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Designing an outcome study to monitor the progress of students with autism spectrum disorders. Joel R. Arick; Helen E. Young; Ruth A. Falco; Lauren M. Loos; David A. Krug; Marilyn H. Gense; Steven B. Johnson.
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The Autism Spectrum Disorders Outcome Study is tracking the educational progress of 67 students, between the ages of 2 and 6 years, whose primary diagnosis for services is an autism spectrum disorder. This article describes the study, how student outcomes have been measured, and how student progress has been reported to service providers and parents. Outcome data has been collected from performance observations, parent and teacher surveys, and standardized assessments. The strength of this data-collection approach is that it uses a variety of sources and multiple methods to monitor student progress. Initial results, based on the first 16 months of the study, have shown that the majority of the children have made significant progress in the areas of social interaction, expressive speech, and use of language concepts. In addition, they have displayed significant decreases in behaviors associated with autism spectrum disorders. This study began in 1998 and will continue at least through August of 2003.

No area of early intervention and early childhood special education (EI/ECSE) has sparked as much controversy in recent years as has the provision of services for young children with autism spectrum disorders. Service providers and parents are often confused about the effectiveness of various intervention practices (Hurth, Shaw, Izeman, Whaley, & Rogers, 1999). This confusion has led to increases in complaints, due process hearings, and legal proceedings, which all sometimes result in highly stressful relations between service providers and parents.

Although during the past decade families, their advocates, and professionals have engaged in extensive debates about the efficacy of various treatments and educational strategies, documentation has emerged indicating that intensive early intervention can have significant, positive outcomes for young children with autism spectrum disorders. These positive effects include acceleration of developmental rates, significant language gains, improved social behavior, and decreased symptoms of autism (Rogers, 1996).

Several promising programs for children with autism spectrum disorders have been documented (Dawson & Osterling, 1997; Green, 1996; Greenspan & Wieder, 1997; Harris & Handleman, 1994; Lovaas, 1987; Olley, Robbins, & Morrelli-Robbins, 1993; Rogers, 1996; Smith, Groen, & Wynn, 2000). The most well known of these programs (Lovaas, 1987) reported that 9 of 19 children who received intensive early intervention successfully completed first grade and obtained average or above-average IQ scores. This program, which used a behavioral approach, included discrete trial teaching methods, recommended 40 hours per week of one-to-one intervention for up to 2 years, and emphasized remediation of speech and language deficits provided, at least initially, in the child's home (Lovaas, 1996). Advocates of this program have indicated to parents that a substantial improvement in their children's long-term functioning is possible if they obtain intensive behavioral intervention for their children (Maurice, Green, & Luce, 1996). Many programs have documented their effectiveness, and some have even claimed that certain treatments they provide for children with autism spectrum disorders are superior to other treatments, but there have been essentially no

studies comparing different comprehensive interventions of equal intensity (National Research Council, 2001).

Even though there is disagreement on the best teaching methods, nationally known and validated educational programs for young children with autism spectrum disorders agree that in addition to early intervention, services should include specialized curriculum, individualization, intensity of engagement, systematic instruction, and family involvement (Hurth et al., 1999). Furthermore, it is now widely accepted that programs based on a behavioral model have shown to have the broadest empirical validation for effectively teaching children with autism spectrum disorders (Schreibman, 2000).

Many EI/ECSE providers are responding to the challenge of providing the best services possible to young children with autism spectrum disorders. Service providers are initiating programs of more intensive services with varied approaches that have demonstrated promising outcomes for these children. In order to develop and sustain these programs, EI/ECSE programs will need to demonstrate positive outcomes for children with autism spectrum disorders. Even those school and home programs with which parents and service providers have been satisfied must document their results to determine the factors that have contributed to their success.

Many researchers have recommended that measures other than the traditionally used standardized tests should be employed to determine the effectiveness of interventions. These measures may include the child's degree of success in communicative exchange, social competence, peer relationships, and competence in natural environments (Prizant & Wetherby, 1998). By using a variety of outcome measures, researchers could discover benefits of interventions or instruction that are not captured by traditional standardized tests.

In 1998, the Oregon Department of Education, realizing the importance of documenting outcome results, contracted with Portland State University to design a study to collect outcome data for young Oregon students with autism spectrum disorders. The Autism Spectrum Disorders Outcome Study was developed at that time. The study began in October of 1998 with 67 students and will continue at least through August of 2003. Approximately 50 new students were added to the study in September of 2001, increasing the total number of student participants to 118.

This article describes the design of the Autism Spectrum Disorders Outcome Study, including the methods used to measure student outcomes and how student progress was reported to service providers and parents. In addition, some initial results collected through August 31, 2000, are discussed.

Method

Design of Study

This study was designed to track program implementation variables and outcome data for students with autism spectrum disorders engaged in school or home programs. When planning this study, we used evaluation elements recommended in current reviews of research regarding early intervention

for young children with autism spectrum disorders. These evaluation elements included

1. a standard protocol of assessments that captures a range of skills and symptoms at specific points in time (Rogers, 1996),

2. clear descriptions of the characteristics of children participating in the programs (Olley et al., 1993),

3. clear descriptions of the components of the programs and how they were implemented (Olley et al., 1993), and

4. the documenting and accounting of variables outside of the study intervention package that is the object of the study (Prizant & Rubin, 1999).

During the initial planning phase of the project, the research team (three of the primary researchers each had more than 25 years of experience in the field of autism spectrum disorders) determined that the purpose of collecting the student outcome data would be to provide the following:

* objective individual student outcome data for participating programs and parents;

* information to assist service providers in planning student programs;

* a description of the various instructional strategies being used by programs serving students with autism spectrum disorders;

* a comparison of the outcome data results of various school- and home-based programs;

* information on the effectiveness of specific instructional strategies; and

* a framework for a statewide database of student characteristics, student assessment data, and program implementation strategies that would allow for longitudinal tracking of students and program performance.

Numerous data-collection methods were used to acquire the information for this study. Outcome data were collected at baseline and quarterly, biannually, and annually. Combinations of measures were used to collect the data. These measures included standardized tests, non-standardized forms, surveys, and interviews.

