TREATMENT OF PSYCHOTIC CHILDREN IN A CLASSROOM ENVIRONMENT: I. LEARNING IN A LARGE GROUP[1]

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The purpose of this study was to investigate systematically the feasibility of modifying the behavior of autistic children in a classroom environment. In the first experiment, eight autistic children were taught certain basic classroom behaviors (including attending to the teacher upon command, imitation, and an elementary speaking and recognition vocabulary) that were assumed to be necessary for subsequent learning to take place in the classroom. Based on research documenting the effectiveness of one-to-one (teacher-child ratio) procedures for modifying such behaviors, these behaviors were taught in one-to-one sessions. It was, however, found that behaviors taught in a one-to-one setting were not performed consistently in a classroom-sized group, or even in a group as small as two children with one teacher. Further, the children evidenced no acquisition of new behaviors in a classroom environment over a four-week period. Therefore, Experiment II introduced a treatment procedure based upon "fading in" the classroom stimulus situation from the one-to-one stimulus situation. Such treatment was highly effective in producing both a transfer in stimulus control and the acquisition of new behaviors in a kindergarten/first-grade classroom environment.

Autism is a severe form of childhood psychosis characterized by the relative absence of appropriate speech, play, and social behavior, and by a relatively high frequency of bizarre, repetitive mannerisms and tantramous behaviors. A large majority of the research investigating variables in the treatment of autistic children has utilized a one-to-one teacher-child ratio

(Lovaas and Koegel, 1973). For example, a one-to-one teacher-child ratio was employed with autistic children by Wolf, Risley, and Mees (1964) to modify tantrum behavior; by Hewett (1965), Lovaas (1966, 1969, in press), and Risley and Wolf (1967) to establish functional speech; by Lovaas, Freitas, Nelson, and Whalen (1967) and Metz (1965) to condition generalized imitation; by Hewett (1964, 1966) to teach reading skills, and by Marshall (1966) to establish self-help skills. While the results of these studies show that behavior modification procedures in one-to-one treatment have been extremely productive in a variety of situations and with diverse behaviors, such procedures have not been systematically investigated in the classroom setting.

Research in classroom design has progressed enormously in the last 10 yr with normal, culturally deprived, and retarded children (cf. Kazdin and Bootzin, 1972; O'Leary, 1972; O'Leary and Drabman, 1971). Several investigators have also suggested guidelines for the development of classrooms for autistic children

(Elgar, 1966*a;* Halpern, 1970; Hamblin, Buck-holdt, Ferritor, Kozlof, and Blackwell, 1971; Martin, England, Kaprowy, Kelgour, and Pilek, 1968; Rabb and Hewett, 1967). In particular, several studies, using one-to-one treatment pro-cedures, provide methodological guidelines and some encouraging data on the effect of teaching a single autistic child directly in a classroom set-ting (*e.g.,* Hamblin *et al.,* 1971; Koegel and Russo, *unpublished*).

However, no published studies have system-atically investigated procedures for teaching a group of autistic children in a classroom. As a result, few public-school classrooms are now in operation for autistic children. In fact, lawsuits against the Department of Education are in progress in at least seven states in the United States for failure to provide school programs for autistic children. The purpose of a present inves-tigation, then, was to assess the feasibility of con-ducting behavior modification treatment proce-dures with a group of autistic children in a class-room environment.

EXPERIMENT I

Abundant evidence showing that behavior modification techniques have been effective in one-to-one situations for teaching specific verbal and nonverbal behaviors to autistic children prompted us to begin classroom research at that point. That is, we decided to use one-to-one be-havior modification procedures to teach autistic children certain behaviors that seem necessary for learning to take place in a classroom (such as attention to the teacher, imitation, speech, and labelling parts of the immediate classroom environment), and to assess whether the per-formance of these behaviors would transfer to a classroom-sized group of eight autistic children with one teacher. Specifically, this experiment was designed to seek answers to two questions. First, will basic classroom behaviors taught in one-to-one sessions be performed consistently in eight-to-one (eight children and one teacher)

classroom sessions? Second, will the children show any new learning in a classroom of eight children with one teacher?

METHOD

Subjects

Eight autistic children participated in this experiment. All subjects were diagnosed by agencies not directly associated with this study. All were severely psychotic, displaying min-imal, if any, intelligible verbal behavior, large amounts of self-stimulatory behavior (stereo-typed arm and hand movements, rhythmic rock-ing, *etc.*), and minimal responsiveness to verbal instruction. Four of the children were mute, evidencing only a limited set of vowel sounds and no words. The other four children were echolalic, repeating what was said to them either immediately or after a delay. Five children were reported to be untestable when administered the Stanford Binet Intelligence Scale by an inde-pendent testing agency. The other three children attained I.Q. scores of 28, 32, and 38. Social development, as measured by the Vineland So-cial Maturity Scale was between 2 and 4 yr for all of the children. The average chronological age of the children at the beginning of this project was 7.3 yr (range 4.5 to 13 yr). All subjects had been denied admission to, or ex-pelled from existing public-school programs (including special education classes), and were living at home during the course of this in-vestigation.

Setting

All sessions were conducted in a 20 by 30 ft classroom containing one large table (34 in. by 60 in.), two smaller tables (24 in. by 36 in.), and eight chairs. The classroom contained a variety of educational materials (*e.g.,* Peabody Language Development Series, Distar Arith-metic series, maps, clocks, picture charts of ani-mals and objects) and play materials (*e.g.* balls, trucks, blocks, and record player).

