

# Behaviorally-Oriented Intensive Aphasia Program: Collaboration Leads to Optimal Outcomes

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## ABSTRACT

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Aphasia is an acquired disorder affecting all language components across modalities. While common therapeutic approaches can result in some improvements, multiple studies establish that intensive therapeutic interventions are most effective; however, these approaches are not well defined. In addition, behaviorally-oriented approaches have been shown to be effective for other conditions, but have not yet been introduced to the treatment of aphasia. The purpose of the current study was to examine the efficacy of a novel, behaviorally-oriented, intensive communication intervention for aphasia (BICA) designed by a speech-language pathologist (second author) and a Board Certified Behavior Analyst (first author) for a 71-year-old woman with post-stroke aphasia. Using a case study design, the participant was provided with 12 hours/week of therapy for 12 weeks focusing on functional communication goals using a behavioral interpretation of language and stimulus control transfer procedures. The behavior analyst determined conceptually systematic interventions based on targets selected by the speech-language pathologist. The participant demonstrated substantial improvements in written language expression and comprehension, reading fluency, oral language expression, naming, and improved quality of life. Given the substantial gains the participant made in oral and written language post-stroke using the BICA therapy, further study is warranted.

**KEYWORDS:** aphasia, collaboration, intensive, language, verbal behavior

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**Learning Outcomes:** As a result of this activity, the reader will be able to (1) describe how speech-language pathologists and Board Certified Behavior Analyst can collaborate in providing effective aphasia therapy; (2) define stimulus control transfer procedures and how they can be used in language therapy; (3) contrast the different approaches to aphasia therapy (i.e., 1:1, group, intensive) and the challenges and benefits of each type.

## BACKGROUND

Worldwide, stroke is the leading cause of adult disability, with aphasia being one of its common, life-altering outcomes. Aphasia is a communication impairment that can affect all language components (phonology, morphology, syntax, semantics, and pragmatics) across modalities (speaking, reading, writing, and listening), and research has shown that one in every three stroke survivors has symptoms of aphasia.<sup>1–3</sup> Aphasia significantly impacts quality of life (QOL), limiting the ability to convey feelings of pain, hunger, and depression or to express desires, needs, or thoughts. The resulting isolation may be further heightened when others assume that the person with aphasia is not competent or simply has nothing to say.

Given both the prevalence of aphasia and its impact, effective therapy is essential. Improvements in communication skills have been shown to lower frustration and depression among individuals with aphasia and to decrease caregiver burnout.<sup>4</sup> However, there are specific deficits in aphasia therapies that must be addressed if treatment is to significantly improve the QOL for those with aphasia and their communication partners.

Currently, aphasia therapy falls into one of three categories: community aphasia programs, one-to-one speech-language therapy, and intensive aphasia programs. While each offers unique benefits to the client, each has shortcomings and/or barriers that limit their ability to reduce symptoms of aphasia.

When available, community aphasia programs offer individuals the opportunity to engage in functional conversation with fellow stroke survivors. Such programs are generally seen as maintenance programs; though they are integral in aiding post-stroke individuals to reintegrate into their community and build a support network, they are not sufficient to reduce the symptoms of aphasia. Some individuals with aphasia may receive direct one-to-one therapy

with a speech-language pathologist (SLP). Traditionally, one-to-one therapy is offered 1 to 2 hours a week, which, researchers have shown, is not sufficient<sup>5</sup> and typically results in no additional functional language recovery beyond what can be achieved with spontaneous recovery.<sup>4</sup>

Intensive aphasia programs are traditionally facilitated by SLPs and some may also include collaboration with other professionals such as an occupational therapist or a social worker, though this is rare. These programs involve abundant practice and repetition, applying principles of neural plasticity, and studies have shown that they are more likely to result in communication improvements after brain injury.<sup>5</sup> Researchers have shown that functional communication delivered at higher intensities (i.e., 10 or more hours a week) can significantly improve communication abilities.<sup>6,7</sup>

Intensive programs should take a holistic approach, targeting a combination of impairment-based, function-based, and activity-based skills.<sup>5</sup> Such programs should address all domains of the International Classification of Functioning, Disability, and Health (ICF)<sup>8</sup> including reduced participation in communication and community involvement, as well as incorporating the client's needs and values. Despite indications supporting intensive therapy, the optimal dose, frequency, form, and duration are yet to be defined due to disparities in research methodologies.<sup>9</sup> Moreover, such program elements would benefit from professional skills that complement those of the SLP. While interprofessional practice is now the recommended and accepted standard of care following a stroke,<sup>10</sup> collaboration across professions has yet to be introduced into most intensive aphasia programs.

