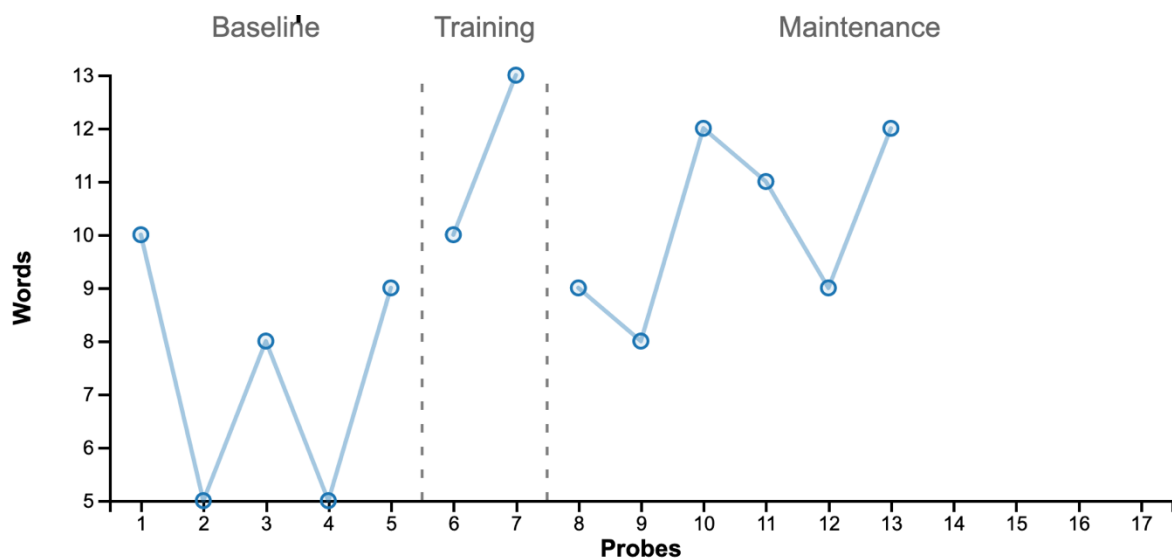
Figure 10. Stress Sequence Probe Sessions for Participant 3.
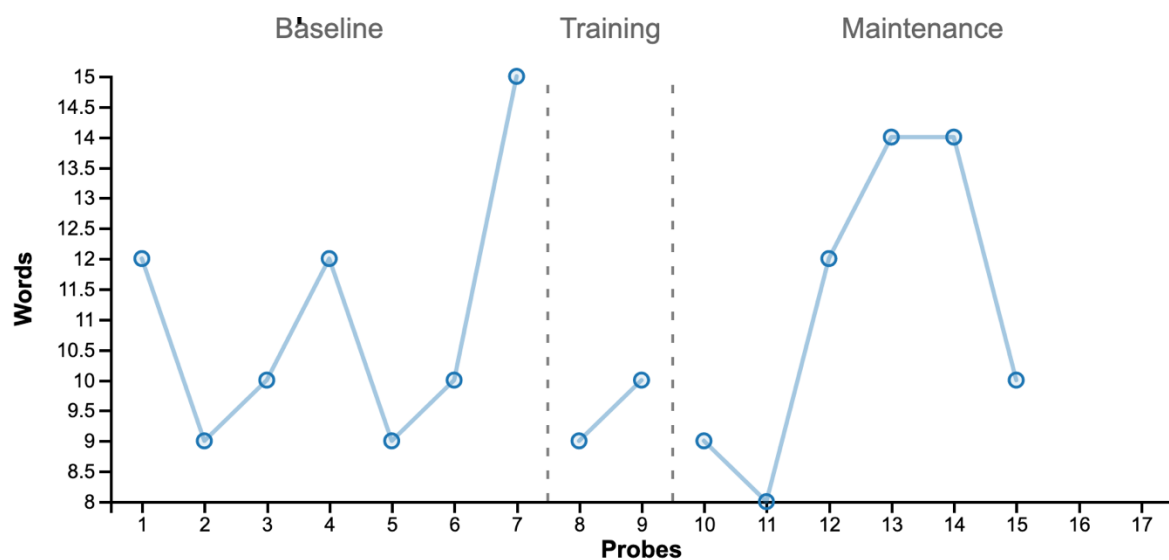
Figure 11. Stress Sequence Probe Sessions for Participant 4.
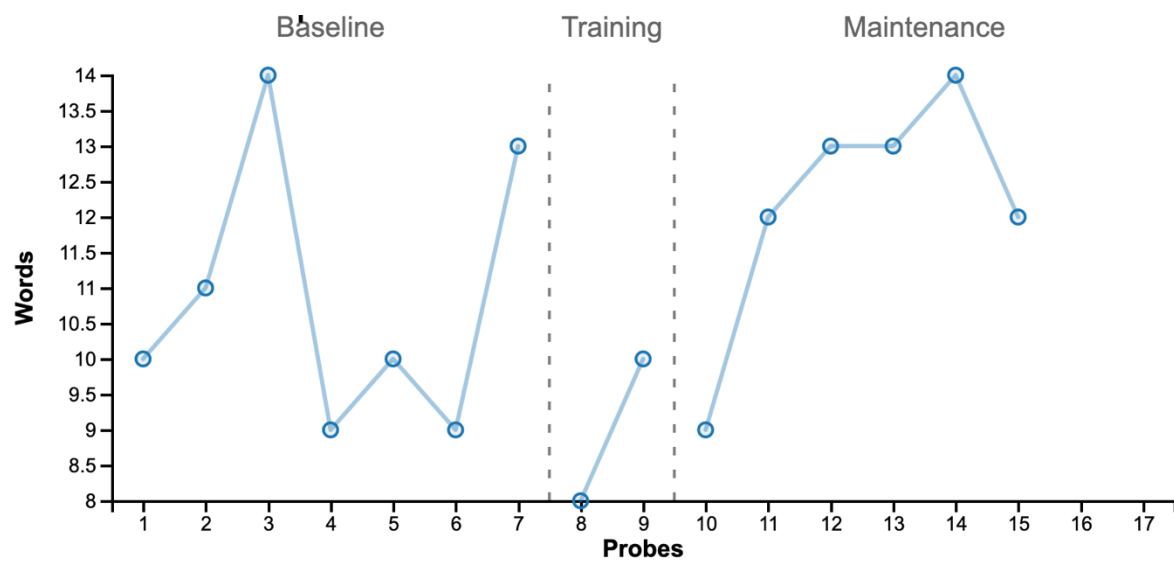
Figure 12. Stress Sequence Probe Sessions for Participant 5.
