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ABSTRACT

This final report describes the activities and outcomes of a federally funded project that was designed to develop, validate, and disseminate a training program for teachers of students with autism. The strategies taught to teachers were those that have been accepted as best practice in autism literature. Since 1996 more than 500 teachers, associates, and other certified professionals from Iowa and surrounding states have been trained in the model, and support teams for training and follow-up have been developed in at least 5 sites outside of Heartland AEA 11. The data suggest that the training model is validated for effect on global intelligence. In addition, there was some impact on observed behaviors associated with autism, cooperative play, and classroom behavior. Impact on adaptive behavior was not well established. The effect on cognitive performance was validated on a small sample of children in two different replication sites. It appears that IEP teams, with support from autism specialists, can program for students with autism in public schools, without needing to resort to "autism" or other categorical classrooms. In addition, it appears that autism support teams can train certified support professionals to teach students with autism. (Contains 23 references and 24 tables.) (Author/SG)

DEVELOPMENT, TESTING, AND DISSEMINATION OF NONAVERSIVE TECHNIQUES FOR WORKING WITH CHILDREN WITH AUTISM: DEMONSTRATION OF A "BEST PRACTICES" MODEL FOR PARENTS AND TEACHERS

The A-B-C-D Model for Supporting Students with Autism (Antecedents, Behaviors, Consequences, Data)

Final Report

Office of Special Education Programs
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Section II. Abstract

ABCD Model for Supporting Young Students with Autism

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The ABCD Model for Supporting Young Children with Autism was designed to develop, validate, and disseminate a training program for teachers of students with Autism. The intent of the model is to support special education teachers by (a) providing teachers with skills needed to teach students with Autism, and (b) surrounding teachers with expertise in Autism to facilitate problem-solving. The strategies taught to teachers are those that have been accepted as best-practices in the Autism literature, such as schedules, communication systems, functional assessment, and peer-mediated social networks. The goals of the project were to:

(a) develop a training module to teach 30 people at a time to manage children with autism,

(b) validate the training module, and

(c) disseminate results nationally.

Since 1996, over 500 teachers, associates, and other certified professionals (School Psychologists, School Social Workers, Speech and Language Pathologists) from Iowa and surrounding states have been trained in the model, and support teams for training and follow-up have been developed in at least 5 sites outside of Heartland AEA 11.

The model was validated using pre- and post-tests of intelligence, adaptive behavior, play in the classroom, academic engagement and attention, and autistic behaviors. In addition, factors like minutes of direct instruction per day, hours of programming per week, implementation integrity, and minutes per day of support from an instructional associate, were monitored for students whose teachers were trained in implementing the model.

The data indicate significant improvement in cognitive skills for the group of children as a whole. In addition, behavior observations indicated fewer behaviors associated with Autism, fewer intervals of not attending in the classroom, and more cooperative play during structured and unstructured opportunities. Adaptive behavior

results indicated increased reports of social interaction and communication, but other indicators of adaptive behaviors were not reported to improve substantially from pre-test to post-test.

Children who were in the evaluation protocol are, for the most part, being served in their home school building and home school district. Many children, while receiving the highest level of funded special education support, are included in general education for substantial portions of their school days. Several of the children, when assessed in reading, were reading at rates that exceed published standards for instructional fluency.

The factors that predicted the best outcome, as defined as having a post-test Broad Cognitive Index of greater than or equal to 90, were months at onset (best outcome average 66 months, not best outcome average 56 months) and CARS score (best outcome average 30, not best outcome average 38). The best outcome group also had lower average treatment integrity index scores (16 out of 21) compared to the group whose post-test Broad Cognitive Indices were below 90 (18 out of 21).

When best outcome is defined as improving from pre-to-post-test on the Broad Cognitive Index at least 20 Standard Score units (more than 1 Standard Error), the predictors of best outcome were: CARS score (best outcome=32, other=37), Years in Project (best outcome=3, other=2), and Treatment Integrity Index (best outcome=14 of 21, other=18 of 21).

The factors that did not contribute to best outcome were: hours per week of school, minutes per day of direct instruction, and pre-test Broad Cognitive Index. Importantly, there were several children with measured pre-test Broad Cognitive Indices well below 50 (the Woodcock-Johnson Cognitive is scaled to provide interval level data from 1 through 200), who obtained post-test scores over 90, or who demonstrated growth at better than chance levels.

The data suggest that the training model is validated for effect on global intelligence. In addition, there was some impact on observed behaviors associated with Autism, cooperative play, and classroom behavior. Impact on adaptive behavior has not been well established. The effect on cognitive performance was validated on a small sample of children in 2 different replication sites.

It appears that IEP teams, with support from Autism specialists, can program for students with Autism in public schools, without needing to resort to "Autism" or other categorical classrooms. In addition, it appears that Autism support teams can train certified special education teachers without background in Autism, as well as other certified support professionals, to teach students with Autism. The impact of such support on long-term performance of individuals with Autism, such as meaningful employment or educational opportunities, has yet to be assessed. In addition, much more work is needed from the Autism research community on instructional, environmental, and curricular factors that impact student learning.