## Interprofessional Collaboration

Given the growing number of studies showing the benefits of interprofessionalism as part of

various treatment modalities, in the next section, we explore the ways in which this approach can improve the effectiveness of intensive aphasia programs. Interprofessionalism is a process undertaken by professionals from different disciplines who establish a foundation of shared values, ethics, and standards, to effectively engage in collaborative practice.<sup>11</sup> Interprofessional collaboration in rehabilitation has been associated with several benefits for clients and care providers, including enhanced quality of care, improved client health outcomes, improved work-life of health professionals, stronger partnerships between professionals and their clients, and optimized cost of health care.<sup>12</sup>

Traditionally, intensive aphasia rehabilitation places speech therapy at the forefront, as SLPs have the specific training, skills, and competencies for assessing and treating individuals with aphasia. The SLP can make recommendations for therapy utilizing dynamic assessment, integrating the client's values, and using the best practice recommendations for aphasia therapy. Most SLPs do not, however, have experience treating in an intensive model, nor is the research in intensive SLP rehabilitation conclusive or prescriptive. Incorporating other professionals and interprofessional practice more generally into the intensive aphasia model has the potential to strengthen the experience for the client and the professionals involved.

Board Certified Behavior Analyst (BCBAs) often have extensive experience providing intensive, comprehensive therapy services with a focus on working across many domains simultaneously. Applied behavior analysis (ABA) uses learning theory and principles of operant and respondent conditioning to improve the human condition in ways that can be applied to many populations. While ABA therapy has been shown to be an effective treatment for autism,<sup>13</sup> it can be applied to many populations, including those with aphasia.

Aphasia, as a heterogeneous and often idiosyncratic disorder, requires an individualized process in determining goals and appropriate interventions. Many current SLP practices incorporate behavioral principles in-

cluding the use of single-subject analysis, antecedent manipulations through prompting and modeling, prompt fading through systematic procedures like copy and recall treatment, or melodic intonation therapy, and SLPs could benefit from further professional collaboration to apply these principles effectively. BCBAs are specifically trained on the single case study design, which can be useful when treating conditions like aphasia and evaluating outcomes. BCBAs can add value to interdisciplinary teams because they focus on measurement, can administer and analyze data from the therapeutic assessment process, aid in developing individualized skill acquisition programs, and help determine teaching approaches related to language function, such as the use of verbal operants.

There is overlap in areas of competency between SLPs and BCBAs. Both professionals target socially significant behaviors and functional outcomes, and both are trained to assess and treat receptive and expressive language deficits. In some settings, SLPs and BCBAs have been at odds with one another due to misunderstandings about respective scopes of practice and incorrect stereotypes about each discipline.<sup>14</sup> There are established paths in healthcare by which successful SLP and BCBA collaboration could be supported which involve establishing a foundation of shared values and creating an "inclusive" team culture,<sup>12</sup> while using the strengths of both professions to design a therapy program that is effective and founded on the best available research.

### **Behavioral Interpretation of Aphasia**

Traditionally, SLPs describe the individual's deficits as oral or written language and expression or understanding. Using the expressive/receptive dichotomy to assess and treat aphasia symptoms may not, however, account for all of a person's unique linguistic profile. For individuals with aphasia, it is often not the entire receptive or expressive repertoire that is impacted. In behavior analysis, language is broken down into categories based on its function, called verbal operants, such as requesting (mand), labeling (tact), repetition (echoics), reading (textual), and writing (transcription).

A behaviorally-oriented approach is useful for assessing an individual's expressive and receptive communication, and is also useful when defining precise targets for therapy and developing prompting strategies.<sup>15</sup> The verbal operants<sup>16</sup> provide a framework for more precisely defining language and identifying impairments compared with a topographical approach.

Topographical classifications of language deficits can be useful when describing language impairments but pose challenges in creating an intervention strategy.<sup>15,17</sup> Baker et al<sup>15</sup> offered a behavioral interpretation of aphasia that focused on observed deficits and therapy to remedy those deficits. Importantly, a functional approach to language allows clinicians to describe areas of strengths and deficits precisely, enabling them to develop individualized, effective treatment programs for individuals with heterogeneous conditions like aphasia.

By assessing a skill across verbal operants, clinicians are able to identify which operants are preserved (strong) and which operants are impaired (weak) and determine appropriate prompts and teaching strategies. In an overview of cueing hierarchies, Patterson<sup>18</sup> highlighted the importance of utilizing prompts that are appropriate for the individual's specific impairment (e.g., anomia), used in an order most likely to elicit an appropriate response, and combined with carefully selected targets. As such, it seems pertinent to suggest that an individualized assessment based on the verbal operants be conducted prior to therapy to determine which strategy may be the most effective for that individual, rather than applying a prompting hierarchy indiscriminately across clients.

Sidman<sup>19</sup> described aphasia as a "fracturing of stimulus control" meaning that there is a breakdown between the antecedent stimuli that is meant to occasion the response and the person with aphasia's response repertoire.<sup>20,21</sup> For example, a person with aphasia might see a book and say "book." That same person may not be able to ask for a book, or use the word "book" when asked, "what is something you read."<sup>15</sup> In the first example, the stimulus-response relation is intact (i.e., saying "book" when seeing a book), while in the second and third it is fractured (i.e., inability to say the word,

"book" when desired or when asked a question). Stimulus control transfer procedures come from the behavior literature and refer to using prompt fading and prompt delay techniques to improve an individual's skills.<sup>19</sup> In stimulus control transfer procedures, a strong verbal operant is used as a prompt for a weaker verbal operant which is systematically faded over time. Using a behaviorally oriented intensive communication therapy for aphasia (BICA) approach means assessing the skill across verbal operants prior to teaching to determine which operants are strong and which operants are weak (to be addressed in teaching). Once this information has been gathered, an individualized prompting strategy can be created and can guide the clinician in selecting the right approach to treatment.