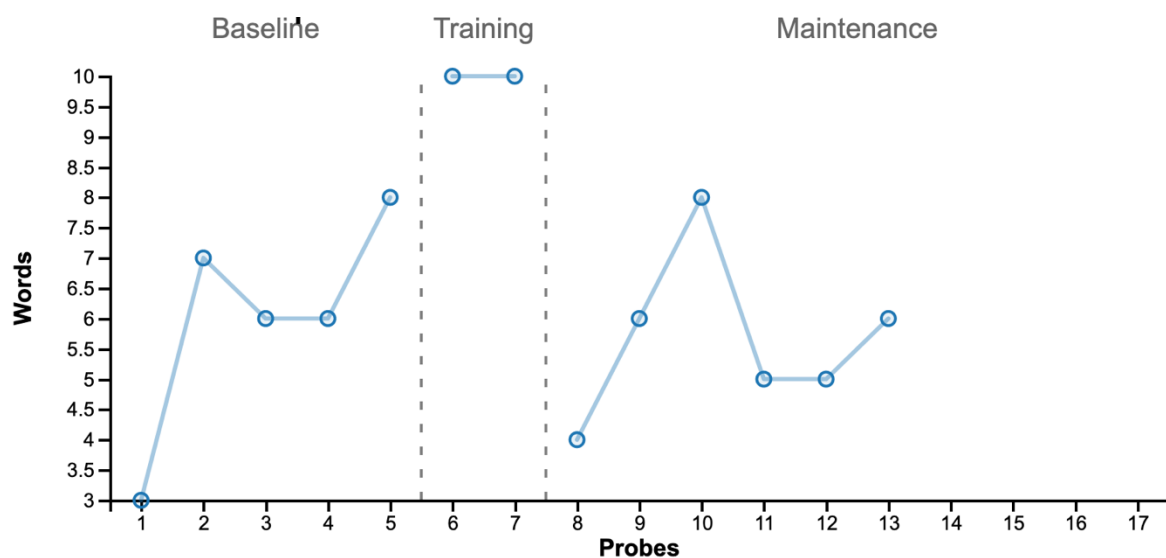
Figure 13. Stress Sequence Probe Sessions for Participant 6.
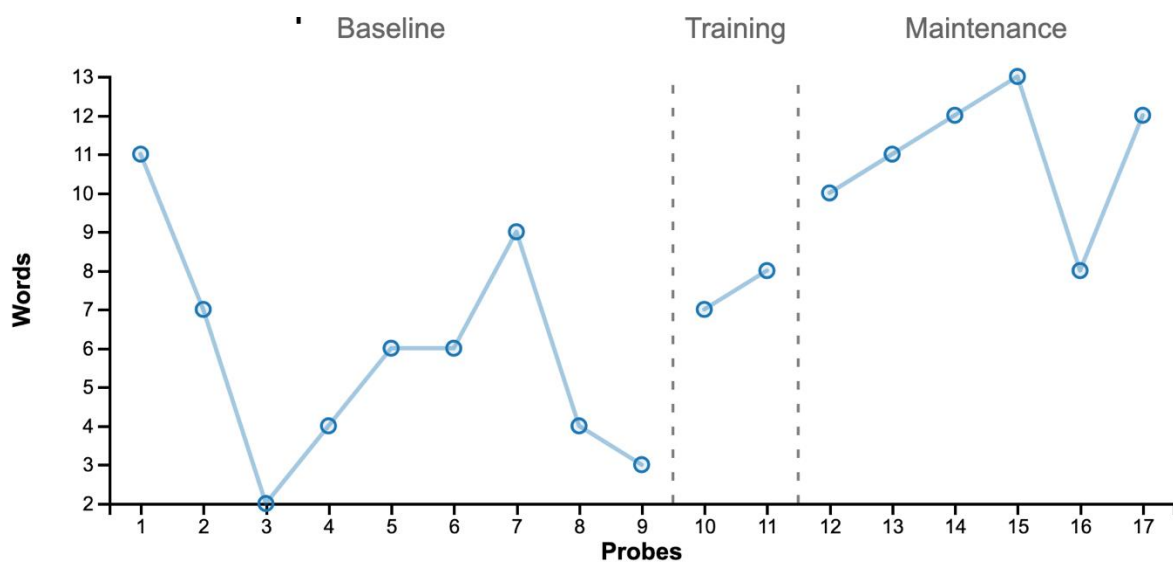
Figure 14. *Stress Sequence Probe Sessions for Participant 7.*
