Word retrieval deficits are the most consistent characteristic observed in aphasia (Davis, 2007; Goodglass, Kaplan, & Barresi, 2001; Wilshire & Coslett, 2000). Improvement is observed but these deficits typically become chronic (Brookshire, 2002; Goodglass & Wingfield, 1997; Raymer & Rothi, 2001; Wilshire & Coslett, 2000) with anomia often becoming the most prominent feature of the overall impairment (Davis, 2007; Goodglass et al., 2001).

Persistence of anomia in aphasia has resulted in numerous studies implementing protocols to remediate word retrieval. These treatment investigations have accommodated several objectives including level of processing of deficit, generalization at single word and discourse level, length of treatment, and number of treatment stimuli (Boyle, 2004; Boyle & Coelho, 1995; Drew & Thompson, 1999; Hillis, 1989; Howard, Patterson, Franklin, Orchard-Lisle, & Morton, 1985; Kiran & Thompson, 2003; Lowell, Beeson, & Holland, 1995; Massaro & Tompkins, 1992; Thompson & Kearns, 1981; Wambaugh, Linebaugh, Doyle et al., 2001). All have reported success in remediating anomia in small group or single subject designs. However, there have been mixed reports relative to generalization to untrained stimuli and to other language and assessment contexts (Davis, 2007; Raymer & Rothi, 2001). Furthermore, there has been controversy regarding length of treatment programs and intensity of treatment (Brookshire, 2002; Davis, 2007).

Semantic Feature Analysis (SFA) (Boyle, 2004; Boyle & Coelho, 1995; Coelho, McHugh, & Boyle, 2000; Massaro & Tompkins, 1992) is an approach in which participants are guided to produce words semantically associated to a target word. The approach is ongoing as ability to retrieve targets is achieved over time. Furthermore, burden of cueing should transfer from clinician to patient, as patients learn to independently use feature analysis strategies for retrieving words. The current investigation used SFA with an extended treatment phase (length, intensity) to improve word retrieval skills with three gentlemen with chronic aphasia. It was predicted that increasing length of the treatment program would positively affect generalization to untreated stimuli.

METHOD

Three right-handed, native English-speaking males (RF, JB, RR) participated. All presented with aphasia resulting from left CVA (Table 1). All passed modified hearing screenings for older adults (Ventry & Weinstein, 1983; 1992), achieved 100% on matching 20 black-and-white line drawings (Snodgrass & Vanderwart, 1980), and had received speech-language therapy intermittently since CVA. However, none received any additional treatment while participating in this study.

Stimuli were 260 black-and-white line drawings (Snodgrass & Vanderwart,1980). Each was enlarged and mounted individually on poster board. Pictures were presented in random order to each participant to name across three trials. Treatment and probe (untreated) stimuli were selected from pictures that a participant could not name on at least 2 trials, yielding 60 stimuli for both RF and RR, and 80 stimuli for JB. From these, 20 stimuli were randomly chosen as probe items and 40 as treatment stimuli, yielding different stimuli for each participant.

Single subject A-B-A designs were implemented for each participant to examine retrieval of treated and generalization to untreated stimuli. Three baseline sessions were completed prior to initiating treatment naming both probe and treatment pictures. Each participant attended three weekly treatment sessions, with a ten-week treatment phase. Twenty of the 40 treatment pictures used for each participant were randomly ordered and utilized in each treatment session. Probes assessing generalization to untreated pictures were presented at the end of the last weekly session. Follow-up sessions for treatment and probe stimuli occurred at two and four weeks after

treatment program end.

Treatment was Semantic Feature Analysis (SFA) (Boyle, 2004; Boyle & Coelho, 1995) in which participants were shown a target picture (treatment stimuli) and requested to name it. The clinician then asked participants to produce words semantically related (features) to the target (questions, sentence completion), which was on a chart surrounded by these features (Figure 1). Features included superordinate category/group, use, location, physical properties, association, and coordinate of same category. The examiner wrote features produced by participants on the chart; when participants could not produce a feature, the clinician produced it verbally, and then graphically on the chart. If participants could not retrieve targets after listing all features, the clinician said the word, had the participant repeat it, followed by review of features of the target. Treatment accuracy for each session was the number of pictures named correctly on initial confrontation naming. Generalized naming improvement was defined as ability to name at least 5 more probe items than maximum named at baseline.