A recent article by Ritchie et al<sup>22</sup> examined the clinical utility of a functional approach to defining and assessing language for individuals with aphasia. In this study, two stimulus control transfer procedure methods were compared, and the functional approach was shown to be effective and useful. Other studies that focused on the rehabilitation of language for older adults support similar findings, namely that a functional approach to language is effective, useful, and enables clinicians to create an individualized intervention strategy.<sup>22-26</sup>

Overall, a behavioral interpretation of aphasia involves using the verbal operants<sup>15</sup> to address observable deficits in therapy, and the use of stimulus control transfer procedures in teaching. Skinner's<sup>16</sup> *Verbal Behavior* proposed an approach to language based on its function and has been widely adopted in the developmental disabilities' population.<sup>27-30</sup> This approach is underused in the rehabilitation of language for adults with acquired communication disorders, despite their being recent research indicating its utility with heterogeneous conditions such as aphasia.<sup>15,31,32</sup>

## METHODS

In the current study, an adult woman with aphasia participated in a novel BICA program. Through interprofessional collaboration, the program integrated a linguistic model based on topography with a behaviorally oriented

**Table 1 Treatment Schedule for Claire**

	<b>Monday</b>	<b>Tuesday</b>	<b>Wednesday</b>
9:30 AM–12:30 PM	1:1 treatment with supportive personnel	1:1 treatment with supportive personnel	1:1 treatment with supportive personnel
12:30 PM–1:00 PM	Lunch break	Lunch break	Lunch break
1:00 PM–2:00 PM	1:1 SLP treatment	1:1 SLP treatment	1:1 treatment with supportive personnel "life skills"
2:00 PM–2:30 PM	+ 30 min SLP treatment	+ 30 min SLP treatment	

Abbreviation: SLP, speech-language pathologist.

Note: Additional 1-hour of SLP treatment added as per client request; 30 minutes, 2 days per week.

verbal operants' model based on functionality to identify specific deficits, to develop meaningful goals for the individual, and to create a dynamic teaching program. The research questions were as follows:

1. Will the BICA approach result in improved functional communication abilities in the participant?
2. Will the BICA approach result in improved naming abilities in the participant?
3. Will the BICA approach result in improved reading skills in the participant?
4. Will the targeted intervention result in improved QOL in the participant?

It was expected that intensive, targeted instruction that focused on improving functional language abilities, in addition to reading and writing instruction, would result in affirmative answers to each of these questions.

### **Program Overview**

The BICA program targeted the participant's language impairments and participation/functional language skills and provided education in Supported Conversation for Adults with Aphasia (SCA)<sup>33</sup> for the participant and communication partners. The program consisted of 12 to 13 hours of training per week over a 12-week period (150 hours in total). The first week consisted of collecting baseline measures, and the final week was used for post-test measures, resulting in 10 weeks of treatment. Instruction was provided by the SLP (second author) for 2 to 3 hours a week (client requested to increase to 3 hours

early in the program), and supportive personnel facilitated 10 hours of therapy per week under the supervision and direction of the SLP and BCBA (see Table 1 for the treatment schedule, see Table 2 for role descriptions). All clinicians involved in the program were trained in SCA.<sup>33</sup>

The SLP utilized a dynamic assessment approach<sup>34</sup> which involved interviewing the participant, conducting diagnostic and standardized assessments to guide a collaborative goal-setting process, and ongoing discussion of the results with the participant. The SLP incorporated the client's perspective on priorities for improving functional language skills (e.g., selecting a goal to successfully retrieve information from a voicemail) and interpreting her performance on standardized assessments (i.e., improving reading comprehension was identified as an area of weakness in testing and was also a priority for the client).

The BCBA conducted baseline and post-test assessments for individual therapy goals determined by the SLP, developed conceptually systematic treatment protocols for goals identified by the SLP (including data collection and prompting procedures), supervised the supportive personnel, and conducted ongoing data analysis. Therapy was designed with the following elements: defining language using the verbal operants, stimulus control transfer procedures, reinforcement, ongoing data analysis, and interpretation.

### **Participant**

The participant was a 71-year-old Caucasian, monolingual woman with aphasia post-left

**Table 2 Team Role Division**

Team role division	BCBA	SLP	Supportive personnel	Participant
Conducted initial language assessments		✓		
Determined program goals	✓	✓		✓
Developed data collection procedures	✓			
Determined prompting procedures	✓			
Implemented treatment		✓	✓	
Clinical observations and supervision of supportive personnel	✓	✓		
Assess participant progress and program success	✓	✓		
Participated in team meetings to review progress	✓	✓	✓	✓

Abbreviations: BCBA, Board Certified Behavior Analyst; SLP, speech-language pathologist.

hemisphere CVA in 2017. Two years after her stroke, Claire (name changed to maintain client confidentiality) contacted the private clinic where therapy was provided to inquire about participating in an intensive aphasia program. She previously received individual one-to-one speech therapy for more than 1 year, and had participated regularly in weekly community aphasia programs, but sought out an intensive aphasia program to address specific communication challenges that continued to negatively impact her daily life. Before retiring, she was a highly motivated and driven individual who had a busy career as an acute/critical care nurse and clinical research associate. Claire was proudly independent and lived alone, although her immediate family members were actively involved in her life. She also had a supportive partner who not only assisted her in articulating her unique challenges but was also involved in selecting functional therapy goals.