Design

In order to assess whether behaviors taught in a one-to-one treatment setting would be performed in larger group sizes, each of the children were initially taught various verbal and nonverbal behaviors that would be appropriate in a classroom with a one-to-one teacher-child ratio, and then tested for performance of the behaviors in "groups" of one child with one teacher, two children with one teacher, and eight children with one teacher. Starting the first week of the study, the children were also tested in weekly classroom sessions in which a teacher attempted to train a variety of new verbal and nonverbal behaviors in order to measure novel learning in a classroom environment.

One-to-one treatment procedures. All children participated in one-to-one treatment sessions once per day, five days per week, each session lasting 50 min. Primary reinforcement (food) was used throughout one-to-one treatment. These sessions were directed towards teaching basic verbal and nonverbal skills believed necessary for learning to take place in a classroom-sized group of children. Table 1 presents representative examples of the stimuli used during the one-to-one treatment. Appropriate nonverbal responses were shaped by first rewarding the child for establishing eye contact with the teacher until the child would consistently (90% correct trials for three consecutive days) look at the teacher for a period of at least 5 sec when the teacher commanded, "Look at me". Then, nonverbal imitation was gradually established by prompting and reinforcing copying behaviors until the subject could consistently imitate all of the following trained behaviors: nose touching, head touching, hand clapping, feet touching, elbow touching, and block stacking; and all of the following novel (not specifically trained) behaviors: standing, sitting, jumping, holding hands, and raising one arm. Imitation was then used as a prompt to teach other nonverbal responses to instructions. For example, the teacher would say, "Touch your nose" and prompt the correct response by saying "Do this" and modelling the correct response. The prompts were then faded until the child could perform all of the following commands without prompts: touch your nose, touch your elbow, clap your hands, sit down, hands on your lap, touch your feet, *etc.* Detailed descriptions of similar treatment procedures have been provided by Lovaas *et al.* (1967) and Metz (1965). Following this training, each child would remain seated in his chair, would look at the teacher when requested to do so, would imitate the teacher upon request, and had acquired some elementary receptive language.

The procedure used for establishing appropriate verbal behaviors in the mute children followed four steps. First, the teacher rewarded the child for all vocalizations emitted during the session, thereby increasing the frequency of vocalizations. Second, stimulus control was established by rewarding the child only for vocalizations made within 5 sec of the teacher's vocalizations. Third, the child was rewarded only for gradually closer approximations to the teacher's speech. Finally, meanings were established for each of the words by differentially reinforcing use of the word in the appropriate stimulus conditions. For example, the child would be prompted and receive reinforcement for the target response "cookie" in response to the question "What is this?" when a cookie was presented. Detailed descriptions of similar procedures have been presented in written form by Hewett (1965) and Lovaas, Berberich, Perloff, and Schaeffer (1966), and are also available on film (Lovaas, 1969).

Speech was taught to the echolalic children by showing them pictures of objects and asking "What is this?," and then prompting the correct response, which the child would echo. The prompt was gradually faded until the child responded with the correct answer without any prompt. Detailed descriptions of similar procedures have been provided in written form by Risley and Wolf (1967) and on film by Lovaas (1969). During the course of one-to-one ses-

Table 1

Examples of Stimuli Presented During Experimental Sessions

One-to-One Training of Basic Classroom Skills		*Acquisition of New Behaviors in the Classroom*	
General Class of Stimuli	*Examples*	*General Class of Stimuli*	*Examples*
I. Attending to the teacher	A. "Look at me" B. "Sit down" C. "Hands on the table"	I. Discrimination Training: body parts, colors, people, animals, clothing, household and classroom objects and activities, *etc.*	A. "Touch your ___" (pants, finger, *etc.*) B. "What color is this?" (red, blue, green, *etc.*) C. "Who is that?" (Mommy, Polly, Lynn, *etc.*) D. "What does the bird do?" (fly, *etc.*) E. "What do you eat with?" (fork, knife, *etc.*) F. "What clothes are you wearing?" (shirt, pants, shoes, *etc.*)
II. Imitation	A. "Do this"—teacher touches nose, feet, elbow, head, *etc.* B. "Do this"—teacher stands up, jumps, claps hands, picks up pencil, stacks blocks, hangs up coat, *etc.*	II. Basic writing skills	A. "Pick up the pencil" B. "Draw a ___" (A, B, *etc.*) C. "Trace the lines" (cat, elephant, *etc.*) D. "Write your name" (Eddie, *etc.*)
III. Speech	A. "Say m," "b," "c," *etc.* B. "Do this"—teacher holds lips in position to say "mm" C. "Say cat," "mama," *etc.*	III. Basic reading skills *Distar Reading series*	A. "This is ___; say ___." (mm, aa, *etc.*) B. "When I point to the sound, tell me what it says." (d, i, r, *etc.*) C. "What is this" (*e.g.*, th), "and this" (a), "and this" (t). "Say it fast" (that) D. "What word is this?" (feed, sock, *etc.*)
		IV. Basic arithmetic skills: *Distar Arithmetic series*	A. "What number is this?" (1, 2, 3, *etc.*) B. "Count to ___" (10, 20, 50, *etc.*) C. "How many balls do you see?" (1, 5, 10, *etc.*)

sions, both mute and echolalic children acquired basic skills of verbal imitation and labelling pictures (*e.g.*, food objects, clothing objects, toys, people, and body parts). When a child completed this speech training, he could verbalize any word upon presentation of the in-

struction, "Say ———," and could label at least three objects.

