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# Teaching Intraverbal Behaviour to Children with Autism: Comparing the Effectiveness of Expressive vs. Receptive Teaching

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**Teaching Intraverbal Behaviour to Children with Autism: Comparing the Effectiveness  
of Expressive vs. Receptive Teaching**

by

Jennifer C. Taylor

A Thesis

Submitted to the Graduate Faculty of

St. Cloud State University

in Partial Fulfilment of the Requirements

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### **Abstract**

One of the defining characteristics of autism spectrum disorders is the marked delay in or absence of functional language and as such, children with autism often lack or have a deficient intraverbal repertoire. Intraverbal behaviour is typically taught expressively. Rates of acquisition can be affected by the level of discrimination required in order to answer questions correctly. As such, Eikeseth and Smith (2013) suggested teaching intraverbal behaviour receptively. The current paper conducted a direct comparison of acquisition and maintenance rates of intraverbal behaviour using two teaching techniques: Receptive teaching and Expressive teaching using tact prompts. Results found that Receptive teaching required significantly fewer teaching trials with spontaneous generalisation to the expressive format.

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## **Introduction**

### **Intraverbal Behaviour**

One of the defining characteristics of autism spectrum disorders is the marked delay in or absence of functional language or other communication (Filipek et al., 1999). Often, approaches to teaching language and communication have incorporated the theoretical framework of Skinner's model of verbal behaviour (1957). Skinner defined verbal behaviour as being reinforced through the mediation of another person's behaviour and was primarily concerned with the behaviour of the speaker, rather than the listener. Speaker behaviour typically requires an individual to give a verbal response. Listener behaviour, however, requires an individual to respond to a verbal stimulus using a physical response such as pointing or touching the corresponding visual stimulus.

Skinner makes a distinction between five verbal operants; echoic, mand, tact, textual, and intraverbal (Ingvarsson & Hollobaugh, 2010). Briefly, they are distinct in that a mand is evoked by a specific motivating operation and has point-to-point correspondence, for example a child being hungry, seeing a biscuit and saying "biscuit". A tact requires specific stimulus control and is maintained by social reinforcers. Here a child may say "dog" in response to seeing a dog and receiving praise for doing so. Echoic behaviour also has point-to-point correspondence yet with a verbal stimulus. It too is maintained by social reinforcers, for example a child saying "water" following an adult asking the child if they would like water. In contrast, intraverbal behaviour does not have point-to-point correspondence between the antecedent that evokes the behaviour and the verbal response (Eikeseth & Smith, 2013). The behaviour is evoked by a verbal stimulus and requires a response which does not have formal

similarity. For example the question “What does a dog say?” might result in the response “woof”.

Skinner suggested that children with autism have delayed, defective, or non-existent intraverbal repertoires despite having acquired other verbal operants including manding, tacting, and echoic behaviours. For example, despite a child being able to tact ‘bed’ when they see a photo of one, mand ‘bed’ when they are tired, and repeat an adult’s model in order to say ‘bed’, upon hearing someone say “sleep” or “you sleep in a ...” the child may not be able to respond appropriately (Skinner, 1957). As such, intraverbal behaviour is likely to require specific teaching and instruction in order for a repertoire to emerge.

Intraverbal behaviour is important for the acquisition of: academic skills, categorisation, conversational turns, fill-in-the-blanks tasks, question answering, and typical social functioning. Deficiencies in intraverbal behaviour may affect later academic performance (Partington & Bailey, 1993; Ingvarsson & Hollobaugh, 2010).

Sundberg and Sundberg (2011) noted that children with autism often fail to acquire a functional intraverbal repertoire. Despite acquiring simple intraverbal behaviour such as providing one’s name in response to the question “what is your name?”, further difficulties may arise when presented with more difficult questions such as describing experiences, staying on a specific topic of discussion, and maintaining conversation between two or more people. A weak intraverbal repertoire may also result in the use of irrelevant or rote language. Often this difficulty in acquiring more complex intraverbal behaviour is due to the complexity of verbal stimulus control.

## Conditional Discrimination and Compound Stimuli

Eikeseth and Smith (2013) proposed conditional discrimination can be aided by teaching the discrimination of verbal stimuli and production of verbal response separately.

A discriminated operant consists of a three-term unit that contains a discriminative stimulus, a response, and a reinforcing stimulus. Examples include fill-in-the-blank tasks such as “Ready-set ...” According to Skinner (1957), multiple words do not function as multiple stimuli but as one unit, meaning that “Ready-set” is perceived as one discriminative stimulus. The three-term unit comes under contextual control and its function as a discriminative stimulus is dependent on another stimulus. That is, one discriminative stimulus alters the evocative effects of a second stimulus in the same antecedent event (or vice versa), and they collectively evoke a response (Sundberg & Sundberg, 2011)

Intraverbal behaviour, is often under multiple control that requires conditional discriminations. Conditional discriminations involve a four-term unit (Sidman, 2000). In conditional discriminations the stimuli controlling the verbal behaviour can be both verbal and non-verbal, with the defining feature being that the same stimulus can function as a  $S^D$  and a  $S\Delta$  ( $S\Delta$  is a stimulus that precedes a response, but does not correlate with reinforcement).

Eikeseth and Smith (2013) argued that the conditional discriminations are necessary in order to develop a listener repertoire, and that advanced listener behaviour may facilitate the acquisition of intraverbal behaviour. However, other such discriminations are required in order to develop intraverbal behaviour, such as compound stimulus control. This occurs when either the conditional stimulus contains two or more elements, or the  $S^D$  contains two or more

stimuli. In this example, the S<sup>D</sup> involves two or more elements that together evoke a particular response such as “clap, slow” whereby the listeners behaviour must come under the control of both S<sup>D</sup>s, clap and slow, in order to receive reinforcement.

Perez-Gonzales and Alonso-Alvarez (2008) investigated the control by compound samples in conditional discriminations. In experiment 1, single-sample conditional discriminations were taught. Experiment 2 aimed to determine if single-sample control would emerge after compound-sample stimulus training. Experiment 3 addressed the failure to acquire compound-sample conditional discrimination by one participant following single-sample conditional discrimination training. Experiment 4 tested teaching compound-sample conditional discriminations with a second stimulus set to naïve participants.

The results indicated that experiences with compound conditional discriminations are necessary for the emergence of compound stimulus control. The learner must be sufficiently trained to respond to stimulus compounds proficiently, not simply to emit rote responses, in order to develop listener behaviour. It is this listener behaviour which is necessary for an effective intraverbal repertoire.

### **Early Intensive Behavioural Intervention and Instructional Sequencing**

Expressive and receptive language is taught in Early Intensive Behavioural Interventions (EIBI). Lovaas (1987) recommended comprehension be taught before production i.e., teaching receptive language prior to expressive language, however, other models such as the verbal behaviour model (Petursdottir, Carr, Lechago, & Almason, 2008) do not support this. Receptive and expressive language can be understood in terms of Skinner’s (1957) distinction of listener and speaker behaviour. Listener behaviour can be

likened to receptive teaching in which the child is required to discriminate verbal stimuli and produce a physical response of touching or pointing. Expressive teaching can therefore be likened to speaker behaviour in that a verbal response is required. In EIBI programmes this is established by teaching such skills as: responding to social questions, responding to general knowledge questions, and describing objects in terms of their attributes. As such, intraverbal behaviour is primarily taught as an expressive or speaker behaviour.

