NORTHERN ILLINOIS UNIVERSITY

Examining the Efficacy of Computerized Treatment Options for Aphasia

A Thesis Submitted to the

University Honors Program

In Partial Fulfillment of the

Requirements of the Baccalaureate Degree

With Upper Division Honors

Department Of

Health and Human Sciences

By

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DeKalb, Illinois

December 2012

University Honors Program

Capstone Approval Page

Capstone Title (print or type)

Examining the Efficacy of Computerized Treatment Options for Aphasia

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Date of Approval (print or type) 1/11/13

HONORS THESIS ABSTRACT
THESIS SUBMISSION FORM

AUTHOR: Griselda Gomez

THESIS TITLE: Examining the Efficacy of Computerized Treatment Options for Aphasia

ADVISOR: Jaime Mayer

ADVISOR'S DEPARTMENT: College of Health and Human Sciences

DISCIPLINE: YEAR: 2012

PAGE LENGTH: 15

BIBLIOGRAPHY:

ILLUSTRATED:

PUBLISHED (YES OR NO): No

LIST PUBLICATION:

COPIES AVAILABLE (HARD COPY, MICROFILM, DISKETTE):

ABSTRACT (100-200 WORDS):

Computerized treatment protocols for aphasia are becoming more widely available, but their efficacy remains to be established. Toward this aim, as part of a larger, single-subject, multiple-baseline study, an individual with aphasia was asked to work 60-90 min/day independently on a commercially available, computerized aphasia

Abstract:

Computerized treatment protocols for aphasia are becoming more widely available, but their efficacy remains to be established. Toward this aim, as part of a larger, single-subject, multiple-baseline study, an individual with aphasia was asked to work 60-90 min/day independently on a commercially available, computerized aphasia treatment program, with weekly probes examining three specific language skills: (1) verbal expression, (2) memory/auditory comprehension, and (3) reading.

Introduction:

A medical condition identified as aphasia could be defined as an impairment of the cognitive system that specifically affects the areas of the brain that serve to comprehend and formulate language to communicate, while leaving intact the abilities of all other areas under the jurisdiction of the cognitive system (Davis, 2007). Aphasia is known to occur due to damage or injury to the brain; most commonly caused by a stroke. The American Speech and Hearing Association (ASHA) suggests that once a patient is diagnosed with aphasia, a speech-language pathologist may begin to assess the patient's aphasic communication impairment to create a patient-specific treatment program that would aid in regaining or creating compensatory strategies for the language and communication skills that were affected as a result of the injury to a specific language area of the brain (DeRuyter, Fromm, Holland, Stein). ASHA also states that speech-language pathologists may consider exercises such as naming objects, following direction, and answering comprehension questions as part of their treatment program for their patients ("Aphasia: Benefits of,").

A study conducted with 120 aphasia patients showcased a significantly greater improvement in patients that were exposed to aphasia treatment for 8-10 hours each week for 12 weeks than patients who were not treated (Wertz, Weiss, Aten, Brookshire, Garcia-Bunuel, Holland, Kurtzke 1986). In an ideal world, every patient diagnosed with aphasia would be provided with an appropriate amount of hours in a week and the appropriate amount of weeks to aid him/her in treating the onset of symptoms triggered by his/her brain injury. Unfortunately, this is not the case for many patients diagnosed with aphasia. As a newsletter published by the National Aphasia Association states, usually, patients only receive reimbursement for their speech-language therapy for the first months and for only 2-3 times a week after their diagnosis. After a patient's reimbursement period has ended, the patient or his/her family members would have to seek less expensive treatment alternatives or stop treatment all together (Klein, 2009). An alternative treatment option that has emerged and progressed over the past 31 years to serve as an affordable aphasia treatment alternative that could potentially be acquired via a patient's personal computer is known as *Parrot Software* ("About parrot software,"). The software's website states that the software is often recommended by clinicians to their clients because it contains over 100 programs designed to aid in the rehabilitation of a person's speech, language, memory, and motor functions to reestablish their communication skills. With the ease of access to this software, and because of its affordable price, in theory, a patient could use this software to achieve the adequate amount of therapy needed for proper rehabilitation; unfortunately, there is limited research available to provide evidence towards the efficacy of this software.

