Facilitating The Acquisition Of Two-Word Semantic Relations By Preschoolers With Down Syndrome: Efficacy Of Interactive Versus Didactic Therapy

Encouragement de l'énonciation de nouveaux doublets chez les enfants d'âge scolaire atteints du syndrome de Down : Comparaison de l'efficacité des traitements interactif et didactique

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Abstract

A single-subject alternating-treatments design was employed to compare the relative effectiveness of interactive modelling versus didactic elicitation treatment methods for facilitating the acquisition of novel two-word utterances by preschoolers with Down syndrome. The two subjects used single-word utterances at pre-test and demonstrated emergence of two-word semantic relations. Each child received 140 minutes of therapy per treatment condition over a six-week period. The two treatments were administered discretely within the same session using different target combinations randomly assigned to each condition. At post-test, both subjects demonstrated more efficient learning of the specific target items assigned to the didactic condition. Furthermore, each child demonstrated greater generalization of the underlying semantic rules assigned to the didactic treatment condition. Targets assigned as control behaviours were not learned. Given that children with Down syndrome tend to experience difficulties with word-finding and oral-motor speech skills, we hypothesize that the didactic treatment embedded within a naturalistic play theme may address the intrinsic speech and language needs of these children.

Abrégé

On a alterné les traitements appliqués à un sujet en vue de comparer l'efficacité de la modélisation interactive à celle de la provocation didactique pour encourager l'énonciation de nouveaux doublets chez les enfants d'âge préscolaire atteints du syndrome de Down. Les deux sujets parvenaient à prononcer des mots simples lors des épreuves préalables et montraient l'initiation de relations sémantiques pour les doublets. Chaque enfant a bénéficié de 140 minutes de thérapie par traitement au cours d'une période de six semaines. Les deux traitements ont été appliqués de façon ponctuelle au cours de la même séance grâce à différentes combinaisons de mots cibles, sélectionnés de façon aléatoire dans chaque cas. À la conclusion des tests, les deux sujets avaient montré qu'ils apprenaient mieux les éléments spécifiques associés au traitement didactique. Chaque enfant a aussi démontré qu'il généralisait davantage les règles de sémantique sous-jacentes reliées au traitement didactique. Les mots cibles qui devaient servir de traitement témoin n'ont pas été appris. Puisque les enfants atteints du syndrome de Down éprouvent généralement des difficultés à trouver leurs mots et à maîtriser les aptitudes orales-motrices du langage, on suppose que le traitement didactique pourrait répondre au besoin intrinsèque de la parole et du langage de ces enfants dans un cadre ludique naturel.

The purpose of this study was to investigate the relative effectiveness of interactive modelling versus didactic elicitation in facilitating two-word productions in young children with Down syndrome. Current research on children with Down syndrome indicates that these children have prolonged delays in their acquisition of language, including the development of multi-word utterances (Coggins, 1979; Folwer, 1988; Miller, 1988; Tager-Flusberg, Calkins, Nolin, Baumberger, Anderson, & Chadwick-Dias, 1990), and are at high risk for long-lasting language impairments (Gibson, 1991; Miller, 1992). Whereas typically-developing children begin combining words once they have approximately 50 words in their expressive lexicon (Nelson, 1973), children with Down syndrome tend to start to use two-word phrases only after they have exceeded this milestone (Miller, 1988). One explanation for this delay is that the lexicons of children with Down syndrome are characterized primarily by referential words, with deficiencies in the grammatical marking of their vocabulary (Fowler, 1990; Miller, 1988). This explanation is consistent with theoretical notions which argue for continuity between lexical acquisition and later language development, i.e., single-word utterances may

represent semantic-syntactic rules such as subject, action, and object before the emergence of true syntax (Thal & Bates, 1992). In addition, the onset of word combining by children with Down syndrome may be negatively influenced by memory constraints and difficulties with oral-motor control and timing (Miller, 1988). Therefore, facilitating the emergence of semantic-syntactic rules in two-word utterances is an important objective in early language intervention for children with Down syndrome.