Section III. Table of Contents

Section IV. Goals and Objectives of the Project

The original anticipated outcomes for this project were:

(a) development of a training module that can be used to teach 30 people at a time to manage children with autism,

(b) to validate the training module, and

(c) to disseminate results nationally. Parent advocacy groups, lawyers, physicians, and educators will be targeted as recipients of the results. Positive change in children as a function of participating in this model will result in region and nationwide offering of the training materials, and of the supports needed to successfully implement the training materials.

As the project progressed from 1995, with technical assistance from NECTAS, an additional component was added to objective (a). This project is about more than a training module. This project is about supporting teachers of young children with Autism through (a) training, and (b) ongoing support from experts in the area of Autism.

Evidence of completion of each objective has been provided throughout the funding of this project. In year 1, as part of the grant year-end report, the training modules were sent. Training was held 4 times in each of the last 5 years, consistent with the original grant proposal.

To date, this project has met the objective of developing a training module and support from an Autism resource team. This report presents data about validation of the model. Objective c, to disseminate results nationally, has been met partially. Two presentations, one at a large national conference (Council for Exceptional Children), the other at a state-level regional group (Ohio), have been done on the efficacy of the treatment. Replication data will be presented in this report to examine whether or not the effects of the origination site were found at other sites.

This report answers 5 important questions. First, what are the characteristics of the children being diagnosed as Autistic, which participated in the study? Second, what level of cognitive growth was measured for the participants? Third, how much did behaviors associated with Autism improve over time? Fourth, how did school related-

behavior improve over time? Fifth, what were the reported changes in adaptive behavior over time?

In addition, data were gathered on fidelity of implementation, as well as on numbers of minutes of direct instruction provided per week. These variables will be included in an analysis that answers the question, "what factors predict the best outcomes for students with Autism who participated in the project?"

Section V. Theoretical or Conceptual Framework for the Project

In recent years, proliferation of litigation and treatments for children with Autism can be found in the professional literature. Yell & Drasgow (2000) summarize 45 published due process cases in the area of Autism between 1993 and 1998. The primary issue in the cases reviewed were funding for Lovaas-type discrete-trial home-based therapy (Yell & Drasgow, 2000). At heart of many of the cases was the lack of treatment efficacy data available for children with Autism. In the 1990s, the UCLA group headed by Ivar Lovaas (Lovaas, 1987; McEachin, Smith, & Lovaas (1993), was amongst the few programs that had outcome data using group research design.

These outcome data became the center point of debates that raged nationwide on supporting young children with Autism, as evidenced by the congressional hearing on Autism held in June of 2000. Lovaas (1987) found that 47% of participants in an intensive therapy (>40 hours per week) achieved normal intellectual functioning and successful completion of first grade. The follow-up study of this cohort by McEachin et al. (1993) found that, after 4.5 years, 8 of 9 students who had achieved the best outcome at age 7 had intellectual and adaptive behavior functioning in the average range.

Parents of young children with Autism used the evidence from Lovaas to demand and, in many cases, to prevail at due process proceedings regarding appropriateness of IEP team program and placement decisions (Yell & Drasgow, 2000). The issue between "Lovaas vs. others" came to a head in a series of articles published in *Behavior Disorders* (1997). In this series of articles, (Gresham & MacMillan, 1997; Smith & Lovaas, 1997), debate around potential biased samples of subjects, the lack of randomization of subjects in most studies, and the ethics of making claims that may not be substantiated given the data, were presented.

Other journals devoted entire volumes to assessing and treating Autism (School Psychology Review, Journal of the Association of Persons with Severe Handicaps). The National Early Childhood Technical Assistance System (NECTAS) published a resource collection on Autism Spectrum Disorders (Whaley & Shaw, 1999) to assist schools in understanding Autism, consider intervention and education, and summarize the legal issues in Autism that were prevalent at the time.

The professional literature in Autism was ripe with opinion, short on data. Studies on neurological bases and autism diagnosis could be found. Still lacking were additional efficacy data from (a) Lovaas replication sites, and (b) large scale evaluation of school-based programs. Several researchers, however, were able to examine certain treatment programs for children with Autism or for behaviors associated with Autism (e.g., Baker, Koegel, & Koegel, 1998; Harris & Handleman, 1994; McGee, Daly, & Jacobs, 1994; Strain & Cordisco, 1994).

Given the data-in-hand, empirical and anecdotal, consensus emerged that effective programs for students with Autism contain components of: (a) curricular activities with sufficient scope to address the behaviors associated with Autism, (b) structured environment, (c) schedules and routines, and (d) a functional approach to assessing problem behaviors (Dawson & Osterling, 1997; Gresham et al., 1999; Harris & Handleman, 1994; Quill, 1997).

The purpose of this project was to develop, validate, and disseminate a school-based model for supporting young children with Autism. The model incorporated:(a) appropriate curriculum and work systems, (b) structure, (c) schedules and routines, (d) communication systems, (e) functional assessment of problem behavior, and (e) promoting social interactions.

Section VI. Description of the Model and Participants

Participants

Teachers. Teachers who received training and on-going support were certified special education teachers in the State of Iowa. In addition, paraprofessionals who had been hired to support students, if needed, also attending training and received follow-up support. While over 300 teachers were trained between 1996 and 2001, classrooms of about 49 teachers were observed to evaluate the model.