### Setting

The participant attended the therapy clinic 3 days per week for therapy sessions, which were held at approximately the same time each day. If a session needed to be skipped for any reason, attempts were made to reschedule. The treatment room consisted of a table and chairs with limited to no background noise. For generalization, the clinician added background noise via an iPad app and sessions occurred in a natural environment, such as inside a coffee shop or a grocery store, for at least 1 hour every week.

### Assessment Measures

Claire's language was assessed using both standardized and qualitative measures before treatment to identify her baseline strengths and challenges, and to determine goals for the program. The SLP administered the Western Aphasia Battery - Revised (WAB-R),<sup>35</sup> and Claire was found to have "mild" aphasia with an aphasia quotient of 85.5 (an AQ of 75+ is considered mild). Qualitative measures included evaluating Claire's ability to use correct pronouns, sentence structure, writing out dates and numbers, recording details from a voicemail, and conversation samples. In conversation, Claire struggled with anomia, circumlocution, and had difficulty providing clear and concise verbal narratives and giving instructions. She used phonological (i.e., "bastry" for *pastry*), semantic ("mom" for *daughter*), and neologistic paraphasias (i.e., "igit" for the word *describe*) in conversation.<sup>36</sup> Claire was aware of errors just 58% of the time in a 1-hour conversation sample that took place pretreatment. When Claire was aware of her errors, she would self-correct (i.e., saying, "*Pitsdelia... No, that's not right, it's Pittsburgh*"), repeat variations of the word multiple times until she arrived at the correct word (i.e., saying "*line ... lane ... plane ... no, it's a runway!*"), or say the word with a questioning intonation (i.e., "*Harrison? No, Harrisburg*"). When she was unaware of her errors, she would use the paraphasia in a sentence and not attempt to repair, clarify, or request assistance.

Claire demonstrated strengths in her single-word receptive vocabulary, achieving a

high-average understanding of single words using the Peabody Picture Vocabulary Test, 5th edition (PPVT-5)<sup>37</sup>—a standard score of 109 (confidence interval [CI]: 105–113), where average scores fall between 85 and 115. The SLP assessed Claire’s expressive vocabulary using the Expressive Vocabulary Test, 3rd edition (EVT-3)<sup>38</sup> which found that her receptive vocabulary was significantly greater than her expressive vocabulary, with an EVT-3 standard score of 77, where average scores fall between 85 and 115, compared with PPVT-5 standard score of 109, a significant difference ( $p = 0.05$ ). Claire’s understanding of words was significantly greater than her ability to label words, likely due to her word-finding difficulties.

The PPVT-5 and EVT-3 were used for three reasons. First, both tests include a broad range of vocabulary and therefore can be used to measure the degree of aphasia and vocabulary impairment in adults.<sup>39</sup> Second, the EVT-3 is co-normed with the PPVT-5, allowing for direct comparisons between expressive and receptive vocabulary knowledge. Finally, the tests have parallel test forms with similar content and design but unique items that allow for repeated administration to monitor progress without using the same stimuli.<sup>38</sup>

In terms of her written language skills, Claire could write single words but struggled to generate grammatically correct written sentences containing a subject, verb, and object structure, achieving 0% on a pretest. She also had difficulty understanding written language, as indicated by her “score” at the “frustration” level when answering comprehension questions on a 6th-grade reading passage on the Qualitative Reading Inventory-6 (QRI-6).<sup>40</sup> In addition to the aphasia battery (WAB-R),<sup>35</sup> the receptive (PPVT-5),<sup>37</sup> and expressive (EVT-3)<sup>38</sup> language assessments administered prior to treatment, the SLP administered diagnostic assessments including the Mount Wilga High Level Language Test<sup>41</sup> and the aphasia domain on the assessment for living with aphasia (ALA)<sup>42</sup> to better understand the participant’s strengths and challenges and to inform areas of focus for therapy.

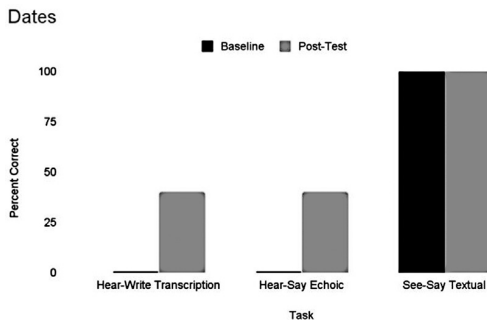
## Experimental Design

Claire provided informed verbal and written consent to participate in the intensive aphasia program and for the authors to present her information, goals, and progress in this article. The assessments and intervention sessions were part of her regular therapy program. Dynamic assessment<sup>34</sup> was utilized throughout treatment, whereby decisions made by the BCBA and the SLP on changes to the intervention depended on what the data showed about the effects of the current intervention. Variations to specific interventions were primarily made to the type of prompts provided to aid the participant in the task. Prompts were consistently applied across sessions and faded as progress was made. If the participant’s performance in a task deteriorated across two sessions, the prompt level was increased.

