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### The Use of Instructive Feedback for Teaching English and Familial Language Vocabulary to Children with Autism Spectrum Disorder

Guangyi Lin

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**The Use of Instructive Feedback for Teaching English and Familial Language Vocabulary  
to Children with Autism Spectrum Disorder**

by

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A Thesis Submitted to the Graduate Faculty of

St. Cloud State University

In Partial Fulfillment of the Requirements

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Master of Science

in Applied Behavior Analysis

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## Abstract

There is limited research that has evaluated familial language acquisition in children diagnosed with autism spectrum disorder (ASD) using instructive feedback (IF). There are many challenges that children with ASD face as most of them have skill deficits in the area of social interaction and communication. As most of the applied behavior analysis services are only provided in English in the United States, Language skills are mainly taught in English and English only. In regards to bilingual familial in need of services, the skill deficits found in children with ASD might be further exacerbated due to the lack of services provided in their familial languages or familial language learning. Thus, the purpose of the study is to examine the effects of IF used in tact training on the emergence of untrained relations between English and familial languages. Participants were taught to label the pictures in either English or familial language and IF was delivered to provide information in the other language. The result revealed that using IF, both participants were able to demonstrate multiple untrained relations. Participants tacted the picture accurately in the languages that were embedded in IF. Furthermore, participants gained receptive skills and transitivity relations (i.e., translating between languages without pictures). The results support the use of IF with tact training when teaching language targets to be a time-sufficient and cost-effective teaching strategy.

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## Chapter 1: Introduction and Literature Review

In the United States, one-third of the total population is from culturally diverse backgrounds (Zhang & Bennet, 2003). Data reveal that the number of people who can speak a second language at home has grown approximately 207.4% since the 1980 Census (U.S. Census Bureau, 2017). Despite these increases, the percentage of Americans above the age of five who report speaking an additional language is still only 21.6% (U.S. Census Bureau, 2017).

Within the applied behavior analysis (ABA) field, the lack of diversity among practitioners is evident. As of January 28, 2022, 70.05% of Board Certified Behavior Analysts (BCBA) identified as White Caucasian, 6.85% as Asian, 3.93 % as African American, and 10.56% as Hispanic (Behavior Analyst Certification Board, 2022). There is a considerable need for greater attention to the issue of cultural diversity and cultural humility within the field of ABA in terms of the way that we support diverse families (Fong et al., 2016; Fong et al., 2017). Specifically, the field is falling short of addressing issues related to language diversity. Behavior analysts need to abide by the Ethics Code for Behavior Analysts, which states explicitly in section 1.05 the need to consider cultural diversity regarding deciding various treatment options (Behavior Analyst Certification Board, 2022). Moreover, speaking one's inherited language is a critical element of cultural sensitivity, as research reveals that families have higher levels of cohesion when they communicate in their native language compared to families that speak in second languages (Tseng & Fuligni, 2000).

Benefits are not only observed within individuals' families but also outside of the family settings. Park (2014) reviewed studies that examined the effects of second-language instruction with children diagnosed with an autism spectrum disorder (ASD). Even though the research on the topic is limited, the studies reviewed did not support the recommendation of using only



English. Seung et al. (2006) conducted a longitudinal case study with a child diagnosed with ASD. The result of the study supported the practice of providing services in the primary language when English is not the language used at home to establish linguistic foundations in the familial language.

As the overall population becomes more diverse, there will be more cultural diversity among families with children diagnosed with ASD. Nonetheless, there is very limited published research that has directly compared bilingual to monolingual interventions for children with intellectual disabilities or diagnosed with ASD (Thordardottir, 2010 ). Because there is minimal research on multilingual versus monolingual services, many practitioners in the United States feel more comfortable recommending providing services in English only. Many educators and clinicians fear that dual-language exposure could contribute to additional challenges and delays in language development (Seung et al., 2006). However, the results from Perozzi and Sanchez (1992) might reveal that these assumptions might not be true. The study found that the bilingual group mastered their English targets in 32% fewer total learning trials including both Spanish and English compared to the English-only group.

Many families request that both their familial language and English be included from the start of the services. However, not many studies directly address the question of whether to conduct training in one language at a time or multiple languages concurrently (Wang et al., 2019). There are problems associated with limiting the provision of behavior-analytic services to English-language instruction. When considering the social significance of our practices as a field and per families' requests, individuals need to be able to communicate and interact with their family members and communities. Exposing them exclusively to English could hinder the opportunities that the individuals have to interact with their families who might have poor

English proficiency and vice versa (Yu, 2013). In a broader sense, multilingual instruction can also help advance the discipline of ABA, as programs and curricula are developed in multiple languages and can therefore be transferred more readily to an increasingly global clientele.

One of the ways to establish relations between language skills is through tact training. Defined by Skinner (1957), tacting is a verbal operant that is controlled by a non-verbal stimulus (e.g., a picture of a car, an event, a motion, or a property of event or object). As May et al. (2012) stated, when initially training for tact, reinforcers are contingent on behavior of the individual correctly naming the object. To maintain and establish the relation reinforcement is usually delivered in the form of social praise. Using a car as an example, when an individual sees a car and say the word “car,” the therapist would provide reinforcement by responding “Excellent job, it is a car.” Tact training can be used to teach object naming, but it can also be used to teach individuals to tact locations, emotions, or features of objects (Marchese et al., 2012; Sundberg 1990).

Because tact training involves the direct relation of an object and the name of the object, it can be considered a first step in the development of stimulus equivalence classes (Green, 2001). Stimulus equivalence is the emergence of accurate responses to untrained stimuli and stimulus relations following reinforcement of responses to the trained relations (Cooper et al., 2007; Sidman & Tailby, 1982). There are three main elements required to demonstrate stimulus equivalence (i.e., reflexivity, symmetry, transitivity) (Green & Saunders, 1998; Sidman & Tailby, 1982). Reflexivity is when an individual can demonstrate the skill of matching identical stimuli (e.g., A=A) (Green & Saunders, 1998; Sidman & Tailby, 1982). Symmetry is when bidirectional relations are established (e.g., if A=B, then B=A; Green & Saunders, 1998). Transitivity emerges without any direct training or reinforcement, and it is the product of the

training of two other relations (e.g., if  $A=B$  and  $B=C$ , then  $A=C$ ; Sidman & Tailby, 1982). For instance, in English-language training, when presented with a photograph of a pineapple (A), a client says “pineapple” (B). When the target is taught in the second language, when presented with the same photograph (A) the client says “Bōluó” (C). Symmetry would be tested by asking the  $B \rightarrow A$  relation (“touch pineapple”) and the  $C \rightarrow A$  relation (“touch Bōluó”), and transitivity would be displayed if, when asked “in Mandarin Chinese, how do you say ‘pineapple’,” the client responded “Bōluó.”