Participants

The participants were 67 preschool students who were between the ages of 2 and 6 (at baseline) and whose primary diagnosis for services was an autism spectrum disorder. This diagnosis was confirmed by the initial assessment results. The primary monitoring instrument used to assess the students in the study was the Autism Screening Instrument for Educational Planning--Second Edition (ASIEP-2; Krug, Arick, & Almond, 1993). Baseline scores from the students in the study matched the

students from the national standardization data of ASIEP-2, within one standard deviation of the population mean.

All eight Oregon regional programs for students with autism spectrum disorders were invited to nominate students. The participants were located in seven geographic areas of Oregon, in approximate proportion to the state's population distribution. Region I, located in the far eastern portion of the state, nominated no students to be included in the study. This area is located in one of the least populated sections of Oregon.

The main criteria for selection was that the child had to be already involved in some type of school and/or home behavioral program. Parents were sent letters by their child's early intervention program asking them to voluntarily include their child in the study. Sixty-seven parents returned permission forms, and all of their children participated in the study.

Information collected from baseline demographic surveys and the Student Learning Profile (Arick, Loos, Falco, & Krug, in press), completed by teachers at the beginning of the study, showed that 34% of the students were nonverbal, 79% engaged in self-stimulating behavior, 25% never engaged in imitative play, and 37% did not respond to simple commands, such as "come here." On average, the students received 18.5 hours (15.9 at school and 2.6 at home) of instruction per week. The majority of instructional hours occurred in small or large groups. All of the children received some one-to-one instruction (M = 6.8 hours per week). The most common one-to-one instructional strategies reported were functional routines, incidental teaching, pivotal response training, and discrete trial training.

Table 1 shows that the 67 students represented approximately 10% of all the children ages 2 to 6 years in Oregon whose primary diagnosis for services was an autism spectrum disorder. The majority of the children in the study were 3 years old when the study began, and they represented approximately 27% of the 3-year-old children in the state of Oregon whose primary diagnosis for services was an autism spectrum disorder. The nine 2-year-olds in the study represented approximately 50% of the 2-year-old children in Oregon whose primary diagnosis for services was an autism spectrum disorder in the 1998 Oregon Census.

Instruments

In order to monitor the educational progress of the students, the assessment team administered numerous standardized tests to each student during the 3-year study. Assessments were administered at baseline and then quarterly and annually. In addition, information was collected from teachers, specialists, parents, and consultants. A more detailed description of each instrument follows.

Autism Screening Instrument for Educational Planning. This standardized instrument was used to monitor each participant's progress over time. The subtests of this comprehensive instrument have been shown to be good monitors of progress, due to the lack of practice effects (Frye & Walker, 1998). In addition, the ASIEP-2 subtests have been used to reliably and validly assess students with autism (Turton, 1985). Four separate standardized ASIEP-2 subtests were administered:

TABLE 1
Comparison of Participants to all Students in Oregon Whose Primary Disabling Condition Is an Autism Spectrum Disorder

Age group (in years)	Number of children		Percentage of students in Oregon represented in the study
	Study[a]	Oregon[b]	
2	9	18	50
3	23	86	27
4	22	126	17
5	10	196	5
6	3	217	1
All students (ages 2–6)	67	643	10

[a]As of November 30,1998. [b]Taken from the 1998 Oregon Census of children whose primary disabling condition was an autism spectrum disorder.

1. the Autism Behavior Checklist, a screening instrument for nonadaptive behaviors, used to see how an individual looks in comparison to others;

2. the Sample of Vocal Behavior, which evaluates expressive speech at the preverbal and emerging language level and measures communication expressed by vocalizations accompanied by gestures or other means;

3. the Social Interaction Assessment, which elicits an individual's social responses in a controlled setting with stimuli presented in a systematic fashion; and

4. the Educational Assessment, which probes an individual's repertoire of adaptive language concepts and is designed to accumulate information that will be of direct value in curriculum placement.

The Autism Behavior Checklist was completed at baseline and then once a year by each participant's teacher or other specialist. The Sample of Vocal Behavior, the Social Interaction Assessment, and the Educational Assessment were administered at baseline and then on a quarterly basis during the school year (fall, winter, and spring of each school year).

Expressive One-Word Picture Vocabulary Test (Brownell, 2000). This norm-referenced test provides an assessment of an individual's English vocabulary. Fourteen students in the study reached the ceiling on the ASIEP-2 Sample of Vocal Behavior subtest; therefore, during their fifth assessment in the spring of 2000, those students were given the Expressive One-Word Picture Vocabulary Test as an alternative measure of their expressive language. The project staff administered this alternative assessment to these students on a quarterly basis during the school year.

Extended Basic Academic Skills Assessment System (Tindal, McDonald, Crawford, & Tedesco, 2000). This assessment was developed by researchers at the University of Oregon for the state to use to assess a student's emerging skills in reading, writing, and math. Eleven students in the study reached the ceiling on the ASIEP-2 Educational Assessment and, during their fifth assessment in the

spring of 2000, were given portions of the Extended Basic Academic Skills Assessment System as an alternative measure of their educational progress in reading, writing, and math. This assessment was administered to these students on a quarterly basis during the school year.

Battelle Developmental Inventory: Cognitive Domain Screening Test (Newborg, Stock, Wnek, Guidubaldi, & Svinicki, 1984). This standardized assessment was used to measure each participant's conceptual skills and abilities. If there were previous age-equivalent scores for this assessment in the student's file, they were recorded as baseline scores during a file review at the beginning of the study. The Battelle Developmental Inventory was also administered on a yearly basis by a trained assessment team member who held a doctorate in special education.

Vineland Adaptive Behavior Scales: Interview Edition (Sparrow, Balla, & Cicchetti, 1984). This standardized assessment was used to provide a general assessment of each participant's adaptive behavior. The participant's classroom teacher or another specialist completed a survey each school year.

Student Learning Profile. This learning profile can be found in The Star Program: Strategies for Teaching Based on Autism Research (Arick, Loos, Falco, & Krug, in press). It was designed to assess and monitor growth in areas taught in the students' curriculum-based instruction. Assessment areas included expressive language, receptive language, daily routines, pre-academics, play behavior, and social interaction behavior. Teachers used the Student Learning Profile to record student progress on written programs. In addition, this profile was used to collect information on how the student requested wants or needs (e.g., verbal, picture systems, voice augmented system, sign language, gestures). This profile was completed at baseline and then on an annual basis by the teacher or other specialist.