Given the known constraints in healthcare dollars in conjunction with neuroplasticity research demonstrating the wide range of recovery options possible following stroke or brain injury, a number of individuals with chronic, neurogenic communication disorders have turned to

alternative treatment options, such as computerized exercises, to supplement traditional speech-language therapy or following discharge from such treatment. Therefore, the purpose of this study was to examine the efficacy of the *Parrot Software* program, with respect to effecting change in expressive and/or receptive language skills, for Dxx, an participant with chronic aphasia. As part of a larger, single-subject, multiple-baseline study, Dxx was instructed how to use the *Parrot Software* program and to complete the program for 60-90 min/day independently over a period of 23 weeks. Treatment effects were monitored via (1) pre- versus post-treatment testing, and (2) weekly probes examining three specific language skills: (a) verbal expression, (b) memory/auditory comprehension, and (c) reading.

Methods:

Sampling

For this study, the individual was selected by contacting local speech-language pathologists and giving them information about the study as well as potential participant criteria. The speech language pathologists were asked to share information about the study with past or current patients whom they felt fit the criteria. Interested individuals were instructed to contact the investigator directly. The criteria needed for an individual to be eligible to become a participant included: prior diagnosis with aphasia, basic computer/internet function, and availability to interact with the software on a daily basis, as well as, attend weekly assessment sessions.

Instrumentation

The baseline assessment instruments were chosen to detect the presence of aphasia and measure the language functioning of the individual to determine the individual's degree of aphasia. The instruments used were: Western Aphasia Battery, Boston Aphasia Examination,

Test of Nonverbal Intelligence, and the Communication Activity Log self-assessment test. The weekly assessment instruments were designed to measure the individual's software efficacy after exposure to the software. The pre-treatment instruments were also used as post-treatment instruments to measure the individual's response to the treatment. The instrument analyzed the participant's verbal expression, memory and auditory comprehension, and reading and spelling.

Probes

Response to treatment could be determined in a variety of ways, including measuring accuracy levels within treatment sessions, and administrating the baseline assessments at the end of the treatment to determine the efficacy of the treatment. The participant's verbal expression was measured by giving the participant a set of ten Webber Photo Cards (one at a time) and asked to explain the image. The participant's responses were recorded through an on-line transcription where the researcher would write down the responses verbatim. The participant's responses were analyzed by calculating the following: total number of words produced, total number of Correct Information Unit (CIU), total number of words produced, and the Mean Length of Utterance (MLU).

The participant's memory and auditory comprehension were assessed by giving the participant four-step directions that consisted of pair and directional instruction using picture cards. The participant would then need to retain and reproduce the directions using picture cards that had been laid out on a table. The participant was given a total set of four, four-step directions, to assess memory comprehension and a total set of four, four-step directions to assess auditory comprehension. The assessment was scored by giving the participant a point for correct pairs and a point for correct direction reproduction.

Reading and Spelling scores were determined by using the book "Nonfiction Reading Practice Grade 3." The participant was asked to read a passage from the book aloud and then answer comprehension questions corresponding to the passage. Reading errors were noted and scored to determine the participant's percent of correct decoding and comprehension.

Implementation

A six month *Parrot Software* exposure approach was implemented by giving the participant access to the *Parrot Software* program. This approach allowed for the participant to, independently, work on the software at his own pace and during allotted time which he had chosen to best fit his schedule. The participant was asked to work on the predetermined programs for at least 60-90 min/day. The six month exposure to the software was separated into three sections in order for the researcher to analyze the three language areas: verbal expression, memory/auditory comprehension, and reading. The first seven weeks were focused on verbal expression. During this time, the individual was asked to focus on the following *Parrot Software* programs: "Multiple Meaning Words I," "Multiple Meaning words II," and "Verbal analogies." The Multiple Meaning Word consisted of the participant choosing appropriate homographs and homophones to fit the given sentence. The "Verbal Analogies" program consisted of the participant choosing from a set of five words that would best complete the given analogy.

For the following three weeks, the participant was asked to complete the "Remembering Written Directions" and "Remembering Spoken Directions programs" from the software. The Remembering Written Directions program consisted of the participant reading a set of directions, then reproducing the directions indicated by moving the object to the correct place on the screen. The directions provided by the program were to be retained and then performed by the

participant. Similarly, for the Remembering Spoken Directions, the participant was to listen to a set of directions, then reproduce the task by retaining the information provided.