A reliable and efficient method using ABA principles that can be implemented in language acquisition is instructive feedback (IF). IF involves presenting non-target stimuli with the consequent event of a target response to promote the acquisition of the response that is not directly targeted (Bennett et al., 2011). In other words, extra information is provided to clients during teaching trials and the clients do not need to respond to IF stimuli. IF, when combined with other teaching strategies (e.g., prompting and prompting fading) can be more time-efficient in terms of skill acquisition (Bennett et al., 2011). Research showed that most individuals with or without intellectual disabilities can acquire and respond using IF without establishing the reinforcing contingency on the IF stimulus (Werts et al., 1995). Research also demonstrated treatment effects when using IF to teach category names to children with autism (Loughrey et al., 2014) and language skills (Delmolino et al., 2013). IF allows skill acquisitions without explicitly teaching the non-target stimulus.

The purpose of the current study was to examine the effect of IF on teaching targets in English and familial language. Specifically, tact training was conducted for both English and familial language targets; in other words, if the familial language target was taught, IF was incorporated into feedback of the English language tacts, and vice versa. The emergence of

untrained stimulus relations (i.e., transitivity) in the familial and English language was tested following acquisition of the targets in the other language that was explicitly taught.

## Chapter 2: Method

### Participants and Setting

Two children diagnosed with ASD participated in this study. Chris was five years and two months old. He could communicate vocally in English using two-to-three-word sentences, and his mother chose Mandarin Chinese as his familial language. Sam was six years and 8 months old and spoke vocally in English in complete sentences. When Sam's mother asked Sam to choose between Mandarin Chinese and Spanish, Sam chose Spanish as his familial language. Both participants attended an autism center and previously demonstrated the ability to acquire tact and interverbal targets. All probe sessions were conducted by the researcher and familiar therapists. The participants worked 1:1 with the researcher and therapist during instructional sessions. Either the researcher or a trained therapist took treatment integrity and interobserver agreement data throughout the study.

### Materials

The researcher provided laminated picture cards as target pictures (11 cm x 13 cm). A table and two chairs were used during learning sessions. Datasheet print outs, pencils, and three-ring binders were also provided by the researchers. All the reinforcers used were selected by the participant using a multiple stimulus without replacement (MSWO) preference assessment (DeLeon & Iwata, 1996).

### Dependent Measures

The dependent variable was the percentage of correct tacting of presented pictures when asked by the therapist within five seconds in a tacting program. The total number of correct responses for each target for each session was divided by the total number of trials, and the result was converted to a percentage. Targets were mastered when participants could independently

tact the picture within five seconds of the instruction on 90% of given opportunities for three consecutive sessions.

### **Interobserver Agreement and Treatment Integrity**

Trial-by-trial interobserver agreement (IOA) was conducted for at least 30% of the trials for each language target. IOA was calculated as the number of intervals with occurrence agreements divided by the sum of the number of intervals with occurrence agreements and number of intervals with occurrence disagreements and then multiplied by 100%. The IOA ranged from 90% to 100% (M=98.5%)

Treatment integrity data were collected by other trained therapists for at least 30% of sessions across all phases of the study. For teaching trials, critical steps such as whether the therapist delivered the correct instruction, provided the correct instructive feedback, and delivered the reinforcer were scored. Treatment integrity data for teaching trials ranged from 80% to 100% (M=99.8%). For probe trials, treatment fidelity was assessed by examining whether the correct instruction was delivered and whether reinforcement or feedback was delivered after each trial. Treatment integrity data for probe trials were 100% (see Appendix).

### **Experimental Design**

The researcher used a concurrent multiple-probe A-B-(B') design across targets to evaluate the acquisition of targets in both languages. The B' phase was only added to the intervention if there was minimal or no treatment effect after the first intervention phase (i.e., B phase). Minimal or no treatment effect was defined as zero correct responses when probing for the language targets taught using IF once the explicitly trained target was mastered. The B' phase consisted of explicitly teaching the language targets that were provided as a part of the instructive feedback.

## **Procedure**

### ***Therapist Training***

Two trained therapists and the researcher conducted most of the sessions, with one therapist present per session. Behavioral skills training (Parsons et al., 2012) was used to ensure the therapists implemented the treatment accurately. Once language targets were determined, targets were made into laminated picture cards with the correct tacts (i.e., both English and familial language) written on the back. The pronunciation of the target was written on the datasheet and on the back of the picture cards to maximize correct pronunciation when conducting the trials for the study. Therapists were asked to tact the items on the picture in both English and familial language. The researcher, whose first language is Chinese Mandarin, and a therapist who is fluent in Spanish listened to the pronunciation of the targets and decided whether the therapists had the accurate pronunciation. The mastery criteria were met when the therapist could pronounce targets 100% correctly in both languages over three trials. To train implementation of the tacting program, a checklist was created for each step (see Appendix). The therapist read through the checklist and the researcher answered any questions that the therapists had. The researcher then modeled the implementation of the tacting program with another staff member. Following the researcher-led role play, the researcher took the role of the client and the therapist implemented the tacting program. Feedback was delivered after each role play. Mastery criteria were met when the therapists performed 100% of steps correctly (see Appendix).

### ***Pre-assessment***

To identify language targets for baseline and training, a list of pre-selected targets was used (see Appendix). Additional potential targets for both English and familial language were selected depending on individuals' skill levels and caregivers' input (e.g., family relations, or

culturally specific food or items). Some of the pre-selected categories were animals, fruits, music instruments, or colors. Examples of target and IF pairs are shown in Table 1. During the pre-assessment, the researchers went through the list of 25 targets to determine identify pictures that were unknown to the participants in both languages. The researcher held up a photo and delivered the instruction “In English, what is this?” to assess tacting skills in English. When assessing targets in the familial language, the instruction will be “In [familial language], what is this?” Each target was tested for up to three trials. For all the responses during pre-assessment, the therapist did not deliver any reinforcers, attention, or feedback contingent on correct or incorrect responses from the participants. Once five targets were identified, the pre-assessment phase was terminated. Sam was able to tact most of the targets in English. Thus, only two targets were identified. For Sam, another list of targets was presented to identify three additional targets.