**Instructional sequencing.** Petursdottir and Carr (2011) conducted a review of recommendations for sequencing receptive and expressive language instruction. Nine published studies were identified in order to compare; receptive-before-expressive sequencing, expressive-before-receptive sequencing, and expressive-only training. Dependent variables included the number of trials to mastery, emergence of one repertoire following instruction in the other, stimulus generalisation, and maintenance. Four of the studies found fewer trials were required to complete expressive training if the participants had received receptive training first. However, studies showed expressive training had greater facilitative effects on receptive training, rendering receptive training unnecessary.

In general, receptive-before-expressive sequences took twice as many trials to mastery than expressive-only training. After receptive training, expressive training was still necessary. In three studies, expressive training was more likely to generate receptive identification than receptive training was to generate expressive responding. Few studies reported generalisation or maintenance data. Generalisation of the trained repertoire to novel stimuli was assessed following receptive training. Emergence of the alternate repertoire was tested with novel exemplars following expressive training. Significantly greater receptive generalisation was

found after receptive than expressive training. Overall, the studies in this review did not support sequencing receptive before expressive teaching. They suggested that expressive training rendered receptive training unnecessary and by conducting receptive training, it may simply increase the number of teaching trials.

The results of these studies were limited as only two of the reviewed studies included children with autism and little detail was known about the participants existing verbal repertoires. This is significant given that many EIBI, who largely work within the autistic population, promote the receptive before expressive sequencing. Therefore, without a direct comparison of sequencing instruction on intraverbal behaviour, it remains unclear which method is most effective.

Wynn and Smith (2003) studied generalisation between expressive and receptive language in six boys with autism. A multiple baseline design across expressive and receptive training modalities was counterbalanced (three participants received receptive training first and three received expressive training first). Receptive training comprised of giving a verbal instruction related to the materials and reinforcing the child for a correct nonverbal response of touching the correct object. Expressive training comprised of asking a question in the presence of the materials and reinforcing the child for a correct verbal response. Training continued until mastery was achieved across four pairs of stimuli. Following this, generalisation probes to the untrained modality were conducted. The results suggested that participants were more likely to show generalisation from expressive to receptive language. However, this was more evident with participants who had relatively high language abilities. Participants with lower language abilities showed less generalisation from receptive to

expressive due to the lack of language (inability to respond) rather than a failure to generalise. On occasion participants showed expressive mastery before receptive, however, this led to syntactical and grammatical errors. Exceptions to both these patterns included some children failing to generalize to either modality regardless of the order of teaching. The results suggested there are high individual differences in generalization, however generalisation across modalities was possible regardless of which order was taught first.

Greer, Stolfi, Brown and Rivera-Valdes (2005) evaluated the effect of multiple exemplar instruction. This included teaching participants to; point to the correct picture, tact without a verbal antecedent, and tact with a verbal antecedent comprising of the question, “what is this?” The dependent variable was the number of correct responses to probe trials of untaught listener and speaker responses. A multiple-probe baseline across word sets and participants was used where untaught responses were probed following each of the two training conditions. During baseline each child was taught a matching responses (listener or receptive skills) using Set 1 pictures. Following this, probes were conducted for the untaught repertoires of point-to, tact with no teacher verbal antecedent (Pure tact) and tact after the teacher had given a verbal instruction (Impure tact). Next, Set 2 words were taught to mastery comprising the multiple exemplar instruction across the above repertoires (i.e., point-to, pure tact and impure tact). Following this probes were conducted for the untaught three functions using Set 1 pictures. A similar procedure was then used for Set 3 pictures in which all pictures were taught to mastery using the matching repertoire and probes were conducted for point to, pure tact and impure tact.

Results showed that following mastery of matching responses, generalisation to untaught responses; point-to, pure tact, and impure tact emerged. Therefore stimulus control across listener (point-to) and speaker (pure tact and impure tact) repertoires were successful. Generalisation of listener to speaker behaviour also occurred. The reverse response, transfer of speaker to listener behaviour, was not evaluated. Lowe, Horne, Harris & Randle (2002) suggested that these may be separate stages. The ability of a child to act as both a listener and speaker is a critical developmental milestone in the acquisition of more complex verbal repertoires, allowing children to acquire new tacts simply by exposure as a listener. In turn, they may then emit a speaker response without direct instruction. In order for this to occur, there may need to be an instructional history of joint stimulus control across speaker and listener responses.

Sundberg and Partington (1998) suggested sequencing recommendations should be based on the level of language being targeted. Many early intraverbal behaviours do not have corresponding receptive instructional targets, i.e., filling in the blanks, rhymes, and phrases. Despite later intraverbal behaviour having receptive targets, for example when teaching responding to “you drive a ...” the participant can be taught to touch a picture of a car, they argued that pre-requisite tacting skills are likely to be present making receptive teaching unnecessary. Instead, teaching should consist of fading visual stimuli. However, some initial receptive training by objects function, feature, or class may be required in order to start tacting behaviour.

Following from Lovaas’ assumption that comprehension should be taught before production, and given Sundberg and Partington’s suggestion that receptive training can

promote expressive language, and recognising that teaching more advanced intraverbal behaviour will require both the discrimination of complex verbal stimuli and the production of complex verbal behaviour, it can be proposed that learning intraverbal behaviour may be optimised by teaching these two skills separately.

### **Current Research on Teaching Intraverbal Behaviour**

Comprehensive intervention programmes for children with autism teach the use of intraverbal behaviour through prompting appropriate intraverbal responses in the presence of pictures, text, or other stimuli that occasion the target intraverbal response. Following acquisition of the correct intraverbal behaviour, the instructor must fade these prompts so that stimulus control is transferred to the appropriate verbal antecedent (Ingvarsson, Tiger, Hanley, & Stephenson, 2007).

Kodak, Fuchtman, and Paden (2012) compared three intraverbal training procedures. Effectiveness was measured through the number of correct unprompted responses defined as providing a relevant answer to a question prior to a prompt. Data was also collected on echoics to determine whether echoics interfered with the acquisition of intraverbal responses. Training procedures included echoic prompts plus error correction, tact prompt plus error correction and cues-pause-point (CPP). Training sessions included the random presentation of three target intraverbals presented four times per session. The echoic and tact prompt plus error correction conditions utilised a progressive prompt-delay. A 0-s prompt delay was used initially until participants exhibited 90% correct prompted responses. The delay was increased by 1 s each session contingent on more than 50% of the incorrect responses being a non-response. Each trial included the target questions being asked, implementation of the prompt

delay, delivery of an echoic (or tact prompt depending on the condition) and the elapse of 5s in order to allow for an unprompted response. Error correction was implemented if a correct unprompted response was not emitted during the trial by repeating the trial sequence until either an unprompted response was achieved or the sequence had been repeated five times. During the tact prompt plus error correction condition, the tact prompt comprised of holding a picture corresponding to the correct response for 5 s. During the CPP condition, the therapist first taught tacting of the response by placing a picture of the corresponding response on the table and pointing to it. Following successful tacting of the picture, the questions were delivered in a similar manner however the picture covered .e.g., the therapist pointed to the covered picture. If the participant did not tact the covered picture, an echoic prompt was delivered.