The final program that the participant was asked to work on was chosen to measure the participant's reading and spelling levels. The program the participant worked on was the "Open Definitions" program which consisted of giving the participant a definition of a word, and then having the participant type in the word that he believed was being described.

Results

Baseline assessments

The participant was given a self-evaluation questionnaire known as the Communicative Activity Log (CAL) to obtain information about the participant's quality and amount of communication in everyday life. The test addresses speech output and language comprehension while monitoring speech acts and features of communicative behavior. Prior to beginning the *Parrot Software* treatment, the participant scored a 33 for his perspective of his quality of communication, and a 39 for his quantity. After treatment, the participant scored a 36 for his quality of communication score and a 49 for his quantity of communication score (See Figures 1 & 2).

The Test of Nonverbal Intelligence 3 (TONI-3) is a language-free measure of intelligence, aptitude, abstract reasoning, and problem solving. The participant's total raw score was a 19 during baseline assessment. His score is found under the 12-13th percentile rank, according to the TONI-3 test manual. The participant's score increased to a 26 during post-treatment assessment; the final score is also included in the 12-13th percentile rank (See Figures 1 & 2).

Based on the performance of the baseline measures for the Western Aphasia Battery, the participant's aphasia quotient was at a 86.7%, this score was obtained by adding the participant's performance in the following subsets of the test: spontaneous speech, comprehension, repetition, and naming. The participant's score is proportional to the severity of aphasia regardless of type or etiology; thus, the participant's score represents the participant to be under the "mild aphasia" category. The participant scored a 24 out of the 34 possible points for the writing subset of the test. For the reading portion of the test, the participant scored 88 points out of 100 (See Figure 1).

Improvement is visible in the participant's performance during the post-treatment administration of the test. Although the participant remains under the "mild aphasia" category based on the scoring standards of the Western Aphasia Battery, the participant's aphasia quotient increased by 8.6 points. Both of the participants's reading and writing score increased by four points during the second administration of the test (See Figure 2).

The participant was also given the Boston Diagnostic Aphasia Examination, a test that evaluates the language skills of an individual based on perceptual modalities, processing functions, and response modalities. For the purposes of this study, the following subtests of the exam were evaluated: written picture naming, cognitive/grammatical influences on written word-retrieval and narrative discourse. During the baseline testing, the participant scored at a 75% on the written picture naming subtest, 83% on the cognitive/grammatical influences on written word retrieval and narrative discourse, and a 50% on the narrative discourse portion. During the post-treatment assessment, the participant's scores visibly improved because the individual scored a 100% on the written picture naming subtest, 96% on the cognitive/grammatical influences on written word retrieval and narrative discourse, and a 57% on the narrative discourse portion (See Figures 1 & 2).

Baseline Assessments

CAL scores		
	Quality of communication	33
	Amount of communication	39
TONI-3		
	Total score	19
Western Aphasia Battery		
	Spontaneous speech	15
	Comprehension	9.25
	Repetition	9.4
	Naming	9.7
	Aphasia quotient	86.7
	Reading	84
	Writing	24
Boston Diagnostic Aphasia Exam		
	Written picture naming	75%
	Cognitive/Grammatical Influences on Written Word-Retrieval	83%
	Narrative discourse	50%

Figure 1

Post treatment testing (November)

CAL scores		
	Quality of communication	36
	Amount of communication	49
TONI-3		
	Total score	26
Western Aphasia Battery		
	Spontaneous speech	15
	Comprehension	9.85
	Repetition	9.7
	Naming	9.1
	Aphasia quotient	95.3
	Reading	88
	Writing	28
Boston Diagnostic Aphasia Exam		
	Written Picture naming	100%
	Cognitive/Grammatical Influences on Written Word-Retrieval	96%

	Narrative discourse	57%

Figure 2

Weekly Probe Results

The weekly probes were created to analyze the individual's performance after the treatment exposure in the following language areas: verbal expression, memory/auditory comprehension, and reading. The results of the participant's performance in the weekly probes testing the participant's verbal expression levels demonstrated a 10.7 point increase from initial assessment implementation to the final assessment. The 10.7 point increase is seen after assessing the participant's production of Correct Information Unit (CIU). As seen in Figure 3, outliers were removed based on their deviation from the norm. The participant demonstrated steady increase in CIU production performance throughout the weekly probes that were administered during the treatment.