Program Implementation Checklist. This checklist was developed by the research team to gather detailed information from the teacher regarding each child's specific program. Information collected with this form included the total hours per week each participant received services, how the services were provided (e.g., in a group, pull out, one-to-one), what type of one-to-one or pull out teaching they received (e.g., pivotal response training, discrete trial), and who provided the services (e.g., teacher, educational assistant, related services staff member). In addition, this form was used to collect information on the students' written programs and note whether the student used augmentative or other alternative communication strategies (e.g., sign language, PECS [Picture Exchange Communication System; Frost & Bondy, 1991], picture/visual symbol systems). This form was completed at baseline and then on a biannual basis by the classroom teacher. Information on this form was verified by consultants during annual classroom visits at the end of each school year.

Parent Survey. This survey was developed by the research team to gather information from the parents about their child's progress in the areas of communication, social interaction, and behavior. In addition, parents had the opportunity to comment on their satisfaction with their child's program, identify any special treatments they were using with their child, and describe any additional intervention services they were paying for with their own family funds. This survey was sent to parents at the end of each school year.

Classroom Observation Form. This observation form was developed by the research team to collect information regarding the child's program, the student's involvement level in classroom activities, and the type of instruction the student received. In addition, the observation form included a section that allowed the observer to use a rubric to rate the appropriateness of six areas: placement, written programs, one-to-one instruction, group instruction, social interaction, and communication instruction. Special education professionals with expertise in designing and implementing programs for children with autism spectrum disorders were employed as consultants to conduct the classroom observations in the spring of each year.

Procedures

Training of the Assessment Team. Prior to the baseline visits, assessment specialists were trained extensively by special education professionals. They were taught how to complete file assessments, how to obtain and record age-equivalent scores when the Battelle Developmental Inventory had been previously administered, and how to interview the teacher and help him or her complete the Student Learning Profile and the Program Implementation Checklist.

In addition to learning how to complete file reviews and interview the teachers to obtain necessary information, the new assessment specialists were taught how to score the subtests of the ASIEP-2 by two of the test's developers. They watched training videos and then practiced scoring by using prior videotapes of students who were given the ASIEP-2 subtests. They were then accompanied by previously trained special education professionals during all the baseline assessments.

Baseline Assessment Visits. Baseline assessment visits were scheduled for each participant in the study. A team of assessment specialists arrived at each site and completed file reviews. Information obtained from student files included the participant's date of birth, autism spectrum disorder diagnosis date, and age-equivalent scores from the previously administered Battelle Developmental Inventory. They then assisted the teacher in completing the Student Learning Profile and the Program Implementation Checklist. The assessment specialists also collected the ASIEP-2 Autism Behavior Checklist, which were mailed to teachers prior to the visits.

After meeting with the teacher, the assessment specialists administered the ASIEP-2 Sample of Vocal Behavior, Educational Assessment, and Social Interaction Assessment subtests to the student. Each subtest took between 10 and 30 minutes to complete. Specific administration instructions and protocol described in the ASIEP-2 manual regarding materials, stimuli, procedures, and scoring were followed.

To ensure the accuracy of the scoring, the ASIEP-2 Sample of Vocal Behavior and Interaction Assessment subtests were videotaped and then watched and rescored by the assessment specialists after their visit. All numbers on the assessments were then rechecked by another specialist before the data were entered into the SPSS computer software data file. In addition, videotapes were randomly selected and scored by independent raters as an additional reliability check.

Behavioral Instructional Strategies Training for Teachers. In an effort to strive for fidelity of implementation, training workshops in extensive behavioral instructional strategies for teaching

children with autism spectrum disorders were conducted each school year. These workshops were conducted by special educational professionals with extensive experience in teaching instructional behavioral techniques for children with autism spectrum disorders. Each participating region was given at least two full-day training workshops per year. Topics covered included pivotal response training, discrete trial training, and functional routines. The materials were taken from The Star Program: Strategies for Teaching Based on Autism Research. Instruction in data-collection strategies was included in the training workshops. All teachers and staff members who taught students participating in the study were invited and encouraged to attend all training workshops.

TABLE 2
Descriptive Statistics of ASIEP-2 Subtests

Area assessed	*n*	Range of possible scores	Scores at baseline		Scores at 12 to 16 months into study	
			M	*SD*	*M*	*SD*
Autism Behavior Checklist						
Body/object use	60	0–38	12.03	7.08	9.90*	7.87
Language	60	0–31	14.07	6.10	12.23*	5.97
Total score	60	0–158	70.47	19.82	61.60*	25.86
Educational Assessment						
Receptive language	60	0–12	4.98	3.08	6.87**	3.50
Expressive language	60	0–12	2.83	2.78	4.63**	4.30
Body concept	60	0–12	4.38	3.80	7.27**	4.37
Speech imitation	60	0–12	5.22	3.40	7.37**	4.10
Total score	60	0–60	28.82	12.63	37.90**	15.44
Social Interaction Assessment						
Appropriate social interactions	57	0–48	5.63	5.27	9.18**	8.15
Self-stimulation/nonresponsive to adult	57	0–48	22.86	11.88	17.37**	12.60
Total score	57	0–96	65.21	15.35	56.19**	18.60
Vocal Behavior						
Noncommunicative utterances	60	0–50	35.97	14.03	23.17**	18.20
Unintelligible utterances	60	0–50	37.41	14.08	24.68**	20.43
Words used during sample	59	na	25.39	36.0	52.37**	52.32
Expressive language age score	56	na	23.21	8.50	33.51**	16.70

Note. ASIEP-2 = *Autism Screening Instrument for Educational Planning–Second Edition* (Krug et al., 1993).
[a]Assessment administered at approximately 12 months. [b]Assessment administered at approximately 16 months.
*$p \leq .05$. **$p \leq .01$.

Results

The following results are pre-post comparisons of student progress data, survey data collected from parents and teachers, and observational data collected during the first 16-month instructional period. These initial results are provided to show how the Autism Spectrum Disorders Outcome Study was used to monitor the progress of students with autism spectrum disorders.