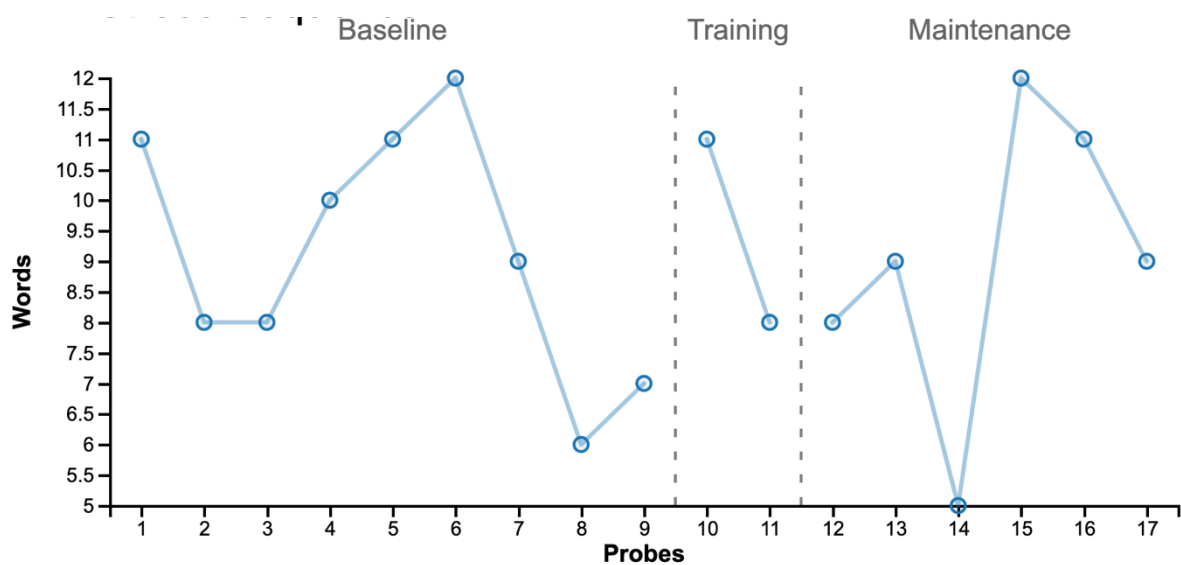
Counting Sounds Probe Sessions:

Figure 15. *Counting Sounds Probe Sessions for Participant 1.*
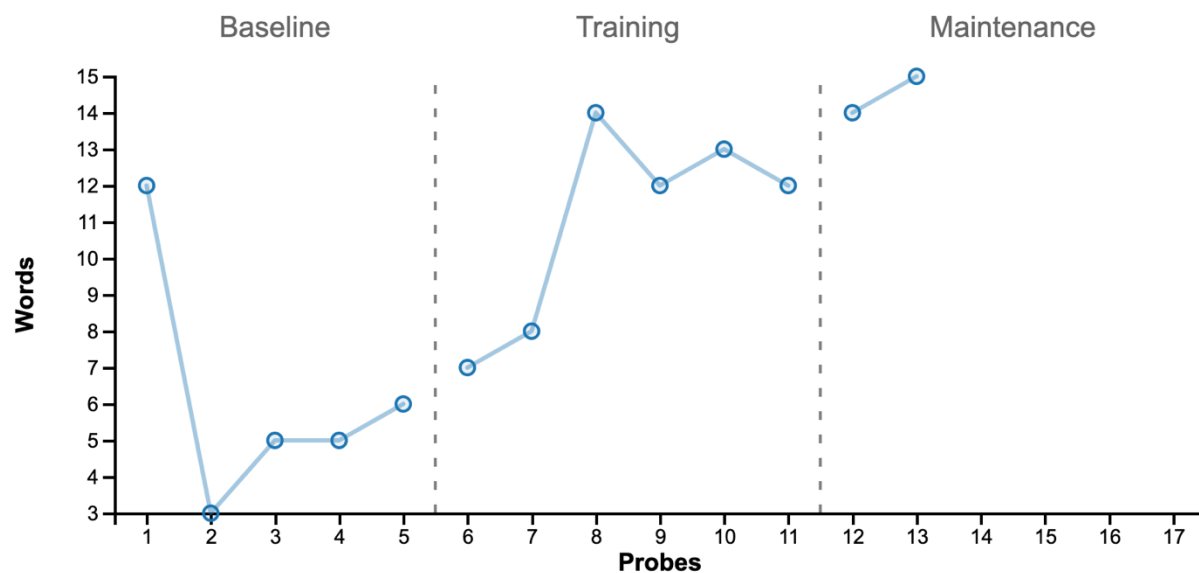
Figure 16. Counting Sounds Probe Sessions for Participant 2.
