
Developmental Changes of Preschool Children with Autism and Normally Developing Peers

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The Battelle Developmental Inventory and Learning Accomplishment Profile were used to assess changes in developmental rate of preschool children with autism and their normally developing peers over one school year. Although the normally developing children were at a higher developmental level before and after treatment, the children with autism made significant gains in their relative rate of developmental progress and no longer differed from peers on these measures after treatment. The data support the notion that very young children with autism are capable of important developmental progress.

Educational research of recent years suggests that the prognosis for very young children with autism is brighter than was expected a decade ago. Lovaas (1987) reported that nearly half of the preschool children who received his full, intensive treatment package achieved normal educa-

tional and intellectual functioning at follow-up. Strain and his co-workers (e.g., Odom, Hoyson, Jamieson, & Strain, 1985; Odom & Strain, 1986; Strain, Hoyson, & Jamieson, 1985) report major social and educational benefits from their integrated preschool program for autistic-type children.

Although it is not yet clear to what extent these procedures will benefit the full range of children with autism, the initial results are very encouraging.

Following the opening of two specialized preschool classes at the Douglass Developmental Disabilities Center in 1987, we noted tangible educational changes in our young pupils as well. Our earlier reports (e.g., Handleman, Harris, Tomchek, & Kristoff, 1990; Handleman, Harris, Kristoff, Fuentes, & Alessandri, in press; Harris, Handleman, Kristoff, Bass, & Gordon, 1990) documented that those children made significant changes in language and developmental skills. These early reports were based on a small sample of children and thus were preliminary in nature. We now have a larger pool of children from which to draw and are able to reach firmer conclusions about the developmental changes we witness over the course of the school year.

The present study reports on the progress of children with autism in our preschool program and compares them to a group of normally developing youngsters, most of whom were enrolled as "peers" in our integrated preschool class. We also included five normally developing youngsters from a university day care center to provide a large enough comparison group for statistical purposes.

Using the *Battelle Developmental Inventory (BDI)* (Newborg, Stock, Wnek, Guidubaldi, & Svinicki, 1984) and the *Learning Accomplishment Profile (LAP)* (LeMay, Griffin, & Sanford, 1977) we predicted that (a) the children with autism would be functioning at a lower developmental level and (b) would be advancing at a slower developmental rate than the normal peers before treatment. We further predicted that (c) after treatment the children with autism would remain at a lower developmental level, but would be (d) progressing at a similar rate to their normal peers. Finally, we predicted

that (e) the children with autism would show a significant increase in their rate of progress from pretesting to posttesting, but that (f) this rate would remain stable for the normally developing youngsters.

Method

Setting

The Douglass Developmental Disabilities Center is a Rutgers University based, behaviorally oriented program for the treatment of children with autism. The Center includes two preschool classes — a "segregated" class for six children with autism, with a teacher and three assistants, and an "integrated" class which includes six children with autism, seven normally developing peers, a teacher, and three assistants. Children are typically admitted to the segregated class and after one or two years move to the integrated class from which they are promoted to various public and private school placements.

The school is open five hours a day, five days a week, for 11½ months a year. Both preschool classes emphasize small and large group instruction, have monthly class themes, take regular field trips, use computer-based learning opportunities, and include daily outdoor recreation. The programs emphasize language and social development paced to each child's needs. Incidental teaching techniques are extensively employed with discrete trial instruction as needed. Support for home programming is provided as well.

The university day care center, from which five children who participated in the *LAP* sample were drawn, is a full day, five days a week, full year program. The program is for children 30 months to 72 months. The student teacher ratio is 6 to 1. The center emphasizes daily outdoor activities, weekly classroom themes, monthly field trips, and computer terminal instruction.

Subjects

The participants in this study were preschool-age children with autism and their normally developing peers. The number of children for each measure varied because the *LAP* was introduced a year before the *BDI*. There was considerable overlap among the children who took the tests.

The children with autism were referred to the center with this diagnosis from an outside agency, and the diagnosis was confirmed at our center by an experienced clinical psychologist. Children admitted in 1987 were diagnosed according to criteria of *DSM-III* (American Psychiatric Association, 1980), and those children in 1988 and 1989 by the criteria of *DSM-III-R* (American Psychiatric Association, 1987). The *Childhood Autism Rating Scale (CARS)* (Schopler, Reichler, DeVellis, & Daly, 1980) was employed as an additional measure of autistic behavior. The normal peers were drawn from two sources — our integrated preschool class and the university day care center. These children were chosen because they exhibited no known developmental difficulties. Parental consent was obtained for all children.

