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The effects of intensive tact instruction with young children having speech delays on pure tacts and mands in non-instructional settings: a partial replication

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ABSTRACT

The present study is a partial replication of the intensive tact instruction tactic. Previous applications of this tactic have demonstrated improvements in the pure verbal operant behaviors of preschool students with autism and speech delays and in middle-school students with special needs (Pistoljevic & Greer, 2006). Tacts, mands, and conversational units have been increased across three non-instructional settings (NIS), before and after the mastery of five categories of pictures using 100 tact learn units. The participants in the present study included two boys and one girl with autism who ranged in age from six to nine years old and attended a private school in Hong Kong. The experimental design was a delayed multiple probe design across participants. All probe sessions were conducted for a cumulative time of 15 minutes including five minutes in each of the three NIS. All three students were observed to emit significantly more tacts after mastering the 100 learn units through the intensive tact instruction. There were collateral effects observed in the number of mands emitted for two of the three students. The present study adds to the external validity of the intensive tact instruction tactic with an older age-range of students.

KEYWORDS: autism, mand, partial replication, tact, verbal behavior

One of the major areas of deficit identified in children diagnosed with autism is their delay in verbal development. Teaching that targets the development of the speaker repertoire becomes an essential part of a child's success in school and beyond. In Skinner's analysis of verbal behavior (1957), mands and tacts are described as two vocal operants (behaviors) that can be controlled by antecedent stimuli. Tacting, in particular, requires a person to identify aspects of one's environment using their own senses. Functinally, it informs another person about what the tacting individual is identifying. Tacting is a verbal operant that is reinforced through social attention. The tact repertoire is critical for the advancement of a fluent speaker repertoire in children with developmental delays (Delgado & Oblak, 2007; Partington, Sundberg, Newhouse, & Spengler, 1994).

There are various studies within the sub-field of applied behavior analysis, verbal behavior analysis that have identified effective procedures in teaching children functional verbal operants. These tactics include: the use of echoic prompts to increase spontaneous mands and tacts (Kodak & Clements, 2009), teaching mands-to-tacts to facilitate rapid acquisition of tacting (Arntzen & Almas, 2002), and providing intensive tact training to increase spontaneous tact, mand, and intraverbal behaviors (Greer, 2002). One disadvantage of the echoic to tact training by Kodak & Clements (2009) was that it produced limited language interaction without a careful transfer of stimulus control from the echoic prompt (vocal antecedent) to the naturally occurring stimuli. In comparison, Greer's use of the intensive tact protocol produced a more rapid result and participants were observed to emit an increased number of verbal operants in their natural settings. The use of the intensive tact instruction procedure on various young learners has been observed. Children who have benefited from this procedure include preschoolers (Pistoljevic & Greer, 2006; Delgado & Oblak, 2007) to middle school aged-students (Schautffler & Greer, 2006) diagnosed with autism, pervasive developmental disorder, emotional problems, and behaviors disorders with developmental delays. All participants were found to increase their number of pure mands and tacts.

In a replication of Pistoljevic & Greer's (2006) study, Delgado & Oblak (2007) used the intensive tacting procedure with three preschool students diagnosed with developmental delays. The results showed that the procedure effectively increased the number of pure mands and tacts emitted in non-instructional settings. In another experiment conducted by Schauffler & Greer (2006), the effects of the intensive tact instruction on the emission of audience-accurate verbalizations were tested on two middle school students. Findings showed a significant increase in the number of

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Table 1. Description of three students participating in the study

Student	Gender	Age	Diagnosis/level of verbal capability	Verbal behavior operant verbal behavior analysis (Greer & Ross, 2008)
A	Boy	9.2	Autism Listener/speaker Emergent reader	Mands/tacts Intraverbals Textual responding
B	Girl	6.7	Autism Listener/speaker Emergent reader	Mands/tacts with autoclitic frames Intraverbals Textual responding
C	Boy	8.6	Autism Listener/speaker Emergent reader	Mands/tacts Intraverbals Textual responding

audience-accurate tacts and conversational units for both participants and a decrease in the number of inappropriate tacts for one of the participants. Their study expanded the external validity of the intensive tact protocol tactic by showing effects with an older age range of students and by demonstrating that the tactic can improve other verbal operants that are not directly taught which may suggest a type of adduction.