Overall, both echoic and tact prompt plus error correct procedures produced mastery of intraverbal responses and reduced echoic behaviours. CPP did not produce an increase in correct intraverbal behaviour, and echoic prompts plus error correction was the more effective training procedure. This may be due in part to the echoic behaviour coming under appropriate verbal stimulus control, whereas in the tact and CPP conditions the intraverbal behaviour occurred in the presence of nonverbal stimulus.

Ingvarsson and Hollobaugh (2011) found that tact-to-intraverbal procedures were more effective in teaching intraverbal behaviour than echoic-to-intraverbal transfer-of-stimulus-control procedures. Three boys with a diagnosis of autism were used in the study. Thirty-two questions with answers that could be prompted either vocally or with pictures were selected and evaluated during pre-test in order to identify those which were unknown to each

participant. A prompt comparison was then conducted using an adapted alternating treatment design and the effectiveness of echoic versus tact prompts was assessed using a non-concurrent multiple baseline design across participants. During the prompt comparison phase questions were presented and immediately followed by a prompt for three trials (either an echoic, “say...” or picture prompt). In subsequent trials a 5-s prompt delay was implemented. Descriptive praise was provided for correct responses. Incorrect responses or non-responses resulted in a repeated vocal or tact prompts for (two times). Following no response two teaching trials were conducted for that question that were identical to the first trial with the exception that an immediate, 0-s prompt delay, was used. Mastery criteria was defined as three sessions with 80% correct answers on the training probe trials. A generalisation probe was conducted with each question set that was identical to baseline with the exception that the participant’s regular teaching staff conducted the probes. Acquisition of intraverbals was evident for both participants and faster and more stable performance rate occurred in the picture (tact) prompt condition. All participants reached the mastery criteria with fewer training trials in the picture prompt condition.

Tact prompts increased intraverbal behaviour; however, the effectiveness may be due to individual learning histories in which verbal prompts may not be as effective for all learners. It may be that for individuals who find complex verbal discriminations difficult, have a limited verbal repertoire, or lack a history of vocal prompting, learning through tacting may be more effective.

Eikeseth and Smith (2013) examined the extent to which intraverbal behaviour emerged as a result of teaching receptive discriminations. Four boys and one girl with a

diagnosis of autism aged between 5 and 15 were used in the study. A non-concurrent multiple baseline design was used in which each participant learned the responses to six questions in a receptive format. This required each participant to respond to a verbal question with a non-verbal response of touching or pointing to the correct picture. Correct responses were followed with verbal praise but did not contain the noun label shown in the picture. For example following the question, “what’s an animal that’s grey?” the participant would respond by touching the picture of an elephant. Verbal praise such as “great, well done!” was delivered but praise statements did *not* contain “yes, an elephant, great!” This ensured teaching was purely receptive. Following mastery of all six questions an intraverbal probe was conducted. Here, each question was asked without any other materials or pictures present. Generalization to untaught questions was also probed by asking two novel questions. Four of the five participants were able to answer receptive questions without pictures present achieving either 5/6 or 6/6 questions correct. One participant required additional training procedures in order to transfer to the intraverbal format. This participant was taught to tact by including the noun label in the verbal feedback during receptive teaching, e.g., “elephant, well done”. Generalization to untaught questions did not occur, i.e. four participants did not answer either novel question correctly and one participant answered one question correctly.

The results demonstrated that it is possible to teach intraverbal behaviour first as a receptive skill, however, generalisation would be optimised by including labelling as part of the receptive teaching process. This is supported by Partington and Bailey (1993) who demonstrated that tact and intraverbals responses are separate verbal operants in normal developing children. To train verbal responses, it may be necessary to do so in the presence of

verbal stimuli or at least present the verbal stimuli concurrently with the tact prompt.

Therefore in order to facilitate generalisation from receptive to expressive skills, labelling stimuli may be necessary.

## Research Proposal

Current research suggested that intraverbals are separate verbal operants that require specific training in order to emerge. A number of methods have been identified to teach intraverbals, however, large variability exists across participants with no one method showing reliably high acquisition rates. The large variability may be due to the participants existing verbal repertoire; those with a large verbal repertoire learning quickly through echoic prompting versus participants with a small verbal repertoire responding better to tact prompts. Due to the complexity of discrimination required and the difficulty for some to form a verbal response, Eikeseth and Smith (2013) proposed that it may be possible to teach intraverbal behaviour first as a listener skill in order to transfer the behaviour to a speaker skill. Greer et al. (2005) demonstrated understanding may facilitate production, however—generalisation from listener to speaker behaviour needs to be taught and trained rather than expected to occur naturally. Similarly there is a need to teach naming in order to promote speaker behaviour when teaching generalisation from the listener to the speaker. A limitation of rote teaching intraverbals through echoic prompts is a lack of conditional discrimination leading to incorrect use of the behaviour (Ingvarsson et al., 2007). Instead, a proficient listener repertoire is required to respond correctly to compound stimuli (Perez-Gonzalez & Alonso-Alvarez, 2008) and therefore use intraverbals effectively. As such, teaching methods which focus on developing an individual's listener skills to later promote speaker skills may be more effective in teaching intraverbal behaviour compared to methods which rote teach responding.

The aim of the current study is to conduct a direct comparison of acquisition and maintenance rates of intraverbal behaviour using two teaching techniques: Receptive teaching and Expressive teaching using tact prompts.

## **Method**

### **Participants**

Three males diagnosed with autism served as participants. Each participant was enrolled in an intensive behavioural intervention programme

James was aged 4 and mildly autistic. He had advanced language skills and was able to hold short conversations. Sessions were conducted in his home. Edward was aged 13 and was moderately autistic. He had a strong expressive and receptive repertoire, basic conversational skills and some more advanced language skills. Sessions were conducted in a private therapy room in school. Paul was aged 12 and was moderately autistic. He had a strong expressive and receptive repertoire but limited language and conversational skills. Sessions were conducted in his home.

Prior to the study, participants acquired a minimum level of receptive and expressive language skills including; identify objects by their name, labelling objects by their name, identify objects by at least two attributes (e.g., blue ball, in the presence of a red ball, blue ball, and blue car), answering intraverbals about themselves (e.g., “where do you live?” and “what’s your name?”), and imitating and responding verbally in short sentences.

### **Settings**

Teaching sessions were conducted in a private therapy room located within the participant’s home or school. Sessions occurred two times per day, once in the morning (9:00 to 12:30) and once in the afternoon (13:30 to 17:00), 5 days a week. Teaching was conducted by the participant’s daily teaching staff.

## Materials

Twenty pictures of noun labels which correspond to previously unlearned intraverbals. These pictures were taken from the internet as either photos or cartoons. Images were printed on plain white paper and approximate A6 in size.