Standardized Tests

Table 2 shows the means and standard deviations of the students' baseline assessment scores and their last 1999/2000 school year assessments, completed at 12 to 16 months into the study. The ASIEP-2 Autism Behavior Checklist was completed by the teacher, and all of the other assessments were completed by the research study assessment team. Using paired t tests, the research team found significant differences on several components of each subtest, as well as on the total scores for each subtest. The results of the ASIEP-2 Autism Behavior Checklist showed that there were significant decreases in behaviors associated with autism from students' baseline assessment (M = 70.47, SD = 19.82) to their final assessment (M = 61.60, SD = 25.86), t(59) = 2.476, p [less than or equal to] .05. The total score for the ASIEP-2 Educational Assessment showed that there were significant increases in the number of students' correct responses from their baseline assessment (M = 28.82, SD = 12.63) to their final assessment (M = 37.90, SD = 15.44), t(59) = -7.629, p [less than or equal to] .01. The results from the ASIEP-2 Social Interaction Assessment showed that the students had significant decreases in their total autism social interaction scores (students were displaying more social interactions with the adults present during the assessment) from their baseline assessment (M = 65.21, SD = 15.35) to their last assessment (M = 56.19, SD = 18.60), t(56) = 4.111, p [less than or equal to] .01.

Figure 1 shows the language gain or loss for each student. The student who made the most progress started out with a baseline verbal language age of 41 months. This child had a gain of 43 months and, at the 5th assessment, 16 months into the study, had a verbal language age of 84 months. The average language age gain for all students was 10 months in the first 16 months. There was a significant increase between the students' baseline assessment scores (M = 23.21, SD = 8.50) and their last assessment scores (M = 33.51, SD = 16.70) in the spring of 2000, t(55) = -6.848, p [less than or equal to] .01. Seventy-two percent of the students made some language age gain, and 36% gained 16 or more months in the first 16 months (as shown by the dotted line on the graph in Figure 1).

Table 3 shows that no correlations were found between the students' chronological age at the first assessment and their language age gain. Students were just as likely to make gains at any chronological age. However, the students in this sample were within the narrow age span of 2 to 6 years. This finding also indicates that maturation does not influence student gains.

There were correlations found between the students' language age gain and other variables. Table 3 shows that there was a significant relationship found between the 16-month language age gain and (a) the students' baseline Battelle Developmental Inventory age-equivalent scores, r(27) = .498, p [less than or equal to] .05, taken from their file reviews before the project started; (b) the students' Battelle Developmental Inventory age-equivalent scores, r(53) = .511, p [less than or equal to] .05, from the assessments administered in winter of 2000; and (c) the students' winter 2000 I.Q. scores, r (64) = .469, p [less than or equal to] .05.

Parent Survey Information

At the end of the 1999/2000 school year, parents were sent surveys and asked to provide input on their children's progress. Forty-one parents (61%) returned their surveys. Table 4 shows the responses from parents when they were asked to advise us of changes in their child's skills and

behaviors during the 1999/2000 school year. A skill or behavior was listed on the survey, and parents were asked to rate whether the skill or behavior had decreased, stayed the same, or increased. In each of the 10 areas listed, the majority of parents thought their child's skill or behavior had increased over the school year. The highest percentage of parents agreed that their child's skills had increased in the area of using language or other means (e.g., augmentative or other alternative communication strategies) to communicate. Ninety-three percent of the parents thought their child's skills had increased in this area. In the specific area of labeling, there was a significant relationship found between the 16-month language age gain and the parents' positive responses, r(32) = .473, p [less than or equal to] .05, when asked to rate any changes in their child's ability to label items and pictures in response to questions.