Current philosophical trends suggest that interactive intervention, in which language is taught in a naturalistic manner, is appropriate for children with developmental delays (see Norris & Hoffman, 1990; Tannock, Girolametto, & Siegel, 1992). Interactive intervention procedures arise from the social-interactionalist theories of language acquisition which propose that simplified language modelled by adults serve motivational and informational functions that help the child make comparisons between the nonlinguistic and linguistic contexts, as well as induce the relationships between words, objects, and events (Cross, 1977; Fey, 1986; Hoff-Ginsberg, 1986; Moerk, 1976). This incidental learning of language is facilitated by the high semantic overlap between object or events and the adult's speech input, which presumably increases the child's motivation and interest, and frees the child's processing capacity for appropriate phonological, semantic, and syntactic comparisons. The implicit assumption of clinicians who use interactive intervention methods is that children with Down syndrome learn language in essentially the same way as children developing in a typical manner, but require a slower pace, the opportunity to hear multiple presentations of the target, and modifications to enhance their motivation to communicate. This approach is consistent with research which indicates that the language development of children with Down syndrome is not marked by deviant processes of acquisition, but reflects a slowed-down, normal learning process (for a review, see Fowler, 1990). The clinical application of the interactive model of language intervention is summarized in Table 1.

In contrast, didactic intervention procedures arise from operant theories of language acquisition which propose that language is learned through explicit associations between stimulus and an ensuing response. Language learning occurs as a result of frequent practice of the target behaviour. It is presumed that the elicitation of words in a carefully controlled manner facilitates the child's access to the phonological representation of the word, and helps the child to refine and strengthen its mental representations (Connell & Stone, 1992; Ellis Weismer, Murray-Branch, & Miller, 1993). The adult's role is to elicit imitation and provide consistent feedback and reinforcement. Thus, an implicit assumption of the didactic approach is that children with Down syndrome may be unable to organize information in a similar manner as a typically developing child, and that the overt practice elicited by didactic intervention may play a significant role in language acquisition for these children. Given the noted deficits in oral-motor control and timing in children with Down syndrome (Elliott, Weeks, & Chua, 1994; Miller, 1988), this approach may also provide opportunities for the children to practice language targets in a manner which may address these specific deficits. The clinical application of the didactic model of language intervention is also summarized in Table 1.

Table 1. Summary of the contrasts between interactive and didactic intervention methods.[1]

Interactive Intervention	Didactic Intervention
predetermined two-word phrases will be targeted	predetermined two-word phrases will be targeted
free-play activities will focus on a theme	structural play activities will focus on skill acquisition within a theme
related exemplars of the two-word phrase goal will be modelled with high frequency	related exemplars of the two-word phrase goal will be elicited with high frequency
if a child produces a two-word phrase, the researcher will expand on it	if a child produces a two-word phrase, the researcher will re-enforce the correctness of the production
modelling and expansion are used to teach language	elicitation and shaping are used to teach language
instruction is indirect and discovery based	instruction is structured, directed and systematic
child is viewed as an active participant who abstracts or deduces underlying linguistic rules	child is viewed as a respondent to operant techniques
response rate is low	response rate is high
spontaneous production rate is high	spontaneous production rate is low
play may be child- or adult-directed	adult maintains control within goal-oriented activities

[1]Adapted from Cole & Dale (1986), Fey (1986), and Norris & Hoffman (1990).

Few studies have examined the specific effects of language intervention for children with Down syndrome. Many intervention studies have included these children in with other children who have general developmental delays, and therefore, the specific impact of intervention on etiological categories cannot be determined (e.g., Girolametto, 1988; Tannock, et al., 1992; Weistuch & Lewis, 1985). Existing studies which have included children with Down syndrome have demonstrated the efficacy of both didactic intervention procedures (MacDonald, Blott, Gordon, Spiegel, & Hartmann, 1974; Romski & Ruder, 1984) and interactive intervention procedures (Cheseldine & McConkey, 1979). Although these studies have demonstrated a treatment effect when using either didactic or interactive intervention procedures with children with Down syndrome, there are no studies which have compared the relative effectiveness of these two intervention approaches for these children.