The main dependent variable in all tasks was the number of correct responses out of 10 opportunities, or the total number of correct responses in a 1-minute timing. Responses were scored as correct or incorrect. The independent variables used throughout the program consisted of the following: (1) giving standardized instructions about a task and target behaviors; (2) setting the occasion for the target skill to occur (i.e., asking a question, showing a picture, etc.) and waiting the allotted amount of time for a response; (3) providing prompts and models to increase success with a given target and to fade these out systematically using stimulus control transfer procedures; (4) correcting errors through rehearsal; and (5) reinforcing correct responses through positive remarks and visual performance feedback through data graphing.

## Teaching Procedures

Once a target skill was selected, the clinicians established a baseline for the skill across verbal operants (e.g., labeling numbers, repeating strings of numbers, and identifying numbers receptively; see Fig. 1) to determine the strengths and weaknesses of the individual. For example, among Claire’s goals was to be able to write down a date after it was told to her (e.g., for an appointment). Prior to treatment, the clinician probed Claire’s ability to read a



**Figure 1** Baseline and posttreatment scores for Claire on intervention programs.

date that was written on a piece of paper (see-say textual<sup>43</sup>), repeat a date told to her (hear-say echoic), and write down the date when told orally (hear-write transcription). No prompts or performance feedback were provided during baseline measures. After gathering these data, the BCBA determined that Claire could complete the see-say textual task with ease, but struggled with echoic and transcription trials (see Fig. 2). This information was used to increase her ability to transcribe a date using stimulus control transfer procedures.

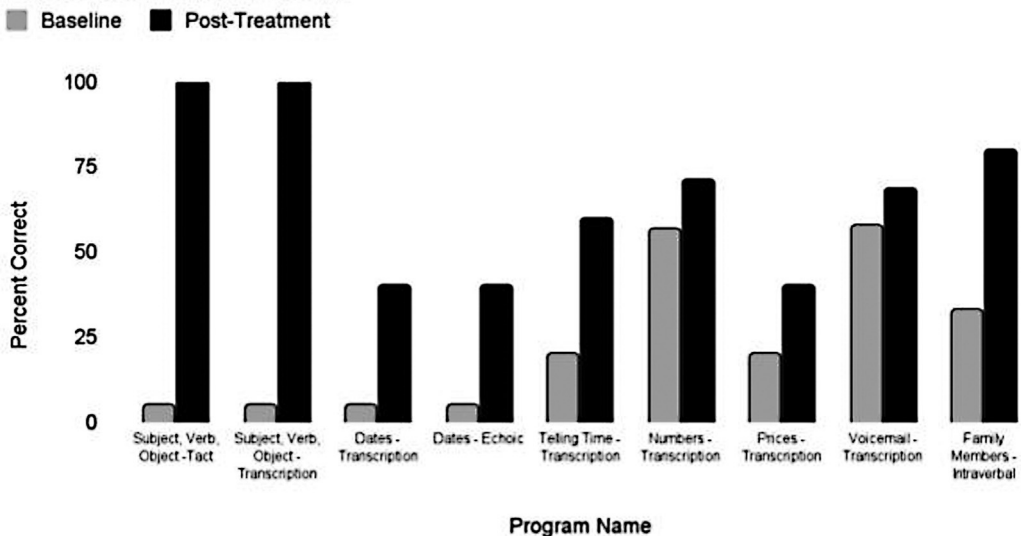
Materials were developed using personally relevant and motivating themes for the participant, including family, travel, and medicine. For example, the participant’s own family tree was used when targeting pronouns, and relationship words, naming targets including nouns such as “stethoscope” and “anesthesia.”

Data analysis was conducted weekly by the BCBA to assess the effectiveness of the teaching procedure. Dynamic assessment was evident in the continuous interaction between assessment, therapy, and data used to inform teaching procedures. A goal was considered mastered when Claire achieved over 90% for 3 consecutive days, after which maintenance and generalization efforts were completed and these goals were practiced less frequently and conducted within more naturalistic conditions. At the end of therapy, baseline measures were repeated (with different stimuli) to assess treatment effects (see Fig. 1).

**Therapy Goals**

An individualized treatment plan was created for Claire, reflecting both her baseline scores and her own goals. Therapy goals focused on improving her verbal expression (including

**BICA Curriculum Data**



**Figure 2** Baseline and posttreatment scores for Claire on a skill acquisition program focused on increasing her ability to write dates told to her orally. Strengths in see-say textual were used as a prompt for echoic and transcription trials. BICA, behaviorally oriented, intensive communication intervention for aphasia.



reducing paraphasias, improving naming, use of pronouns, use of relationship words, and numbers), improving her written expression (writing complete and accurate sentences), improving her reading fluency (quickly and accurately reading words), and improving her reading comprehension (see Table 3 for summary).