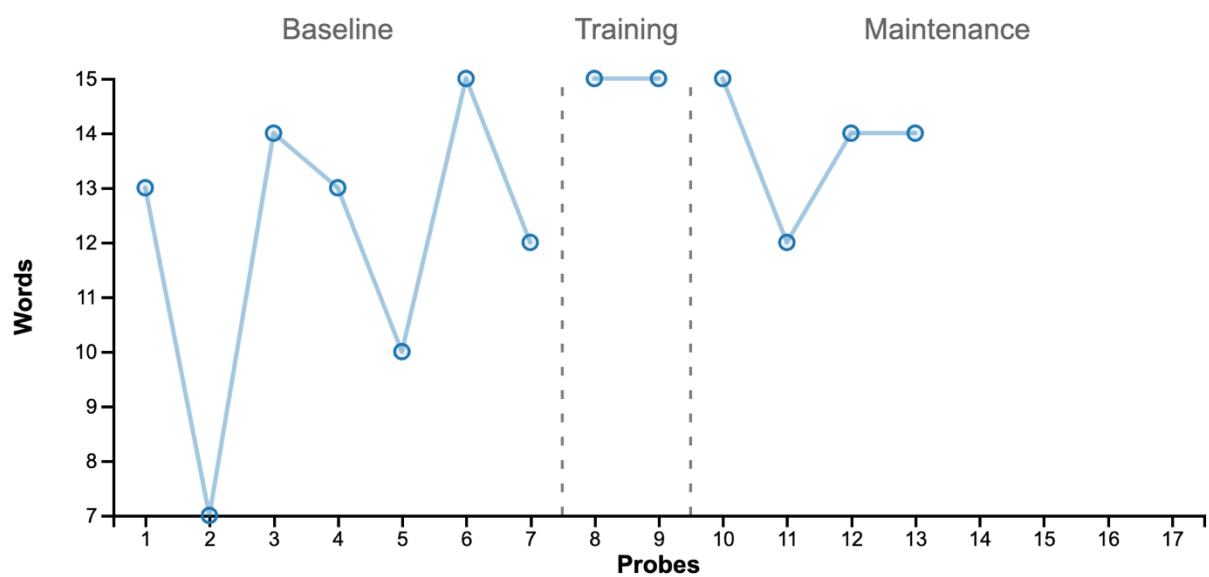
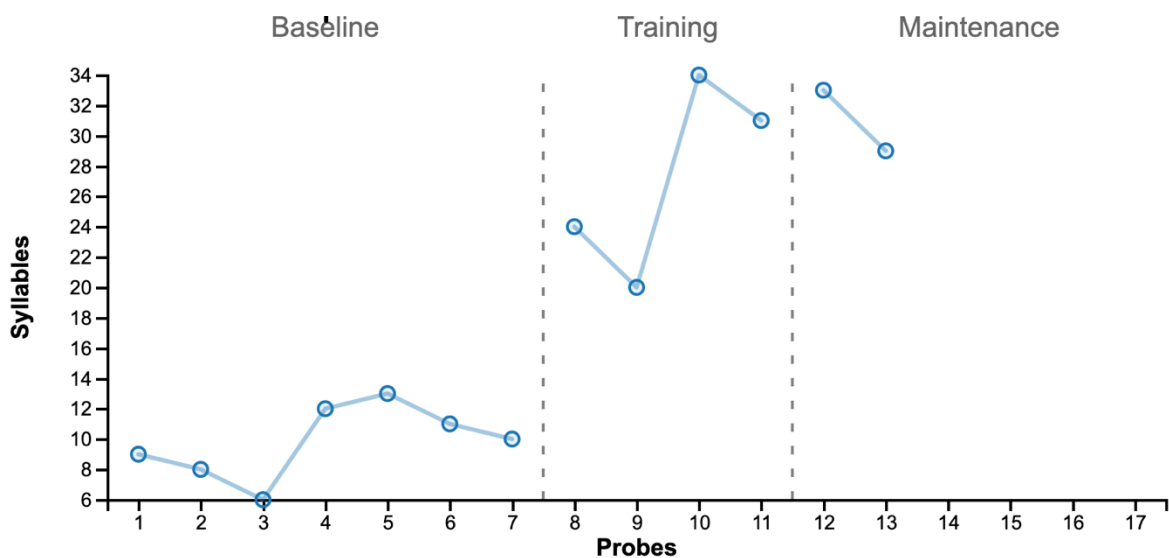*Figure 17.* *Counting Sounds Probe Sessions for Participant 3.*
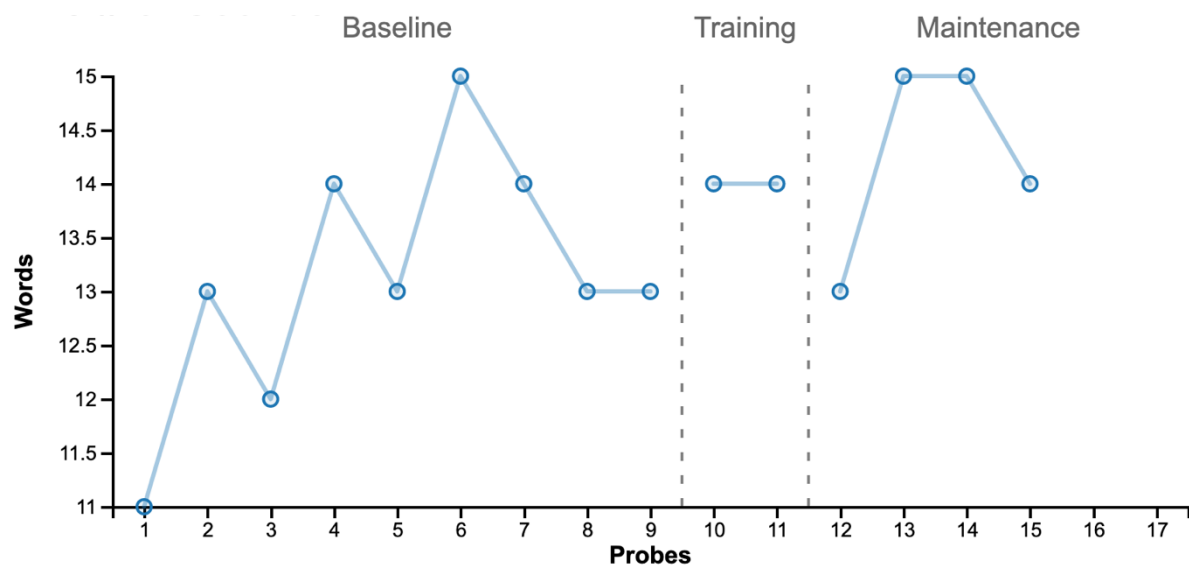
Figure 18. Counting Sounds Probe Sessions for Participant 4.