### ***Baseline***

A single MSWO preference assessment was conducted in both baseline and intervention (DeLeon & Iwata, 1996). Items for the MSWO were selected from caregiver suggestions or observation of the participant. Baseline sessions included three trials of each of the four targets. Similar to the pre-assessment phase, the therapist held up the photo of the target and delivered the instruction “In [familial language or English], what is this?” Participant responses were recorded, but no feedback or reinforcers was delivered contingent on the response.

Reinforcement for appropriate behavior was delivered to maintain participation (e.g., “I love how you’re sitting nicely,” “You’re working so hard today!”). The pre-assessment data were used as one of the baseline sessions, and a therapist collected two additional sessions of baseline data. Once two targets were in intervention phase, single-trial baseline probes for the other language targets were conducted every two weeks and immediately before intervention began.



### *Intervention*

**Tact Training with IF.** Starting the teaching trials, the researcher selected two targets from the same category (e.g., fruits). For one of the targets, the therapist taught English explicitly and provided IF in the familial language. For the other target, the participants were taught explicitly how to tact the target in the familial language with English embedded in IF. Each tact training session included two probe trials of the IF-language targets (one trial per target), followed by ten trials of English or familial language tact instruction. Figure 1 depicts the sequence of steps in a teaching trial for English and familial targets. The IF-language probe was conducted identically to baseline trials, using the instruction “In [IF language] what is this?” In training trials, the therapist held up a picture to participants’ eye level and delivered the instruction, “In [English or familial language], what is this?” A most-to-least prompting sequence was implemented (i.e., full vocal, partial vocal, time delay). The criterion for prompt fading was 90% within a session for three consecutive sessions. Once the participants tacted the picture correctly, the therapist delivered praise with IF by stating, “Good job! In [English or familial language] it is [item on picture in English or familial language]!” and delivered a reinforcer. The partial-vocal prompt was provided by vocally pronouncing the first syllable sound of the target. When the prompt level was a time delay, a partial-vocal prompt was delivered if the participant did not respond after 5 s. Correct, independent, and incorrect responses were recorded on each trial to yield a percent independent score for both targets. A target was considered mastered when the participant correctly tacted the picture independently in the explicitly taught language on 90% of trials for 3 consecutive sessions; however, therapists continued sessions to test for emergence of the IF-language tact. If the participant correctly tacted the target in the IF language in the initial probe of these post-mastery sessions, the

subsequent ten teaching trials were skipped. The target then was considered mastered in the IF-language when the participant correctly tacted the picture in the IF language on three consecutive probe trials. Teaching trials for the next two targets began once the first two targets were mastered in both English and the familial language.

**IF-Language Training (Chris only).** If the participant mastered a target in the explicitly taught language but failed to demonstrate IF-language tacting after three additional sessions, the researcher conducted a B' phase in which the IF-language target was taught explicitly. The IF-language training was conducted identically to tact training, apart from not implementing IF. Once the participant reached the mastery criteria of responding 90% correctly for three consecutive sessions, they moved on to test for transitivity.

**Modified Instructions (Chris only).** Following session 17, the researcher noticed that Chris always tacted the target correctly but was unable to discriminate the language wanted within the SD (i.e., English vs. Mandarin). Thus, SD was adjusted to “What is this?” and then “Tell me in a different language.” As the purpose of the study was to teach tacting in two languages and not categorizing words as being in English or Mandarin, the modified instructions for Chris served to remove the confound of a separate discrimination repertoire.

**Probe for Transitivity.** After meeting mastery for a target in both English and the familial language, a single probe session was conducted to test for untrained equivalence relations. Sessions included three trials testing the B→C (English → familial language) relation and three trials of the C→B (familial language → English) relation. No pictures were presented in these trials. The therapist presented the instruction “What is [item in English] in [the familial language]?” for B→C trials and “What is [Item in familial language] in English?” for C→B

trials. No feedback was delivered contingent on correct or incorrect responding, and reinforcers were delivered on a variable-ratio schedule to maintain participation.

**Receptive Probe.** After participants achieved mastery criteria for a target, a receptive probe was conducted. Participants were asked to choose a target photo from an array of three photos: one distractor and the two targets that were teaching as a set. For example, when conducting receptive probe for Sam, the array consisted of pictures of a beet, pomegranate, and turnip. Both English and familial language were probed for each target. Each target and language were randomly presented, and the position of the picture cards were switched after each trial.

### ***Follow-up***

Follow-up data were collected two weeks and one month after a target was mastered. During the follow-up phase, tacting of targets in both languages were assessed. The researcher ran one trial of each language target. If the percentage of independent correct trials was equal to 100%, this indicated that the participants maintain the particular response.

### Chapter 3: Results

Figure 2 shows the progression of learning for Chris. For the first set of targets (i.e., pelican and antelope), the baseline was stable at 0% correct. During teaching trials, Chris went through three sessions each of full vocal and partial vocal prompts. After six trials of teaching using prompts, no emergence of IF-language learning was observed. During those IF probe trials, researchers delivered the instruction asking for a specific language. For example, the therapist delivered instruction. “In Chinese, what is this?” while holding a picture of a pelican. Thus, the researcher proceeded with the IF-language teaching phase to explicitly teach the language that was delivered within IF during teaching trials. Data was relatively variable even with explicitly teaching. However, once Chris moved on to the modified instructions phase in session 18, he immediately showed skills in tacting both targets in Chinese and English.

For the second set of targets (i.e., loquat and cauliflower) no correct responses were observed during baseline probes. Chris was able to tact the picture in the language embedded in IF for both targets starting the second session of teaching trials. Moreover, Chris continued to independently tact the picture in the IF language for both targets. Once six trials of teaching implementing prompts, modified instructions phase was introduced. Chris’s data shows that he was able to consistently tact the pictures in both languages.