The following were administered pre-treatment, 4 and 8 weeks during treatment, and post-treatment: 1) *Western Aphasia Battery (WAB)* (Kertesz, 1982), Aphasia Quotient (AQ); 2) *Boston Naming Test (BNT*) (Kaplan, Goodglass, & Barresi, 2001); and 3) *Test of Adolescent/Adult Word Finding (TAWF*) (German, 1990). The *Test of Word Finding in Discourse* (*TWFD*) (German, 1991) was administered along with probes at end of each week to examine generalization to discourse. The *Communicative Effectiveness Index* (*CETI*) (Lomas, Pickard, Bester, et al., 1989) and *ASHA Quality of Communication Life Scale* (*QCL*) (Paul, Frattali, Holland et al., 2003) were administered pre- post-treatment as social validation measures.

RESULTS

Data for treatment and probe nouns are in Figures 2, 3, and 4 for RF, JB, and RR, respectively. RF improved in naming treatment nouns, going from 8.3% at baseline accuracy to 85% accuracy at treatment end, maintaining 80% accuracy at follow-up. JB demonstrated improved naming of treated nouns, going from 0.3% baseline accuracy to 45% accuracy at treatment end, maintaining this accuracy one month later. RR made remarkable gains through treatment week 8, hovering at about 80% accuracy.

Generalization to untreated nouns was observed. RF improved from 10% baseline to 55% at final probe; 45% at one month follow-up. JB could not name any probes at baseline. He improved to 30% accuracy at treatment end, maintaining this one month later. RR made gains to treatment week 8, maintaining about 50% accuracy.

Generalization to standardized measures was observed (Table 2). Slight increases were noted on *WAB* AQ; greatest increases occurred on Naming with increases also on *BNT* and Picture Naming: Nouns on *TAWF*. Generalization to the *TWFD* was only noted for RR (Figures 5, 6, 7). However, clinically important improvement was observed via CETI (Table 3) and ASHA QCL (Table 4).

DISCUSSION

Results revealed all participants improved ability to name treated and untreated picture stimuli. Thus, accessing semantic features of stimuli from different categories in a structured, systematic manner, improved ability to retrieve words. Participants learned to use this process as a strategy to retrieve novel words, independently, thus benefiting from treatment emphasizing components of semantic representation, with different severity levels and different aphasia types. These findings replicate outcomes of previous studies using SFA (Boyle, 2004; Boyle & Coelho, 1995) and support outcomes of others using unique feature generation treatment protocols (Drew

& Thompson, 1999; Kiran & Thompson, 2003; Lowell et al., 1995). Improvement on standardized measures was observed, particularly on tasks involving picture naming of nouns, and social validation. However, generalization to discourse was observed for only one participant.

A unique feature of the study was extended length of the treatment phase. As predicted, all participants continued to demonstrate improvement in retrieval throughout the treatment phase. Longer treatment may have influenced improvements on standardized measures and increases on probes. Investigations measuring success of SFA in independent use of self-cueing are needed.

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Table 1. Participant demographic data.

	Age	Gender	Years Education	Months post-stroke	Type of Aphasia
RF	72	Male	18	50	Anomic
JB	68	Male	16	24	Wernicke's
RR	58	Male	19	14	Anomic

Table 2. Pre-, inter-, and post-treatment testing on standardized tests.												
	RF				JB				RR			
Tasks	Pre	4 wk	8 wk	Post	Pre	4 wk	8 wk	Post	Pre	4 wk	8 wk	Post
Spontaneous Speech												
Information	9	9	9	9	8	8	8	8	8	8	8	9
Fluency	9	9	9	9	8	8	8	8	9	9	9	9
Total	18	18	18	18	16	16	16	16	17	17	17	18
Comprehension												
Yes/No Questions	52	52	52	54	40	40	38	42	52	54	54	60
Word Recognition	50	50	50	52	34	34	34	34	30	34	34	44
Sequential Com.	70	72	72	74	54	54	54	56	56	62	64	76
Total	8.6	8.7	8.7	9.0	6.4	6.4	6.3	6.6	6.9	7.4	7.6	9.0
Repetition	9.2	9.2	9.3	9.6	3.4	3.4	3.5	3.8	7.2	7.6	7.6	8.0
Naming												
Object Naming	45	47	49	52	22	20	22	24	42	44	44	52
Word Fluency	15	15	15	15	5	7	7	7	10	10	11	15
Sentence Completion	8	8	8	8	3	3	3	5	8	8	8	9
Responsive Speech	8	8	8	9	4	4	4	6	6	6	6	7
Total	7.6	7.8	7.9	8.4	3.4	3.4	3.6	4.2	6.6	6.8	6.9	8.3
AQ	86.8	87.4	87.8	90.0	58.4	58.4	58.8	61.2	75.4	77.6	78.2	86.6
Boston Naming Test	45	45	46	50	14	14	15	22	32	39	38	45
TAWF	78	80	80	88	23	24	27	31	58	60	67	71
Standard Score	86	87	87	91	70	70	70	70	72	73	75	78
Picture Naming:Nouns	25	26	26	33	6	7	8	11	20	21	24	25
Sentence Completion	14	14	14	14	6	7	8	8	12	13	15	15
Descriptive Naming	10	11	10	11	2	1	2	2	8	7	9	9
Picture Naming:Verbs	13	13	14	14	4	4	4	5	10	11	10	13
Category Naming	16	16	17	16	5	5	5	5	8	8	9	9