Reinforcers were selected prior to the start of each session using a brief preference assessment. Reinforcers used during the study included small edibles, brief access to tangibles, and social reinforcers. Responses were recorded on a trial-by-trial data sheet.

A training session was conducted and detailed written notes given to each member of staff prior to the study starting. Training comprised of role play with fellow teaching staff conducted by an experienced trainer. Teaching staff were assessed using a training checklist (see Appendix C) and achieved each skill before starting the study. Extra training was provided if and when required. Staff were monitored by an experienced trainer once a week.

Table 1

### *Participant Questions*

Participant	Receptive	Expressive
Paul	What's a vehicle that goes on water? (a boat)	What do you hear with? (ears)
	What do you smell with? (your nose)	What do you eat that's crunchy? (carrots)
	What's a vehicle that's red? (a bus)	What animal has tentacles? (octopus)
	What do you taste with? (your mouth)	What do you see with? (eyes)
	What clothes do you wear on your head?(a hat)	What a food that's yellow? (a banana)
	What do you put petrol in? (car)	What's an animal that's brown? (a horse)
	What's a food that's green? (an apple)	What's an animal that flies? (a bird)
	What animal gives us milk? (cow)	What's a drink that's white? (milk)
	What's an animal that's grey? (an elephant)	What clothes do you wear on your feet? (socks)
	What's a vehicle that has two wheels? (a motorbike)	What do you play with that has wheels? (a car)

James	What do you make at the beach? (sandcastles)	What do you make tea with? (kettle)
	What animal gives us wool? (sheep)	What has pages? (book)
	What plant has bark? (tree)	What breathes through gills?(fish)
	What do you hear with? (ears)	What do you get on at the airport? (plane)
	What do you smell with? (nose)	What do you charge your iPad with? (electricity)
	What animal changes colour (chameleon)	What animal is nocturnal? (owl)
	What does an author do? (write books)	What animal has tentacles? (octopus)
	What animal has tusks? (elephant)	What vehicle goes into orbit? (rocket)
	What heats your house? (radiators)	What do you see with? (eyes)
	What vehicle has an anchor? (boat)	What do you taste with? (mouth)
Edward	What number house does the Prime Minister live at? (10)	What vehicle do you get on at a port? (boat)
	What part of a vehicle makes tracks? (tyres)	What is the capital of England? (London)
	What do you use to drain liquid? (sieve)	What do you need if you have a hole in your tooth? (Filling)
	What do we make plates from? (clay)	What do we make jumpers from (wool)
	What do you charge your iPad with? (electricity)	What powers your TV? (electricity)
	What heats your house? (radiators)	What is the name of the Prime Minister? (David Cameron)
	What clothing has soles? (shoes)	What force keeps us on the earth? (gravity)
	What object has bristles? (brush)	What clothing has lenses? ( glasses)
	What does an author do? (write books?)	What planet is closet to earth? (mars)
	What do you get at the pharmacy? (medicine)	What do you shave with? (razor)

### **Interobserver Agreement**

Interobserver agreement (IOA) was conducted twice a week by a trained observer during either the morning or afternoon session. Data was recorded on each trial (of the session) using the pre-prepared trial-by-trial data sheet as the teaching was conducted. Separate data sheets were used for the teaching staff and the observer with each sheet concealed from the other. IOA was computed after the session had ended by comparing the number of correct, prompted, or incorrect trials recorded by the teaching staff and the

observer. The smaller number was divided by the larger and multiplied by 100. IOA was 98% across all conditions and participants.

### **Experimental Design**

An alternating treatment design was used with a 1 week embedded non concurrent multiple baseline across participants. The Expressive and Receptive teaching was alternated daily from morning to afternoon, for example, on day one Expressive teaching was conducted in the morning and Receptive teaching conducted in the afternoon. Day two, Receptive teaching was conducted in the morning and Expressive teaching conducted in the afternoon. This was counterbalanced across participants. Separate intraverbals were targeted in Expressive versus Receptive teaching. Following mastery of either Expressive or Receptive teaching, maintenance probes were conducted once a week for three consecutive weeks.

### **Dependent Variables**

The dependent variable was the number of trials to mastery and percentage of intraverbals answered correctly during the Expressive and Maintenance probes.

### **Independent Variables**

**Expressive teaching.** Expressive teaching comprised of participants responding to a question with a verbal response. For example, following the question, “what vehicle goes into orbit?” the participant was prompted to say “rocket”. Tact prompts were used whereby a picture of the noun label was presented until the participant gave a verbal response. If no verbal response was given within 5s, a verbal prompt was be used. 10 intraverbals were taught in this way.

**Receptive teaching.** Receptive teaching comprised of participants responding to a question with a selection response. For example, following the question, “what vehicle goes into orbit?” the participant was presented with three pictures and prompted to select the picture of the rocket. 10 intraverbals were taught in this way.

### **Procedure**

Twenty previously unknown intraverbals were selected for each participant. Intraverbals were presented as questions in trials comprising of; (1) the participant being asked the question (the intraverbal), (2) a response or non response being made (saying the answer or selecting the correct picture), (3) and a consequence being delivered (prompt or reinforcement).

**Baseline.** During baseline 20 questions were asked to each participant. The questions were asked in a randomised order. No other materials were present. Responses were recorded as either correct or incorrect using a trial-by-trial data sheet. Non responses, no response within 5 seconds of the question presentation, were recorded as incorrect. After each response or non-response the teaching staff gave neutral verbal feedback in the form of a statement saying “OK”. If a participant answered any question correctly, the question was discarded and a replacement identified.

**Expressive teaching.** During Expressive teaching participants responded to a question with a verbal response. For example, following the question “what vehicle goes into orbit?” the participants were prompted to say “rocket” using a tact prompt. If a tact prompt was not effective a verbal prompt was used. Ten questions were taught in this way. One question was

randomly identified for teaching first. Contingent reinforcement was used throughout. Thirty trials were conducted per session. Teaching was conducted as follows;

**Stage 1. Mass Trials.** The first question was taught by presenting a question (e.g., “what vehicle goes into orbit?”) and delivering a tact prompt e.g. presentation of a picture of a rocket in order for the participant to say “rocket”. Following the participant’s response reinforcement was delivered for approximately 5s. If the participant did not respond to the tact prompt within 5 s a verbal prompt was provided (e.g., “say rocket”). The tact prompt continued to be provided until the participant demonstrated independent correct responding to the question with 90-100% accuracy for 10 trials. At this stage a second question was introduced (e.g., “what plant has bark?”) and a tact prompt delivered (e.g., a picture of a tree) if required. Once independent correct responding was achieved with 90-100% accuracy for 10 trials, both the first (what vehicle goes into orbit?) and the second (what plant has bark?) questions progressed to stage 2.

**Stage 2. Random Rotation.** The first question (what vehicle goes into orbit?) and the second question (what plant has bark?) were asked for in a randomised order until 90-100% correct responding was achieved across 10 trials for question 1 and 10 trials for question 2. A tact prompt was delivered if no response or an incorrect response was made. If after 60 teaching trials correct responding was not achieved to this level, an additional procedure was implemented in order to facilitate the discrimination, Stage 3. Block rotation.