When examining the learning progression of the first set and second set of targets, Chris exhibited faster learning acquisition when learning the second set of targets. Starting session 23, Chris was able to tact the targets language that is embedded in IF (i.e., Loquat in Chinese, Cauliflower in English). In other words, Chris, acquired tacting targets in IF language before the teaching sessions ended.

Figure 3 depicts the first set of targets for Sam. For the first set of targets (i.e., turnip and pomegranate), baseline data were stable at 0%. During prompted teaching trials, Sam's data shows that he was able to tact the IF language but did so inconsistently. Once the prompted teaching trials ended, the data show that Sam was able to tact the picture in both languages for three consecutive sessions. During the first one-month follow-up, Sam was only able to tact both languages for turnip. However, the next day after the one-month follow-up, Sam was able to tact both targets (i.e., Turnip, Pomegranate) in English and Spanish.

In terms of second set of targets, Sam continued to demonstrate similar learning progression when compared to the first set. Baseline probe data were stable. Once the prompt sequence ended, Sam was able to tact both targets in English and Spanish. Despite not being able to tact chimes in English at session 26, Sam achieved 100% for all targets in both language for three consecutive sessions.

Figure 4 shows Chris's performance on receptive skills. For the first set of targets, data suggest that Chris was only able to consistently identify the picture of a pelican in Chinese starting the sixth session of the probe phase. The data for pelican in English and antelope in both languages reveal the emergence of receptive skills after tact training. The data for receptive skills for the second set of targets suggest that Chris's receptive skills emerged after the teaching trials ended. As seen in Figure 5, a similar pattern of responding was seen for Sam, who was able to show the emergence of receptive skills for three consecutive trials after the teaching trials.

Table 2 depicts the transitivity relations of targets for Chris and Sam. Chris and Sam demonstrated transitivity for both sets of targets when probed after mastering the tacts in both languages.

## Chapter 4: Discussion

The current study extends the literature on tact training and bilingual instruction by using IF to teach tacts in two languages to two boys diagnosed with autism spectrum disorder. One noteworthy observation was that when the therapist delivered the IF in training sessions, both Chris and Sam repeated the item in the language that was delivered within IF. Regardless of whether the participants repeated after the therapist, the therapist did not deliver praise or reinforcer contingent on their repetition but rather their attending skills (e.g., “Nice looking at the picture.”). The repetition of words could be due to that both participants had experience with behavioral services and specifically interverbal training and vocal prompting sequence (e.g., full vocal, partial vocal); thus, it is expected that the reinforcement history has maintained the behavior of repeating after the therapists. It is unknown to the researchers the effects or the lack of effects of this observation regarding the acquisition of IF language.

When therapists probed for the first set of targets for Chris after teaching sessions, Chris could tact the two targets in both languages (i.e., English and Chinese). However, it often was scored as incorrect because Chris would respond to the instruction with the word in the incorrect language. For instance, when the therapist asked Chris to tact the picture of the pelican in Chinese, Chris would tact the picture in English and vice versa. As the researchers observed this pattern, a modified instruction was provided to test whether Chris had developed acquisition of both languages for a target through explicit teaching and IF despite not consistently pairing each tact with a particular language (i.e., “pelican” as English). This particular phenomenon should be noted when considering functionality of the responses. Even though, when asked to tact the picture in a specific language, Chris was unable to tact it in the correct language, Chris still tacted the picture correctly and thus constitutes a functional response. When encountering natural

contingencies, one would assume that when one language is not understood by listeners, speakers will resort to a different language or means of communication. The modified instructions mimicked the situations that Chris could experience in the natural environment. Future studies could examine individuals' skill to discriminate between English and familial languages prior to teaching trials. Discrimination of languages could also be considered as a prerequisite skill for the study or taught as a separate target skill.

In terms of trials to mastery, IF was implemented in both participants' first language (i.e., English) and familial language (i.e., Chinese or Spanish) for each set of targets. It was anticipated that using IF to teach English would be most effective or require fewer trials in comparison to using IF to teach familial languages, which neither of the participants speaks. However, the trials to mastery are relatively similar regardless of what language IF was used.

The learning progression of second set of targets for Chris aforementioned, was faster than the first set. The data revealed that Chris was able to tact the picture independently in the language that was embedded in IF. It would be due to a practice effect. Even though the two targets are new for the second set, the idea of two words can mean the same picture has been practiced. It could also be that the Chris had experienced the pronunciations of languages.

One limitation to the current study is that acquisition could have been increased due to participants' hearing or learning the language at home or when watching content online. However, to increase internal validity, the language targets chosen were relatively obscure and parents were not informed of the actual teaching targets but only their categorical names. Also, baseline data were probed for second set of targets when teaching the first set. Thus, the opportunity for participants to encounter the learning targets outside of training sessions was minimized. Furthermore, the baseline probes of the second set of targets did not reveal any

learning until explicit tact training was introduced, minimizing the likelihood of interference from outside sources.

Although the obscurity of the targets aided in internal validity, the lack of exposure to these items in other environments may have limited opportunities for generalization and maintenance. Even without having a generalization phase, though, Sam's mother mentioned that Sam told her that he has been learning the word "nabo" and when she asked him what that meant, Sam told her it means "turnip" (a demonstration of the emergent transitive relation). Thus, it appears that some measure of generalization across settings did occur.

It was noted that the carry-over effects might influence the receptive and expressive probe data. In other words, when probing receptive skills, the instructions for receptive trials might become a prompt to participants' responses when being probed for expressive skills, as they might use the instructions from receptive skills as a "vocal prompt" when asked to label the pictures expressively. To avoid this confounding variable, the therapists ensured that there was at least 30 minutes and sometimes multiple days between expressive and receptive probes. In addition, the orders of those expressive and receptive probes were randomized so the receptive instructions were not always presented prior to expressive probes.

When analyzing the data for receptive skills and transitivity relations, baseline data were not collected. It is therefore possible that the individuals might have had the receptive skill prior to teaching trials. However, it is unlikely that these participants, due to their advanced vocal-verbal repertoires, would demonstrate receptive skills in the absence of the correlated expressive tact (i.e., recognize a word but not state it) or that they would have established transitivity relations between languages for each target without the learning trials. In addition, when examining the data of receptive skill, Chris was unable to consistently select the picture of



pelican when therapist asked in Chinese (i.e., Tí niǎo). Thus, the acquisitions of receptive skills prior to teaching trials might be improbable. Nonetheless, future studies should consider collecting baseline data for receptive skills to enhance internal validity, especially for participants whose vocal-verbal skills do not demonstrate transfer of functional control between receptive and expressive repertoires.