To further establish how the participant's verbal expression had been affected by the treatment, the participant's Mean Length of Utterance was also measured. Figure 4 demonstrates how the participant showed steady MLU production throughout the seesions, except for session's number five and six where the participant visibly increased his MLU score from a 1.13 to a 1.54. It is also important to note that during session number 7, the participant's MLU decreased by 0.42 points.

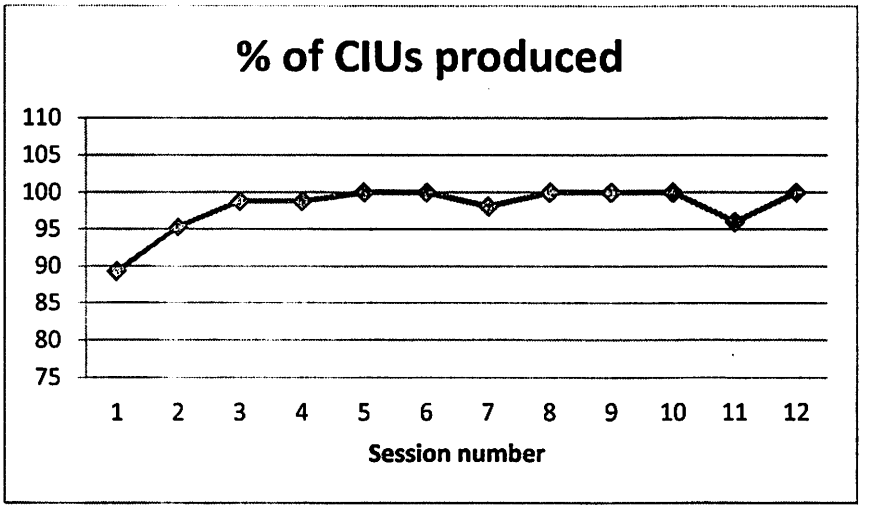

Figure 3

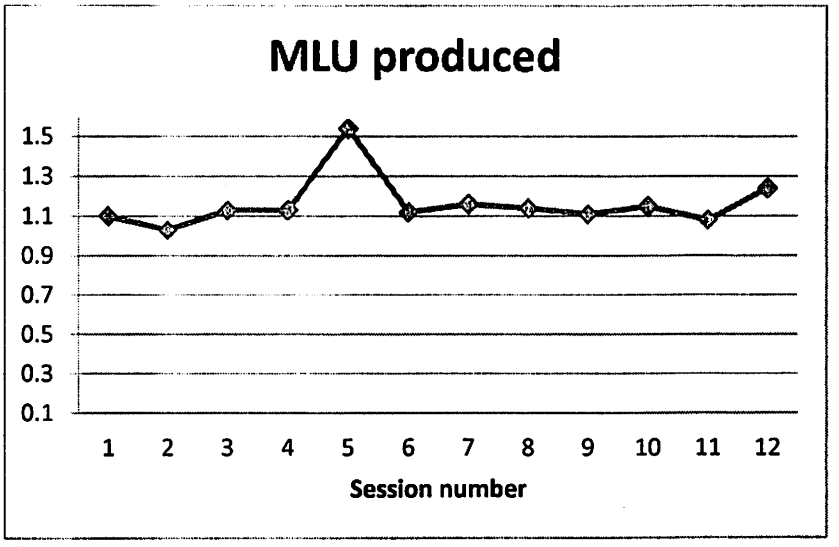

Figure 4

The participant's memory and auditory comprehension performance scores seemed to have fluctuated throughout the sessions. However, as Figure 5 shows, the participant's written percentage score began at a 31.3% and then increased to a 81.3% for the final session. It was also noted that in sessions two through seven, the participant demonstrated gradual increase in written percentage correct scores by scoring a 12.5% for the first session and then scoring an 81.3% for the seventh session. After the seventh session, his score decreased to a 59.4% and then began to fluctuate throughout the remaining sessions.

The participant's auditory percent correct also fluctuated throughout the sessions, causing his scores to display sporadic increase and decrease in performances. The participant scored a 31.6% for the first session and concluded with 87.5%. Although the participant did not score below the initial probe results, as Figure 6 demonstrates, there were sessions in which participant would score below previous sessions.