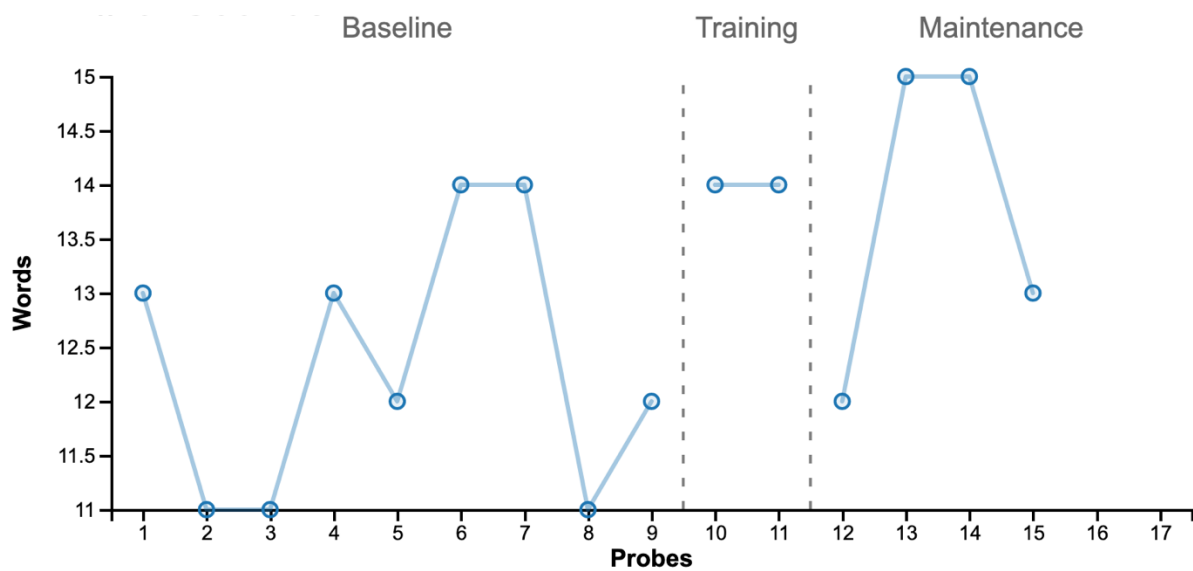
Figure 19. Counting Sounds Probe Sessions for Participant 5.
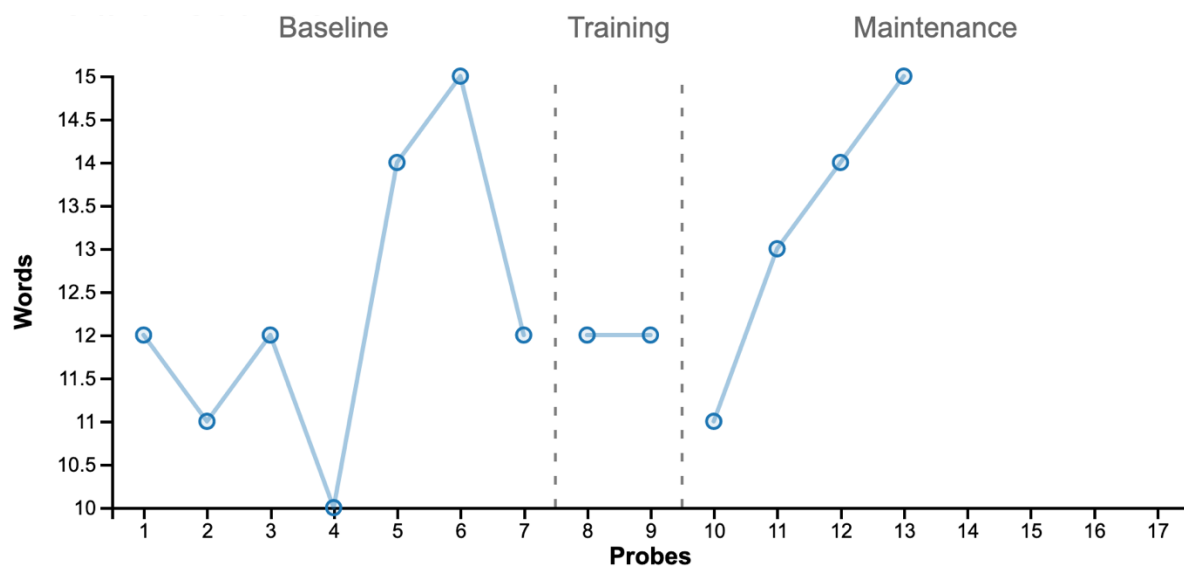
Figure 20. *Counting Sounds Probe Sessions for Participant 6.*
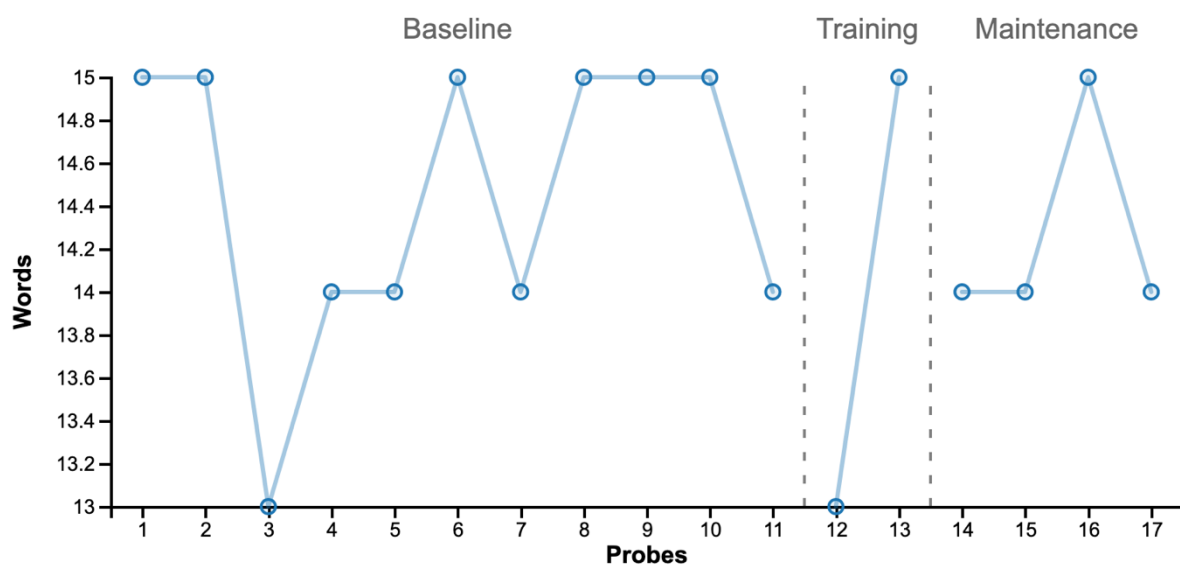