The purpose of the current study was to replicate the original research findings conducted by Pistoljevic & Greer (2006) on the use of intensive tacting protocol with three, six to nine year-old children diagnosed with autism. This is a much older group of participants than the three preschool students from Schauffler and Greer (2006). The intensive tact protocol had not been applied to children in this age group in previous studies. Delgado & Oblak (2007) did successfully replicate earlier findings with the same preschool aged students. Our study tested the effects of the intensive tact instructions of 100-tact learn units on the number of vocal operants (i.e. mands and tacts) emitted during three non-instructional settings with an older age range of students.

» METHOD

Participants

There were three students who participated in the present study that ranged in age from six to nine years old. The three students were selected for the study because they emitted low numbers of pure tacts within non-instructional settings. Table 1 contains a brief description of each student. Two of the three students also attended a mainstream school part-time, located within the same commercial building where the center-based school was situated. The students' repertoires were assessed using the Assessment of Basic Language and Learning Skills - Revised (ABLLS-R, Partington, 2010).

Setting

The study was conducted in a private not-for-profit, school for children with special needs including autism in Hong Kong Special Administrative Region. The school provides a one to one student to teacher ratio and uses direct special instruction with Applied Behavior Analysis (ABA). All three participants attended a classroom with six students, one head teacher, and six ABA teachers. Most of the long and short term objectives (annual goals) for the participants were derived from the results of the ABLLS-R and were contained in the students' Individualized Educational Program (IEP).

During all probes for pure tacts and pure mands, data were collected in three non-instructional settings: the play area of the classroom upon arrival at school, at the lunch table during lunchtime, and in the play area of the classroom after lunchtime. The play area was located at the back of the classroom and was sectioned off by padded square mats that measured 8' × 5' (244 cm × 152 cm). It was equipped with a shelf holding storybooks and bins of toys on one side of the play area, and a small trampoline on the other side. Lunch was taken at square-shaped wooden tables inside two mainstream classrooms located at the lower level of the school. All of the participants sat at the table for about 25 minutes during lunch. During the tact instruction, participants sat at his/her respective tables in the classroom, next to his/her ABA teachers.

Table 2. Description of tact sets and lists of the categories of two-dimensional stimuli pictures that were taught as pure tacts operants

Categories	Set 1	Set 2	Set 3	Set 4
Instruments	Guitar Harp Organ Xylophone	Tuba Harmonica Flute Cello	Drums Violin Saxophone Piano	Triangle Accordion Clarinet Trombone
Transportation	Bulldozer Sail boat Motorcycle Forklift	Sled Tricycle Crane Ferry	Tractor Escalator Airplane Train	Bicycle Dump truck Helicopter Speed boat
Community Helpers	Photographer Taxi driver Surgeon Crossing guard	Rower Stewardess Basketball player Referee	Painter Ballerina Garbage man Florist	Baseball player Fisherman Lifeguard Scientist
Food	Cashews Asparagus Watermelon Cotton candy	Sushi Donut Coffee Salad	Pasta Beans Bacon Waffle	Bagel Potatoes Pie Grapes
Animals	Crab Starfish Bubble bee Mouse	Dragonfly Squirrel Shark Alligator	Penguin Ants Lizard Fox	Octopus Guinea Pig Turtle Goat