Some insight into therapeutic approaches for children with Down syndrome can be derived from comparisons between didactic and interactive interventions for children with language impairment who do not have Down syndrome. These studies have comprised two broad categories: (a) comparisons of intervention packages for children with a wide range of therapy goals and pre-intervention abilities, and (b) experimental manipulations of key techniques representative of the two procedures, e.g., elicited imitation (didactic) versus modelling (interactive). Unfortunately, comparisons of global intervention programs have failed to provide consistent results due to methodological shortcomings, including insufficient power to detect aptitude by intervention interactions due to small sample sizes (Smith & Sechrest, 1991), large variability in subject characteristics (Cole & Dale, 1986) and use of global measures of language development which are unrelated to the specific goals of intervention. In contrast, those studies which examined the role of elicited imitation (didactic) versus modelling (interactive) have provided consistent support for the preferential effectiveness of elicited imitation for teaching a variety of morphosyntactic rules to children with language impairment (Connell, 1987; Connell & Stone, 1992) and to children developing normally (Goldstein, 1984). Camerata and Nelson (1992), however, followed their subjects after the training ended and reported longer term advantages for interactive modelling over didactic treatment. In addition, Ellis Weismer and her colleague (1993) reported conflicting findings, with one subject showing preference for each type of intervention procedure.

The current study was designed to provide an evaluation of the relative effectiveness of elicited imitation (i.e., didactic) versus modelling (i.e., interactive) intervention procedures for teaching two-word semantic relations to children with Down syndrome. Given their difficulties in language development, and the subsequent impact of delayed language on social and educational skills, the question of effecting faster acquisition of language skills appears to be critical. It was hypothesized that children with Down syndrome would learn more experimental two-word semantic relations than control two-word semantic relations, irrespective of treatment type. It was further hypothesized that the didactic intervention procedure would effect faster initial productivity of experimental two-word semantic relations, but that the interactive intervention procedure would promote more effective generalization of experimental two-word semantic relations to a conversational context.

Method

Participants

Two male children with Down syndrome, Stephen and Brydon, participated as subjects in this research study. At the beginning of the research program, they were four years one month old and four years nine months old, respectively. Both preschoolers were recruited from an in-home intervention program in which services were provided twice weekly by the first author. The in-home programs employed a hybrid of both elicitation and modelling techniques which were used during child-centred, play-based activities. Stephen had participated in this in-home program for approximately six months, and Brydon for approximately three months. The focus of these sessions was to enhance preliminary communication skills such as attending, remaining on task, developing vocabulary (signed and verbal), requesting and labelling. At no time was the acquisition of two-word utterances the focus of intervention.

Each child's mean length of utterance in morphemes was estimated from two 20-minute spontaneous language samples obtained during separate interactions between the first author and the children. As can be seen in Table 2, the children were in Brown's Stage 1 of language development. Both children presented as active conversationalists (Fey, 1986). They were able to initiate and expand on topics and activities, request and reject actions and objects, use good turn-taking skills, as well as establish and maintain joint focus over a number of consecutive turns.

In order to estimate the size of each child's expressive lexicon, parents were asked to complete *The Communicative Development Inventory* (CDI; Fenson, Dale, Reznick, Thal, Bates, Hartung, Pethick, & Reilly, 1993). Both children used a core vocabulary of at least 50 words and were primarily verbal (i.e., manual signs had been used in an augmentative manner only). Their readiness for the acquisition of two-word semantic relations was determined by evidence of at least one two-word semantic relation during: (a) the two 20-minute spontaneous language samples, or (b) subtests 11 and 12 of the *Environmental Prelanguage Battery* (EPB; Horstmeier & MacDonald, 1978).

Table 2. Eligibility measures for each subject

	Stephen	Brydon
Type of Down syndrome	Trisomy 21	Translocation
Chronological Age	4 years, 1 month	4 years, 9 months
CDI- # of words	305	225
MLU	1.2 morphemes	1.2 morphemes
PPVT-M (A.E.	3 years, 5 months	B.N.E.[2]
TACL-R subtest I (A.E.)	41-43 months	32-34 months

[2]BNE = basal levels could not be established.