Table 3. Pre and post-treatment testing and difference scores on the CETI (10pt analog rating scale)

Question #	RF Pre	RF Post	RF Diff	JB Pre	JB Post	JB Diff	RR Pre	RR Post	RR Diff
1 Getting somebody's attention	7.3	8.3	+1.0	7.0	8.8	+1.8	3.3	8.8	+5.5
2 Getting involved in group conversations that are about him/her	4.5	5.0	+0.5	4.5	7.5	+3.0	1.1	4.4	+3.3
3 Giving yes and no answers appropriately	6.25	8.2	+1.9	7.0	8.6	+1.6	5.0	7.3	+2.3
4 Communicating his/her emotions	5.4	5.9	+0.5	5.8	7.8	+2.0	6.5	7	+0.5
5 Indicating that he/she understands what is being said to him/her	4.1	5.4	+1.3	6.1	7.0	+0.9	4	5.9	+1.9
6 Having coffee-time visits and conversations with friends and neighbors	4.5	6.2	+1.7	4.0	3.8	-0.2	0.6	6.7	+6.1
7 Having a one-to-one conversation with you	5.5	7.5	+2.0	5.5	7.5	+2.0	2.9	4.3	+1.4
8 Saying the name of someone whose face is in front of him/her	4	4.9	+0.9	4.0	2.5	-1.5	0.8	3.6	+2.8
9 Communicating physical problems such as aches and pains	6.1	6.1	0.0	5.2	5.2	0.0	3.8	4.2	+0.4
10 Having a spontaneous conversation	5.6	5.0	-0.6	7.0	8.0	+1.0	2.4	3.8	+1.4
11 Responding to or communicating anything without words	5.6	7.6	+2.0	2.6	3.6	+1.0	6	7.2	+1.2
12 Starting a conversation with people who are not close family	4.4	6.5	+2.1	2.4	3.0	+0.6	1.8	4.4	+2.6
13 Understanding writing	3.5	6.2	+2.7	3.5	6.0	+2.5	2.8	5.2	+2.6
14 Being part of a conversation when it is fast and there are a number of people involved	2.5	2.7	+0.2	2.5	0.7	-1.8	1	1.8	+0.8
15 Participating in a conversation with strangers	4.2	5.3	+1.1	3.2	4.3	+1.1	0.8	4.0	+3.2
16 Describing or discussing something in depth	3.2	3.7	+0.5	6.2	7.7	+1.5	1.6	3.1	+1.5
Total Difference Score			+17.8			+15.5			+36.5

Table 4
Pre and post-treatment testing and difference scores on the ASHA Quality of Life Communication Scale.