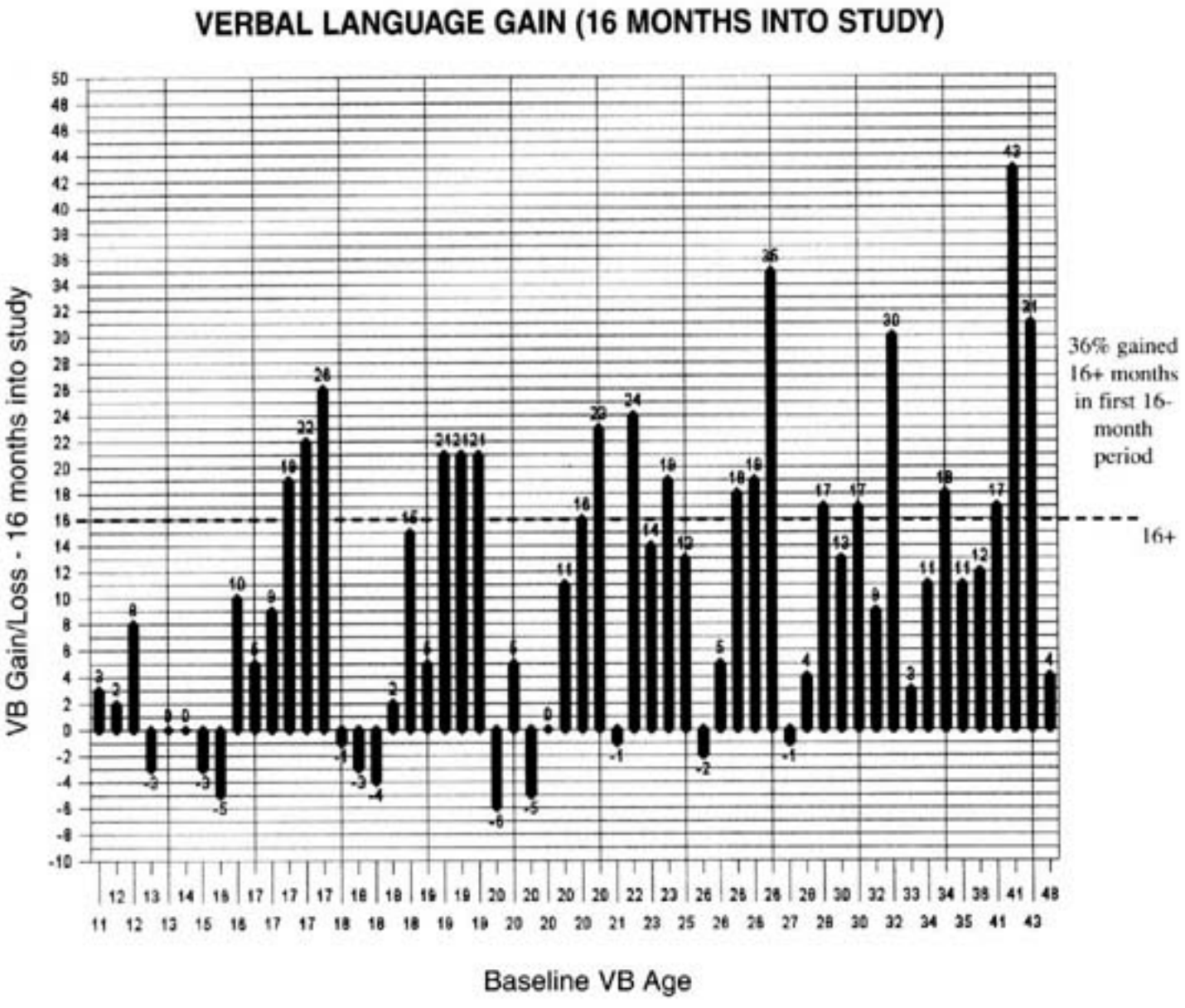

FIGURE 1. Verbal language gain scores for students. *Note.* The baseline verbal language age is shown on the x-axis. The gain or loss for each child is represented by the individual bars. This figure displays data for only 56 students because some students started the study late, so we did not have both pre- and postassessment data for all children.

Furthermore, parents were asked to list specific examples of how their child's behavior had changed. Parents' responses, which included both positive and negative changes, can be found in Table 5.

Common examples of changes the parents had seen included observations that their children were "more aware of their surroundings," they wanted to "interact with others now," and their "communication skills had improved."

Family Involvement. Family involvement is important to a child's progress and was addressed in two questions on the parent survey. When parents were asked to rate their involvement level in their child's early childhood or school-age program, their mean rating was 7.66, where 1 = not involved and 10 = intensely involved. When asked to rate how satisfied they were with their involvement level, their mean rating was 6.95, where 1 = not at all satisfied and 10 = extremely satisfied. Parents rated themselves above average on both questions.

Other Treatments Reported by Parents. Some researchers think outcome research has ignored outside variables that may contribute to a child's progress (Prizant & Rubin, 1999). Therefore, to determine if other factors were affecting their child's educational progress, parents were asked to list any services or treatments they provided to their child that were not paid for by their child's early intervention or school-age program. Table 6 shows all the parents' responses. Common treatments reported by parents included gluten-free/casein free diets, secretin, and vitamins.

Classroom Observation

Trainings in extensive behavioral instructional strategies for teaching children with autism spectrum disorders were conducted each school year. Instruction on data-collection strategies were included in the workshops. As a follow-up to the trainings, special education professionals with expertise in behavioral instructional strategies and extensive knowledge in designing and implementing early education and school-age programs for children with autism spectrum disorders visited each classroom. They observed the student, viewed data collected on the student, and gave individual consulting advice to the teacher. The Classroom Observation Form was completed during the visit, and a comment sheet was given to the teacher. While in the classroom, the consultant observed the student and his or her program and then completed a form rating the appropriateness of six areas: placement, written programs, one-to-one instruction, group instruction, social interaction, and communication instruction. Table 7 shows that the ratings in these areas ranged from 2.30 to 2.93 on a scale of 1 (not appropriate) to 4 (very appropriate). When examining the area of communication, there was a significant relationship found between the 16-month language age gain and the rating given by consultants, $r(48) = .424$, p [less than or equal to] .05, when they were asked to rate whether or not they thought the communication instruction in the classroom was appropriate for the child.

Validity and Reliability of Instruments

TABLE 3
Correlations with Gains in Verbal Age (16 Months Into the Study)

Variable	*n*	*M*	Pearson correlation
Chronological age at first assessment (in months)	56	51.00	.073
Battelle Developmental Inventory (cognitive domain) age-equivalent scores given before the project began	29	14.70	.498**
Battelle Developmental Inventory (cognitive domain) age-equivalent scores administered in winter 2000	55	27.89	.511**
IQ score—Winter 2000	55	44.66	.469**

Note. *Battelle Developmental Inventory* (Newborg et al., 1984).
**$p = .05$.

This study used numerous standardized instruments to assess the students. Table 9 shows the concurrent validity between these assessment instruments: (a) ASIEP-2, (b) Battelle Developmental Inventory, and (c) Vineland Adaptive Behavior Scales. In addition, Table 8 displays test-retest reliability for the same ASIEP-2 subtests administered in the fourth and fifth quarters. The validity coefficients between instruments were moderate to high (r = -.492 to r = .782, p [less than or equal to] .01). The reliability coefficients on the ASIEP-2 subtests were high (r = .647 to r = .875, p [less than or equal to] .05). These correlations indicate that the instruments were reliable and valid measures of the students' progress.

Discussion

The initial results collected by the study demonstrate how the design used for the Autism Spectrum Disorders Outcome Study can be followed by others to monitor the progress of students with autism spectrum disorders. The data show that many of the students have made significant progress in the areas of social interaction, expressive speech, and adaptive language concepts. Additionally, two factors (students' initial cognitive level and experts' rating of the appropriateness of students' classroom communication instruction) significantly correlated with the students' verbal language age gain.

Student reports that documented each individual child's progress were generated each quarter and sent out to parents, programs, and teachers (see Figure 2). Parents and teachers were extremely cooperative in returning the needed forms and surveys for collecting data. Many parents voiced appreciation at being able to provide information on their child's progress, welcomed the opportunity to have their children monitored, and looked forward to receiving the quarterly student reports. Many of the teachers expressed that the outcome data from the study provided them with valuable information to use in curriculum planning for their students.