Schools in Iowa determine how they are going to serve students with disabilities. Schools in Iowa do not have categorical disability designations. Hence, teachers who participated in training were special education teachers whom the IEP teams determined would be able to provide the specific programs developed by the IEP teams. In Iowa, students with disabilities are weighted 0.0, 1.68, 2.35, or 3.74.

Schools operationalize the programs under each funding level, on a district-by-district basis. Descriptors for each level of service would be something like: support services only (0.0 weight, for speech/language only, occupational therapy only, physical therapy only); 1.68 programs would be called Level 1 or Resource; 2.35 programs would be called Level 2, Self-contained with integration, or Level 2 Resource; and 3.74 programs would be called Self-contained special class, self-contained with little integration, or Level 3 Resource.

The roughly 49 teachers who participated in the evaluation supported programs across all levels and designations (see Table 23 for current placements of students), and represented about 19 of 57 public school districts supported by the intermediate unit coordinating Autism support services to schools.

Autism Support Staff. The Autism Support staff work for the intermediate unit. The intermediate unit supports 57 public school districts and 34 accredited non-public school districts in central Iowa. There are 15 intermediate units in Iowa, most of who have an Autism support team of similar composition. Our team members carry the title of Autism Resource Specialist, and work 194 contract days that correspond as closely as possible to schools in their assignments. Each Autism consultant serves about 12 school districts across hundreds if not thousands of square miles. Their backgrounds are early childhood, speech and language, adaptive physical education, school-aged instructional consultant, and school psychology.

It is important to note that every school building has an assigned team that consist of a school psychologist, school social worker, instructional consultant, speech and language pathologist, occupational therapist, physical therapist, audiologist. Other staffs, like hearing and vision teachers, early childhood consultants, home intervention teachers, are assigned to buildings as needed. These support staff are also trained in supporting students with Autism, so that they can consult with teachers when the Autism Resource

Team specialist is not available. The Autism Team serves as a support to school-based teams and teachers, and does not carry direct teaching or specific services on an IEP.

Children. Participants were recruited each year during the implementation of this project. Hence, subjects received educational programming for varying years over the course of the project. Parents of fifty-six children who were identified as eligible for and in need of specialized instruction, under the category of Autism, participated in the evaluation. In preparation for this report, the data entered in our spreadsheet over time was checked against raw data. Data for 3 children were sufficiently incomplete, so they were dropped from the analysis, leaving a total of 53 children in the analysis.

Needs of each individual child were determined by the IEP team and instruction was implemented by the teacher in consultation with the IEP team.

The breakdown of students in the evaluation sample is depicted in Table 1.

Table 1. Frequencies of Students by Age at Initial Evaluation

Age at first evaluation period	Number of Students
2-3 years	3
3-4 years	7
4-5 years	11
5-6 years	16
6-7 years	12
7-8 years	3

The participants were 13% girls (n=7), 87% boys (n=46).

The total time frame that elapsed between 1st evaluation point and last evaluation point are depicted in Table 2.

Table 2. Years out of 5 that Children were Followed/Evaluated

Years in Study	Number of Children
0	2
0.5	5
1	8
1.5	3
2	6
2.5	14
3	2
3.5	2
4	6
4.5	2
5	3
Grand Total	53

Educational Programming

All students included in this evaluation were found eligible for and in need of special education, following procedures set forth in Iowa's Rules of Special Education. The IEP team determined the goals and services needed to meet educational needs of each individual student. The IEP team made the determinations of Free and Appropriate Public Education and Least Restrictive Environment.

This project provided training to teachers and Autism specialists as supports to the teacher and other IEP team members.

Data on school placement was available for 49 of 53 students. Forty-seven of 49 (96%) attended school in their home school district. Forty of those forty-seven students (85%) received services in their home school *building*, meaning that 7 students with Autism were served in their home school district but at a different school building.

Training and Support

The teachers of students identified as Autistic are given 5 days of direct training on supporting students with Autism. The training covers: characteristics of Autism, using visual schedules and structure in the classroom, developing communication skills through routines, independence, promoting social interaction, and managing behavior.

Teachers are provided with a lecture for each morning, and then work directly with students with Autism in the afternoon of each training day.

Instrumentation

The measures used as dependent measures were (a) Woodcock Johnson Cognitive-Revised (Woodcock & Johnson, 1989, 1990; Woodcock & Mather, 1989, 1990), (b) The Ritvo-Freeman Real Life Rating Scale, an observational measure of autistic behavior, (Freeman, Ritvo, Yokota, & Ritvo, 1986; Ritvo, Freeman, B., Pingree, Mason-Brothers, Jorde, Jenson, McMahon, Petersen, Mo, & Ritvo, 1989) (c) partial interval recording observations systems for classroom and play behavior, and (d) the Scales-of Independent Behavior-Revised (Bruininks, Woodcock, Weatherman, & Hill, 1996).