Figure 21. *Counting Sounds Probe Sessions for Participant 7.*
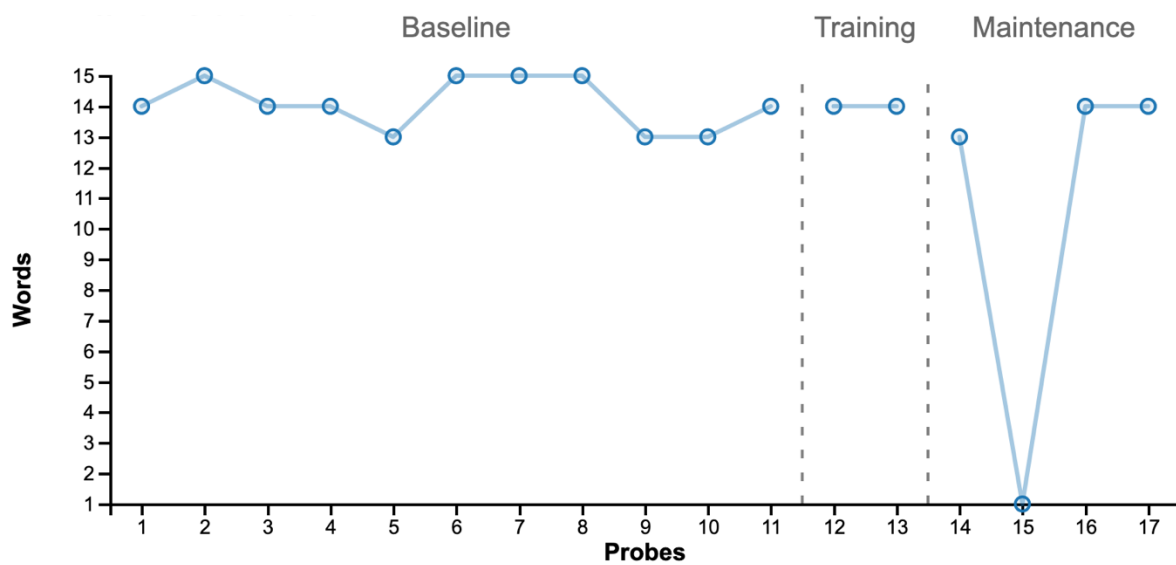
IPA Transcription Probe Sessions:
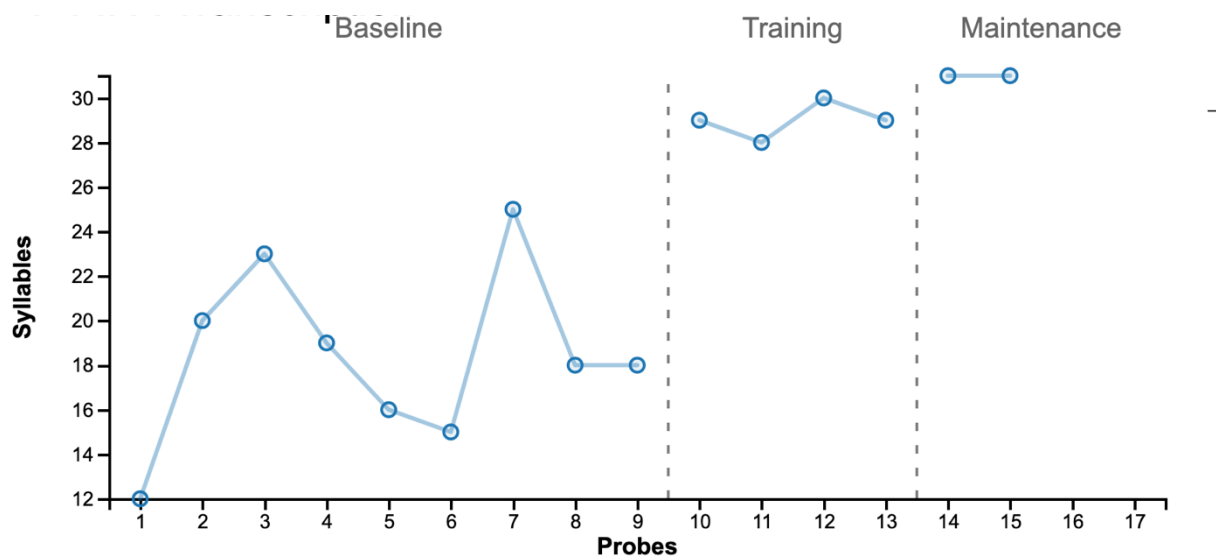
Figure 22. IPA Transcription Probe Sessions for Participant 1.