TABLE 4
Parents' Responses on Changes in Skills or Behaviors of Their Children

Skill or behavior	Parent response		
	Decreased (%)	Stayed the same (%)	Increased (%)
Using language or other means to communicate	0	7	93
Using spontaneous communication to request foods, toys, or activities	0	15	85
Labeling items and pictures in response to questions	0	27	73
Understanding and responding to directions	0	10	90
Imitating other children and adults during play	0	34	66
Playing with toys in ways that are appropriate to his/her age	0	29	71
Playing with other children	3	29	68
Engaging in imaginative or pretend play	0	46	54
Demonstrating self-care and independence in areas such as eating, dressing, or toileting	3	29	68
Behaving appropriately	2	25	73

To improve the outcome data generated by the study, the research team realized there was information that should have been collected at the beginning of the project that would have been useful in examining the progress of the students in the study. Additional data that are being collected on the new children who were admitted to the study in September 2001 include the following:

* additional family demographic information (e.g., family characteristics, ethnicity, socioeconomic status);

* information on whether or not the family receives support, such as counseling and training;

* baseline scores for the Battelle Developmental Inventory and the Vineland Adaptive Behavior Scales for all new students (instead of relying on scores obtained from prior records);

* a more specific measurement of the students' social interaction with peers;

* more detailed information on outside factors that could affect progress, such as diet and other treatments; and

* information on the staff members working with each student (e.g., prior training, educational level, degree).

This new cohort of students includes only children who, at their baseline assessment, were less than 48 months of age and were going to receive early intervention services for at least 2 years. In addition, they had to have a recent educational diagnosis to receive service for an autism spectrum disorder. Accepting only newly diagnosed children helps control for any interventions used before the student was admitted to the study and enables a clearer analysis of any possible relationships

between student outcomes and intervention variables.

One of the primary goals of this study was to collect outcome data to help service providers' plan effective programs for students with autism spectrum disorders. The verbal feedback received so far from teachers has shown that service providers have appreciated the information and are using it to help monitor student progress and plan educational programs. At the end of the study, the data amassed will be reported and made available to assist others in planning effective programs for their students with autism spectrum disorders.

In addition to giving service providers a way to monitor student progress and to help them with program planning, the information produced by this study could potentially be used to identify effective intervention strategies to use with students with autism spectrum disorders. The strength of the data-collection approach used to collect information for this study is that it used a variety of sources and multiple methods to obtain the outcome data. Progress was measured by observation of performance, surveying of parents and teachers, and use of standardized assessments. Data collected on intervention strategies (e.g., type of teaching, number of instruction hours, group size) and other variables (e.g., quality of instruction, student demographics, outside factors) will continue to be analyzed, we hope to identify factors that could have contributed to positive outcomes, such as the gains found in the majority of the students' verbal language age (see Figure 1). Although the tracking and reporting of student progress is useful, we also hoped that when the outcome data is more thoroughly analyzed at the end of the study, we will be able to identify specific intervention strategies that will lead to effectively educating children with autism spectrum disorders.

TABLE 1
Comparison of Participants to all Students in Oregon Whose Primary Disabling Condition Is an Autism Spectrum Disorder

Age group (in years)	Number of children		Percentage of students in Oregon represented in the study
	Study (a)	Oregon (b)	
2	9	18	50
3	23	86	27
4	22	126	17
5	10	196	5
6	3	217	1
All students (ages 2-6)	67	643	10

(a) As of November 30,1998. (b) Taken from the 1998 Oregon Census of children whose primary disabling condition was an autism spectrum disorder.

TABLE 2
Descriptive Statistics of ASIEP-2 Subtests

Area assessed	n	Range of possible scores

Autism Behavior Checklist		
Body/object use	60	0-38
Language	60	0-31
Total score	60	0-158
Educational Assessment		
Receptive language	60	0-12
Expressive language	60	0-12
Body concept	60	0-12
Speech imitation	60	0-12
Total score	60	0-60
Social Interaction Assessment		
Appropriate social interactions	57	0-48
Self-stimulation/nonresponsive to adult	57	0-48
Total score	57	0-96
Vocal Behavior		
Noncommunicative utterances	60	0-50
Unintelligible utterances	60	0-50
Words used during sample	59	na
Expressive language age score	56	na

	Scores at baseline		Scores at 12 to 16 months into study	
Area assessed	M	SD	M	SD
Autism Behavior Checklist				
Body/object use	12.03	7.08	9.90 *	7.87
Language	14.07	6.10	12.23 *	5.97
Total score	70.47	19.82	61.60 *	25.86
Educational Assessment				
Receptive language	4.98	3.08	6.87 **	3.50
Expressive language	2.83	2.78	4.63 **	4.30
Body concept	4.38	3.80	7.27 **	4.37
Speech imitation	5.22	3.40	7.37 **	4.10
Total score	28.82	12.63	37.90 **	15.44
Social Interaction Assessment				
Appropriate social interactions	5.63	5.27	9.18 **	8.15
Self-stimulation/nonresponsive to adult	22.86	11.88	17.37 **	12.60
Total score	65.21	15.35	56.19 **	18.60
Vocal Behavior				
Noncommunicative utterances	35.97	14.03	23.17 **	18.20
Unintelligible utterances	37.41	14.08	24.68 **	20.43
Words used during sample	25.39	36.0	52.37 **	52.32

Expressive language age score	23.21	8.50	33.51 **	16.70

Note. ASIEP-2 = Autism Screening Instrument for Educational Planning--Second Edition (Krug et al., 1993).

(a) Assessment administered at approximately 12 months,

(b) Assessment administered at approximately 16 months.

* p [less than or equal to] .05. ** p [less than or equal to] .01.

TABLE 3
Correlations with Gains in Verbal Age (16 Months Into the Study)

Variable	n	M	Pearson correlation
Chronological age at first assessment (in months)	56	51.00	.073
Battelle Developmental Inventory (cognitive domain) age-equivalent scores given before the project began	29	14.70	.498 **
Battelle Developmental Inventory (cognitive domain) age-equivalent scores administered in winter 2000	55	27.89	.511 **
IQ score--Winter 2000	55	44.66	.469 **

Note. Battelle Developmental Inventory (Newborg et al., 1984).