Throughout the one-to-one sessions, disruptive verbal and nonverbal behaviors were treated with extinction, or the application of contingent aversive stimuli (shouting "NO!" or slapping the child briskly). Since some self-stimulatory behaviors appear to interfere with learning (Koegel and Covert, 1972), such behavior was also treated with contingent aversive stimulation.

Assessment of performance in various group sizes. After each child achieved a criterion of at least 80% appropriate responses in the one-to-one treatment sessions, performance of those behaviors was measured in groups of eight-to-one, two-to-one, and one-to-one. One-to-one training sessions were continued once per day throughout the testing. In each of the test sessions, the children were seated around the rectangular table, with the teacher seated at the head of the table. Each child was within arm's reach of the teacher. No primary reinforcement was used, in order to ensure that no new learning took place during the test trials.

We attempted to control for the order of group sessions in the following way: with three group sizes there are six different sequences of testing (8, 2, 1; 1, 2, 8; 2, 1, 8; 1, 8, 2; 2, 8, 1; 8, 1, 2). Each subject was tested in three randomly selected sequences of group sizes. Since there were eight subjects and three sequences per subject, a total of 24 test sequences was used.

When the children reached the 80% criterion in the 1:1 training sessions, they were tested in all three group sizes on each of the next three days. Fifteen different stimuli were presented in each group size. For each session, these stimuli were randomly selected from each of the three classes of stimuli given in Table 1. Variability in the number of trials presented was eliminated by recording responses to only the first 15 different stimuli. The children received a total of 45 test trials in each group size. A child's companion was randomly selected

for testing in a group of two. However, different children had to serve as companions for each test session.

In these test sessions, the teacher presented one trial to each child in the group before proceeding to the next stimulus. For example, the teacher would say "Say mmm" once to each child starting from left to right. After each child in the group had received one trial, a new stimulus was presented in the same way. This procedure continued until each child had received 15 different stimuli.

Assessment of new learning in the classroom. To assess learning of new behaviors in a classroom environment, classroom sessions with eight autistic children and one teacher were videotaped once per week. Each session was conducted for 50 min, with videotape time samples recorded during three randomly spaced 4-min segments of each session. At the start of each session, the eight children were seated around the rectangular table, with the teacher seated at the head of the table. All subjects were within arm's reach of the teacher. The teacher then followed a training curriculum based upon the California State Department of Education Curriculum guidelines for kindergarten/first-grade children. These guidelines were selected because the children had no prior academic skills (as they had little or no previous school experience). The teacher presented approximately 125 (range 70 to 150) stimuli per session. Table 1 presents representative examples of the stimuli used. Fifty per cent of the stimuli were commands, and 50% were questions. Also, 50% of the stimuli required verbal responses, and 50% required nonverbal responses. Both questions and commands were presented to subjects individually and as a group. For example, the teacher would first say, "Everyone, tell me what this is" and then, "John, tell me what this is", "Eddie, tell me what this is", *etc.* No primary reinforcement was used during these sessions. However, appropriate responses were reinforced socially in order to approximate normal classroom conditions.

For each weekly videotape, two observers selected from a pool of seven naive observers recorded the occurrence of both appropriate verbal and appropriate nonverbal responses as defined below in the instructions to the observers.

Appropriate verbal responses consist of verbal responses which are clear and distinct and are relevant to the question or command given by the teacher. The child's response must occur within 10 seconds of the teacher's stimulus. For example, if the teacher holds up a blue card and asks "What color is this?" and the child responds "Blue" within 10 seconds an appropriate verbal response should be recorded. The response should be recorded as inappropriate if it occurs more than 10 seconds after the teacher's question or command, or if it is irrelevant to the teacher's stimulus. For example, screaming, echoing the teacher's question, or answering the question, "What color is this?" with the response, "Square turtle" should be recorded as inappropriate. For each session, the percentage of appropriate verbal responses is defined as the number of appropriate verbal responses per session divided by the total number of stimuli that require verbal responses directed to the child in that session. For example, if the teacher presents 25 questions and commands requiring verbal responses from the child, and the child responds appropriately 20 times, he should receive a measure of 80 percent appropriate verbal responses for that session.

Appropriate nonverbal responses consist of nonverbal responses that are relevant to the stimulus command or question and occur within 10 seconds of the teacher's stimulus. For example, if the teacher says, "Touch your nose," and the child touches his nose within 10 seconds, it should be recorded as an appropriate non-

verbal response. A response should be recorded as inappropriate if it occurs more than 10 seconds after the stimulus, or if it does not correctly answer or follow the stimulus command or question. For example, if the child engages in self-stimulatory behavior, hits another child or himself, does not respond at all, or emits any other response which does not relate to the question or command, it should be recorded as inappropriate. The percentage of appropriate nonverbal responses is defined as the number of appropriate nonverbal responses emitted by the child divided by the number of stimuli which require nonverbal responses directed toward that child. For example, if the teacher directs 30 questions and commands requiring a nonverbal response by a given child, and the child responds appropriately 15 times, he should receive a measure of 50 percent appropriate nonverbal responses for that session.