Experimental Design

This study employed a single-subject, alternating-treatments design to examine the relative effectiveness of the two different treatment approaches being considered (McReynolds

& Kearns, 1983). A total of 15 visits were conducted; two baseline sessions, 12 treatment sessions, and 4 post-test sessions. Each baseline session was approximately 1.5 hours long and included both standardized and non-standardized measures. Standardized tests were employed to formally assess the child's receptive and expressive language skills prior to treatment, and included the *Peabody Picture Vocabulary Test* (PPVT; Dunn & Dunn, 1981), the *Test for Auditory Comprehension of Language - Revised* (TACL-R; Carrow-Woolfolk, 1985), and the CDI (Fenson, et al., 1993). In addition, nonstandardized tasks included subtests 11 and 12 of the EPB (Horstmeier & MacDonald, 1978) to assess the children's ability to produce and imitate two-word phrases.

In addition to the standardized measures, two 20-minute language samples were collected on different occasions within the same week using a standard set of toys selected to promote interaction (i.e., a Little Tikes family set including a six-member family, a dog, a van, a car, a stroller, a bed, a car seat, park equipment, two desks, and four chairs; a Sesame Street model including a three-dimensional street front, two vehicles, eight small plastic characters, four larger stuffed characters, and some plastic food). Following each taping, the parents were asked about the representativeness of the videotaped interaction. In all cases, the parents rated the language samples obtained as being representative of their child's daily play behaviour, language level, and social interaction skills.

Selection of Treatment

According to Lund and Duchan (1992), an appropriate treatment goal is a target item which is produced between 10-15% of the time in obligatory contexts. For each child, we identified all semantic relations which they produced in less than 10% of obligatory contexts on subtests 11 and 12 of the EPB and during the two 20-minute language samples.

Different, but equivalent, two-word semantic relations were randomly assigned to each of the treatment conditions and a third semantic relation was assigned to be a control behaviour. As can be seen in Table 3, five exemplars for each target semantic relation were developed based on the vocabulary items reported, by the children's parent, on the CDI (Fenson, et al., 1993).

The target items and toys selected for each child and each condition were thematically related. For example, Stephen's interactive goal was Location + Action as reflected in the target utterances: on house, in box, walk on, jump in, and look in. The therapy activity was a game of hide-and-seek using a Sesame Street model, eight small plastic characters, and furniture items.

Table 3. Random assignment of target semantic relations to each treatment condition by child.

	S1: Brydon	S2: Stephen
Didactic	**Attribute + Entity**	**Attribute + Entity**
	little bed	little bed
	wet girl	wet girl
	yellow chair	yellow chair
	hot water	hot water
	big book	big book
Interactive	**Agent + Action**	**Prep+N/ V + Prep**
	mom hug	on house
	baby sleep	in box
	daddy drive	jump in
	boy slide	walk on
	girl swing	look in
Control	**Poss'or + Poss'n**	**Agent + Action(V+ing)**
	Bert pie	mom walk(ing)
	Ernie toast	dad drive(ing)
	mom banana	baby cry(ing)
	dad cookie	boy sit(ting)
	Erin egg	girl slide(ing)

Note: The five examplars selected for each target relation were generated based on vocaculary items identified, by the participant's mothers, on the CDI (Fenson et al., 1993).

Treatment Procedures

Hour-long treatment sessions commenced one week after the collection of baseline measures. Treatment sessions occurred twice weekly in the subjects' homes. During each visit, 20 minutes of each treatment condition was administered. In order to differentiate the two treatment conditions: (a) a ten-minute break was scheduled between the treatment conditions, (b) different instructions were presented at the beginning of each treatment condition (Goldstein, 1984), and (c) the order of the treatments was counterbalanced. A total of 140 minutes of therapy per treatment condition was provided over the six-week period.

Treatment sessions were administered by the first author, a graduate student in speech-language pathology, in the children's own homes. During all treatment sessions, only the toys representing the child's target items were available. The children's parents were not in the room during treatment, and were not informed as to the specific semantic relations or target items being trained. They were, however, debriefed at the end of the study and fully informed as to the content and outcome of therapy.