Definition of behavior: the dependent variable

The dependent variables in this study were the number of pure vocal verbal tacts and mands produced during the five-minute probes across three non-instructional settings. According to Skinner (1957), a tact was defined as "a verbal operant in which a response of given form is evoked by a particular object or event or property of an object or event" (p. 81–82). This study specifically targeted "pure tacts," a type of verbal behavior "controlled by non-verbal antecedent stimuli and results in nonspecific generalized conditioned reinforcement" (Rehfeldt, Ziomek, & Garcia, 2006). Pure tacts had a nonverbal antecedent and were in response to objects or events rather than other verbal behaviors or verbal antecedents such as "What is this?" "Pure mands" were also targeted and the number of pure mands was recorded during the same five-minute probes in the non-instructional settings. Skinner (1957) defined a mand as "a verbal operant in which the response is reinforced by a characteristic consequence and is therefore under the functional control of relevant conditions of deprivation or aversive stimulation" (p. 35–36). As was the case for impure tacts, impure mands were not recorded such as mands in response to verbal stimuli, "What do you want?"

Independent variable: the intensive tact procedure

The independent variable in this study was the additional presentation of 100 tact learning units (Albers & Greer, 1991; Greer & McDonough, 1999; Greer, 2002) delivered throughout the six-hour school day. Here, learning units is used instead of the traditional learn unit. The increased number of tact learning units were presented in addition to the students' regularly scheduled instructional subjects and programs based on the IEP. Four sets of 3" × 5" (8 cm × 13 cm) picture cards of stimuli depicting various objects were used. Five categories with four target stimuli in each category were included in each set. The five categories targeted included musical instruments, transportation, food, animals, and community helpers. There were multiple exemplars of each stimuli (at least three) and they were all interspersed in all teaching conditions. The sets of stimuli are listed in Table 2.

During the tact intervention, a correct response was recorded when the participant vocally labeled the target item in the picture accurately and independently within 3 seconds of the presentation of the stimuli. The antecedent for a pure tact operant is non-verbal and consists of an object, event, or in this case, a picture. Positive reinforcement in the form of generalized social praise (i.e. verbal praise such as "Well done", high-fives, tickles) was then presented immediately contingent on a correct response. Responses that deviated from the correct response were omitted, or those that occurred outside of the three-second intraresponse time resulted in the delivery of a simple correction procedure by the teacher. In the simple correction, the target antecedent (picture) was re-presented and accompanied by an echoic prompt.

Upon the outset of instruction, the teacher presented pictures of the four stimuli within all of the five categories. The teacher labeled the target picture whilst the participant was required to echo the target response. Once the echoic responses for the target set of stimuli were completed, the procedure immediately transitioned to independent tacting of the same set of stimuli. Reinforcement or correction operations were then subsequently delivered according to the participant's pure tact responses.

Twenty learning units were presented for each of the five categories within a specific set on a daily basis. The target sets were rotated until 100 tact learning units were presented to the participant. The same sets of stimuli were repeatedly presented until the participant achieved mastery for all four sets of stimuli within the targeted five categories.

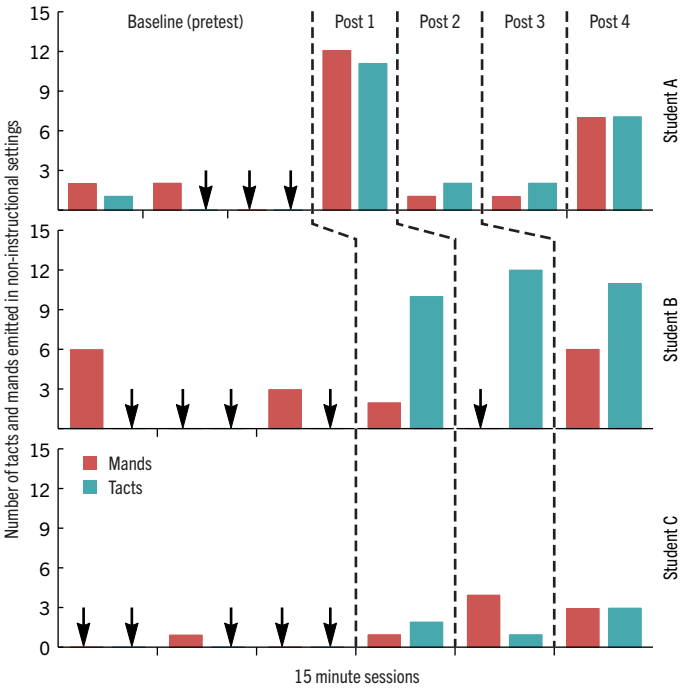

Figure 1. Delayed multiple baseline experimental design across Students A, B, and C's number of tacts and mands emitted across all three non-instructional settings, blocked into 15-minute sessions.