Following 90-100% correct responding, successive questions were introduced (one at a time) in stage 1. When the new question reached stage 2 (random rotation), it was asked in a randomised order with the previously mastered questions (e.g., 1 and 2) and a tact prompt

delivered if required until 90-100% correct responding was achieved across 10 trials (for question 3). Questions 4, 5, 6, 7, 8, 9, and 10 were taught in the same way.

Once all 10 questions were mastered in stage 2, they moved onto stage 4.

**Stage 3. Block Rotation.** The first question was presented (e.g., “what vehicle goes into orbit?”) and a tact prompt provided (e.g., a picture of a rocket) if required. The question continued to be presented until correct, unprompted responding was achieved for one to three consecutive trials. Following this, the second question was presented (e.g., “what plant has bark?”) and a tact prompt provided (e.g., a picture of a tree) if required. The second question continued to be presented until correct, unprompted responding was achieved for one to three consecutive trials. Switching between the two questions continued until participants no longer required prompting on the switch trials and were able to answer each question with a minimum of 90% accuracy across 10 trials. At this stage, the two questions returned to Stage 2, Random rotation.

**Stage 4. Maintenance Probe.** Each of the 10 questions taught expressively were then presented once in a randomised order. Correct responses were reinforced and incorrect or non- responses were provided with a neutral statement (e.g., “OK”) as per baseline. Probes were conducted once a week for three consecutive weeks.

**Receptive Teaching.** Receptive teaching comprised of participants responding to a question with a selection response of pointing to the correct picture. For example, when presented with the question, “what vehicle goes into orbit?” the participants pointed to the corresponding noun picture (e.g., a rocket). Ten questions were taught in this way. During teaching, participants were seated in a chair behind a desk with the teaching staff conducting

the study sat opposite. Pictures of the answers to the questions were placed on the table in front of the participant in a field size of 3. The positions of these pictures were rotated after each trial from a central, right, or left hand position. One question was randomly identified for teaching first. Contingent reinforcement will be used throughout. Teaching was conducted as follows;

***Stage 1. Mass Trials.*** A picture of the answer to the question was placed on the table in front of the participant with two further blank pictures. The question was presented (e.g., “what animal has tusks?”) and a point prompt provided following a 1 s prompt delay for the participant to point to the picture (e.g., an elephant). Once unprompted correct responding was achieved, the blank pictures were removed and two additional pictures (distractors) were presented (e.g., a cow and a tree). Prompts were provided, if required, for the participant to point to the correct picture (e.g., an elephant). Once 90-100% correct responding was achieved across 10 trials, a second question was introduced in the same way.

The second question was presented (e.g., “what has prongs?”) and point prompts provided for the participant to point to the picture (e.g., a fork). Once unprompted correct responding was achieved, two further pictures were presented one of which was the question taught first (e.g., an elephant, a tree, and a fork). Prompts were provided for the participant to point to the correct picture (e.g., a fork) if required. Once independent correct responding was achieved with 90-100% accuracy across 10 trials, both the first (what animal has tusks?) and the second (what has prongs?) questions progressed to stage 2 (random rotation).

***Stage 2. Random Rotation.*** The pictures of the answers to the first and second questions were placed on the table in front of the participant along with a third distractor

picture (e.g., an elephant, a fork, and a tree). The first question (what animal has tusks?) and the second question (what has prongs?) were asked for in a randomised order until 90-100% correct responding was achieved across 10 trials for question 1 and 10 trials for question 2. If after 60 teaching trials correct responding was not achieved to this level, an additional procedure was implemented in order to facilitate the discrimination, Stage 3. Block rotation.

Following this, question 3 was introduced in stage 1, Mass trials. Once mastered in stage 1 it progressed onto stage 2 (random rotation) where it was asked for in a randomised order with the previously mastered questions (e.g., 1 and 2). Mastery was achieved when a minimum of 90% accuracy was achieved across 10 trials (for question 3). Questions 4, 5, 6, 7, 8, 9, and 10 were taught in the same way as question 3.

Once all 10 questions were mastered in stage 2, they moved onto stage 4.

**Stage 3. Block Rotation.** The first question was presented (e.g., “what animal has tusks?”) and prompts provided for the participant to point to the correct picture (e.g., “elephant”) if required. The question continued to be presented until correct, unprompted responding was achieved for one to three consecutive trials. Following this, the second question was presented (e.g., “what object has prongs?”) and prompts to point to the picture provided (e.g., “tree”) if required. The second question continued to be presented until correct, unprompted responding was achieved for one to three consecutive trials. Rotating between the first and second questions continued and the level of prompting required on the switch trials was systematically reduced. Mastery was achieved when participants were able to answer both questions with a minimum of 90% accuracy across 10 trials. At this stage, the two questions were returned to stage 2, Random rotation.

**Stage 4. Expressive Probe.** Each of the 10 questions were presented once in a randomised order *without* the corresponding picture. Correct responses were defined as the participant giving a verbal response (e.g., in response to the question “what animal has tusks?” the participant will respond “an elephant”). Correct answers were reinforced and incorrect or non- responses were provided with a neutral statement (e.g., “OK”) as per baseline. If 100% correct responding was not achieved, any incorrect questions were returned to stage 2 (Receptive random rotation). Once all 10 questions reached criteria in stage 2, a second expressive probe was conducted. If 100% correct responding was again not achieved, the study ended. If 100% correct responding was achieved, the 10 intraverbals progressed onto the next stage.

**Stage 5. Maintenance Probe.** Each of the 10 questions taught receptively were presented once in a randomised order *without* the corresponding picture. Correct responses were reinforced and incorrect or non- responses were provided with a neutral statement (e.g., “OK”) as per baseline. Probes were conducted once a week for three consecutive weeks.