Reliability. Measures were recorded from videotapes for the assessment of new behaviors learned in the classroom, and *in vivo* for the assessment of responding in the three group sizes. Two of seven naive observers independently recorded the teacher's instructions as well as subjects' responses for each session. Examples of the stimuli presented by the teacher in the classroom and group testing sessions are reviewed in Table 1. Responses to each stimulus were recorded as appropriate or inappropriate as defined above. If both observers recorded a particular response as appropriate or inappropriate on a given trial, they were said to be in agreement. If one observer recorded a response as appropriate and the other recorded it as inappropriate, they were said to be in disagreement. Either an agreement or a disagreement was computed for each individual trial in the session.

Reliability between the two observers for each session was calculated according to the following formula:

reliability =

$$\frac{\text{number of agreements per session}}{\text{agreements and disagreements}} \times 100$$

All reliability measures were above 95%.

RESULTS

Comparison of children's behavior in various group sizes. The children required an average of 3.2 weeks (range: two to four weeks) to acquire the behaviors in one-to-one treatment. After the children achieved a criterion of 80% appropriate responding in 1:1 treatment sessions, their behavior was measured in groups of 1, 2, and 8 children with one teacher. Data for each of the eight autistic children, showing their performance of learned behaviors in the various group sizes, are presented in Figure 1. Since verbal and nonverbal behaviors showed the same results, their data have been combined to obtain the percentages given in the figure. The ordinate represents per cent of appropriate responding for each of the eight children separately. In this figure, the black bar depicts responding in 1:1, the dark grey bar depicts responding in 2:1, and the light grey bar depicts responding in 8:1. Each bar represents a percentage obtained in 45 trials. The figure reveals that each of the eight children responded appropriately to at least 80% of the stimuli presented by the teacher in the one-to-one situation. However, appropriate responding decreased when another autistic child was added to the 1:1 group size. That is, every child showed a decrease in correct responding when tested in a group of two children with one teacher. The decrease, however, was highly variable, ranging from a 3% decrease (Michael) to a 78% decrease (Laurie). Test trials in 8:1 revealed an even greater decrease in appropriate responding for each subject. Again, the amount of decrease was variable. The decreases from 1:1 to 8:1 ranged from 34% (Michael) to 81% (Laurie). There was no systematic change during the course of the test sessions.

Assessment of appropriate responding in the

classroom. Weekly classroom sessions were conducted to assess new learning in a classroom environment. The results presented below refer to the children's behavior in the classroom of eight children with one teacher. Data showing the amount of appropriate verbal and nonverbal responding in the classroom, for the mute and echolalic children separately, are presented in Figure 2. The dependent variable is percentage of appropriate responding. Each data point represents responding during one weekly session.

Consider the verbal responding first. Each of the four mute children showed absolutely no change from 0% appropriate verbal responding in the classroom throughout four weeks of daily one-to-one treatment sessions. Although each of these children performed appropriately on more than 80% of the trials in one-to-one sessions, not a single appropriate verbal response was emitted by any of the children in four weeks of classroom sessions. The echolalic children also displayed minimal appropriate verbal responding, ranging from 25% (John) in Session 2 to 0% in at least one session for every child. No trends were apparent for any child.

Analysis of nonverbal responding reveals results similar to that of verbal responding. In brief, there was essentially no change in appropriate nonverbal responding for either mute or echolalic children. Nonverbal responding was minimal, ranging from 24% (Eddie) in Session 2 to 0% in at least one session for seven of the eight children. No trend was evident throughout the four weeks for any of the children.