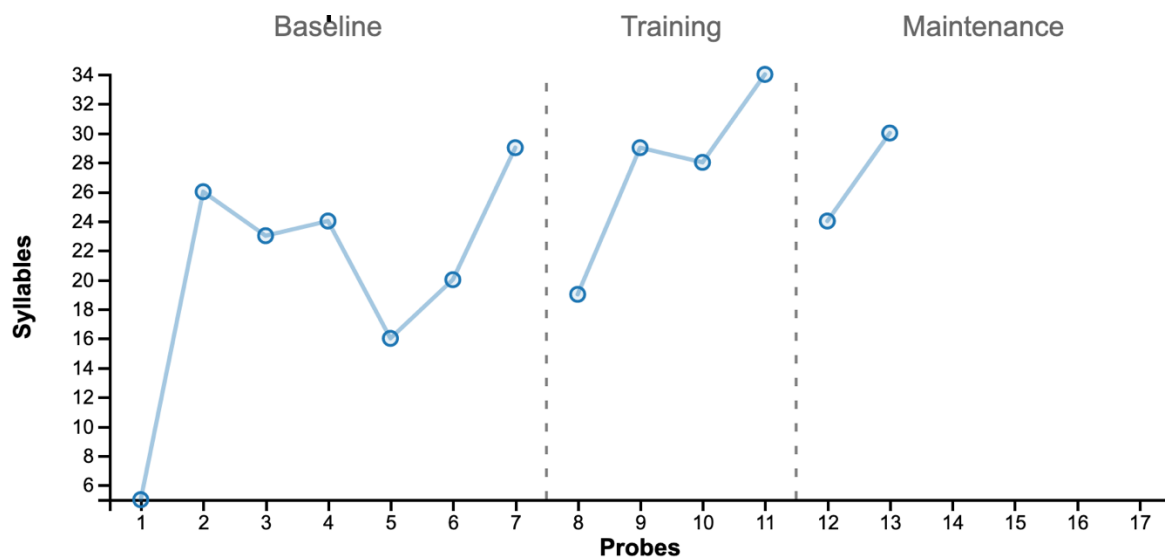
Figure 23. IPA Transcription Probe Sessions for Participant 2.

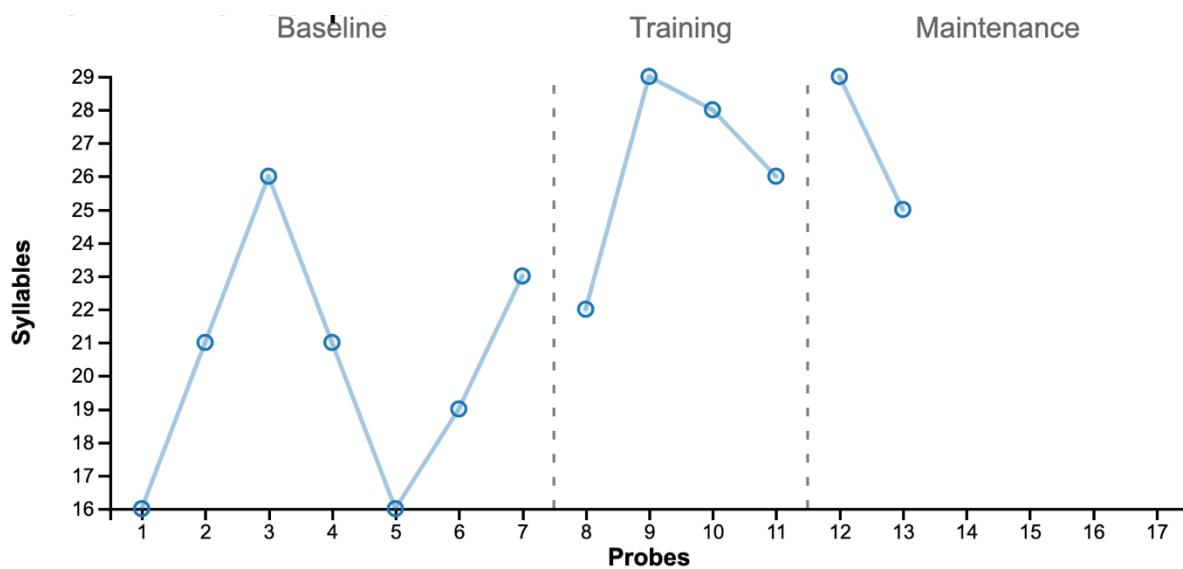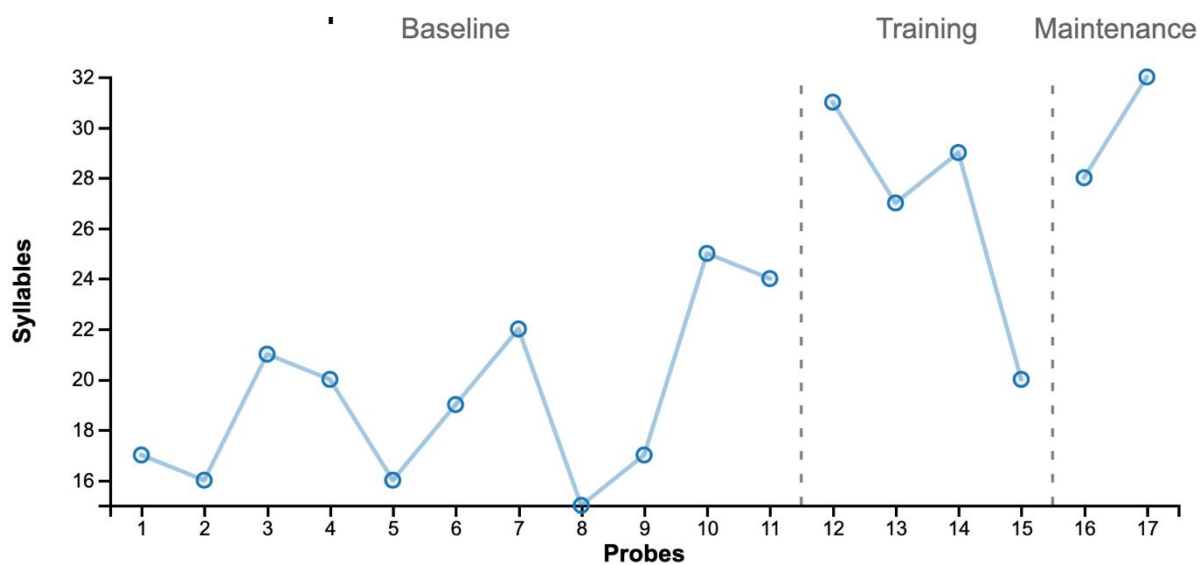*Figure 24.* IPA Transcription Probe Sessions for Participant 3.