In both conditions, the clinician followed the child's lead in play and used the prescribed treatment procedures, once joint attention was established. In the interactive condition, the clinician verbally coded the child's nonverbal behaviour using an appropriate two-word target phrase. Each target phrase was modelled ten times per session. In the

didactic condition, the child was asked to imitate the researcher's two-word utterance in response to a prompt (e.g., "Say ..."). If the child did not respond to the prompt, or if the child's response overlapped with the researcher's prompt, the clinician provided a more explicit request for imitation (e.g., "Your turn, [child's name], say ..."). A total of ten elicitations were attempted per session.

In both conditions, if the child spontaneously produced a target two-word phrase the researcher responded to the communicative function of the production and then expanded on the utterance with a semantically related two-word target item. Thus the researcher's responses acknowledged the child's communication and responded appropriately.

Sessional Measures

The children's imitative and productive use of target items were tallied during each treatment session. All imitations produced during interactive intervention were spontaneous because the clinician did not request imitations in this procedure. In contrast, imitations produced during didactic intervention were elicited by the clinician's prompts. Similarly, productions during interactive intervention sessions were spontaneous because no elicitation occurred, whereas productions during didactic intervention were elicited by the treatment procedure in response to specific questions (e.g., "What happened?").

Posttest Measures

Following the entire set of treatment sessions, posttest production probes were administered to evaluate the children's ability to produce target items in obligatory contexts. The targets for each of the two treatment conditions were presented separately using the same toys employed in the therapy sessions. Two production probes were administered to each child and followed the procedures employed in the EPB (Horstmeier & MacDonald, 1978). Each probe was administered twice, with the child's performance being summed across all four production probes. Productivity of a target item was strictly defined as the use of a specific two-word combination in at least two different testing sessions.

In the first probe, the Face-to-Face Probe, an action was modeled and the clinician asked an elicitation question (e.g., Q: "Where's Bert? A: "in box"). If the child produced the target, then the context for the next target was set up. If the child did not produce the target, then the child was asked a second elicitation question before the next target was set up (e.g., Q: "Oh boy! Bert's hiding. Look, where's Bert?"; A: "in box"). In no case was the target modeled for the child.

In the second probe, a video format was utilized to maximize the child's attention. In the Video Probe each child viewed a four-minute videotape in which the clinician acted out a scenario using toys and actions which depicted each of the target items. At the end of each scenario, the child was asked an elicitation question. For example, for the target "in box", the video showed a game of hide-and-seek during which Ernie hid from Bert, and a voice-over asked, "Where's Bert?", during a pause in the action. If the child produced the target spontaneously, then the tape continued and the scenario for the next target appeared. If the child did not produce the target, the clinician paused the tape, and asked a second elicitation question before releasing pause. In no case was the target modeled.

Generalization measures evaluated each child's ability to use utterances representing the semantic rules across-person, across-interaction style, and across-exemplars. Two generalization measures were developed - *The Parent Questionnaire* and the *Parent-Child Communication Sample*. First, the children's parents were asked to complete a questionnaire based on the format of CDI (Fenson et al., 1993) which was designed to evaluate the degree/level of transfer of the trained two-word utterances to natural interactions with family members. Second, the children's ability to generalize from the targeted exemplars to untrained items representing the underlying semantic rules was assessed in four 20-minute free-play sessions with their mothers, filmed in a two-week period. In two of these sessions, the child played with the toys used during treatment, whereas in the remaining two sessions the children played with their own toys. All parent-child communication language samples were videotaped and subsequently transcribed and coded to yield the child's MLU and use of novel exemplars of the two-word semantic relations assigned to each treatment condition.

Reliability

Inter-rater reliability for imitation and production of target and control behaviours during treatment sessions was conducted by an independent observer for three randomly-selected treatment sessions for each child. Each videotaped session contained 20 minutes of didactic and 20 minutes of interactive training. The videotaped interventions represented 120 minutes of videotaped intervention time per child or approximately 25% of the entire database.