In summary, the results show that the performance of behaviors learned in 1:1 sessions was greatly reduced in a classroom-sized group of eight children with one teacher. Furthermore, the performance of these behaviors was also greatly reduced in a group of only two children. In conjunction with these findings, there was also no evidence of acquisition of new behaviors in classroom sessions conducted over a four-week period. Similar results for each of the eight autistic children directed us to the following
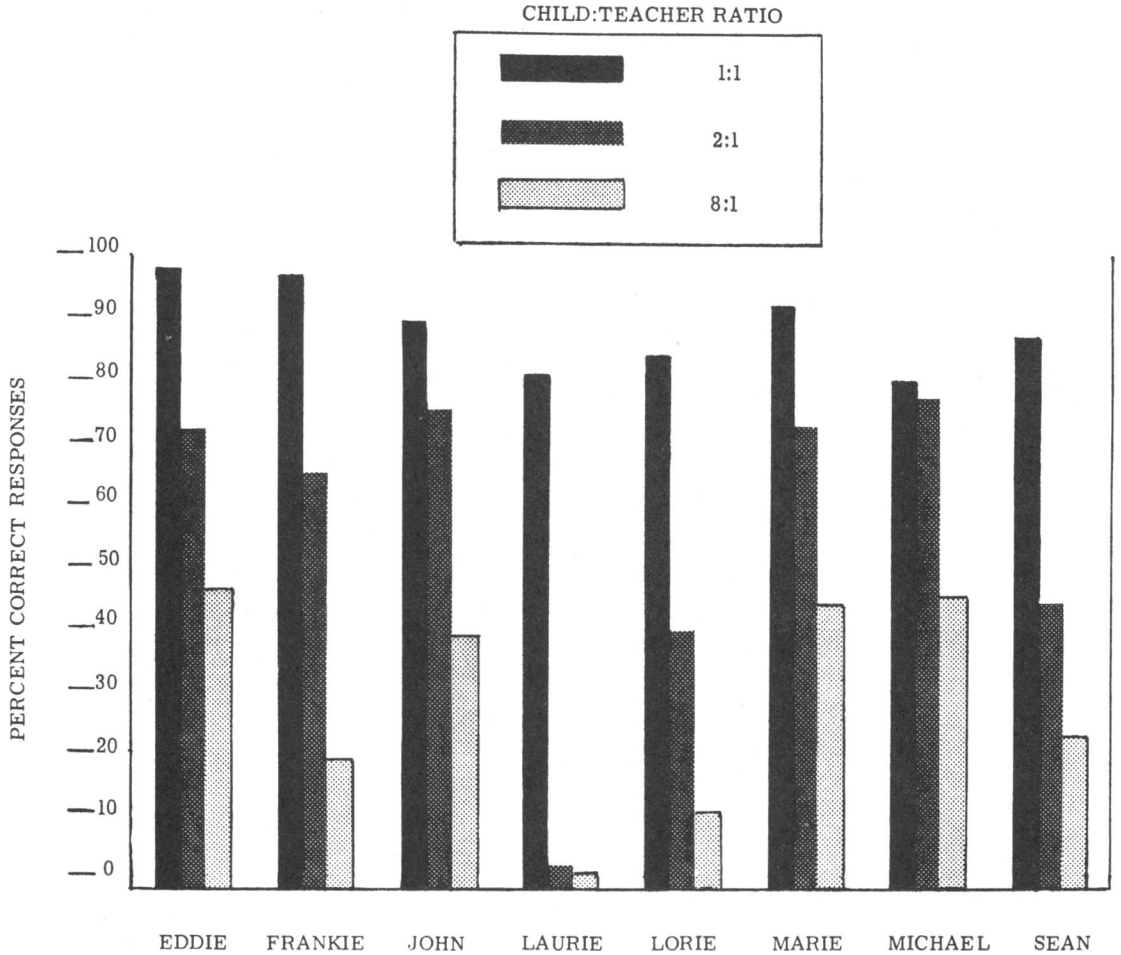
Fig. 1. Performance of learned behavior in various group sizes. Per cent correct responses are plotted individually for each child during test sessions in groups of one, two, or eight children with one teacher.

experiment, which attempted to arrange conditions that would facilitate appropriate responding in the classroom.

EXPERIMENT II

The behaviors learned in one-to-one sessions in Experiment I (speech, attending to the teacher upon command, imitation, labelling parts of the immediate classroom environment) seem essential for even minimal learning to take place in the classroom. However, it was found that the transfer of appropriate responding from one-to-one sessions to larger groups was minimal and variable. Also, it was found that no subsequent learning occurred in the classroom sessions. Therefore, it was necessary to develop a procedure that would facilitate a transfer of appropriate responding to the classroom. Since the children's appropriate responding in one-to-one training sessions did transfer to a "group" of one child with one teacher, but did not transfer to groups of two children or eight children with one teacher, we decided to begin with a small "classroom" of one teacher and one child, and gradually "fade in" more children until a classroom-sized group was consistently perform-
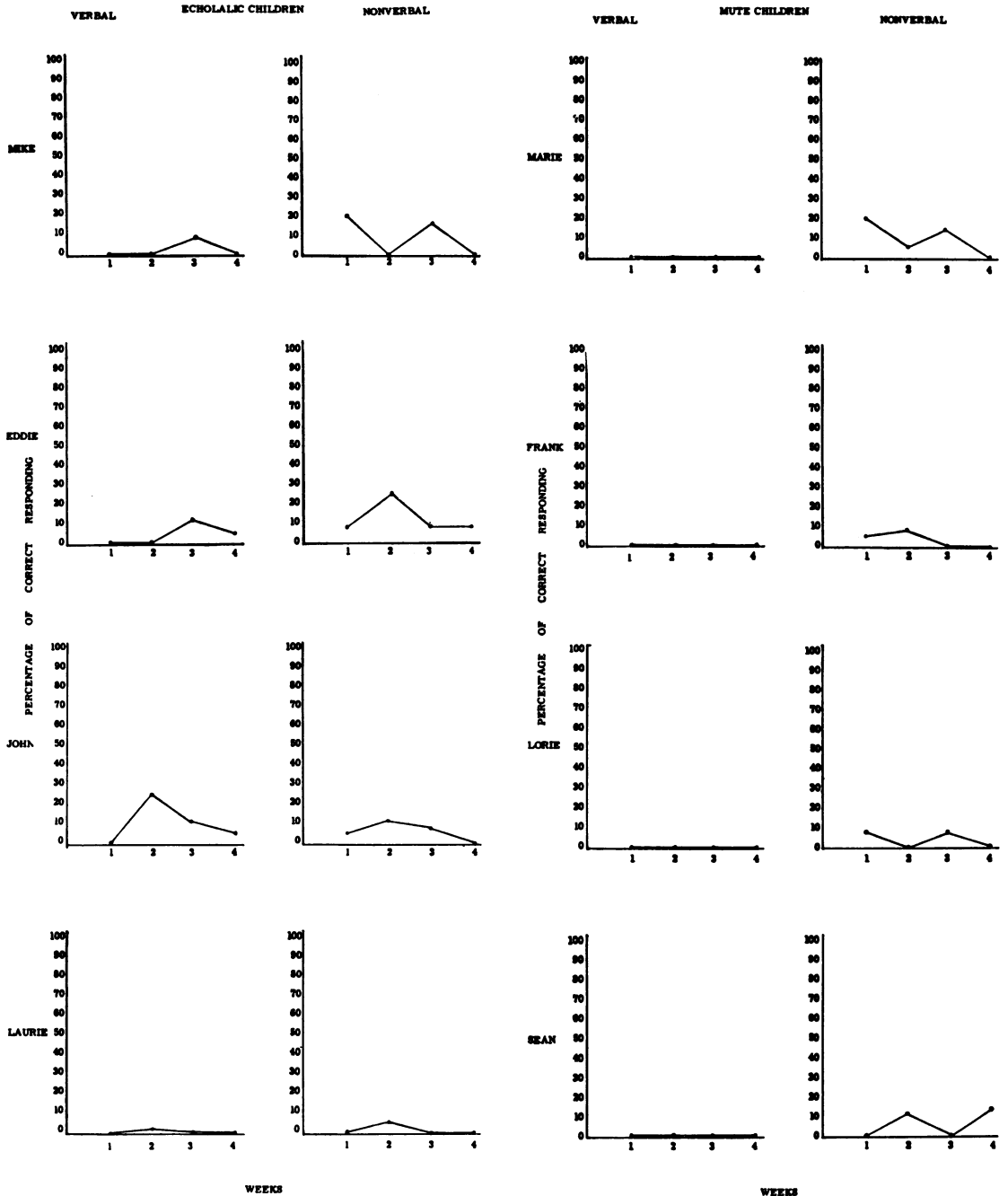
Fig. 2. Per cent correct responding of new verbal and nonverbal behaviors being taught in the classroom. Behaviors are plotted for each child individually. Graphs for the mute children are presented on the right half of the figure; graphs for the echolalic children are plotted on the left. The ordinate represents the mean per cent correct for one weekly session.