Battelle Developmental Inventory

There were 6 children with autism and 5 normally developing peers for whom data were available on the *BDI*. All of the peers had participated in our integrated preschool program. The mean chronological age at pretest of the children with autism was 39.83 months (range 34 months to 44 months), while the normally developing peers had a pretest mean of 36.0 months (range 32 to 43 months), $t(9) = 1.57$, $p = \text{n.s.}$ At time of posttest the children with autism had a mean age of 48.83 months (range 40 to 55 months), and the peers had a mean age of 46.60 months (range 40 to

53 months), $t(9) = 1.291$, $p = \text{n.s.}$ There was one girl in each group. The children with autism had a mean score of 32.25 (range 30 to 37.5) on the *CARS*, placing them in the mildly to moderately involved range.

Learning Accomplishment Profile

There were 5 children with autism and 7 normally developing peers in the *LAP* sample. Five of the peers were from our integrated preschool and 2 from the university day care center. The mean chronological age of the children with autism was 40.60 months (range 34 to 45 months), and the mean age for the normally developing youngsters was 38.00 months (range 22 to 44 months), $t(10) = 1.055$, $p = \text{n.s.}$ There were no girls with autism and two girls in the normally developing comparison group. The children with autism had a mean score of 32.60 (range 30 to 37.5) on the *CARS*.

Instruments

The *BDI* (Newborg et al., 1984) surveys five developmental domains: Personal-Social, Adaptive, Motor, Communication, and Cognitive, yielding a total score and one for each domain. This inventory, for children from birth to eight years, has as one of its primary functions assessment of children with handicaps. According to its developers, the *BDI* is a reliable and accurate measure across its intended range, and it correlates well with established measures of children's cognitive and language abilities (Newborg et al., 1984).

The *LAP* (LeMay et al., 1977) consists of eight domains: Fine Motor Writing, Fine Motor Manipulation, Language Naming, Language Comprehension, Cognitive Matching, Cognitive Counting, Gross Motor Object Movement, and Gross Motor Body Movement, each of which yields a develop-

mental score in months. This test has been extensively used by Strain and his colleagues (e.g., Hoyson, Jamieson, & Strain, 1984) to assess the progress of preschool children with autism. We based our calculations for the present research on a mean score in months across domains.

The *BDI* and *LAP* each provide an age equivalent score which we used for the present study. Developmental rate at pretesting was calculated by a formula using developmental age in months at pretesting divided by chronological age in months at pretesting (Wolery, 1983) to estimate the child's rate of progress prior to training. This formula was the basis for all pretest scores of developmental rate. Progress from pretest to posttest was estimated with the Intervention Efficiency Index of developmental gain (Bagnato & Neisworth, 1980). This index is computed by dividing the number of months of developmental increase from pretesting to posttesting by total number of months from pretesting to posttesting. This formula was the basis for posttesting developmental rate scores. For both formulas, if a child progresses one month developmentally for each month that passes, the index score would be 1.00. Hoyson, Jamieson, and Strain (1984) and Harris et al. (1990) used these formulas to assess children with autism in preschool programs.

In addition to scores documenting developmental rates, we have also included scores reflecting developmental age so that the reader can appreciate the difference between changes in the two measures.

Procedures

The tests were administered by four advanced doctoral students in clinical or school psychology, each of whom had completed a course in cognitive assessment and had at least one year of experience working with children with autism. Each test was ad-

ministered to the children with autism and their peers in the integrated class in the summer before they entered the program, or as soon as possible in the fall of their first year. The children at the university's day care center were tested on the *LAP* in the fall of the school year. The posttest was administered in the spring of the school year. For the *BDI*, the mean time from pretesting to posttesting was 8.6 months (range 5 to 12 months), for the *LAP*, 10 months (range 6 to 13 months).

Each test was administered individually and care was taken to ensure that the child's attention to the task was optimal. Thus, the tests were often given in several brief sessions rather than a single prolonged one, and praise was liberally provided for cooperative behavior. For some of the younger children, a parent or familiar staff member was present to facilitate the assessment.