Table 3. Interobserver agreement

Student	Baseline	Post-probe condition
A	4 (100%, 100%, 100%, 100%) Mean = 100% Range (100%–100%) % of sessions with IOA = 50%	2 (80%, 100%) Mean = 90% Range (80%–90%) % of sessions with IOA = 25%
B	2 (100%, 100%) Mean = 100% Range = (100%–100%) % of sessions with IOA = 33%	1 (100%) Mean = 100% Range = N/A % of sessions with IOA = 17%
C	1 (90%) Mean = 90% Range = N/A % of sessions with IOA = 33%	2 (100%, 100%) Mean = 100% Range = (100%–100%) % of sessions with IOA = 33%

Data collection

Data were collected in 5-minute intervals during both observation probes and across three different non-instructional settings. Event recording was used to collect data on the number of pure tacts and mands by the participants. A "+" was recorded on the data sheet for correct tacts while a "–" was recorded on the data sheet for incorrect tacts. A timer was used for all three non-instructional settings when data was recorded using direct observation. During the five-minute probes within the play area

Table 4. The number of tacts emitted per minute during the 15-minute sessions for all three students

Condition	Student A	Student B	Student C
Baseline probe 1	.07	.40	.00
Baseline probe 2	.00	.00	.00
Baseline probe 3	.00	.00	.00
Post probe 1	.73	.67	.13
Post probe 2	.13	.80	.07
Post probe 3	.13	.73	.20
Post probe 4	.47	—	—

of the classroom upon arrival at school, the participants were allowed free access to all toys and books located in the play area. During the five-minute probes at lunch time, participants were seated at a table among a minimum of three other typically developing peers whilst eating their lunch. During the five-minute probes within the play area of the classroom after lunch, all toys and books were again available to the participants. Data for each five-minute non-instructional probe were blocked into one 15-minute session for the day consistent with the data collection from the Pistoljevic & Greer (2006) experiment. Data during the intensive tact procedure were collected as responses to learning units. Criterion was achieved when responses were correct with at least 90% accuracy across two consecutive sessions. New sets of stimuli were introduced only after criterion was achieved for the target training sets.

Interobserver agreement

Interobserver agreement was collected by an independent observer who recorded all instances of spontaneous pure tacts and mands emitted by the participants. All utterances produced by the participants were recorded as tally marks marked under "T" if it was a pure tact or under "M" if it was a pure mand. In the baseline condition for student A, there were four observations conducted in the baselines condition all with 100% agreement. For student B, there were two observations conducted in the baseline condition all with 100% agreement. For student C, there was one observation with 90% agreement.

In the post-probe condition for student A, there were two observations conducted that resulted in 80% and 100% agreement with a mean of 90%. For student B, there was one observation conducted that resulted in 100% agreement. For student C, there were two observations conducted that resulted in 100% agreement each. Table 3 shows the results of the inter-observer agreement measurements.

» RESULTS

The results for the three students can be reviewed in Table 4 as the rate of verbal operants per minute. The results are also expressed in Table 5 as the number of tacts emitted across the three non-instructional settings. For student A, there was one tact observed across all three baseline pretests. Student A had a total of four mands observed in baseline. For student B, there were zero tacts observed in baseline and a total of nine mands. Student C was observed to tact zero times in baseline conditions with one mand.

Post probes 1 through 4 were are follows for student A's tact responses: 11, 2, 2, and 7, respectively. Student A's mands were 12, 1, 1, and 7, respectively. Post probes 1 through 3 for student B's tact responses were 10, 12, and 11, respectively. Student B's mands across the three post probe sessions were 2, 0, and 6, respectively. Student C's mands across the three post probe sessions were 1, 4, and 3, respectively. Figure 1 shows the delayed multiple probe design used in the study. Figure 2 shows Student B's tact learning unit data during the acquisition of the tact operants across the sets.