ing the basic behaviors originally taught in one-to-one sessions. This would also permit us to assess whether the children would then acquire new behaviors in the classroom.

METHOD

Design

To assess changes in the classroom behaviors of autistic children as a function of the treat-

ment procedures (gradually increasing the group size and thinning the reinforcement schedule—see below), a multiple baseline design was employed across behaviors. For each child, baseline measures were recorded on both verbal and nonverbal responses in the classroom. The treatment procedures for reducing the teacher-child ratio were then introduced for one class of behaviors (nonverbal), while the other class of behaviors (verbal) remained on baseline. Treatment of nonverbal behaviors was initiated first because it was judged that such behavior might be useful in establishing verbal behavior (*e.g.*, nonverbal imitation could be used to prompt the child in the placement of his tongue, *etc.*). Treatment for reducing the teacher-child ratio on verbal behaviors was initiated at a preestablished later date. One-to-one treatment on the basic classroom behaviors was continued as a constant throughout the experiment.

Measurement of classroom behavior. Throughout the experiment, data were obtained on the performance of each child in a classroom with eight children and one teacher once per week. Each of these sessions was conducted in exactly the same manner as the classroom sessions described in Experiment I. That is, data were obtained on appropriate verbal and nonverbal classroom responses. Only social reinforcement was provided during these measurement sessions, since we eventually wanted correct responding to be maintained by "natural" reinforcers, rather than food. Procedures for computing reliability measures were the same as those used in Experiment I. All reliability measures were above 93%.

Treatment procedures for reducing the teacher-child ratio. At the designated point in the multiple baseline design, the procedures for reducing the teacher-child ratio in the classroom were introduced. These sessions were conducted once per day five days per week, and lasted 50 min each. The treatment sessions took place at a different time of day than the classroom measurement sessions discussed above. The treat-

ment proceeded as follows. First, two children were brought together to form a small class of two children, with one teacher and two teacher's aides. The children sat facing the teacher, with the aides seated directly behind the children. All procedures described in the one teacher-one child training sessions of Experiment I were followed here, except that in these sessions, only teacher's aides provided the necessary prompts and reinforcers. For example, the teacher would say "Touch your ear", and an aide would prompt the child to touch his ear (by moving the child's hand), and then give him a candy. When both children reached a criterion of 80% or more appropriate responses (without prompts), the reinforcement schedule was reduced to a fixed ratio 2, in which a given child was rewarded after performing two correct responses. At this point, these two children were grouped with two other children who had achieved the same criterion, to form a class of four children, one teacher, and two teacher's aides. As each child was now responding twice for one reinforcement, the teacher's aides could then provide prompts and reinforcements for two children. The children were again brought to an 80% appropriate response criterion, and the reinforcement schedule was gradually thinned to a fixed ratio 4, in which a child received reinforcement after every fourth correct response. These children were then grouped with four others who had reached the same criteria to form the final class size of eight children. When all of the children again achieved the criteria, the reinforcement schedule was further thinned to a variable ratio 8, in which a given child received reinforcement on the average of every eight correct responses, and both teacher's aides were removed from the classroom.