	RF			JB			RR		
Tasks	Pre	Post	Diff	Pre	Post	Diff	Pre	Post	Diff
1. I like to talk to people.	3	5	+2	5	5	0	5	4	-1
2. It's easy for me to communicate.	4	4	0	3	5	+2	3	3	0
3. My role in the family is the same.	3	4	+1	2	5	+3	2	3	+1
4. I like myself.	5	5	0	2	5	+3	5	4	-1
5. I meet the communication needs of my job or school.	1	1	0	2	5	+3	0	0	0
6. I stay in touch with family and friends.	4	5	+1	5	5	0	4	2	-2
7. People include me in conversations.	4	5	+1	4	5	+1	4	4	0
8. I follow news, sports, and stories on TV/movies.	4	5	+1	5	5	0	4	5	+1
9. I use the telephone.	2	4	+2	3	3	0	4	5	+1
10. I see the funny things in life.	4	4	0	3	3	0	4	5	+1
11. People understand me when I talk.	2	3	+1	5	5	0	2	4	+2
12. I keep trying when people don't understand me.	3	4	+1	5	5	0	1	3	+2
13. I make my own decisions.	5	5	0	4	4	0	4	4	0
14. I am confident that I can communicate.	5	5	0	5	5	0	3	4	+1
15. I get out of the house and do things.	3	5	+2	5	5	0	2	5	+3
16. I have household responsibilities.	4	4	0	3	3	0	1	4	+3
17. I speak for myself.	5	5	0	5	5	0	3	5	+2
18. In general, my quality of life is good.	5	5	0	5	5	0	5	5	0
Total Difference Score			+12			+12			+13

Ratings based on a 5 point rating scale (1-5).

FIGURE LEGEND

Figure 1: Semantic feature analysis (SFA) chart for specific features used during SFA treatment.

Figure 2: RF's data for treatment and probe nouns named accurately during baseline, treatment and follow-up sessions.

Figure 3: JB's data for treatment and probe nouns named accurately during baseline, treatment and follow-up sessions.

Figure 4: RR's data for treatment and probe nouns named accurately during baseline, treatment and follow-up sessions.

Figure 5: TWFD Productivity Index: T-Units for all 3 participants

Figure 6: TWFD Productivity Index: Total Words for all 3 participants

Figure 7: TWFD Word Finding Index for all 3 participants

CATEGORY* **USE** **COORDINATE****

TARGET PICTURE
(NAME)

PROPERTIES+ **LOCATION** **ASSOCIATION**

*** Superordinate Category**
**** Coordinate is another member of the same category**
+ Physical Properties

FIGURE 1

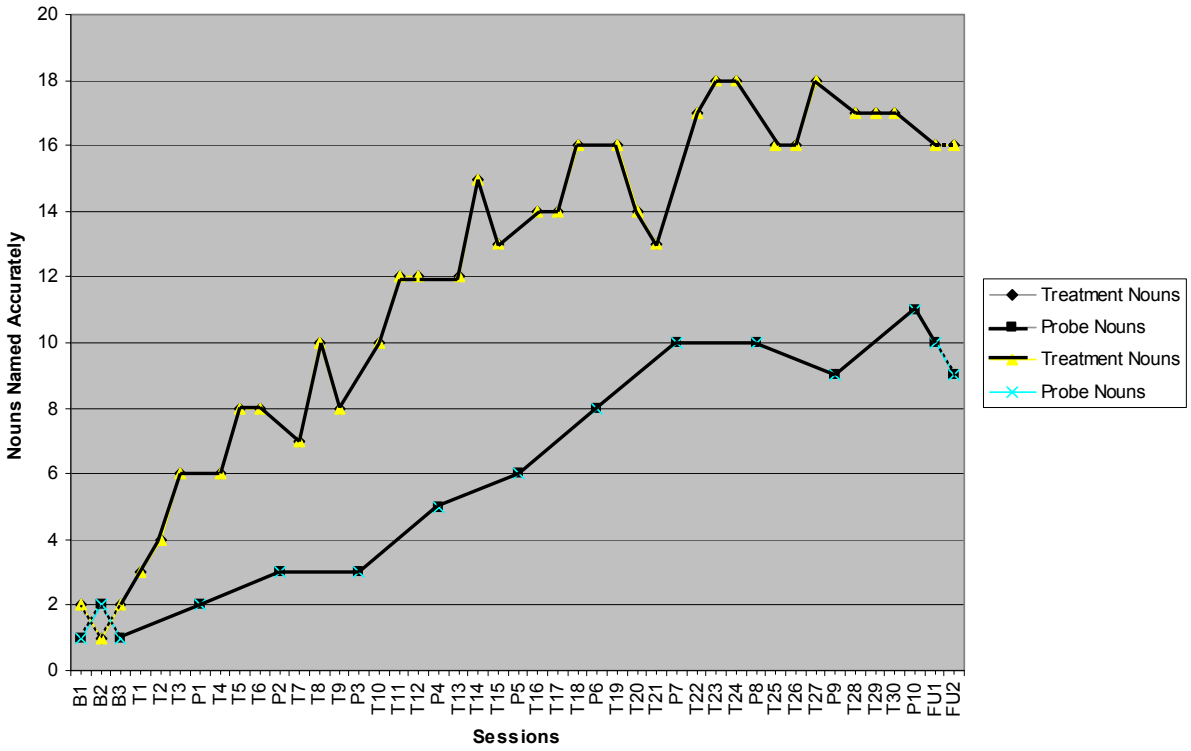
Nouns Named Accurately
Sessions
Treatment Nouns
Probe Nouns
Treatment Nouns
Probe Nouns