The mean inter-rater reliability coefficients were computed as a total of point-by-point agreements divided by the total number of agreements plus disagreements. The coefficients were .92 for child responses in the didactic condition (N=261), and .99 for the child responses in the interactive condition (N=279). The majority of errors in the didactic condition were errors of commission - the event was observed by both coders, but they disagreed as to whether

the response overlapped the researcher's prompt (included as correct).

All four posttest probes for each child were also re-scored, point by point, by an educational consultant who has considerable experience working with children who have Down syndrome. The consultant was blind to the treatment conditions. These coefficients were .98 for child responses in the didactic condition (N=99), .94 for the child responses in the interactive condition (N=115), and .94 for the child responses in the control condition (N=120). Where disagreements occurred, the first author reviewed the tapes in order to resolve the discrepancy and arrive at each child's score for the posttest probes. All posttest videotapes were transcribed by the first author, and two-word combinations were reviewed and coded by both authors. Cases of disagreement were resolved through discussion and consensus.

Results

Analysis of Posttest Data

The data from Stephen's posttest and generalization probes are displayed in Table 4. The posttest probes indicate that Stephen produced five out of five target items from the didactic condition following six weeks of treatment. None of the interactive or control items were produced in any of the four posttest probes.

In contrast, the parent report, i.e., generalization across-person, across-setting and across-stimulus, revealed that Stephen spontaneously used two target items from each of the interactive and the didactic conditions, but did not use any examples of the semantic relation assigned as the control behaviour. During the free-play samples, a more stringent measure of generalization, i.e., generalization to untrained exemplars of the semantic relation, Stephen used two-word relations representative of both the didactic and the interactive targets, but no examples of the control relation.

As can be seen in Table 4, Stephen produced a total of 15 utterances which conformed to the semantic relation assigned to the didactic condition (10 were unique and five were repetitions of the same phrase) and a total of nine utterances which conformed to the semantic relation assigned to the interactive condition (six were unique and three were repetitions of the same phrase). It is noteworthy that Stephen used 40% more utterances which conformed to the semantic relation assigned to the didactic condition, than of the rule assigned to the interactive condition. In general, the data derived from the posttest probes and the parent-child communication sample support the finding that Stephen learned in both conditions, but demonstrated greater use of the semantic relation assigned to the didactic condition than the semantic relation assigned as the control behaviour.

Table 4. Posttest and generalization scores for Stephen.

	Didactic	Interactive	Control
1. Posttest Production Probe	5	0	0
2. Parent Questionnaire	2	2	0
3. P-C Communication Sample	15[3]	9[4]	0

[3]Ten utterances were unique, with five repetitions of an other phrase.
[4]Six utterances were unique, with three repetitions of an other phrase.

Table 5 displays the posttest and generalization data for Brydon. The results from the posttest probes indicate that Brydon produced three out of five target items from the didactic condition and only one out of five target items from the interactive condition. None of the control items was produced in any of the four posttest probes.

The generalization data based on the parent report indicates that Brydon used one target item from each of the three semantic relations assigned as target or control behaviours. Brydon's use of two-word combinations in the 40-minute parent-child communication sample revealed that he produced two utterances which conformed to the semantic relation assigned to the didactic condition, but only one utterance which conformed to the semantic relation assigned to the interactive condition. He did not use any examples of the rule assigned as a control behaviour. Thus, Brydon's learning pattern is consistent with Stephen's pattern of learning. With the exception of the Parent Questionnaire, these generalization findings are consistent with the results from the four posttest probes, that is, Brydon demonstrated greater productivity and generalization in the didactic condition than in the interactive condition.

Table 5. Posttest and generalization scores for Brydon.

	Didactic	Interactive	Control
1. Post-test Production Probe	3	1	0
2. Parent Questionnaire	3	1	2
3. P-C Communication Sample	4[5]	1	0

[5]The four utterances were comprised of two repetitions each of two different phrases.