The *Woodcock Johnson Tests of Cognitive Ability*, standard scale, consists of 7 subtests that provide a broad measure of cognitive ability. *Memory for Names* is a measure of short-term memory. The child is shown a picture of a space creature, and told the creature's name. The child is asked to point to space creatures, with the most recently named creature first, on a page including 9 creatures. *Memory for Sentences* has the child repeating sentences played on a tape recorder, and is also a memory test. *Visual Matching* assesses processing speed, and requires the child to circle identical numbers in a row of six numbers. *Incomplete Words* require the child to listen to a stimulus on a tape recorder. Phonemes are excluded from the stimulus. The child fills in the missing phoneme. *Visual Closure* measures visual processing. The child identifies a picture that is distorted, has missing lines, or has a pattern imposed upon it. *Picture Vocabulary* is a measure of comprehension/knowledge, and requires the child to point to or name familiar objects. *Analysis-Synthesis* presents an incomplete logic puzzle, and requires the child to complete the puzzle. The *Broad Cognitive Index* for children in the age range of this project does not include visual matching or analysis/synthesis.

For the purposes of the analyses used in this report, only the *Broad Cognitive Index* is included. The *Broad Cognitive Index* has, for children between the ages 3 and 8, reliability indices greater than .90 (Woodcock & Mather, 1989, 1990).

Behavioral Definitions for classroom behavior were: (a) responding (actively involved in the activity), (b) attending (looking at the teacher, observing, focusing on materials, but not actively engaged), and (c) not engaged (actively involved in incompatible behaviors). Definitions used in assessing play behavior were: (a) Solitary play: child plays by him or herself; (b) Parallel play: child plays in close proximity to another child (within 3 feet) but each is working on his or her own task; (c) Cooperative play: child works with another on a common task; and (d) Uncooperative Play: child fails to work cooperatively with another child on a common task.

Play behavior was observed for 15 minutes every 6 months, using 15 second partial interval recording, during independent playtime or recess. Academic engaged time was observed for 3 5-minute time frames during which academic work was presented, using 15 second partial interval recording.

Autistic behavior was assessed using the Ritvo-Freeman, for a 30 minute time period, every 6 months. The Ritvo Freeman contains 5 scales, Sensory Motor Behaviors (whirls, flaps, rocks, etc.), Social Relationship to people (appropriate response to interaction attempts, disturbs others, isolates self, etc.); Affectual Reactions (abrupt changes, temper outbursts, cries, etc.); Sensory Responses (uses objects appropriately, rubs surfaces, sniffs self or objects, destructive to objects, stares, etc.); and Language (communicative use of language, appropriate initiations, visual hallucinations etc.).

Reliability of Observers. Twenty percent of play, academic engagement, and Ritvo-Freeman Real Life Rating Scale behavior observations were coded for reliability. Reliability was calculated for both occurrences and nonoccurrences of behavior, using the formula agreements/agreements+disagreements. Table 3 details inter-observer reliability coefficients for play and academic engagement, while Table 4 details reliability of the Ritvo-Freeman Real-Life Rating Scale.

Table 3. Reliabilities of Play and Academic Behavior Observations.

Behavior	Occurrences	Nonoccurrences
Play		
Solitary	86%	88%
Parallel	90%	76%
Cooperative	74%	97%
Uncooperative	75%	97%
Engaged Time		
Responding	89%	91%
Attending	75%	95%
Not Engaged	74%	96%

Table 4. Inter-observer Reliability on the Ritvo-Freeman.

Domain	Reliability Coefficient
Sensory Motor	78%
Social Relationship to People	93%
Affectual Reactions	67%
Sensory Responses	75%
Language	77%

Data collectors were trained each year on the observation protocol in an effort to increase reliability and reduce observe drift.

The *Scales-of Independent Behavior-Revised* (Bruininks, Woodcock, Weatherman, & Hill, 1996) is designed to measure functional independence. The

measure is administered using interview format, using a 0 (never or rarely) through 3 (almost always or always) point scale. The subdomains of Broad Independence used in this evaluation were: Social Interaction and Communication Skills, Personal Living Skills, and Community Living Skills. Reliabilities range from 0.85 for 0-4 year olds on Community Living, through .98 for Broad Independence of 5-12 year-olds.

Evaluation Procedures

All measures were administered every 6 months. For the purposes of analyses, only the first and last data points were used (otherwise, given that some students had 1 administration and others had 7 or 8, the unequal data points would have created too small a sample for statistical analyses).

Behavioral observations were conducted at times when the child was expected to be engaged in the behaviors under observation. Hence, engaged time was observed during instruction and independent seatwork times, and play was observed during structured and unstructured play times. The Ritvo-Freeman was completed during a 30-minute time frame at the opening of the observation period. The teacher completed the Scales of Independent Behavior-Revised, in the majority of cases. The child was taken from the classroom and to a separate room to complete the Woodcock Johnson Cognitive.

An additional measure used in this project included a testing situation compliance rating. This checklist contained 4 items, and was made for the purpose of this project. It has not been validated. The purpose of this measure was to ascertain whether changes in cognitive performance could be attributed to changes in compliance observed during the testing session. The measure was scaled 1 (0-25% of the time), 2 (26-75% of the time), and 3 (>75% of the time), for the best representation of the test examiner on the child's behavior: (a) in seat, (b) attention to task, (c) hands off materials, and (d) making eye contact. Test behavior was rated at each testing period.

A treatment integrity checklist was completed each spring, and included a rating of the extent to which each of 7 components was present in the classroom. A score of 1 was little implementation, a score of 2 was partial implementation, and a score of 3 was full implementation. The research associates observed the classroom throughout data collection, and rated implementation of: (a) schedule matching developmental level, (b) physical boundaries, (c) appropriate independent work tasks, (d) communication system,

(e) communication goals and training infused within the curriculum, (e) reinforcement of the student for desired targeted behaviors, and (f) presence of 1:1 instruction for skill acquisition. The implementation index of the last spring data collection period was used in the analysis.