**RESULTS**

To evaluate the participant’s progress in the therapy program, clinicians analyzed both qualitative and quantitative data. Qualitative data included client’s feedback about the program, generalization of skills and reported increases in confidence. In addition, the SLP administered

**Table 3 Intensive Aphasia Program: Participant Goals**

Goal	Clinician	Description	Type
Improve verbal expression	SLP	Improve ability to independently and accurately provide 5 concrete and concise steps for a verbal explanation given a verbal prompt (i.e., “tell me in 5 steps how to make a cup of coffee”)	Hear–say
Improve naming	SLP + supportive personnel	Improve generative naming using atypical goal-derived categories <sup>47</sup> (i.e., things to pack for a hike) with SLP, and fluency training with supportive personnel using the Semantic Feature Analysis chart for error correction	Hear–say
Improve use of pronouns	SLP + supportive personnel	Improve use of personal (he, she, they) and possessive pronouns (his, hers, their) using fluency training to improve speed and accuracy	See–say
Improve expression of relationship and family words	SLP	Improve verbal expression by accurately using appropriate relationship word to describe a relationship between two individuals in her own family (e.g., “tell me how you and Bill are related”)	Hear–say
Improve ability to listen to, repeat, and/or write numbers	Supportive personnel	Improve ability to listen to and repeat strings of numbers (including numbers and prices up to 5 digits, such as \$149.89)	Hear–say Hear–write
Improve ability to write complete, accurate sentences	supportive personnel	Improve ability to write a grammatically correct and complete sentence using the sentence + verb + object sentence structure, such as “the man is waving a flag”	See–write
Improve reading fluency and comprehension	SLP + supportive personnel	Improve reading words quickly and accurately (with supportive personnel) using fluency training Improve reading comprehension using metacognitive reading strategies (with SLP)	See–say
Improve confidence in conversation and quality of life	SLP + supportive personnel	Improve confidence in conversations (with supportive personnel)	Hear–say

Abbreviation: SLP, speech-language pathologist.

standardized assessments and diagnostic assessments pre- and postintervention to enable computations of effect sizes to calculate the impact of the intervention over and above what would be considered typical progression or development. Clinicians used visual analyses and graphs to examine progress and improvement for measures that did not allow for computations of effect sizes. The results indicate that the BICA approach was effective in improving (1) functional communication abilities, (2) naming abilities, (3) reading skills, and (4) QOL for the participant.

### Research Question 1: Functional Language Skills

The first research question asked whether direct instruction using the BICA approach on specific activity-based language skills would improve functional language ability in the participant. Before treatment, Claire had a moderate impairment in category naming; this improved to a normal response by the end of the treatment. Difficulty “finding the words” is a hallmark of aphasia and was observed in the participant’s pretreatment; following intensive practice, her category naming improved from a moderate impairment to a normal response. She improved in her ability to describe a word (i.e., using the unique semantic features) so that she or her communication partner could arrive at the word and avoid conversation breakdown.

Another functional language target involved constructing and writing a grammatically correct sentence using subject, verb, object, and function words in the correct order (e.g., “The Queen is waving to the crowd”). At baseline, Claire scored 5% on this writing task; a visual prompt (sentence grid) was used during teaching sessions and systematically faded throughout the program. Posttreatment, Claire was able to write grammatically correct sentences for 100% of opportunities (see Fig. 1).

Another example of a functional language target used in the treatment involved reducing the participants’ use of paraphasias and increasing her awareness of such errors. During therapy, Claire engaged in conversations with the supportive personnel in a busy, distracting natural environment (such as a coffee shop or

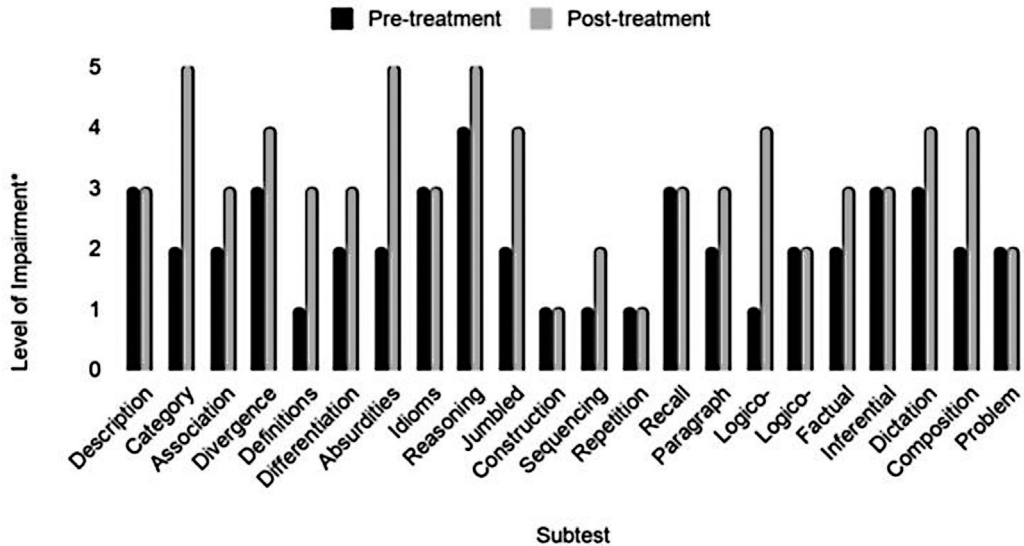
grocery store), and the supportive personnel tracked the type, frequency, and response to her paraphasias. The clinician would make the participant aware of the paraphasia and prompt her to use a repair strategy. This was systematically faded throughout treatment. Before treatment, the participant was aware of her paraphasic errors only 58% of the time; this increased to 83% awareness posttreatment.