FIGURE 2 (RF)

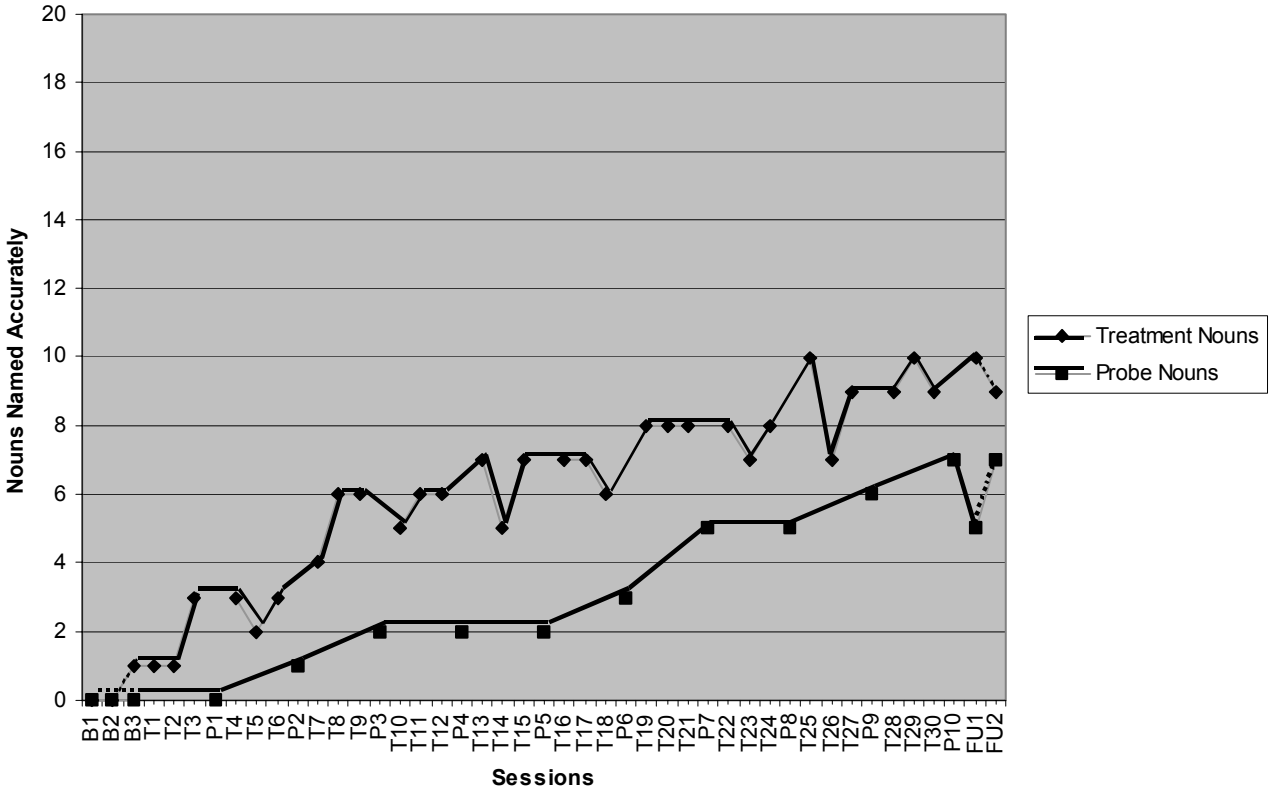
Nouns Named Accurately
20
18
16
14
12
10
8
6
4
2
0
B1 B2 B3 T1 T2 T3 P1 T4 T5 T6 P2 T7 T8 T9 P3 T10 T11 T12 P4 T13 T14 T15 P5 T16 T17 T18 P6 T19 T20 T21 P7 T22 T23 T24 P8 T25 T26 T27 P9 T28 T29 T30 P10 FU1 FU2
Sessions
Treatment Nouns
Probe Nouns