Section VII. Methodological or Logistical Problems

The original grant proposal had a parent training component. While we did develop a parent training model, we did not track if parents who attended training also had students who were participating in the evaluation component of the project.

A second logistical problem was in instrumentation. Originally, we were using the Parenting Stress Index (Abidin, 1995) as a covariate measure. There was some question during an initial visit to our site by a national technical assistance agency, as to the merit of including the measure. As such, we did not include the PSI as an outcome measure over time. There were also problems in differences obtained between teacher and parent reports on the Scales of Independent Behavior-Revised. We decided to use only teacher reports in the last 3 years of the project.

We also had some unreliability in how the Ritvo-Freeman and other direct observations of behavior were recorded. We simplified our coding scheme from frequency counts, to estimates of behavior in 4 categories, consistent with the original development of the Ritvo-Freeman. We also changed our behavior observations from 4 15-minute observation periods, to 1 15-minute observation period.

At the replication sites, we supported the evaluation protocol. Because the sites were some distances from the origination site, (each site was at least a 2-hour drive and required an overnight stay by our data collectors), we streamlined the assessment protocol, so that we did not engage in some of the initial interviews about severity of Autism, and did not get a CARS completed. We also had to be flexible in terms of what and when we could conduct the behavioral observations, so that we could evaluate all students at each replication site in a 2-day time frame.

In addition, our technical assistance group helped us to redefine our model from being purely a training model, to being a model in which teachers are trained, and then provided with on-going technical assistance from the trainers. This clarification has been

helpful in assisting other sites develop capacity for supporting young children with Autism.

Section VIII. Evaluation Findings

Question 1: What are the characteristics of the children being diagnosed as Autistic, which participated in the study?

The Childhood Autism Rating Scale (CARS) scores for the students who participated in are depicted in Table 5.

Table 5. CARS Scores of Participants at Intake

CARS Score	CARS Descriptive Category	Frequency	Percent of Sample
15-29	Non-Autistic	8	16%
30-36	Mildly-Moderately Autistic	17	34%
36.5 and Above	Severely Autistic	21	42%
Missing		7	8%

Prior to participating in this project, all of the students were identified by medical or other qualified mental health specialists as meeting diagnostic criteria of Autism. Using a self-developed checklist derived from the Diagnostic and Statistical Manual (Fourth Edition) (American Psychiatric Association, 1994), parents were asked to indicate the frequency and severity of social, communication, and ritualistic behaviors, as well as indicate age of onset of symptoms. When parents reported symptoms, severity, and age of onset, 37 of 52 students (71%) were confirmed as meeting a diagnosis of Autism. Seventeen of 52 students (29%) would not meet diagnostic criteria defined by DSM-IV. However, of the 17 students whose parent report could lead one to question the authenticity of the Autism diagnosis, CARS scores ranged from 20.5 through 45.5, with all but 2 CARS scores in at least the mildly autistic range.

Interpretation: The students included in the evaluation would demonstrate moderate to significant characteristics associated with Autism.

Question 2: What amount of growth was measured on the Woodcock-Johnson Broad Cognitive Index, between the first and last evaluation data point?

Pre- and post-test group averages of the participants are included in Table 6.

Table 6. Pre- and Post-test Averages on Woodcock-Johnson Broad Cognitive Index

Time of Testing	Group Average	N	Standard Deviation
Entry into Study	45.37	52	41.13
Last Data Point	60.21	52	46.53

Results of a paired sample t-test indicate that the difference in means from post-pre is statistically significant, t (51) = -.485, p. < .001.

The range of growth on the Broad Cognitive Index is depicted on the graph below. The biggest decline over time was –30 Broad Cognitive Standard Score Points. The largest increase was 80 Broad Cognitive Standard Score Points, with a mean growth of 14.8, and a mode of about 10 Broad Cognitive Standard Score units (Figure 1).