RESULTS

Seven of the eight subjects completed the treatment for reducing the teacher-child ratio, eventually performing the basic skills (taught in one-to-one sessions) at a rate of 80% or
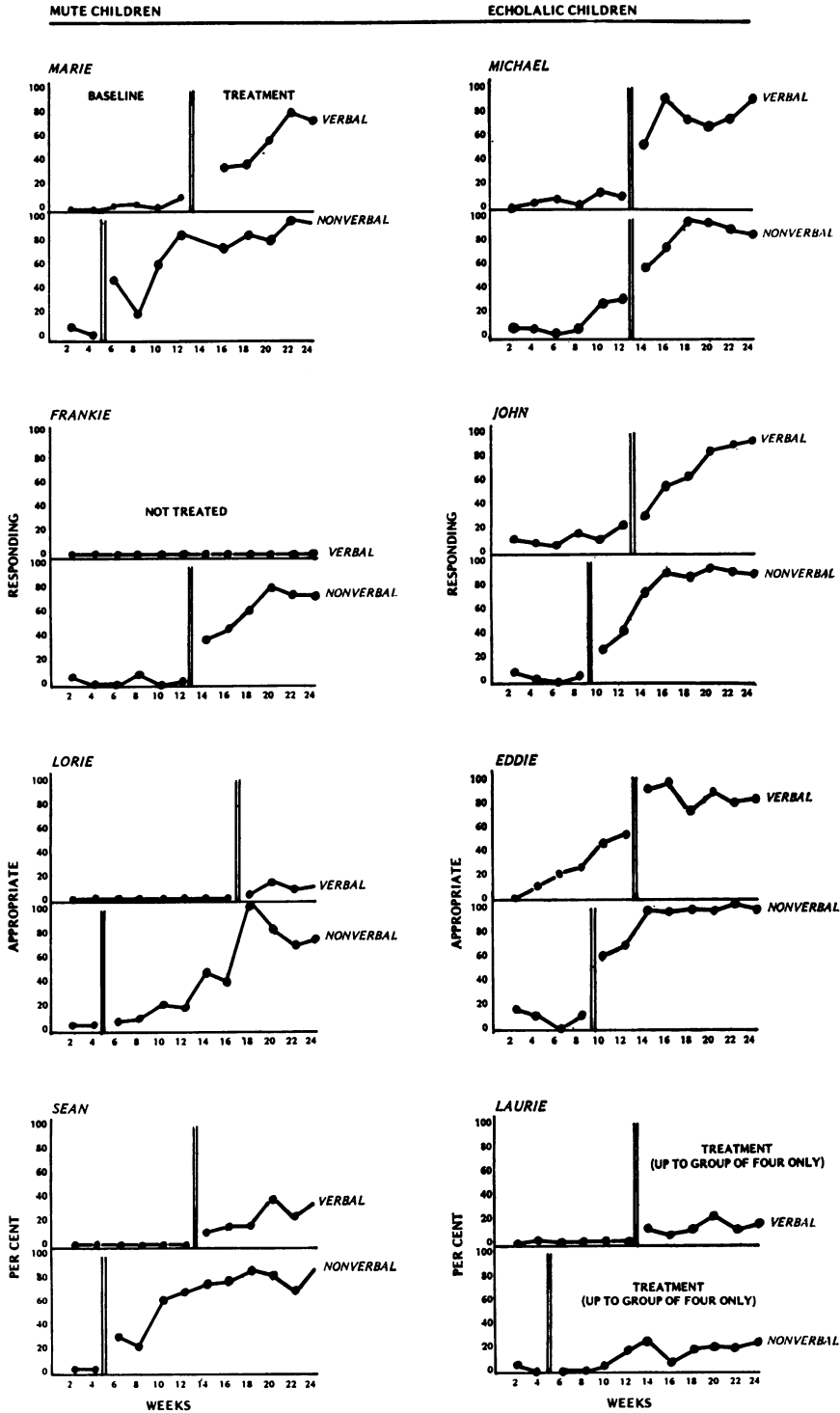
Fig. 3. Per cent correct responding of new verbal and nonverbal behaviors being taught in the classroom. Behaviors are plotted individually for each child. The double line on each graph signifies the introduction of treatment (fading) sessions. Data for mute children are plotted on the left; data for echolalic children on the right. The ordinate represents the mean per cent correct for two weekly sessions.

higher in a group of eight children with one teacher. The number of trials required to achieve the 80% criterion varied considerably (approximately 400 to 2100 trials).

The effect of the treatment procedures upon subsequent learning in the classroom is shown below for each of the eight children, including the one child (Laurie) who did not complete the treatment. All of the results presented below refer to the children's behavior in the classroom of eight children with one teacher. Figure 3 shows the data for the mute children and echolalic children separately. The ordinate depicts per cent of appropriate responses for new verbal and nonverbal behaviors taught in the classroom. Two-week intervals are presented on the abscissa.

Consider the verbal behavior first. Although all of the children were receiving 1:1 therapy throughout the baseline sessions, three of the four mute children never evidenced any appropriate verbal responses in the classroom during the baseline condition. Similarly, three of the four echolalic children displayed only minimal appropriate verbal behavior during the baseline sessions. That is, for six of the eight children, neither the one-to-one treatment sessions, nor repeated exposure to the classroom environment, had any observable effect on performance in the classroom. This is particularly dramatic in the case of Frankie, who never displayed any appropriate verbal responding in the classroom over a six-month baseline condition (Frankie received no treatment on verbal behavior because of his participation in another study not discussed in this paper). Only one child (Eddie) showed any large degree of improvement in the classroom environment during the baseline conditions. It is difficult to determine whether the improvement was a function of transfer from one-to-one training or a function of repeated exposure to the classroom.