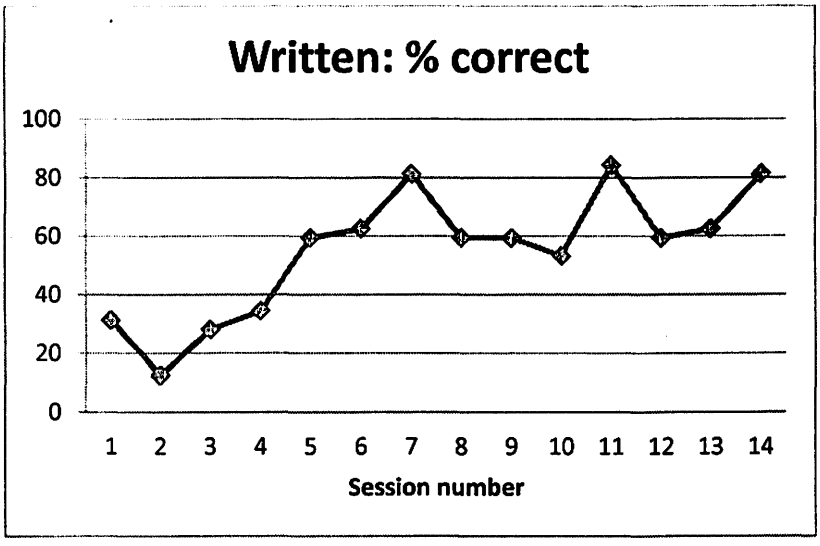

Figure 5

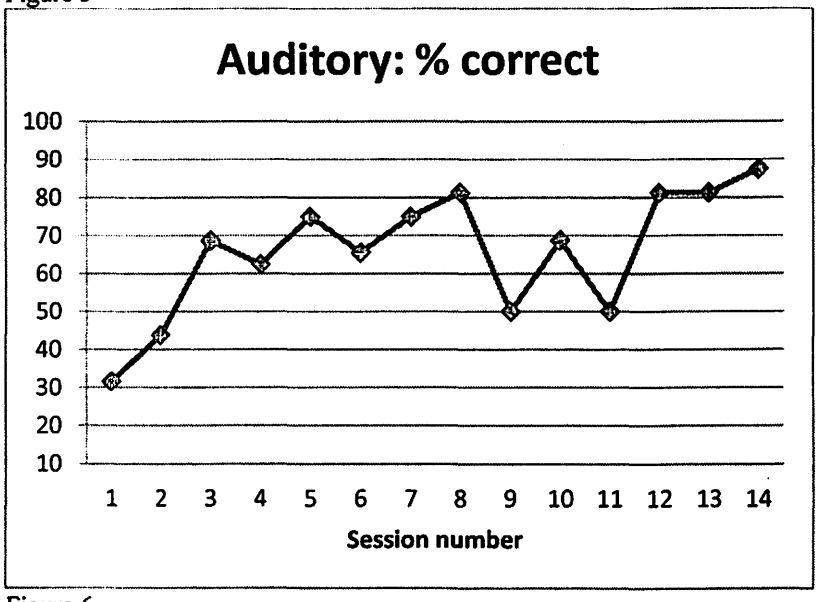

Figure 6

The weekly probe results tested the participant's percentage correct decoding. Outliers were removed from the participant's reading score based on their deviation from the norm.

However, based on the weekly probe results, the participant did not demonstrate visible progress when assessing the participant's percentage in correct decoding (Figure 7). Also as seen in Figure 8, the participants oral reading speed did not show improvement with exposure to the *Parrot Software.*