Analysis of Sessional Measures

Examination of the session-by-session data provides a means of examining aspects of the learning process which may indicate why a treatment approach may or may not have been effective. Figures 1 and 2 display the sessional and posttest data for Stephen and Brydon, respectively.

Stephen imitated only one target in the interactive condition, whereas he produced an average of four imitations per session in the didactic condition, out of a possible maximum of 50 target items. In addition, the data indicated that Stephen verbally produced twice as many target items in the didactic condition as in the interactive condition. Brydon verbally produced six times as many targets in the didactic condition as compared to the interactive condition. Overall, both children had more verbal practise with didactic items than interactive items during the treatment phase. An examination of the data indicates that neither child was consistent in the number of targets imitated or produced during each session.

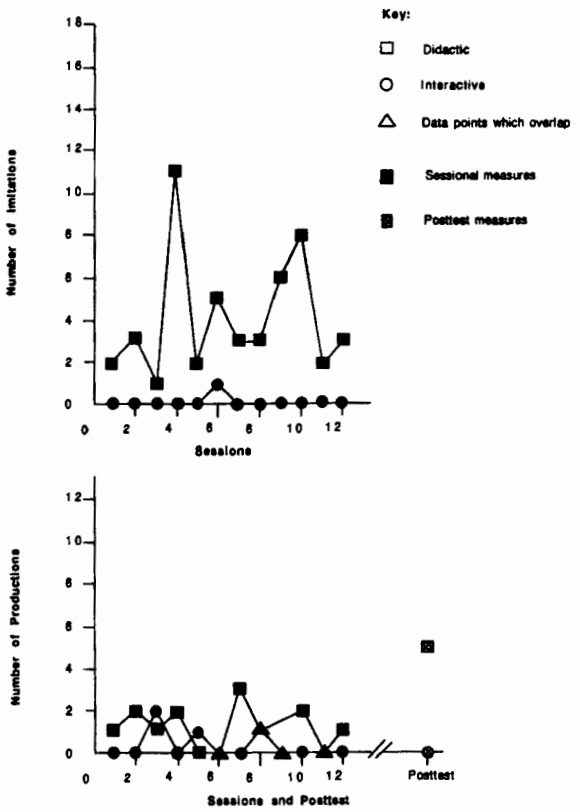

Figure 1. The number of exemplars produced and imitated by Stephen during treatment sessions and the posttest.

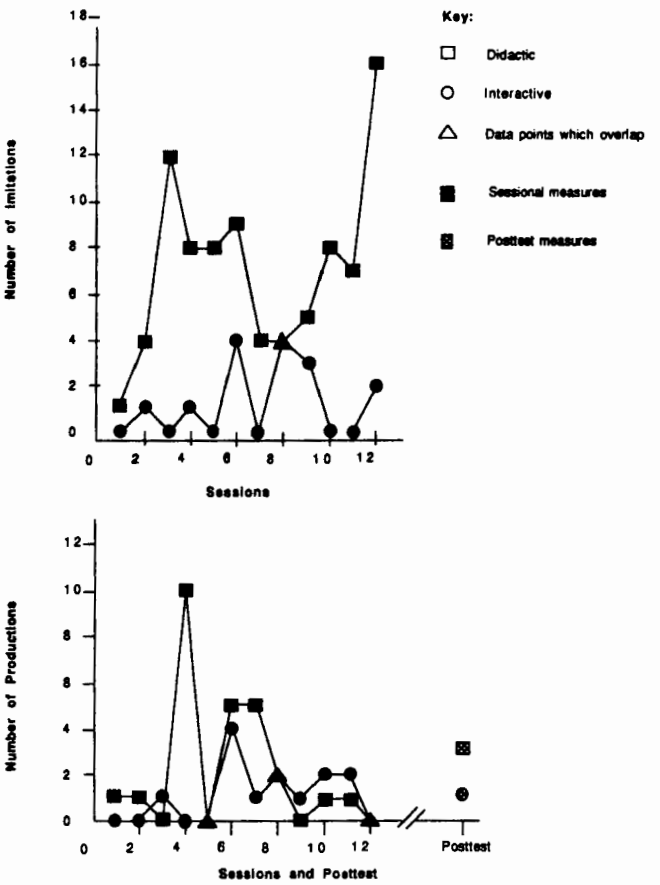

Figure 2. The number of exemplars produced and imitated by Brydon during treatment sessions and the posttest.