Tact behaviors increased significantly across all three students although more so for students A & B and less so for student C. Mands increased as well across two of the students, A & B but stayed about the same (unchanged) for Student B.

» DISCUSSION

The results of the study showed that the participants emitted an increased number of tact and mand verbal operants during non-instructional settings following the implementation of the intensive tact procedure. The results were similar to the study conducted by Pistoljevic and Greer (2006) and subsequent replication by Delgado & Oblak (2007) where the intensive tact procedure increased the independent verbal operants across all three NIs, compared to baseline measures. However, our results differed from previous studies in that mand operants were observed to increase for two of the students while mands did not change for one of the three students. As the mands were measured as collateral verbal operants and were not directly targeted for increase, there are a number of variables that could have contributed to this difference across the studies. Motivational conditions vary from moment to moment in classroom environments and may have effected the mand behaviors with the student participants.

Table 5. The number of tacts emitted across three non-instructional settings for each of the three student participants

Students		Unpacking	Lunch	Play area
Student A	Baseline	1	0	0
	Baseline	0	0	0
	Baseline	0	0	0
	Post probe 1	5	6	0
	Post probe 2	1	1	0
	Post probe 3	2	0	0
	Post probe 4	2	0	5
Student B	Baseline	2	2	2
	Baseline	0	0	0
	Baseline	0	0	0
	Post probe 1	8	2	0
	Post probe 2	1	0	11
	Post probe 3	2	5	4
Student C	Baseline	0	0	0
	Baseline	0	0	0
	Baseline	0	0	0
	Post probe 1	0	1	1
	Post probe 2	0	0	1
	Post probe 3	1	0	2

Student B did not increase mands in the NIS after the intervention. It may have been the case that the increased number of tacts and resulting reinforcement attained through the generalized social praise by the teachers for correct tacts decreased the motivational conditions for Student B to mand in the post probe condition. The intensive pure tact instruction of novel stimuli served to compensate for prior missing language opportunities. Our study has demonstrated that pure tacts in students ranging in age from six to nine years of age who emit low to zero rates of tacts in NIS can be improved through the use of the intensive tact instruction. The treatment package was effective in increasing the pure tact operants across all three settings for all three student participants. Of note is that the tacts were not of the stimuli in the picture sets. This observation suggests that it's the tact capability that has been induced rather than simple tacting of mastered stimuli.

We considered the treatment a partial replication due to the fact that the stimuli used were similar but not identical to the original studies, the environments were similar but not identical and the students were of a different age range. These variables do not seem to limit or affect the results of the study for tact improvement, however they might be implicated in the different results for the mand operants observed.

Limitations

One limitation for this study was the lack of control of the number of learning units the participants received throughout the day. This was difficult to control as the number of hours in one-to-one setting varied between participants as some of them were integrated into mainstream class settings. Although daily learning unit data is collected for each student daily, it was not reported here in this study. Future studies using the intensive tact protocol should control for learning units presented daily. Interobserver agreement was not collected for the teaching of the tacts and could be included as well in future studies. Another limitation of the current study was that some participants received extra hours of instruction after school. Since the number of learning units overall each day was not held constant across the students, this could have affected the number of mands and tacts emitted by these participants.

Future implications

Future studies may target the long term effects that the intensive tact protocol has on students with and without this type of training. Other procedures such as the echoic to tact training protocols can be compared to this procedure to test their effectiveness and efficiency. The length of sentences, the choice of words, and sentence structures may be tested and compared between the two groups. Tacts with autoclitics may be an improvement on the single word tact responses, for example. Another possible target for future studies may be to increase the number of sets used in the intensive tact protocol. This may lead to further significant increases in the number of vocal operant emitted. Further research is necessary to test other positive effects that the intensive tact protocol may have other verbal operants with other populations of learners. ■

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