Another limitation of study is that the researchers only delivered instructions and IF in English when teaching both languages. The researcher did not provide the instructions in participants' familial language (e.g., "¿En Español, qué es esto?") as neither participants' family spoke the familial language at home. Future studies could examine the effects of using the familial languages when delivering instructions and feedback when teaching familial languages. This may be especially beneficial for individuals who have more equal exposure to both English and familial languages in their environment. Pairing the familial-language instructions with a familial-language tact might also allow individuals to learn which words exist in each language.

This study allows further discussion of using IF to teach languages to individuals with ASD. Using IF to increase instructional efficiency remains compelling. This study was able to demonstrate that the effects of IF on teaching languages are evident. As behavior analysts serve more diverse clients, some of whose caregivers are not fluent in English, and incorporate cultural sensitivity into their practices, the importance of having clients being able to communicate with their caregivers in their familial languages continues to grow. The results of the study also challenge the field, which predominantly expects behavior analysts to teach and clients to respond only in English, to reconsider the status quo. Limited research has implemented IF to teach different languages. Thus, further research and replications are necessary to determine the effects of using IF when teaching languages.

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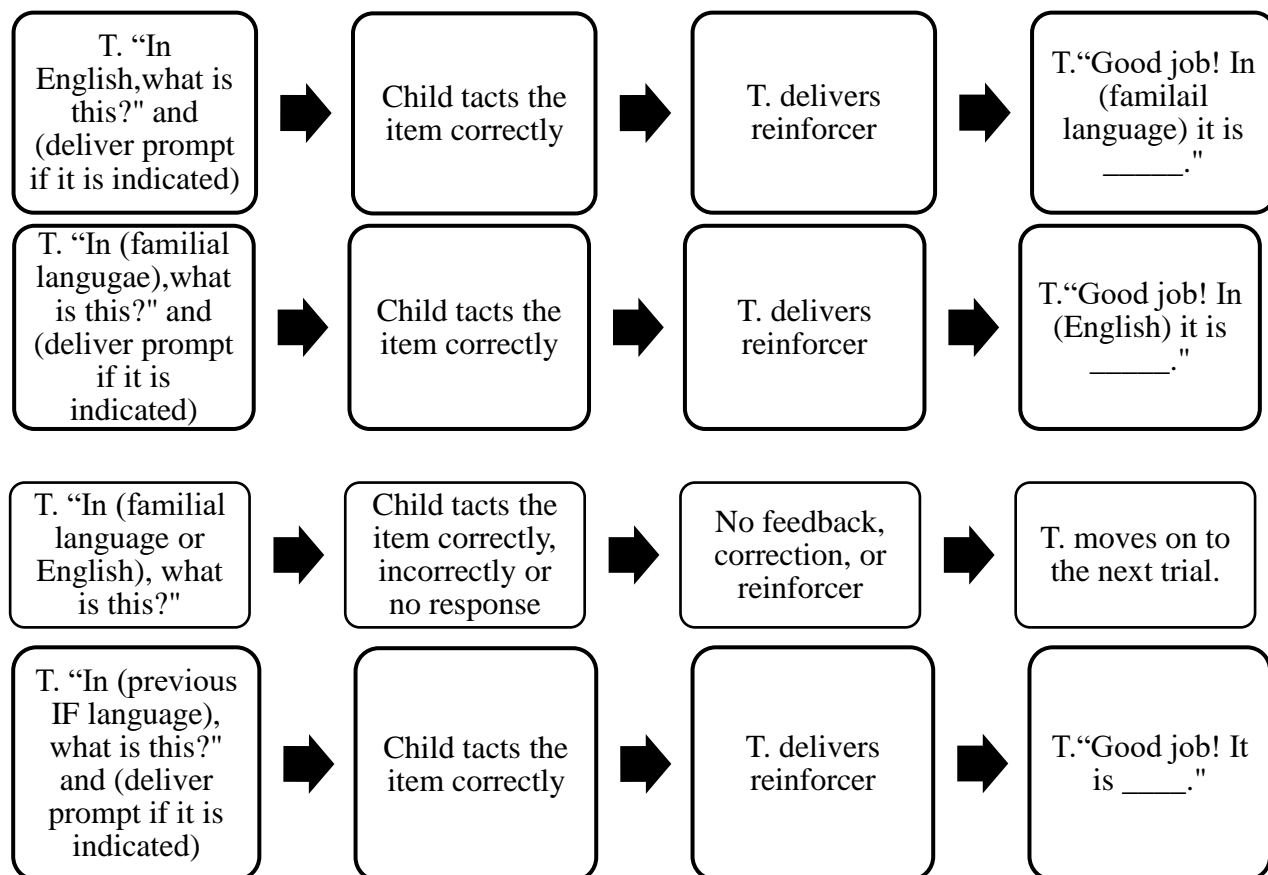
**Table 1***Target Language Pairs*

Participant	Target (English)	Target (Mandarin)
Chris	Pair 1: Pelican	Tí niǎo
	Antelope	Líng yáng
	Pair 2: Loquat	Pí pá
	Cauliflower	Huā Cài
Sam	Target (English)	Target (Spanish)
	Pair 1: Turnip	Nabo
	Pomegranate	Granada
	Pair 2: Tambourine	Pandereta
	Chimes	Campanadas

**Table 2***Chris's and Sam's Transitivity Probe*

	<b>Transitivity Probe (Chris)</b>			
	Pelican		Antelope	
Session	ENG-Chi	Chi-ENG	ENG-Chi	Chi-ENG
1	100%	100%	100%	100%
2	100%	100%	100%	100%
	Loquat		Cauliflower	
	ENG-Chi	Chi-ENG	ENG-Chi	Chi-ENG
1	100%	100%	100%	100%

	<b>Transitivity Probe (Sam)</b>			
	Turnip		Pomegranate	
Session	ENG-Spn	Spn-ENG	ENG-Spn	Spn-ENG
1	100%	100%	100%	100%
	Tambourine		Chimes	
Session	ENG-Spn	Spn-ENG	ENG-Spn	Spn-ENG
1	100%	100%	100%	100%