Results

Battelle Developmental Inventory

A comparison of scores on the *BDI* indicates that at pretest there was a significant difference in rate of development between the children with autism ($M = .48$) and their normally developing peers ($M = .89$), $t(9) = 8.39$, $p = .0001$ (Table 1). This difference was no longer statistically significant after one school year (autistic $M = 1.13$, peers $M = 1.47$), $t(9) = .89$, $p = \text{n.s.}$). The children with autism tended toward a significant increase in developmental rate from pretest ($M = .48$) to posttest ($M = 1.13$), $t(5) = 1.94$, $p = .110$. The normal peers showed a significant increase in rate over time (pretest $M = .89$; posttest $M = 1.47$), $t(4) = 5.81$, $p = .004$.

When developmental scores in months on the *BDI* at time of entry were compared for children with autism ($M = 18.83$) and

Table 1. Changes in Mean BDI Rate and Developmental Months Scores for Children with Autism and Normally Developing Children

	Rate		Months	
	Pretest	Posttest	Pretest	Posttest
Autism	.48	1.13	18.83	28.50
Normal	.89	1.47	31.80	44.60

their normal peers ($M = 31.80$), there was a significant difference between the two groups, $t(9) = 7.39$, $p = .0001$. There remained a significant difference in developmental age at posttest (autistic $M = 28.50$; peers $M = 44.60$), $t(9) = 3.24$, $p = 0.10$. The children with autism made 9.67 months of progress from pretest ($M = 18.83$) to posttest ($M = 28.50$), $t(5) = 3.07$, $p = .03$. During this same interval, the peers gained 12.80 developmental months (pretest $M = 31.80$; posttest $m = 44.60$), $t(4) = 7.11$, $p = .002$.

Learning Accomplishment Profile

Pretest comparison of rate of change on the *LAP* for children with autism ($M = .72$) and normally developing youngsters ($M = 1.32$) revealed a significant difference between the two groups, $t(10) = 8.41$, $p = .0001$ (Table 2). At posttest this difference had reversed in direction, with the children with autism showing a significantly higher rate of progress (autistic $M = 1.73$, normal $M = .93$), $t(10) = 2.30$, $p = .044$. The children with autism made significant progress from pretest ($M = .72$) to posttest ($M = 1.73$), $t(4) = 3.40$, $p < .027$. The normally developing youngsters showed no significant change in rate of development from pretest ($m = 1.32$) to posttest ($M = .93$), $t(6) = 1.684$, $p = n.s.$

Examination of *LAP* scores as measured in developmental months reveals that the

children with autism ($M = 32.48$) and the normally developing comparison group ($M = 48.95$) differed significantly at pretest, $t(10) = 3.97$, $p < .003$. This difference tended toward significance at posttest (autistic $M = 50.70$, normal $M = 59.95$), $t(10) = 2.10$, $p = .062$. The children with autism gained 18.22 months from pretest ($M = 32.48$) to posttest ($M = 50.70$), $t(4) = 5.62$, $p < .0001$.

Discussion

The results of this study are generally consistent with our predictions, and the pattern of data was similar for both developmental measures. Thus, the normally developing peers were functioning at a higher level than the children with autism before and after treatment. Nonetheless, when one examines the rate as opposed to the level of development, it is evident that the children with autism showed an accelerated rate of development on both measures, to the point where their rate after treatment does not differ from their peers. In addition, while the children with autism showed an accelerating rate of development on the *LAP*, their peers remained stable in this regard, continuing in the same developmental trajectory with which they began the year. On the *BDI*, the children with autism showed a tendency toward a significant gain while their peers showed measurable gains on this measure. Given the small number of chil-

Table 2. Changes in Mean LAP Rate and Developmental Months Scores for Children with Autism and Normally Developing Children

	Rate		Months	
	Pretest	Posttest	Pretest	Posttest
Autism	.72	1.73	32.48	50.70
Normal	1.32	.93	48.95	59.95

dren in the sample, it is difficult to judge the stability of this finding for either the children with autism or the peers. However, it is important to note that 5 out of the 6 children with autism showed a higher rate of progress on the posttest, suggesting it was sample size and not clinical effect that precluded our finding a statistical effect for this measure.

The results of the study contribute to the view that young children with autism are able to make important developmental gains during their early years. The results are consistent with our earlier reports (Handleman et al., 1990; Handleman et al., in press; Harris et al., 1990) and those of Lovass (1987) and Odom and Strain (1986). We do not, however, have sufficient data from very young children to determine whether this developmental rate continues to accelerate over time, levels off, or even diminishes. We are continuing to gather the necessary data to address that question and hope to have a sufficiently large pool of children within the next two years to examine their developmental trajectories over time and to document the generality of the findings.

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