** p = .05.

TABLE 4
Parents' Responses on Changes in Skills or Behaviors of Their Children

	Parent response		
Skill or behavior	Decreased (%)	Stayed the same (%)	Increased (%)
Using language or other means to communicate	0	7	93
Using spontaneous communication to request foods, toys, or activities	0	15	85
Labeling items and pictures in response to questions	0	27	73
Understanding and responding to to directions	0	10	90
Imitating other children and and adults during play	0	34	66

Playing with toys in ways that are appropriate to his/her age	0	29	71
Playing with other children	3	29	68
Engaging in imaginative or pretend play	0	46	54
Demonstrating self-care and independence in areas such as eating, dressing, or toileting	3	29	68
Behaving appropriately	2	25	73

TABLE 5
Parents' Specific Examples of Changes in Their Childrens' Skills or Behaviors

My child is more aware of surroundings. (6)

My child now wants to interact with others more. (6)

My child's communication skills have improved. (5)

Expressive communication has greatly increased. (3)

My child's generalizing skills learned at school. (2)

Decrease in inappropriate behavior. (2)

My child has learned to use PECS. (2)

My child screams when he or she doesn't like something.

Gross motor skills have increased drastically.

Fewer tantrums.

Babbles more.

This has been a positive year, with gains in all areas.

My child still needs work on regulating self.

Learned structured teaching schedule.

My child is making amazing progress.

Still has trouble transitioning, but it is getting better.

Can sometimes calm self.

My child has become less tolerant of peers with disabilities.

Throws self on floor if asked to go to the bathroom.

Has intense need to be squeezed.

My child seems to be more mature.

Increased show of affection.

Increased inappropriate vocalizations.

Has become dependent upon aide for

prompts.

Self-management skills are growing.

More connected to other people.

Likes to help others.

Attempting consonants.

My child is able to ride a bike.

Responds better to directions.

My child sings to self.

Has greater sense of the rhythm of language.

Learns very quickly after seeing things demonstrated.

My child is being silly at inappropriate times.

Very little changes this past year.

My child is developing a sense of humor.

Note. Number in parentheses is the number of parents who gave this response. Responses that are not noted were given by only one parent. PECS = Picture Exchange Communication System (Frost & Bondy, 1991).

TABLE 6

Examples of Services and Treatments Paid for by Parents

Gluten-free and casein-free diet (8)

Secretin (7)

Vitamins (6)

Dimethylglycine (5)

Applied behavior analysis programs (4)

Magnesium (3)

B-6 vitamins (3)

Swimming (3)

Dairy-free diet (3)

Speech therapy (3)

Private preschool (3)

Gluten-free diet (3)

Yeast-free diet (2)

Audio sensory training (2)

Respite care (2)

In-home aide to assist with functional skills (2)

Occupational therapy (2)

Swim therapy

Psychologist

Music therapy

Melatonin

Violin

Naturopathy physician's care

Floor time therapy

Vision therapy

Private therapy

Home program teaching independent tasks

Tutoring for academic skills

Therapeutic horseback riding

Less sugar

Autism Research Project at Oregon Health Science University

Autism Research Institute

Zinc

Calcium

Naturopath herb regimen

Prozac

Note. Number in parentheses is the number of parents who gave this response. Responses that are not noted were given by only one parent.

TABLE 7
Results From Classroom Observations

Area observed	n	Mean rating
Placement	57	2.93
Written program	54	2.30
One-to-one instruction	41	2.88
Group instruction	53	2.83
Opportunity for social interaction	57	2.66
Communication instruction	57	2.89

Note. 1 = not appropriate; 4 = very appropriate.

TABLE 8
Concurrent Validity Between Assessment Instruments and Test-Retest Reliability of Assessments Administered Each Quarter

Assessments compared	n	Pearson correlation
Validity of ASIEP-2 Autism Behavior Checklist Total Score compared to VABS Composite Age Equivalent at 4th assessment	57	-.538 *
Validity of ASIEP-2 Social Interaction Assessment Percentile Rank compared to VABS Socialization Domain Raw Score at 4th assessment	61	-.492 *

Validity of ASIEP-2 Sample of Vocal Behavior Percentile Rank compared to VABS Communication Domain Raw Score at 4th assessment	61	-.686 *
Validity of ASIEP-2 Sample of Vocal Behavior Expressive Language Age compared to VABS Communication Domain Age Equivalent at 4th assessment	61	.692 *
Validity of ASIEP-2 Educational Assessment Percentile Rank compared to VABS Written Subdomain Raw Score at 4th assessment	61	-.534 *
Validity of ASIEP-2 Sample of Vocal Behavior Expressive Language Age compared to BDI Cognitive Age at 4th assessment	66	.686 *
Validity of BDI Cognitive Age compared to VABS Communication Domain Age Equivalent at 4th assessment	61	.782 *
Reliability of ASIEP-2 Interaction Assessment Percentile Rank: 4th assessment compared to 5th assessment	63	.647 *
Reliability of ASIEP-2 Sample of Vocal Behavior Percentile Rank: 4th assessment compared to 5th assessment	50	.854 *
Reliability of ASIEP-2 Educational Assessment Percentile Rank: 4th assessment compared to 5th assessment	52	.875 *

Note. ASIEP-2 = Autism Screening Instrument for Educational Planning-Second Edition (Krug, Arick, & Almond, 1993); VABS = Vineland Adaptive Behavior Scales-Interview Edition (Sparrow, Balla, & Cicchetti, 1984); BDI = Battelle Developmental Inventory (Newborg, Stock, Wnek, Guidubaldi, & Svinicki, 1984).

* p = .01.

FIGURE 2. Sample of quarterly student assessment report.