## Results

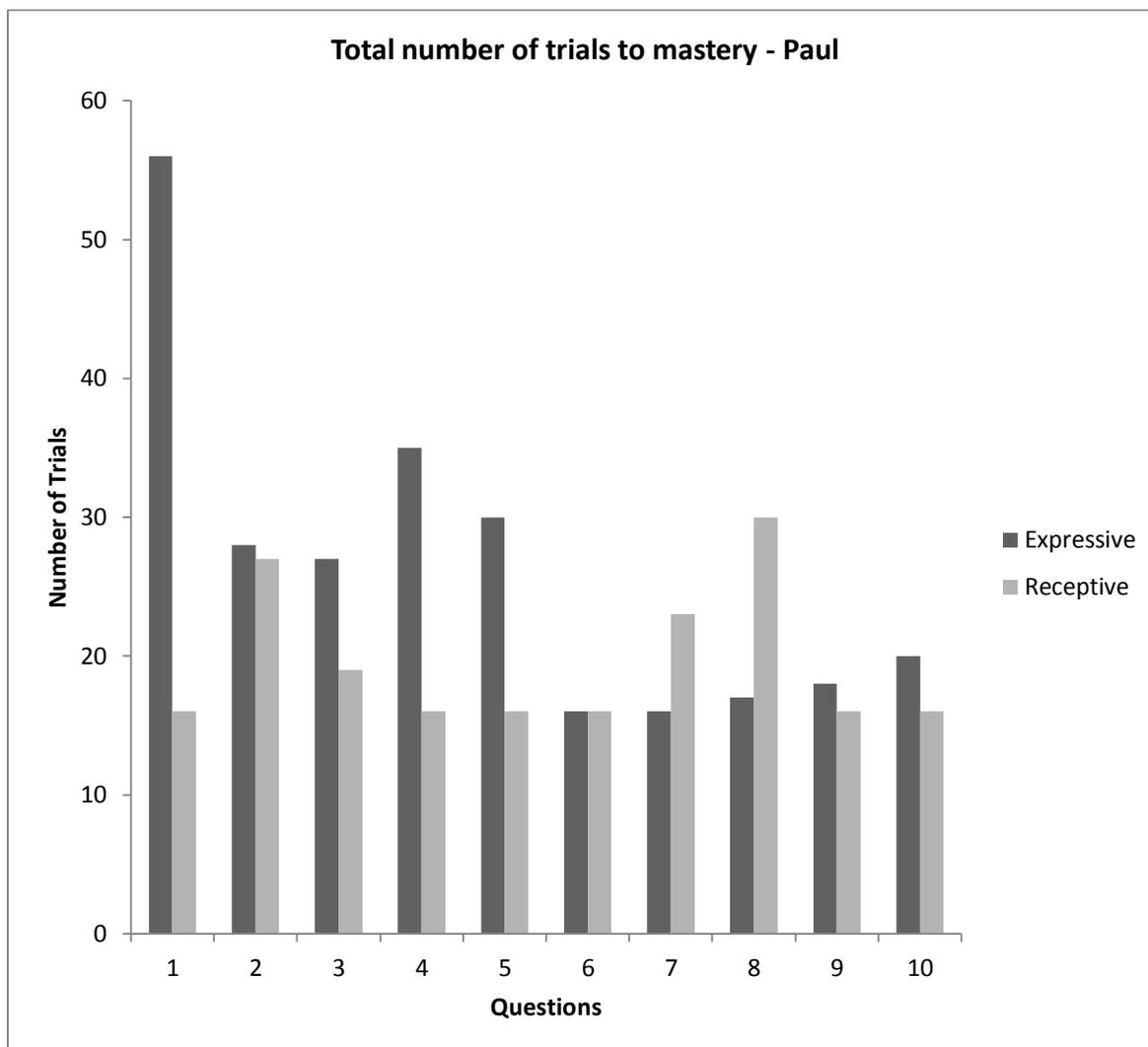
The results for each participant can be seen in Table 2. The number of trials to mastery can be seen for each condition, Expressive teaching and Receptive teaching. All three participants achieved mastery for all questions in both conditions, however, there is large variability both within and across participants as to the number of teaching trials required for individual questions.

Table 2

*Number of Trials to Mastery per Participant and Condition*

Question	Paul		James		Edward	
	Expressive	Receptive	Expressive	Receptive	Expressive	Receptive
1	56	16	25	30	39	25
2	28	27	23	27	33	34
3	27	19	20	23	30	19
4	35	16	21	24	32	29
5	30	16	21	22	21	50
6	16	16	29	22	25	29
7	16	23	20	21	39	19
8	17	30	20	21	20	19
9	18	16	20	21	59	26
10	20	16	20	20	23	33
Total	263	195	219	231	321	283

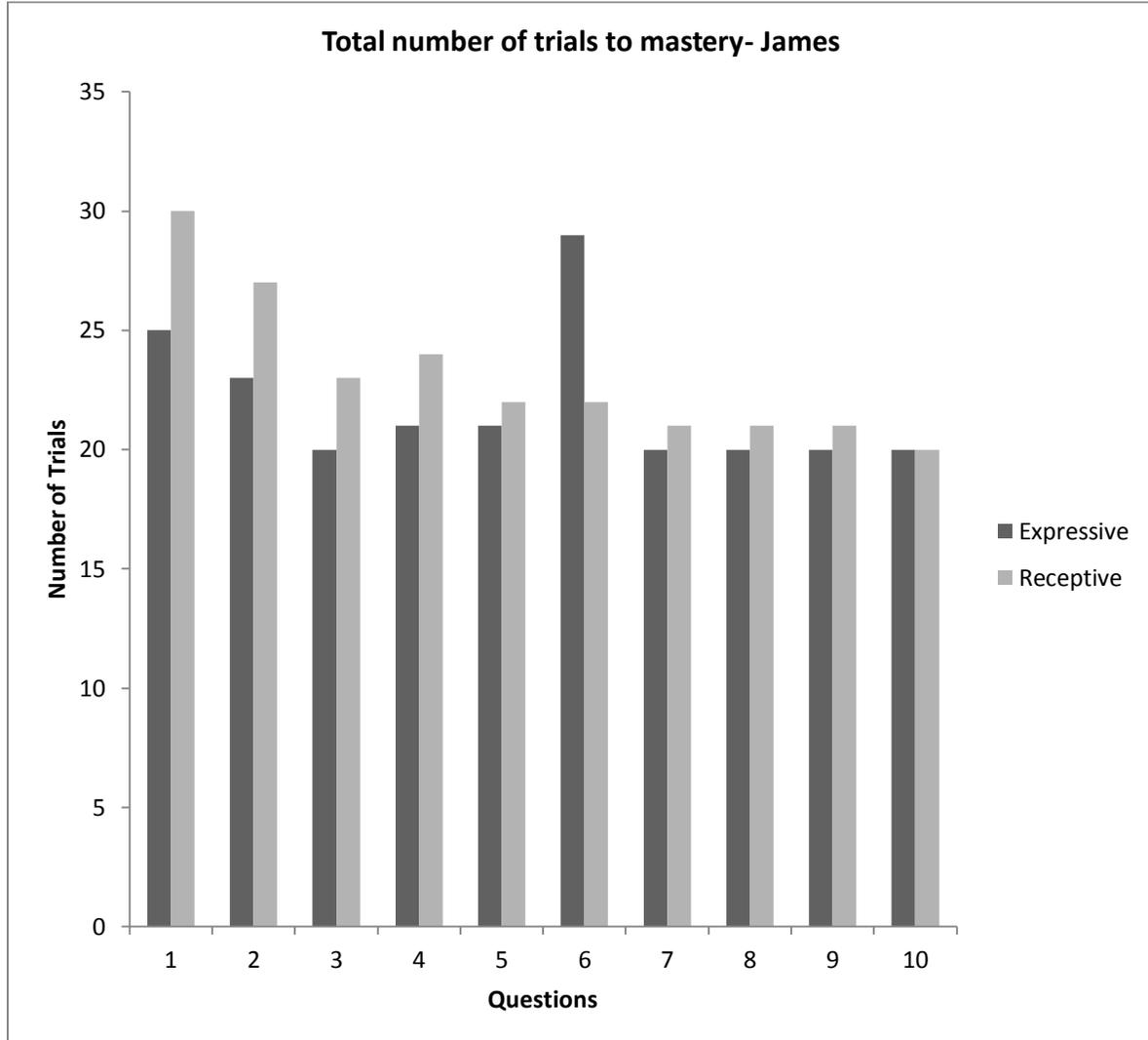
Figure 1 shows the total number of teaching trials to mastery for Paul.