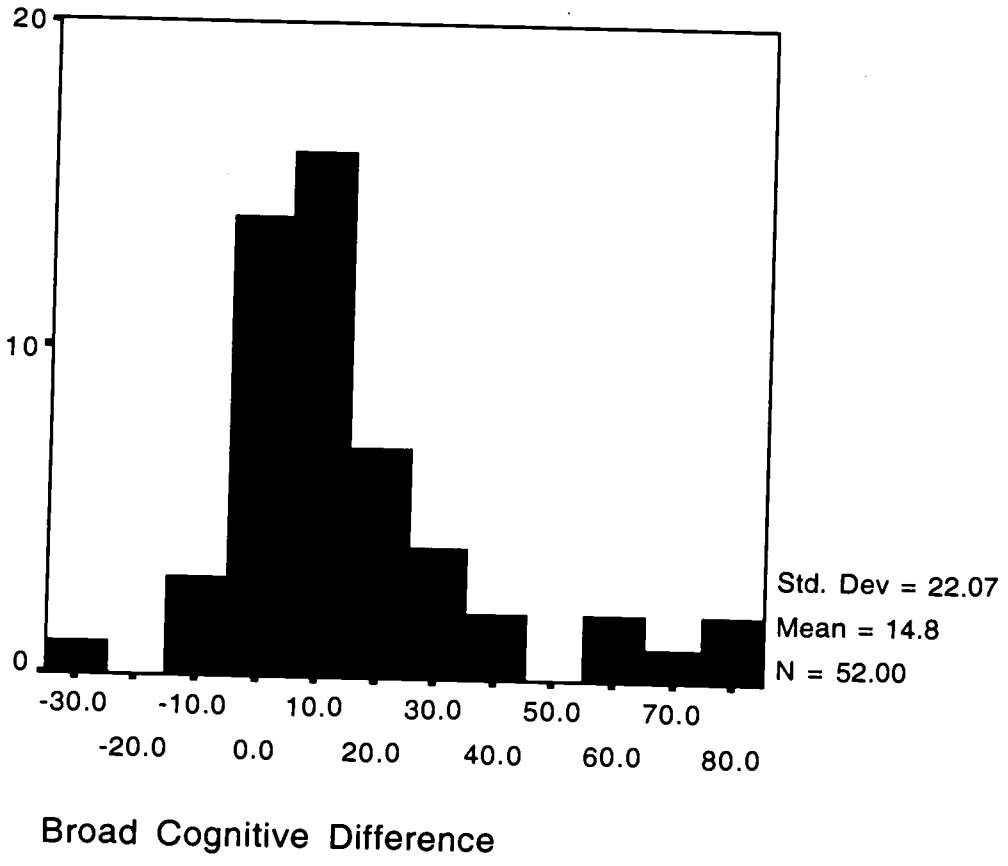

Figure 1. Distribution of Difference Scores

Interpretation: Students gained about 1 standard deviation of growth on a Broad Index of overall cognitive functioning. For 15 students (29%), the gains would be beyond 1 standard error of growth, for another 36 students (69%), obtained difference or gain is

within 1 standard error. One student (2%) had a decline of greater than 1 standard error of measurement.

The Woodcock-Johnson Broad Cognitive score is scaled to have a mean of 100 and a standard deviation of 15. The students in our evaluation tend to scoring about 3 standard deviations below the mean at pre-test, about 2 standard deviations below the mean at post-test.

Question 3: How much did behaviors associated with Autism improve over time?

Results from behavior observations taken using the Ritvo Freeman Real Life Rating Scale are provided in Table 7. Lower numbers indicate fewer observed behaviors. Change from pre-post is desired in the lower direction for positively scaled behavior, in the higher direction for negatively scaled behaviors. Table 8 summarizes t-tests performed on pre- and post- observations of the Ritvo-Freeman.

Table 7. Ritvo Freeman Real Life Rating Scale Results

Scale of Behavior Observation	Group Average	N	Standard Deviation
Ritvo Freeman Sensory Motor Behaviors Time 1	.505	50	.349
Ritvo Freeman Sensory Motor Behaviors Endpoint	.334	50	.328
Ritvo Freeman Social Relationships to People Time 1	-.027	51	.415
Ritvo Freeman Social Relationships to People Endpoint	-.108	51	.380
Ritvo Freeman Affectual Responses Time 1	.477	49	.494
Ritvo Freeman Affectual Responses Endpoint	.314	49	.341
Ritvo Freeman Sensory Responses Time 1	.628	52	.405
Ritvo Freeman Sensory Responses Endpoint	.446	52	.300
Ritvo Freeman Language Time 1	-.082	51	.415
Ritvo Freeman Language Endpoint	-.201	51	.475
Ritvo Freeman Total Time 1	.302	47	.280
Ritvo Freeman Total Endpoint	.153	47	.235

Table 8. Summary of Paired-Comparison T-Tests, Ritvo-Freeman

Pair	t	df	sig
Sensory Motor Behaviors	3.345	49	.002
Social Relationships endpoint-start point	1.435	50	.158
Affectual Responses endpoint-start point	1.924	48	.06
Sensory Responses endpoint-start point	2.616	51	.012
Language endpoint-start point	2.538	50	.014
Total endpoint-start point	4.188	46	.000

Interpretation: there were fewer sensory motor behaviors (whirls, flaps, pacing, bangs self, rocks, toe walks), sensory responses (more appropriate use of objects, less: agitation by noise; whirling objects; rubbing surfaces; agitation by new activity; watching hand; stereotypy; sniffing self or objects; lining up objects; destruction of objects; repetitive vocalizations; staring; covering ears/eyes; and flicking), and fewer language concerns (more communicative use of language, initiating or responding to communication, initiating appropriate verbal communication, less use of echolalia, delusions, auditory hallucinations, visual hallucinations, noncommunicative vocalizations, not responding to communication attempts). There was observed overall declines in Autistic behaviors.

Question 4, how did school related-behavior improve over time?

This question is answered by examining the changes in Engaged, Attending, and Non-attending behaviors over time, and in solitary, parallel, cooperative, and uncooperative play. The data for all observed behaviors represents 15 second partial interval recording across 180 intervals (15 minutes of observation during academic or play tasks), and are summarized pre- and post in Table 9. Results of paired comparison t-tests for statistical significance between pre- and post-test averages, are summarized in Table 10.