Discussion

We hypothesized that the children would learn more target items than control items. This expectation was met for both children. Both children demonstrated evidence of maturational stability during the six weeks of study with respect to their control goals. Hence, the results of this study indicate a clear treatment effect for targeted two-word semantic relations, irrespective of treatment condition.

Based on the findings of previous studies, we also hypothesized that the children would evidence faster productivity with the targets taught in the didactic condition, as compared to the interactive condition. As expected, the two subjects demonstrated a differential response to treatment, favouring didactic procedures. Stephen produced all five target items taught in the didactic condition, and Brydon learned three of the five target items at posttest. The current findings are consistent with those of Connell (1987), as well as Connell and Stone (1992) which reported an

advantage of elicited imitation over modelling for teaching invented morphemes to preschool children.

Finally, based on the findings of Camerata & Nelson (1992), we hypothesized that the children would demonstrate greater generalization of target items learned in the interactive condition to conversational settings. This hypothesis was not met by either child. Although the numbers are not as high for the productivity measures, more exemplars of rules taught in the didactic treatment condition were used by both children. This finding contrasts the results of Camerata and Nelson (1992), who used the same criterion for generalization and reported more efficient generalization of targets learned in interactive treatment. One possible explanation for this contrast is that their study utilized a drill-like activity with picture stimuli in their didactic treatment procedure, which is less likely to promote generalization to everyday conversations (Fey, 1986). We elected to make the treatments equivalent in terms of their potential to motivate the children. Both of our treatment conditions were conversationally embedded and employed theme-based activities which encouraged joint action. Furthermore, teaching during joint action and attention episodes has been shown to maximize the child's attention, facilitate comprehension of adult speech and associated learning (Yoder, Kaiser, Alpert, & Fischer, 1993).

These data also indicated that some targets were learned in the interactive condition. We believe that these results cannot be interpreted as evidence that children with Down syndrome cannot learn using the interactive treatment approach, but rather, that these two children learned more efficiently using the didactic treatment approach. The preferential effectiveness of didactic treatment for Brydon and Stephen may be related to the opportunities which were provided for them to practice target combinations and receive feedback on their attempts. Given that children with Down syndrome tend to experience difficulties with word-finding and oral-motor speech skills, didactic treatment embedded within a naturalistic play theme may address the intrinsic language needs of these children. Further research is needed to confirm this hypothesis.

This single-subject design study is suggestive of the benefits of didactic intervention for the two subjects involved. Replication of this study with more children and minor modifications to the design (e.g., inclusion of periodic probes, counter-balancing of semantic relations across subjects, using elicitation probes representative of interactive procedures) is necessary. In addition to the need for replication, the results of this study must be interpreted cautiously, as children with Down syndrome may be variable in terms of specific etiology (i.e., trisomy 21, translocation or mosaic), language ability, relationship between mental age and language level, social conversational style and readiness to learn (Miller, 1988). Other children with Down syndrome may show unique characteristics which may yield different responses to the two treatments than those reported here. Another limitation of the study is the short treatment period utilized. The authors acknowledge that learning in the interactive treatment condition may take longer than the six-week duration utilized in this study. For example, in a study of lexical acquisition using interactive procedures, Wilcox, Kouri, and Caswell (1991) reported that children required an average of 291 models (range 71-436) to master novel words. In this study, Stephen and Brydon were exposed to a maximum of 120 models of each target utterance in the interactive condition.

Summary

Both children in this study showed a differential response to the two treatments, with more efficient productivity and generalization occurring in the didactic treatment condition. Clinicians working with children who have Down syndrome may need to carefully consider the match between treatment procedures they select and the child's needs. Although current philosophical trends advocate interactive intervention methods for infants and young children with medical and biological risk of language delay, naturalistic forms of treatment which employ didactic procedures may be beneficial for teaching specific language targets.

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