Figure 3 (JB)

Figure 4

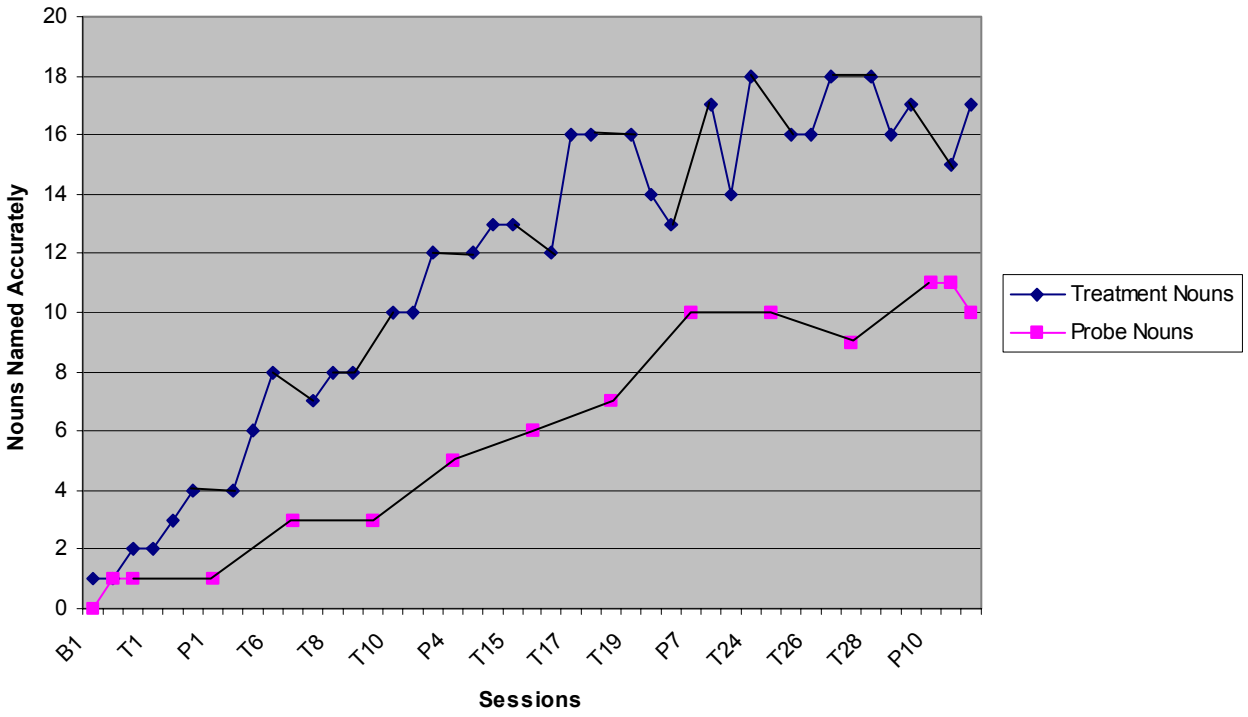

Figure 4 (RR)