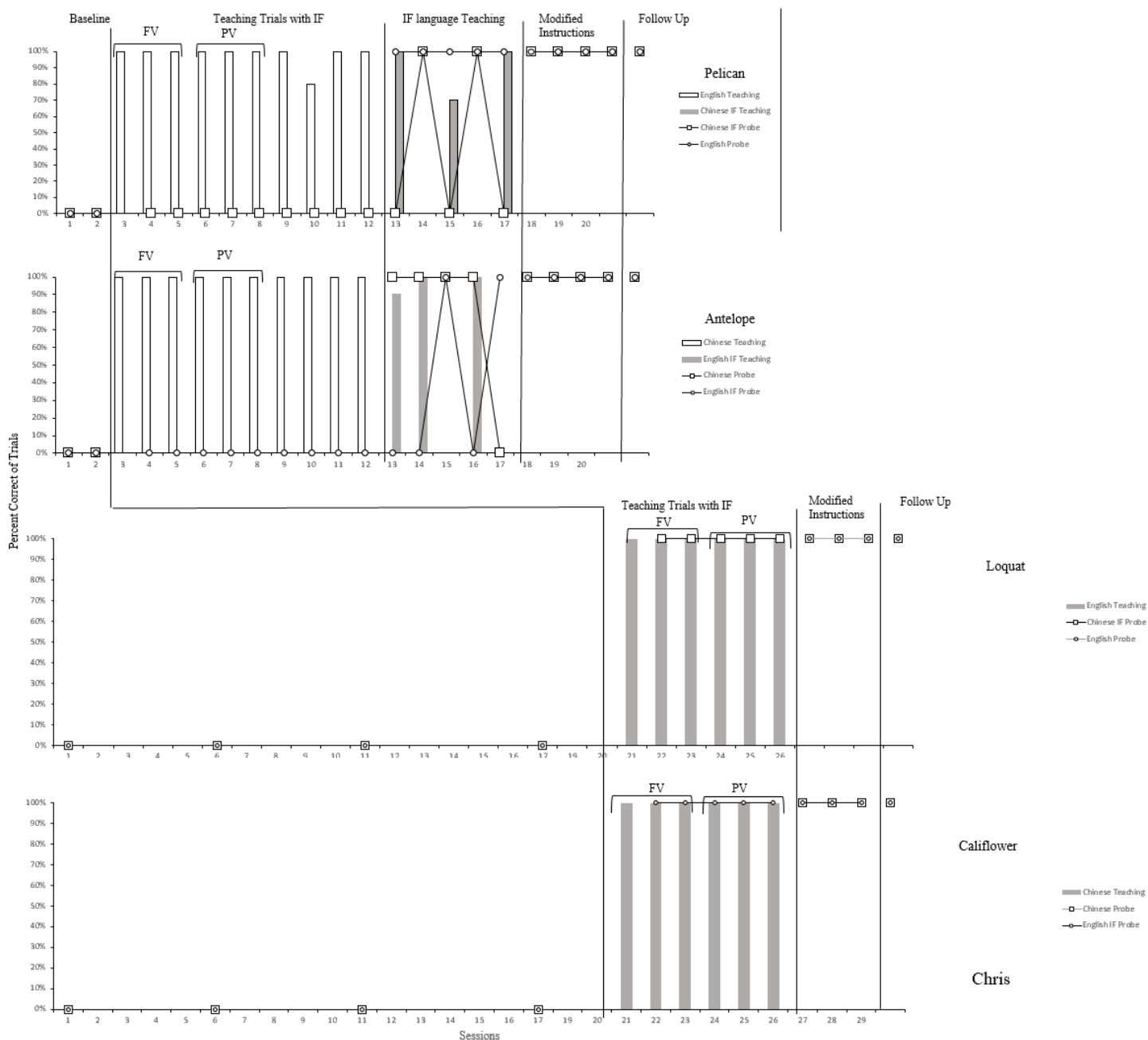
**Figure 1***Teaching Sequence*

*Note.* The figure shows the teaching sequence for English and familial targets (B phase), instructive feedback language target probe, and B' respectively.