AUTISM SPECTRUM DISORDERS OUTCOME PROJECT--STUDENT ASSESSMENT REPORT

CODED STUDENT NAME: 1 EHCM
LOCATION: City School
REGION: 1
DATE: 6/15/00

Type of Assessment: AUTISM BEHAVIOR CHECKLIST (Annual Assessment)

Description of Assessment: A checklist of autistic behaviors capable of providing a general picture of how an individual "looks" in comparison to other children with autism

Date of Assessment	1/7/99
Total Score	74--Score is typical to that of others with autism

Type of Assessment: SAMPLE OF VOCAL BEHAVIOR (Quarterly Assessment)

Description of Assessment: Evaluates expressive speech at the preverbal and emerging language levels through a standardized language sample observation

Date of Assessment	1/7/99	4/29/99
Number and % of original utterances	21 of 50-42%	29 of 50-58%
Number and % of communicative utterances	13 of 50-26%	12 of 50-24%
Number and % of intelligible utterances	9 of 50-18%	8 of 50-16%
Interpreted expressive language age	20 months	22 months
Total words used in sample	9	10

Type of Assessment: INTERACTION ASSESSMENT (Quarterly Assessment)

Description of Assessment: Observes an individual's social responses in a play setting with stimuli presented in a systematic fashion

Date of Assessment	1/7/99	4/29/99
Number and % of appropriate social interactions	2 of 48-4%	8 of 48-17%
Number and % of appropriate constructive play interactions	11 of 48-23%	2 of 48-4%
Number and % of no response or self-stimulation	35 of 48-73%	38 of 48-79%
Number and % of aggressive negatives	0 of 48-0%	0 of 48-0%

Type of Assessment: EDUCATIONAL ASSESSMENT (Quarterly Assessment)

Description of Assessment: A direct assessment that provides information about the child's performance in four common curriculum areas

Date of Assessment	1/7/99	4/29/99
Number and % of correct receptive language responses	1 of 12-8%	3 of 12-25%
Number and % of correct expressive language responses	1 of 12-8%	1 of 12-8%
Number and % of correct body concept responses	1 of 12-8%	1 of 12-8%
Number and % of correct speech imitation responses	0 of 12-0%	2 of 12-17%

Type of Assessment: AUTISM BEHAVIOR CHECKLIST (Annual Assessment)

Description of Assessment: A checklist of autistic behaviors capable of providing a general picture of how an individual "looks" in comparison to other children with autism

Date of Assessment	1/18/00
Total Score	58--Score is typical to that of others with autism

Type of Assessment: SAMPLE OF VOCAL BEHAVIOR (Quarterly Assessment)

Description of Assessment: Evaluates expressive speech at the preverbal and emerging language levels through a standardized language sample observation

Date of Assessment	9/29/99	1/18/00
Number and % of original utterances	37 of 50-74%	29 of 50-58%
Number and % of communicative utterances	16 of 50-32%	25 of 50-50%
Number and % of intelligible utterances	13 of 50-26%	20 of 50-40%
Interpreted expressive language age	26 months	29 months
Total words used in sample	15	35

Type of Assessment: INTERACTION ASSESSMENT (Quarterly Assessment)

Description of Assessment: Observes an individual's social responses in a play setting with stimuli presented in a systematic fashion

Date of Assessment	9/29/99	1/18/00
Number and % of appropriate social interactions	1 of 48-2%	5 of 48-10%
Number and % of appropriate constructive play interactions	21 of 48-44%	27 of 48-56%
Number and % of no response or self-stimulation	26 of 48-54%	16 of 48-33%

Number and % of aggressive negatives	0 of 48-0%	0 of 48-0%

Type of Assessment: EDUCATIONAL ASSESSMENT (Quarterly Assessment)

Description of Assessment: A direct assessment that provides information about the child's performance in four common curriculum areas

Date of Assessment	9/29/99	1/18/00
Number and % of correct receptive language responses	6 of 12-50%	5 of 12-42%
Number and % of correct expressive language responses	1 of 12-8%	1 of 12-8%
Number and % of correct body concept responses	3 of 12-25%	4 of 12-33%
Number and % of correct speech imitation responses	6 of 12-50%	6 of 12-50%

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Date of Assessment	
Total Score	

Type of Assessment: SAMPLE OF VOCAL BEHAVIOR (Quarterly Assessment)

Description of Assessment: Evaluates expressive speech at the preverbal and emerging language levels through a standardized language sample observation

Date of Assessment	5/24/00
Number and % of original utterances	35 of 50-70%
Number and % of communicative utterances	27 of 50-54%
Number and % of intelligible utterances	22 of 50-44%
Interpreted expressive language age	31 months
Total words used in sample	40

Type of Assessment: INTERACTION ASSESSMENT (Quarterly Assessment)

Description of Assessment: Observes an individual's social responses in a play setting with stimuli presented in a systematic fashion

Date of Assessment	5/24/00
Number and % of appropriate social interactions	6 of 48-13%
Number and % of appropriate	

constructive play interactions	27 of 48-56%
Number and % of no response or self-stimulation	15 of 48-31%
Number and % of aggressive negatives	0 of 48-0%

Type of Assessment: EDUCATIONAL ASSESSMENT (Quarterly Assessment)

Description of Assessment: A direct assessment that provides information about the child's performance in four common curriculum areas

Date of Assessment	5/24/00
Number and % of correct receptive language responses	7 of 12-58%
Number and % of correct expressive language responses	3 of 12-25%
Number and % of correct body concept responses	3 of 12-25%
Number and % of correct speech imitation responses	9 of 12-75%

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Vitamins (6)	Melatonin
Dimethylglycine (5)	Violin
Applied behavior analysis programs (4)	Naturopathy physician's care
Magnesium (3)	Floor time therapy
B-6 vitamins (3)	Vision therapy
Swimming (3)	Private therapy
Dairy-free diet (3)	Home program teaching independent tasks
Speech therapy (3)	Tutoring for academic skills
Private preschool (3)	Therapeutic horseback riding
Gluten-free diet (3)	Less sugar
Yeast-free diet (2)	Autism Research Project at Oregon Health Science University
Audio sensory training (2)	Autism Research Institute
Respite care (2)	Zinc
In-home aide to assist with functional skills (2)	Calcium
Occupational therapy (2)	Naturopath herb regimen
Swim therapy	Prozac

Note. Number in parentheses is the number of parents who gave this response. Responses that are not noted were given by only one parent.

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*$p = .01$.

AUTHORS' NOTE

The Autism Spectrum Disorders Outcome Study is an ongoing study conducted by Portland State University in collaboration with The Oregon Department of Education (ODE). The study is supported by Federal IDEA Funds, Part B, CFDA84.027A., ODE Project 01/ 02-37. Additional information about this study can be found on our Web site (www.autismstudy.pdx.edu).

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