With the introduction of treatment, all of the children began to show increased appropriate verbal behavior, and continued to show levels of responding above the baseline level throughout treatment. In general, the echolalic children showed larger increases in appropriate responding than the mute children. Three of the echolalic children (Eddie, John, and Michael) reached levels above 80% appropriate verbal responses by the end of this investigation. Only one of the three mute children to receive treatment (Marie) approached this level of success (79% appropriate verbal responses in the 21- to 22-week interval). The one notable exception (Laurie) to the success of the echolalic children was also the only child participating in this study who did not complete the treatment procedure. In fact, Laurie never achieved the criterion of 80% in the group of four children (within 6000 trials). Her performance, of those basic behaviors previously acquired in one-to-one sessions, did not exceed 69% appropriate responding in the group of four children, and, therefore, she never received treatment in a group of eight children. It is noteworthy that her performance in the classroom sessions was much less appropriate than that of any other echolalic child.

The effects of treatment on nonverbal behavior followed a pattern similar to that of the verbal behavior. In general, the percentage of appropriate nonverbal responses was very low throughout the baseline sessions. Seven of the eight children averaged less than 10% appropriate nonverbal responses per session. With the initiation of treatment, however, all of the children showed large increases in appropriate responding. Seven of the eight children attained levels of 80 to 100% appropriate nonverbal responses per session by the end of the investigation. No obvious differences were observed between mute and echolalic children.

In summary, the results show that: (1) although the children were receiving one-to-one treatment during the baseline condition, there were minimal appropriate verbal or nonverbal behaviors in the classroom before treatment, and (2) treatment procedures based upon gradually thinning the reinforcement schedule and gradually increasing the number of children in the

group did produce large increases in both appropriate verbal and appropriate nonverbal behaviors in the classroom (on both previously learned basic classroom skills, and on new behaviors learned in the classroom).

DISCUSSION

The main purpose of this study was to assess the feasibility of conducting behavior modification treatment procedures with autistic children in a classroom setting. The initial treatment program consisted of teaching the children certain basic skills, such as attending to the teacher upon command, imitation, speech, and responding to the immediate classroom environment. Based on research documenting the effectiveness of one-to-one treatment and the impracticality of teaching eight disruptive children in a class, these basic skills were taught in one-to-one sessions and tested in larger classroom-sized groups. It was, however, found that behaviors taught in a one-to-one setting were not performed consistently in a group of eight children, or even in a group as small as two children with one teacher. Therefore, Experiment II introduced a treatment procedure based upon "fading in" the classroom stimulus situation from the one-to-one stimulus situation, by gradually thinning the schedule of reinforcement for appropriate responding, and gradually increasing the group size. Such treatment was highly effective in producing appropriate verbal and nonverbal behaviors in the classroom.

Implications for understanding autism. It seems important to emphasize that special procedures were necessary in order to produce generalization of one-to-one treatment effects to a classroom-sized group. Others (*cf.* Baer, Wolf, and Risley, 1968) have commented on the importance of treating behaviors in more than one environment in order to produce widespread generalization to other environments. However, it does seem significant to note that, in this study, generalization was minimal even from one-to-one sessions to two-to-one sessions. Such

extreme restriction of stimulus control may suggest a deficit in generalization peculiar to autistic children. A comparison of the generalization gradients of autistic and normal children may shed some light on this issue.

It is also possible that variables other than stimulus generalization may be responsible for the initial failure of these children to respond appropriately in the classroom. Hermelin (1966), Koegel and Wilhelm (1973), Lovaas and Schreibman (1971), Lovaas, Schreibman, Koegel, and Rehm (1971), and Sailor and Taman (1972) have shown that autistic children display peculiarities in their responses to multiple stimulus inputs. Perhaps, in the classroom, the introduction of additional children to the group, along with the required extra stimuli necessary to teach these children, may provide a multiple cue situation that is responsible for the deficits in performance. Several studies investigating these and other possibilities are in progress in our laboratory.

Implications for the development of classroom programs for autistic children. The present results directly contradict the notion that one can simply bring together a group of autistic children and begin academic instruction. Even repeated exposure to the classroom for extended periods of time does not appear to produce much change in the children's behavior. Eleven of the 16 baseline measures recorded for the eight children in this investigation showed either no change at all or deterioration during the baseline conditions. That is, the combined effect of one-to-one treatment and repeated exposure to the classroom environment, for periods of up to six months, produced very little change in the children's behavior in a classroom of eight children with one teacher. Perhaps this is why so few classroom programs exist for autistic children.

However, the present results do show that classroom programs for autistic children can be both feasible and productive. Certain elementary classroom skills such as speech, attending to the teacher, imitation, *etc.* can be taught with be-

havior modification procedures in one-to-one sessions. Then, these skills can be evoked in successively larger group sizes approaching the size of a classroom group. Simultaneously, the schedule of reinforcement can be systematically thinned so that the teacher is able to supply sufficient reinforcers, in the final classroom, to provide for subsequent learning. Once this has been accomplished, as the results of this study show possible, academic progress follows. By the end of this investigation, the children were (among other behaviors) learning to perform various classroom activities such as telling time, reading first-grade books, printing the letters of the alphabet, and solving simple arithmetic problems. It will be interesting to see what the effect of five to 10 more years of education will have upon such children, particularly if advancement occurs in both curriculum development and efficiency in classroom teaching procedures in general.

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