*Figure 1.* Total number of teaching trials to mastery in both the Expressive and Receptive teaching conditions for all 10 questions for Paul.

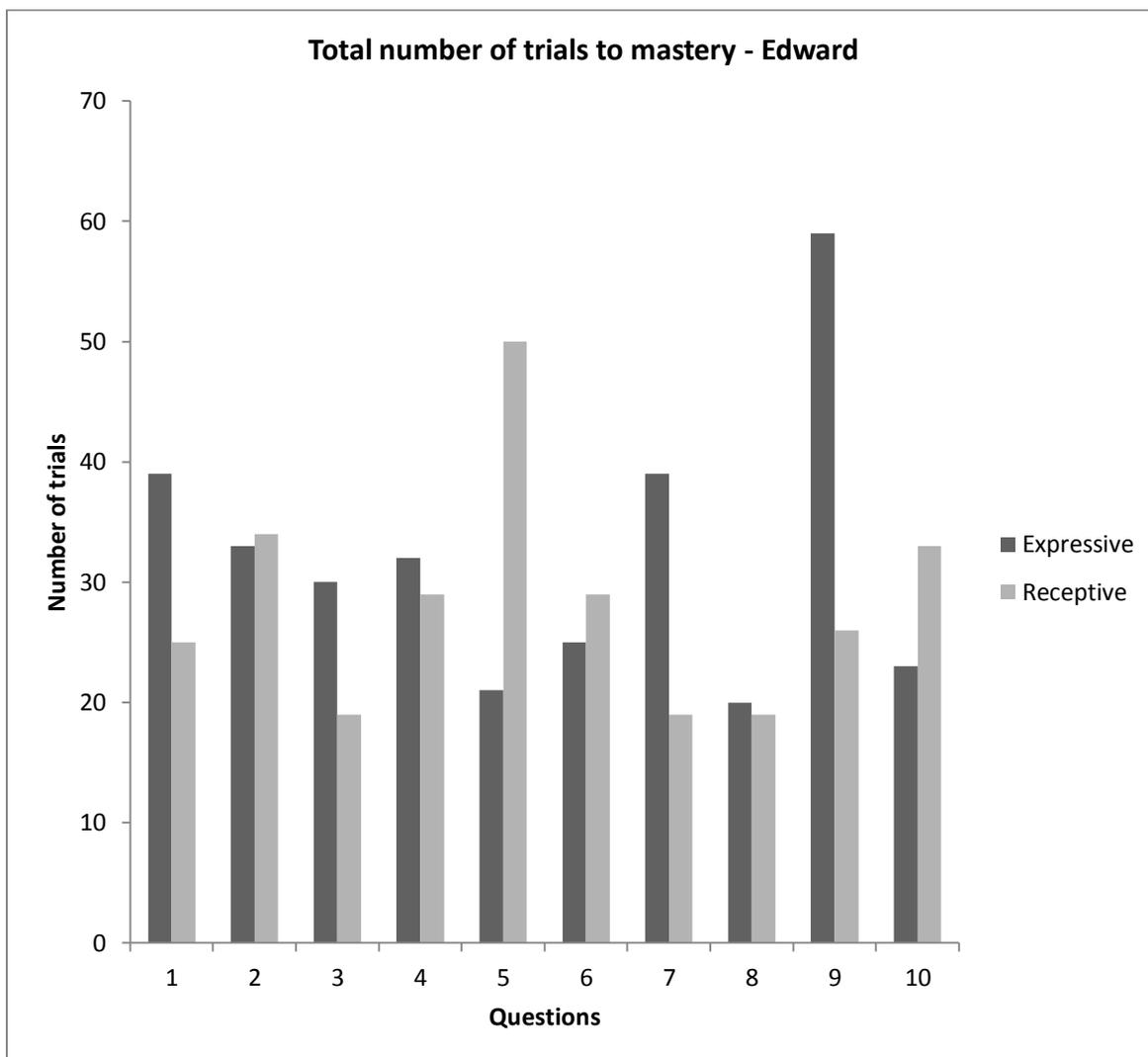
Fewer teaching trials were required in the Receptive teaching condition (195) versus the Expressive teaching condition (263). This is a difference of 68 teaching trials, equivalent to two teaching sessions. This suggests that Receptive teaching was most effective for Paul.

Figure 2 shows the total number of teaching trials for James.



*Figure 2.* Total number of trials to mastery in both the Expressive and Receptive teaching conditions for James.

Slightly fewer trials to mastery were required in the Expressive teaching condition (219 trials) versus the Receptive teaching condition (231). This is a difference of 12 trials suggesting that James required slightly fewer teaching trials in the Expressive teaching condition. Figure 3 shows the total number of teaching trails for Edward.



*Figure 3.* Total number of trials to mastery in both the Expressive and Receptive teaching conditions for Edward.

Fewer teaching trials were required in the Receptive teaching condition (283) versus the Expressive teaching condition (321). This is a difference of 62 trials and equivalent to two teaching sessions. Therefore for Edward, Receptive teaching was more effective.

Table 3 attempts to identify the degree of significance in variability of acquisition rates between the two teaching conditions.

Table 3

*The Number of Questions per Teaching Condition which Achieved Mastery by the Specified Differential.*

Number of Trials Differential	Number of Trials Differential per Teaching Condition					
	Paul		James		Edward	
	Expressive	Receptive	Expressive	Receptive	Expressive	Receptive
2	2	7	8	1	4	6
4	3	4	4	1	3	5
5	2	4	1	1	2	4
10	1	3	0	0	2	4

A differential criterion has been applied to the data meaning that only questions which have been mastered (in one teaching condition) by criterion or fewer trials than in the reverse teaching condition were included. When a differential criterion of two is applied to the data for Paul (meaning that questions in one condition achieved mastery in two or less trials than the reverse teaching condition) a significant difference can be seen between the two teaching conditions. Two questions in the Expressive condition required fewer teaching trials to mastery compared to seven questions in the Receptive teaching condition showing a strong preference towards Receptive teaching. When this criterion is increased to 10, the significance remains with three questions in the Receptive teaching condition requiring fewer trials to mastery compared to one question in the Expressive condition.

When the same criterion is applied to James' data, the significance is more limited. Applying a criterion of two, he mastered eight questions with fewer teaching trials in the Expressive versus the Receptive teaching condition showing a strong preference towards

Expressive teaching. However, as the criterion is increased, this significance reduces. There is no difference across teaching conditions when a criterion of 10 is applied. Therefore for James, there is a slight but non-significant preference towards Expressive teaching.

Finally, when applied to Edward's data we can see more significant variability. Again, with a criterion of two, four questions achieved mastery in fewer teaching trials in the Expressive condition compared to six questions in the Receptive condition. When a criterion of 10 is applied, four questions achieved mastery in fewer trials in the Receptive condition compared to two questions in the Expressive condition. This suggests that there is a significant preference to Receptive teaching.