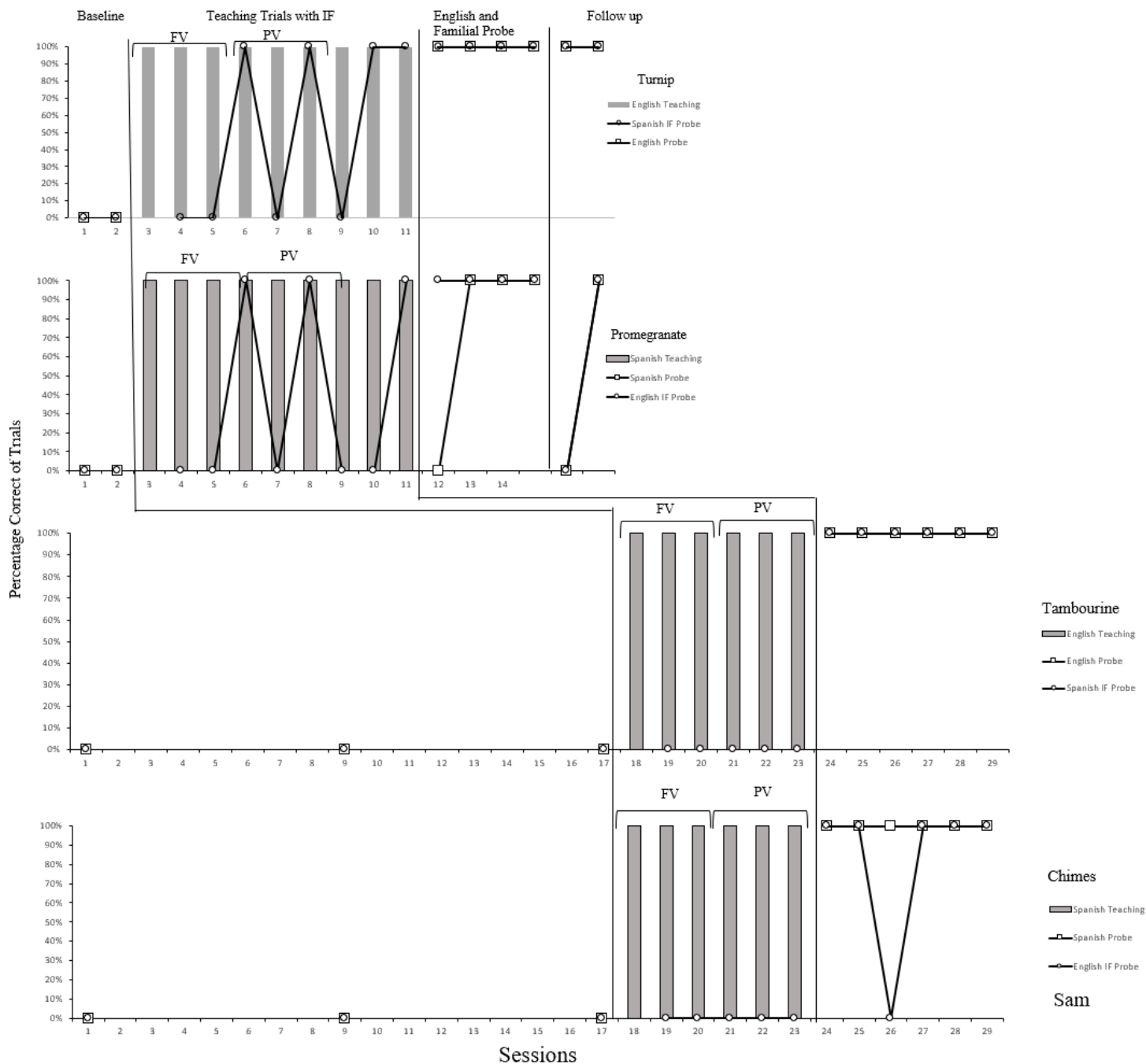
**Figure 2**

*Chris's Tacting Sets One and Two*



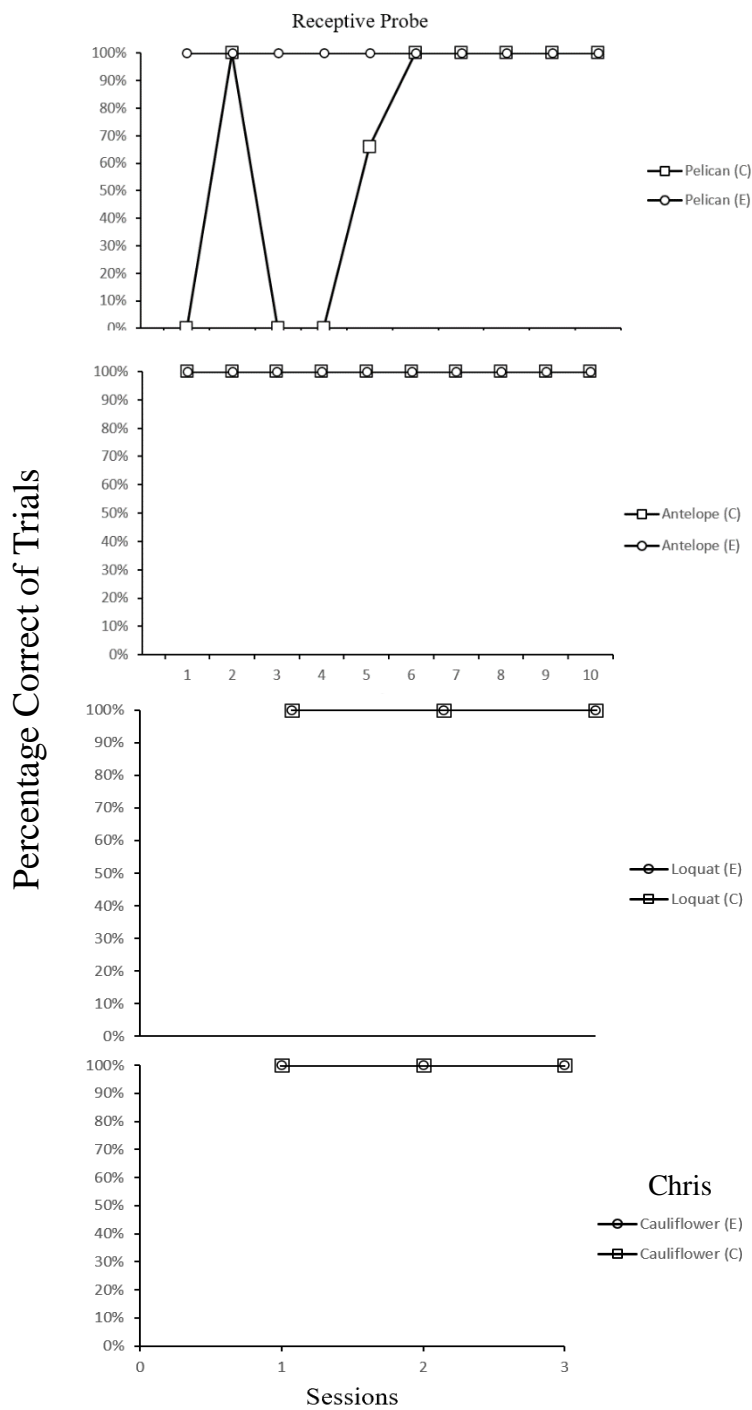
*Note.* The figure shows the progression of learning trials and probe data for tacting. FV indicates when full vocal prompt was used and PV indicates when partial vocal prompt was implemented.