It was hypothesized that functional language programs would also generate positive change on the diagnostic assessment tools. Claire demonstrated gains across domains on the Mt. Wilga High-Level Language Test.<sup>41</sup> Individual elements of the assessment also showed improvement, even on aspects not specifically targeted for intervention (see Fig. 3). On the aphasia domain of the ALA,<sup>42</sup> a self-reported measure of communication skills (talking, understanding, reading, writing, and aphasia overall), Claire’s score increased from 58% (11.5/20) preintervention to 78% (15.5/20) postintervention. Claire reported improvements across all domains except for understanding language which was attributed to her being more aware of what she did not understand after therapy targeting comprehension strategies.

### Research Question 2: Naming

The second research question asked whether direct instruction on naming using the BICA approach would improve the participant’s naming abilities. Standardized assessments administered pre- and posttreatment demonstrated improvements in the participant’s word-finding and naming ability ( $d = 0.2$ , indicating a small effect),<sup>44</sup> with standard scores on an expressive vocabulary measure (EVT-3)<sup>38</sup> increasing from 77 to 81 (where scores from 85 to 115 are within the average range). Clinicians used two parallel forms of the EVT-3 (Form A at pretest and Form B at posttest); the tests contained similar content and design with unique vocabulary items to demonstrate progress. The participant made improvements across three types of naming on the Mount Wilga High-Level Language Test,<sup>41</sup> including category naming, association naming, and divergent semantics (see results in Table 4). Category naming, which was

### Mt. Wilga High Level Language Test



**Figure 3** Pre- and posttreatment scores on the Mount Wilga High Level Language Test for Claire. \*Level of impairment: 1 = severe impairment, 2 = moderate impairment, 3 = mild impairment, 4 = mild reduction in fluency, 5 = normal response.

directly targeted in therapy, improved from a moderate impairment pretreatment to a normal response posttreatment.

### Research Question 3: Reading and Writing

The third research question asked whether targeted direct instruction using the BICA

approach that focused on reading and writing skills would improve the participant’s abilities in written communication, which was assessed pre- and posttreatment using the QRI-6<sup>40</sup> and the Mount Wilga High Level Language Test.<sup>41</sup>

At pre-test using the QRI-6, the participant read 6th level words aloud with 65% accuracy (considered to be frustration level); by the end of the treatment, Claire read 6th level words aloud with 90% accuracy (considered to be at an independent level).

Oral reading fluency was also assessed pre- and posttreatment. At baseline, the participant could read 29 words per minute accurately; by the end of the treatment, she increased to 49 words per minute. To improve her reading comprehension, Claire was taught to use metacognitive reading strategies while reading a novel; these prompts were systematically faded with success. At pre-test, she answered comprehension questions about the text with 58% accuracy; by the end of the therapy, she answered questions with 75% accuracy. Not only did her comprehension of the text improve markedly over the course of therapy, but so did her overall confidence in reading. On the Mount Wilga High-Level Language Test,<sup>41</sup>

**Table 4 Results of Diagnostic Assessments Pre- and Posttreatment**

Measure	Pre-test score	Post-test score
EVT-3 <sup>a</sup>	77 (CI: 74–80)	81 (CI: 78–84) <sup>a</sup>
QRI-6	65%	90%
Sight words (6th grade)		
ALA		
Aphasia domain	58%	78%
Wall question	50%	88%

Abbreviations: ALA, assessment for living with aphasia; CI, 95% confidence interval; EVT-3, expressive vocabulary test, 3rd edition; Form A, used at pre-test; form B, used at post-test; QRI-6, Qualitative Reading Inventory, 6th ed.

<sup>a</sup>M = 100, SD = 15.

<sup>b</sup>Small effect (0.2).

Claire increased from a mild-moderate reading impairment to mild impairment (see Fig. 3). On the ALA,<sup>42</sup> Claire rated her reading ability as 38% (a score of 1.5/4) before treatment, which increased to 75% (a score of 3/4) posttreatment.

#### Research Question 4: Quality of Life

The fourth research question asked whether the BICA approach would result in improved QOL, as aphasia is known to have a significant negative impact on self-identity, relationships, confidence, and participation in life events.<sup>4</sup> As part of their ALA, Simmons-Mackie et al<sup>42</sup> designed a valid and reliable measure to assess QOL for people living with aphasia and was administered both pre- and posttreatment. Before the intensive BICA program, the participant reported that her aphasia was acting as a barrier or “wall,” stopping her from doing things she wanted to do approximately 50% of the time (a score of 2/4). Posttreatment, Claire reported that aphasia was no longer a “wall” and that she was able to participate in her life 88% of the time (a score of 3.5/4). These results were affirmed by qualitative observations that Claire reported feeling more confident being in the community alone, engaged in hobbies she had not in a while (like reading novels), and even took a trip to visit family on her own.