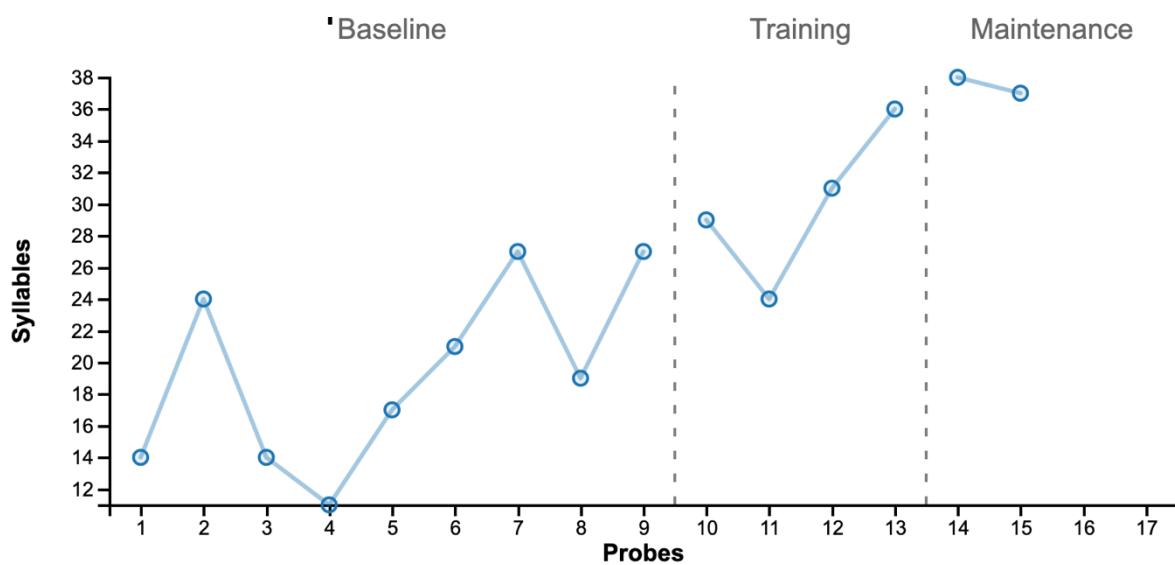
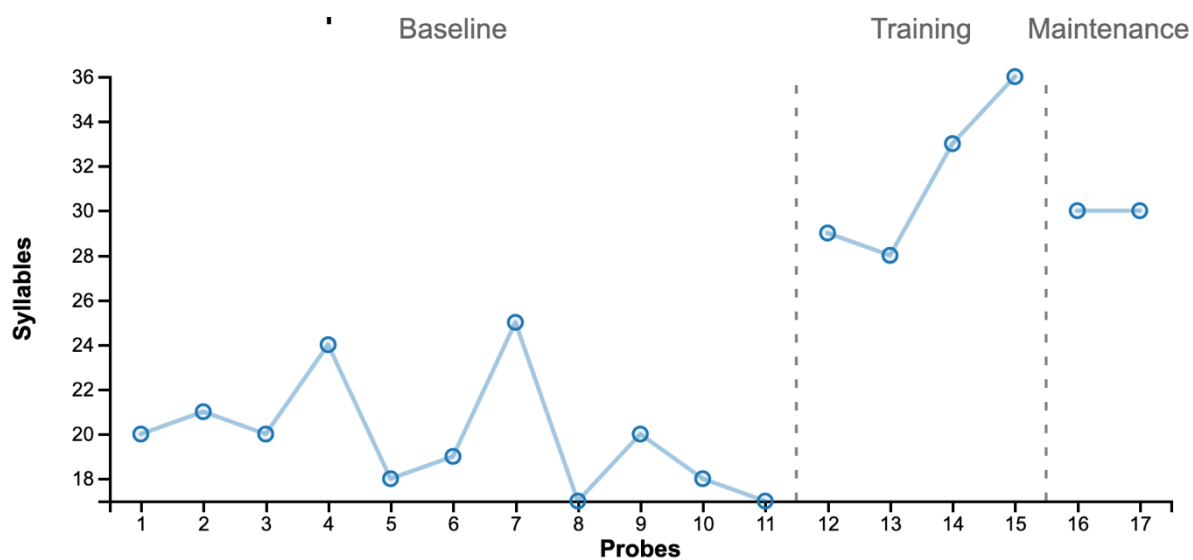*Figure 25.* IPA Transcription Probe Sessions for Participant 4.

Figure 26. IPA Transcription Probe Sessions for Participant 5.

Figure 27. IPA Transcription Probe Sessions for Participant 6.

Figure 28. IPA Transcription Probe Sessions for Participant 7.

Appendix A:
Data collection sheet utilized by participants during the study for baseline, training, and maintenance probes.

Participant # _____ Date: _____ Probe # _____ B: _____T: _____M:_____

IPA Transcription	Word	Syllable Boundaries example: ca.sa	Stress Sequence s= strong w= weak example: w-w-s	# of Sounds

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