Table 9. Academic and Play Behavior Observation Results

	Group Average	N	S. D.
School Behaviors			
Engaged Pre	25	34	13
Engaged Post	29	34	15
Attending Pre	13	34	11
Attending Post	14	34	12
Non Attending Pre	19	34	17
Non Attending Post	13	34	12
Play Behaviors			
Solitary Pre	35	47	23
Solitary Post	41	47	23
Parallel Pre	28	46	19
Parallel Post	25	46	17
Cooperative Pre	6	46	9
Cooperative Post	13	46	16
Uncooperative Pre	2	46	3
Uncooperative Post	2	46	3

Table 10. Paired-comparison t-test results for academic and play behavior.

Behavior (Pre- Post-)	t	df	sig
Engaged	1.57	46	n.s.
Attending	.161	33	n.s.
Non Attending	2.355	33	.02
Solitary Play	1.57	46	n.s.
Parallel Play	.876	45	n.s.
Cooperative Play	2.662	45	.01
Uncooperative Play	.695	45	n.s.

Interpretation: Children were observed being non attentive in fewer intervals at post-test when compared to pre-test. Children were observed engaged in more cooperative play at post-test compared to pre-test.

Question 5: What were the reported changes in adaptive behavior over time?

The Scales of Independent Behavior-Revised, include measures of: Social Interaction, Community Living, Personal Living Skills, and Broad Independence. The averages of Standard Scores for each domain, for the students as a group at the first and last data point, are presented in the Table 11. The magnitude of the change, statistically, is also presented in Table 11. The SIB-R is scaled to have a mean of 100 and a standard deviation of 15.

Table 11. SIB-R Means at Pre- and Post-test, and Statistical Significance of Change

Domain	Mean	SD	N	t(df)	Sig.
Social Interaction and communication Pre	38.71	34.73	48	4.08 (47)	.000
Social Interaction and Communication Post	47.88	33.46	48		
Personal Living Skills Pre	50.85	27.49	48	.79 (47)	n.s.
Personal Living Skills Post	53.04	25.47	48		
Community Living Pre	62.06	21.29	48	1.07 (47)	n.s.
Community Living Post	59.10	20.82	49		
Broad Independence Pre	42.17	28	48	1.25 (47)	n.s.
Broad Independence Post	44.56	25.70	48		

Interpretation: Students are reported by caregivers as improving in social interaction and communication. However, the gains realized still have the students at well below the 1st percentile when compared to nondisabled students of the same age.

Additional Questions

The initial analyses suggest improvements in Broad Cognitive functioning, autistic behaviors, not attending, cooperative play, and social interaction and communication. The next sets of questions were done post hoc, and are designed to assess the factors that contribute to the best outcome students.

Question 6: What are the factors that predict best outcome?

a. If best outcome is defined as having a post-test IQ greater than 90, regardless of pre-test IQ score, what factors (implementation fidelity, time in study, age of onset, CARS score at pre-test, numbers of social behaviors from the DSM-IV rated severe at onset, numbers of communication items rated severe at onset, numbers of ritualistic items rated severe at onset, special education weighted enrollment factor, minutes of direct instruction per week, engagement at post-test) might predict best outcome?

This analysis was purely exploratory. First, a backward regression was conducted. The variables that accounted for 48% of the variance in "best outcome" was (a) initial CARS score (31 for the Best Outcome Group, 39 for the Not Best Outcome group) and (b) age when evaluation started in this project (66 months for the Best Outcomes Group, 51 months for the Not Best Outcomes group). The means for each group on each variable, are presented in Table 12.

Table 12. Means of Best and Not Best Outcome Groups on Predictive Factors

	Best Outcome			Not Best Outcome		
Variable	Mean	SD	N	Mean	SD	N
Integrity Index	14.6	3.40	10	17.2	3.16	15
Hours per week of school	29.6	9.78	10	27.9	10.4	15
Special Education Weight	3.22	1.21	10	3.74	000	15
Minutes per day direct instruction	72	129	10	77	108	15
Months at onset	**66**	**10**	**10**	**51**	**12**	**15**
Social DSM-IV	9	3	10	6	3	15
Communication DSM-IV	7	2	10	4	3	15
Ritualistic DSM-IV	1	1	10	2	1	15
CARS	**31**	**5**	**10**	**39.6**	**5.9**	**15**
Years in Study	2.95	1.3	10	3.26	.97	15
Responding Post	28.8	10.72	10	23.8	13.8	15
Attending Post	13.6	6.78	10	10.96	10.07	15
Not Attending Post	7.05	10.09	10	17.6	13.95	15

Note: Bolded Variables contributed to the regression equation.

Next, high-lo plots of each of the above variables were made, with "best outcome of IQ >= 90 as the blocking factor. The variables that had distributions that were somewhat normal in visual analysis, were included in a discriminant function analysis. The discriminant function correctly classified 86. 5% of cases (Table 13). Table 14 summarizes the predictor variables that account for the most variance in the discriminant function, while Table 15 summarizes the means of the variables included in the discriminant function, with the significant predictors highlighted in bold text.

Table 13. Classification Results for Discriminant Function

			Predicted Group Membership		Total
		Best Outcome Categories	Post IQ<90	Post IQ>=90	
Original Grouping	Count	Post IQ<90	21(87.5%)	3 (12.5)	24
		Post IQ>=90	2(15.4%)	11 (84.6%)	13

86.5% of original grouped cases correctly classified.