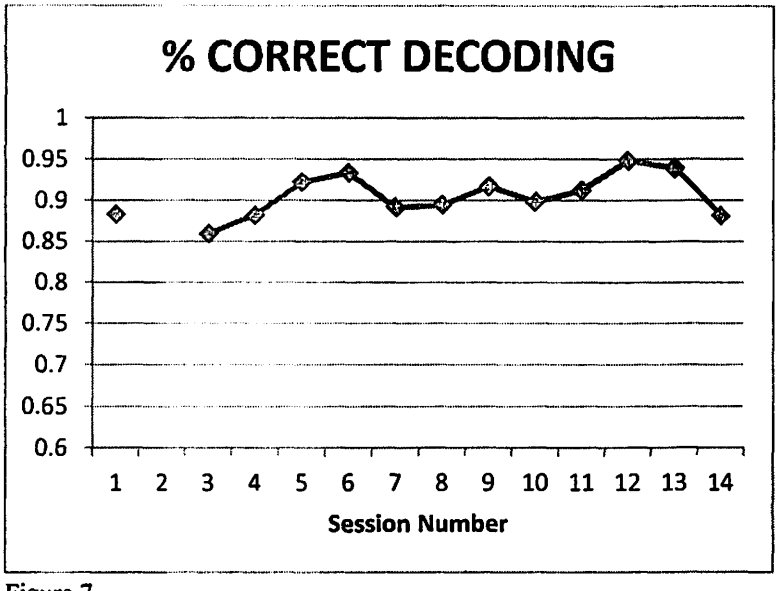

Figure 7

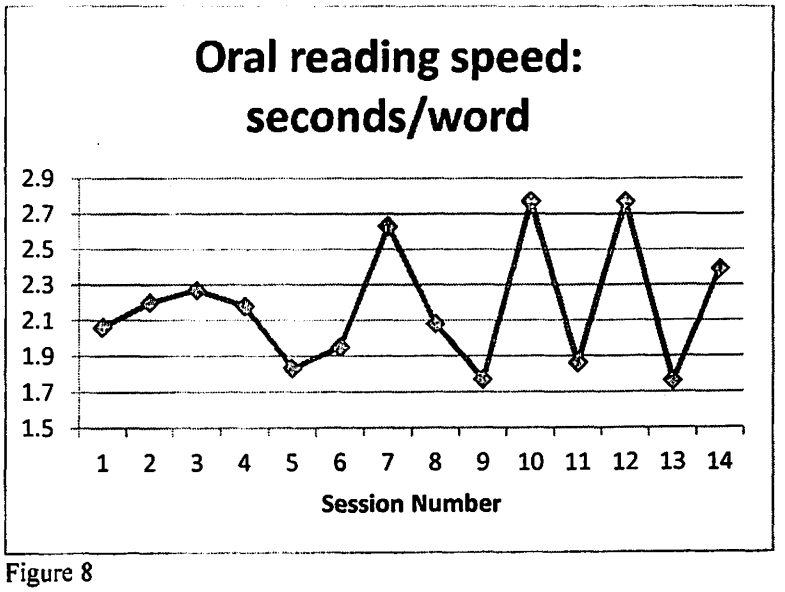

Figure 8

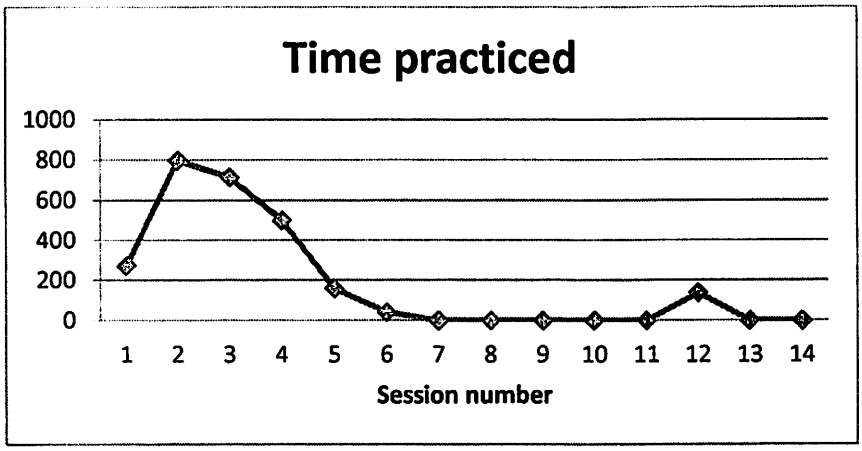

Figure 9

Discussion

The results of this study do not provide absolute indication about the *Parrot Software*'s efficacy. The study investigated the participant's expressive and receptive language after exposure to the software and found that the participant demonstrated modest improvement in his production of CIUs and in the areas of auditory and written comprehension.

Although the participant demonstrated an increase in assessment performance for the standardized tests (Western Aphasia Battery, Boston Aphasia Examination, Test of Nonverbal Intelligence, and the Communication Activity Log self-assessment test) there is not enough evidence available to correlate the participant's scores to the treatment. As Figure 9 demonstrates, the lack of evidence occurred due to the fact that the participant did not demonstrate the adequate exposure to the *Parrot Software* that was needed to determine the efficacy of the program. The study suggest that further testing of the alternative treatment option, *Parrot Software*, is necessary to determine the program's capability to produce an effect on people diagnosed with aphasia.

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