#### DISCUSSION

This article examines the impact of a novel, intensive therapy for aphasia that combines the expertise of an SLP with that of a BCBA. The authors developed the BICA in response to a clear need among those struggling with this common outcome of brain injury for better therapies. Having run community aphasia programs and provided one-to-one therapy for many years, the second author understood the limitations of current therapeutic approaches to treating aphasia. Moreover, the importance of ABA in other fields clearly indicated its promise as part of an intensive aphasia program. The result, we hope, is a powerful approach that utilizes the best practices from the SLP field with the intensive approach well known to the

field of ABA. Using a case study of a client who experienced a stroke 2 years earlier, we aimed to demonstrate the effectiveness of a functional approach to language combined with best practice research in aphasiology.

Combining a linguistic and behavioral interpretation of language and aphasia successfully improved all three language domains and QOL for an individual with aphasia 2 years following a stroke.

The BICA program demonstrated that effective interprofessional collaboration between the SLP and BCBA was critical to successfully treating aphasia. SLPs and BCBAs have complementary areas of expertise whereby the knowledge base and perspective of one can enhance the knowledge base of the other.<sup>14</sup> Interprofessional collaboration allowed the participant to benefit from a client-centered program that embraced the unique contributions and shared values of the clinical team.

Claire’s data highlight improvements in multiple areas of language form and use; however, the real impact of the program was evident in her improved confidence and QOL. Following the intensive aphasia program, Claire reported doing things she had not done for a long time, such as making small talk with strangers out in the community. She went on a trip to visit her son and independently navigated elements of traveling such as communicating in a busy airport, asking for directions on the street, ordering her own meals, and participating in conversations with family and friends. The impact of aphasia can rob an individual of the ability to carry out these tasks independently. The intensive program helped Claire regain confidence and the ability to return to living her life.

#### Limitations and Future Directions

There is still much to be done to define the specifics surrounding an interprofessional, behaviorally-oriented intensive aphasia program. The current case study represented a small applied intensive aphasia program that consisted of several independent intervention variables (e.g., instruction, prompts, and reinforcement). As such, it is impossible to evaluate which variables were integral to the

program's success, and the specifics surrounding who would benefit from this type of intervention remain unknown. These outcomes show that a BICA approach may be an approach that merits wider application for treating aphasia.

Furthermore, case studies have several limitations that require external validation and further analysis. Case studies are often questioned due to the lack of reversal of treatment effects, as well as their inability to rule out other explanations for treatment effects, such as history (i.e., the influence of external factors) or maturation (i.e., spontaneous improvement in the participant).<sup>45</sup> While we affirm these limitations, we also point out that the participant was not receiving any other one-to-one therapy while she participated in the intensive program, and therefore it is unlikely that history was a factor in the results observed. Furthermore, maturation was also unlikely to be a contributing factor, as the participant was already 2 years post-stroke when she began treatment. Future studies should also examine long-term maintenance and generalization of skills. In addition, it would be advantageous to look at various intensity models to determine at what level of intensity do benefits begin to level out.

Finally, noting that while a case study is not an experimental design, it is useful for gaining a better understanding of complex issues and beginning preliminary research. As such, it demonstrated sufficient support for the BICA concept to merit further studies aimed at replicating a behavioral conceptualization of aphasia that include interprofessional collaboration between SLPs and BCBA's to assess treatment effects.

### CLINICAL RECOMMENDATIONS

The findings from this case study support the value of a behaviorally informed intensive aphasia program for individuals with reduced communication skills after a stroke. The benefits of the novel collaboration between SLPs and behavior analysts are apparent in the gains this individual made.

In summary:

- A linguistic approach to language processing in aphasia is useful for understanding the

individual's unique skills and challenges in relation to oral and written language skills.

- A behavioral approach to defining language is useful for identifying the teaching methods based on the function of language and verbal operants.
- The BICA approach was useful for treating functional, relevant goals that result in meaningful change for the participant.
- Using dynamic assessment, a person-centered approach, and actively involving the client's values and needs in all aspects of assessment and therapy, was useful for treating the participant with aphasia.

### CONCLUSION

The ultimate goal of the BICA approach was to increase the participant's functional communication skills, her communication confidence, and her participation in her life. The program followed guidelines from the Best Practice Recommendations for Aphasia,<sup>46</sup> wherein the individual with aphasia was offered individualized and intensive aphasia therapy that had a meaningful impact on her life and communication. In line with these recommendations, the therapy program was collaborative, person-centered, and involved training in SCA<sup>33</sup> and aphasia for both the individual and her communication partners.<sup>46</sup> This participant surely benefitted from participating in the intensive program and had a renewed confidence in her ability to participate in conversations at home, with her family, and in the community.

### CONFLICT OF INTEREST

Both authors received a salary from the private clinic in Canada where the intensive aphasia program was completed.

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