Overall, the data show that Receptive teaching resulted in fewer teaching trials to mastery compared to Expressive teaching for two of the three participants with a clinically significant difference in acquisition rates. For the third participant, James, the difference in rate of acquisition was not significant suggesting that either method can be used to teach intraverbal behaviour.

Following mastery of questions in the Receptive teaching condition, a probe to the Expressive format was conducted. For two participants (Paul and James) all questions generalised to the Expressive format without any additional teaching. For Edward, seven questions generalised and three required the additional teaching procedures. After returning the three questions to Stage 2. Random rotation; the remaining three questions then did generalise to the expressive format.

Weekly maintenance probes were conducted for three weeks. Results can be seen in Table 3. A high level of maintenance was shown for all three participants across conditions.

Paul showed slightly better maintenance in the Receptive teaching condition, James showed slightly better maintenance in the Expressive teaching condition, and Edward showed 100% maintenance across both conditions. This suggests that once mastery was achieved, questions maintained with a high level of integrity regardless of the teaching method.

## Discussion

Overall the results demonstrate that it is possible to teach intraverbal behaviour receptively, and that for some participants, it required fewer trials to mastery than the more widely used expressive teaching. Spontaneous generalisation to the expressive format was also achieved for all three participants and as such, demonstrates that intraverbal behaviour can be achieved through receptive teaching alone. It is likely that this generalisation was aided by the use of modelling during teaching as none of the participants required specific expressive training in order to generalise to the expressive format, e.g., the instructor said “elephant” once the participant had completed the physical response of pointing to the picture of the elephant. At no point was the participant instructed to give an expressive response during receptive teaching.

The study attempted to ascertain any significance in acquisition rates between teaching conditions. The data show that for two participants, mastery was achieved in fewer trials in the Receptive teaching condition and that this result was significant when all criterion levels were applied. The magnitude of this significance and whether it is clinically significant remains unclear. It is likely that for some children, who find learning these types of discriminations difficult, the results are clinically significant and teaching in a receptive format would increase their rate of learning. As there was no standardised language assessment prior to the study it is not possible to identify which participants would benefit from teaching intraverbal behaviour receptively prior to teaching. Anecdotally, James was the most verbal child and had an extensive history of learning language expressively which is likely to account for the minimal variability between teaching conditions. Therefore, it is

possible that for children who are lower functioning and have less expressive language skills, learning intraverbal language receptively would be a benefit and require fewer teaching trials.

This study therefore replicates previous research by Smith et al. (2014) by demonstrating that intraverbal behaviour can be taught receptively, and that both methods (Receptive and Expressive teaching) can increase intraverbal behaviour. It extends this research by directly comparing the acquisition rates in the two teaching conditions and showing that variability in acquisition rates does exist. It has not been possible to say whether this variability is significant. It also adds to existing research which shows individual learning histories significantly affect current learning styles.

Limitations of the study include the relatively small number of participants. Research with a larger number of participants would show more clearly any trend or preference in teaching conditions. Also, the language abilities of each participant were not standardised prior to the start of the study. As such, it is not possible to identify specific participant characteristics which would highlight them as more likely to benefit from receptive before expressive sequencing. Further research should encompass this standardised language assessment and aim to determine the magnitude of significance between teaching conditions.

Future research should also evaluate the best level to set for mastery criteria. Given that receptive teaching essentially used a visual prompt (a picture was presented at the same time as the question), minimal additional prompts (point or hand over hand) were required during teaching. This is in comparison to the Expressive Teaching condition which did require the use of tact and verbal prompts. As such, participants may have been able to achieve mastery in fewer teaching trials if the criteria were reduced showing a more

significant preference towards receptive teaching. However, careful maintenance data would need to be taken to ensure responses maintained over time. It is also possible that additional training would be required at the expressive probe stage. Given that there may be fewer pairings of the question with the correct response and the verbal feedback during teaching, questions may not generalise as readily to the expressive format. Again, the optimal number of receptive teaching trials required for expressive generalisation would benefit from being identified.

Smith et al. (2014) also proposed that teaching intraverbal behaviour receptively may facilitate comprehension. Where expressive teaching is used, they suggested a tact prompt to limit rote responding. Although this study did not evaluate comprehension, both receptive and expressive teaching demonstrated equally successful maintenance rates. As such, future research could assess comprehension and generalisation (participant's responses to the questions when asked in a novel way) as well as evaluating maintenance over an extended period of time to assess if differences between the teaching conditions emerge over time.

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## Appendix C

### Training Checklist

Trainee's name:

Trainers name:

Date of training:

Date of observation:

The above named trainee must be able to demonstrate the following skills for both Receptive and Expressive teaching:

#### Stage 1- Mass Trials

Skill	Demonstrated in role play	Demonstrated in vivo
Can demonstrate how to introduce a new question.		
Presents the correct SD (and picture if in Receptive teaching).		
Applies correction procedure if required.		
Provides reinforcement for 5-30s following prompted and correct responses.		
Can state the mastery criteria for stage 1 and can say when is appropriate to move onto stage 2		

#### Stage 2- Block Rotation

Skill	Demonstrated in role play	Demonstrated in vivo
Presents the correct SD (and picture if in Receptive teaching).		
Presents appropriate distractor pictures during Receptive teaching.		
Applies correction procedure if required.		
Can rotate questions correctly – rotation of 2 questions.		
Provides reinforcement for 5-30s following prompted and correct responses.		
Can state the mastery criteria for stage 2 and can say when is appropriate to move onto stage 3		

#### Stage 3- Random Rotation

Skill	Demonstrated in role play	Demonstrated in vivo
Presents the correct SD (and picture if in Receptive teaching).		
Presents appropriate distractor pictures during Receptive teaching.		
Applies correction procedure if required.		
Can rotate questions correctly- randomised order.		
Provides reinforcement for 5-30s following prompted and correct responses.		
Can state the mastery criteria for stage 3 and can say when is appropriate to move onto stage 4.		

**Stage 4- Expressive probe (Receptive Teaching)**

<b>Skill</b>	<b>Demonstrated in role play</b>	<b>Demonstrated in vivo</b>
Presents the correct SD ( <i>without</i> a picture).		
Provides reinforcement for 5-30s following a correct response and a neutral statement following an incorrect response.		
Can state which stage to move onto next depending on the number of questions answered correctly (either maintenance probe if 100% or return to stage 3-random rotation if less than 100% correct.		

**Stage 4 (Expressive Teaching) and stage 5 (Receptive teaching) - Maintenance probes**

<b>Skill</b>	<b>Demonstrated in role play</b>	<b>Demonstrated in vivo</b>
Presents the correct SD ( <i>without</i> a picture).		
Provides reinforcement for 5-30s following a correct response and a neutral statement following an incorrect response.		
Can state how often probes are to be conducted and at what stage the study will end.		

**Extra skills**

<b>Skill</b>	<b>Demonstrated in role play</b>	<b>Demonstrated in vivo</b>
Completes trial-by-trial data sheet correctly.		
Conducts a brief preference assessment.		