**Figure 3**  
*Sam's Tacting Set One and Set Two*



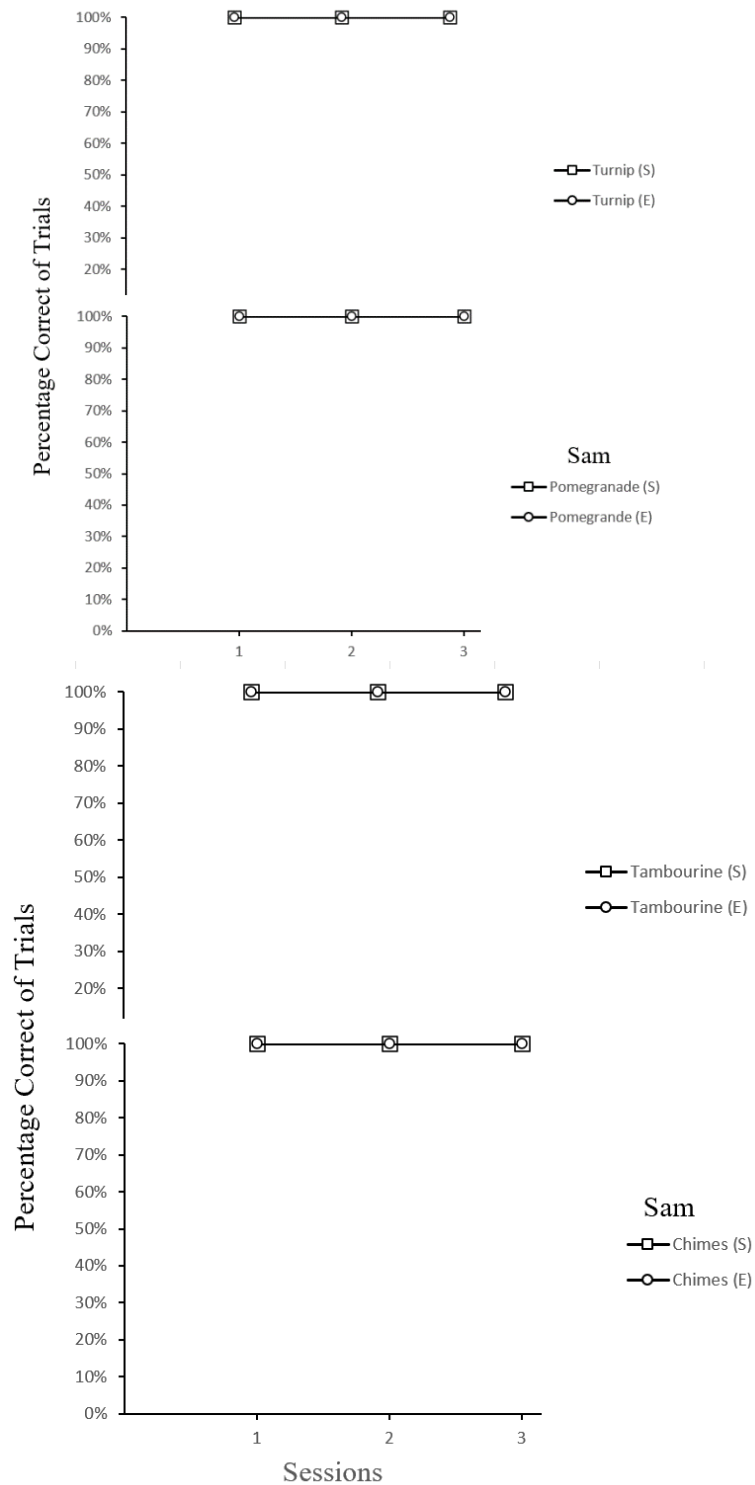
**Figure 4**

*Chris's Receptive Probe Sets One and Two*



**Figure 5**

*Sam's Receptive Probe Set One and Two*



## Appendix A: Checklist for Therapist Training on Tacting Program

### Checklist for Therapist Training on Tacting Program

Trainer(Name):

Date:

<b>Tacting (English Targets)</b>	
	Sitting face to face with the participant at the table
	Remove any stimuli from the participant (If applicable)
	Establish one reinforcer that the participant would like to work for
	Securing attention (e.g., eye contact, participant's body orients toward the therapist)
	Therapist holds up a card to participant's eye level
	Therapist delivers SD "What is this?"
	Therapist delivers current prompt level (If applicable)
	Therapist provides instructive feedback and reinforcer
Percentage:	

<b>Tacting (2<sup>nd</sup> Language Targets)</b>	
	Sitting face to face with the participant at the table
	Remove any stimuli from the participant (If applicable)
	Establish one reinforcer that the participant would like to work for
	Securing attention (e.g., eye contact, participant's body orients toward the therapist)
	Therapist holds up a card to participant's eye level
	Therapist delivers SD "In [2 <sup>nd</sup> language], what is this?"
	Therapist does not deliver reinforcer or feedback
	Therapist moves on to a different trial
Percentage:	

O: if the trainee implements the step correctly

/: if the trainee implements the step incorrectly

N/A: Non-applicable

### Appendix B: Language Targets Pre-Assessment

**Trainer (Name):**
**Date:**
**Participant (Name):**

English Targets				2 <sup>nd</sup> Language Targets			
Animals	Trial 1	Trial 2	Trial 3	Animals	Trial 1	Trial 2	Trial 3
Iguana				Iguana			
Antelope				Antelope			
Jaguar				Jaguar			
Scorpion				Scorpion			
Hedgehog				Hedgehog			
Armadillo				Armadillo			
Pelican				Pelican			
Music Instruments	Trial 1	Trial 2	Trial 3	Music Instruments	Trial 1	Trial 2	Trial 3
Accordion				Accordion			
Banjo				Banjo			
Saxophone				Saxophone			
Tambourine				Tambourine			
Harp				Harp			
Chimes				Chimes			
Colors	Trial 1	Trial 2	Trial 3	Colors	Trial 1	Trial 2	Trial 3
Indigo				Indigo			
Beige				Beige			
Amber				Amber			
Brunette				Brunette			
Maroon				Maroon			
Fruits	Trial 1	Trial 2	Trial 3	Fruits	Trial 1	Trial 2	Trial 3
Sapodilla				Sapodilla			
Rambutan				Rambutan			
Tamarind				Tamarind			
Durian				Durian			
Loquat				Loquat			
Lychee				Lychee			



### Appendix D: Tacting Training Data Sheet

**Program:** Labeling Pictures

**Date:**

**Target:**

**Client:**

Familial Language Target (IF Probe)	Date										
T. "In English what is this?" No feedback or reinforcers	1										
English Target	Date										
T. holds up a picture, "In Chinese, what is this?" + Instructive feedback. e.g., "Good job in English it is _____.")	1										
	2										
	3										
	4										
	5										
	6										
	7										
	8										
	9										
	10										
	% of Correct										

*Staff face to face with client and establish reinforcers and attention. Staff delivers SD.*

- O: When clients can independently tact the item on the picture when asked within 5 seconds
- /: When clients incorrectly tact the item on the presented picture or do not respond after 5 seconds elapse