Figure 5: TWFD Productivity: T-Units

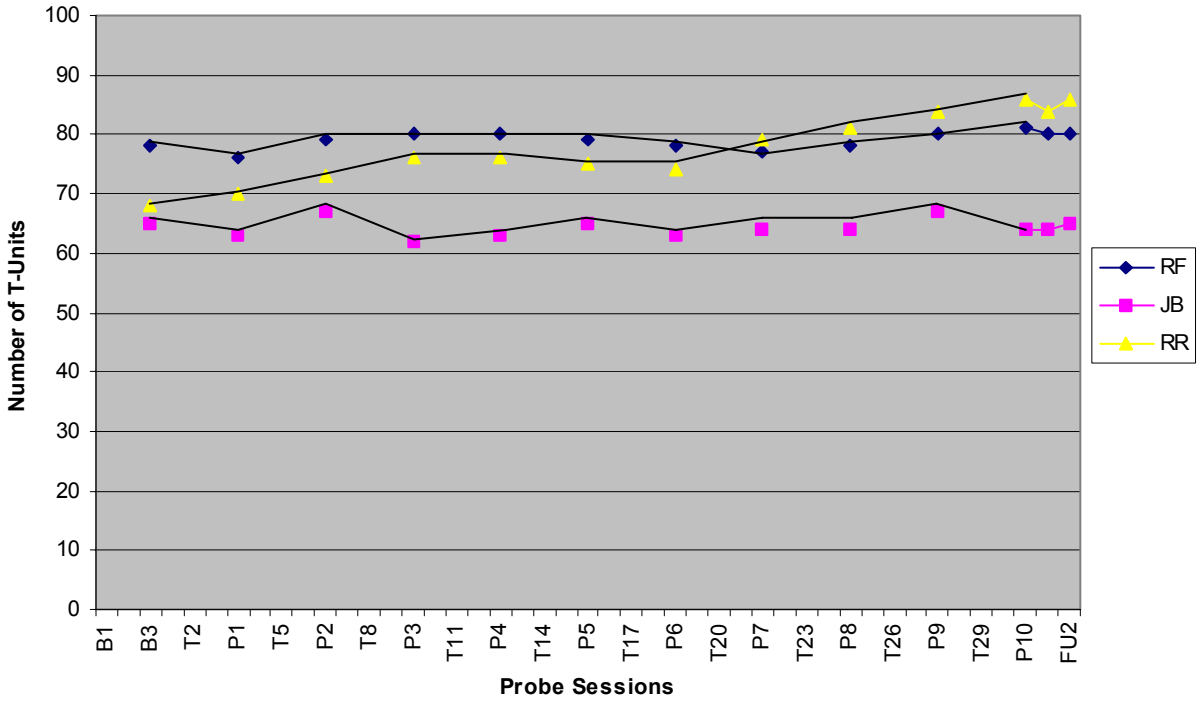

Figure 6: TWFD Productivity: Total Words

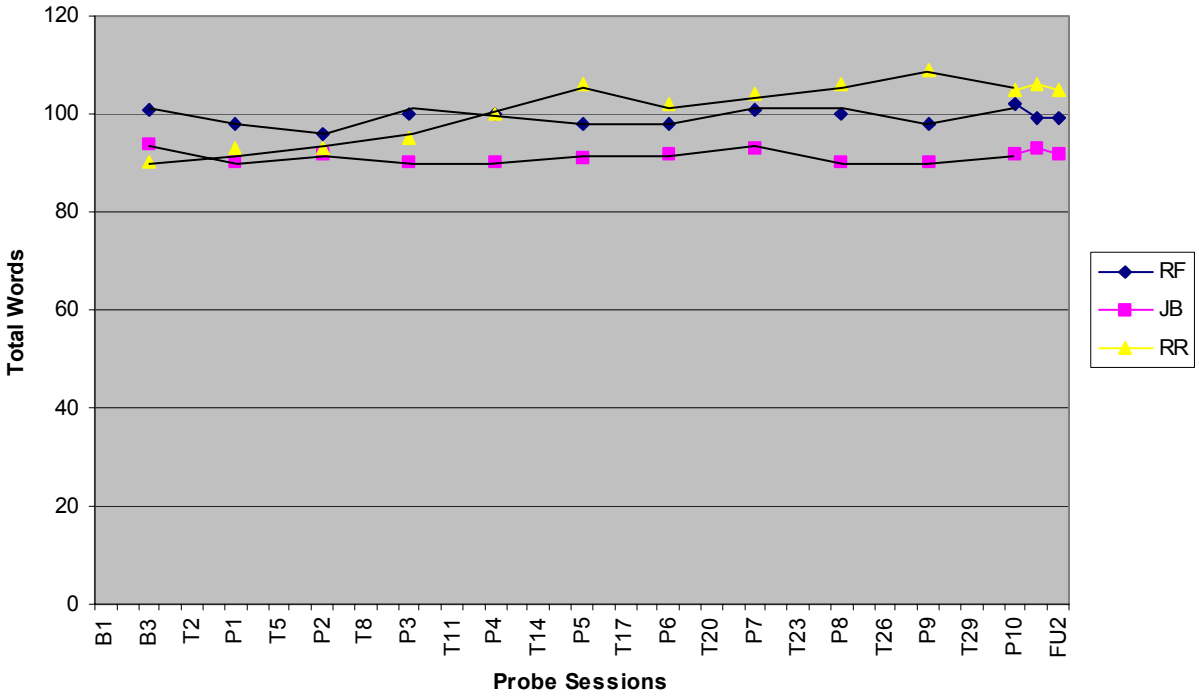

Figure 7: TWFD Word Finding Index