Table 14. Best predictors in the discriminant function.

Variable	Wilks' Lambda	F	df1	df2	Sig.
Months age at onset	**.879**	**4.819**	**1**	**35**	**.035**
CARS score	**.661**	**17.950**	**1**	**35**	**.000**
Years in Study	.996	.154	1	35	.697
Treatment Integrity	**.899**	**3.920**	**1**	**35**	**.056**
Hours per week of School	.984	.556	1	35	.461
Minutes per Day of Direct Instruction	.996	.144	1	35	.707

Table 15. Means and Standard Deviations for each Variable, by Group.

Best Outcome Categories		Mean	Std. Deviation	N
Post IQ<90	**Months age at onset**	**56.0417**	**14.5467**	**24**
	CARS score	**38.1042**	**5.8718**	**24**
	Years in Study	2.7917	1.2847	24
	Treatment Integrity	**17.8333**	**2.9291**	**24**
	Hours per week of School	27.0417	9.6458	24
	Minutes per Day of Direct Instruction	77.2917	110.5223	24
Post IQ>=90	**Months age at onset**	**66.0000**	**10.0250**	**13**
	CARS score	**29.7308**	**5.4758**	**13**
	Years in Study	2.6154	1.3409	13
	Treatment Integrity	**15.6154**	**3.7978**	**13**
	Hours per week of School	29.5000	9.4274	13
	Minutes per Day of Direct Instruction	62.6923	114.1566	13

Interpretation: While the sample size is small, the discriminant function analysis, combined with the multiple regression analysis, suggests that CARS score, months at age of onset, and treatment integrity, are predictive of the students whose ending IQ was above 90.

It is important to examine the actual group means for the best outcome and not best outcome group. The CARS score of the best outcome group is lower, suggesting that there are better outcomes for students having fewer behaviors associated with Autism (a score of 30 or lower on the CARS predicted better outcome). Students in the best outcome group were put into the evaluation part of this project at an average age of 66 months (5 years, 6 months, or Kindergarten), while the poorer outcome group started in the project at 56 months (4 years, 8 months, or late preschool, early Kindergarten).

One explanation yet to be tested is that the less severe students had behaviors that did not look discrepant from peers until they reached Kindergarten. The more severe students had significant impairment such that students in this group were "found" earlier.

An apparent paradox was that the best outcome group had *lower* implementation of strategies taught to teachers than did the group that did not have the best outcomes. An explanation for this is *not* that teachers implemented the strategies with less integrity. Instead, it is possible that the higher functioning students required fewer of the strategies

to be implemented to function in the classroom, hence the teachers' implementation was rated lower.

Question 6b: If best outcome is defined as having an IQ gain of at least 20, what factors (implementation fidelity, time in study, age of onset, CARS score at pre-test, numbers of social behaviors from the DSM-IV rated severe at onset, minutes of direct instruction per week) might predict best outcome?

Again, a discriminant function analysis was conducted. The discriminant function correctly classified 89% of cases.

Table 16. Difference Score Discriminant Function.

			Predicted Group Membership		Total
		Best Outcome Using Difference Score	Worst Decline or Chance Growth	Best Growth	
Original	Count	Worst Decline or Chance Growth	23 (95.8%)	1 (4.2%)	24
		Best Growth	3 (23.1)	10 (76.9)	13

89.2% of original grouped cases correctly classified.

Table 17. Means of Predictors using Difference Score as the Grouping Factor.

Best Outcome Using Difference Score		Mean	Std. Deviation	N
Worst Decline or Chance Growth	Months age at onset	56.5000	14.0248	24
	CARS score	**36.6667**	**7.1012**	**24**
	Years in Study	**2.3958**	**1.2246**	**24**
	Treatment Integrity	**18.3750**	**2.5163**	**24**
	Hours per week of School	27.2708	9.3332	24
	Minutes per Day of Direct Instruction	81.8750	109.0354	24
Best Growth	Months age at onset	65.1538	12.0889	13
	CARS score	**32.3846**	**5.9831**	**13**
	Years in Study	**3.3462**	**1.2142**	**13**
	Treatment Integrity	**14.6154**	**3.5009**	**13**
	Hours per week of School	29.0769	10.1095	13
	Minutes per Day of Direct Instruction	54.2308	115.1963	13

When cognitive growth is the factor of interest, students who showed more than 20 Standard Score point improvement had (a) lower CARS scores, (b) were in the study for about 1 year longer, and (c) had lower treatment integrity scores. These findings would be similar to what was found in the discriminant function in which post-test IQ greater than or equal to 90 was the factor of interest.

The difference score analysis included pre-test IQ as a potential contributing factor. Pre-test IQ was not predictive of best outcome. This is important, because knowing that a student had an early IQ score of, for example, 45, does not mean that the student will not show significant improvement. In our data, we had a student with a pretest IQ of 1, and a post-test IQ of 80; another with a pre-test IQ of 4 and a post-test IQ of 61; another with a pre-test IQ of 9 and a post-test IQ of 91.

Table 18 depicts chance change in IQ, while accounting for pre- and post-test IQ score. Pre-test IQ is the 1st column, post-test IQ is along the first row. The dark gray area indicates that the change from pre-to-post-test was no change. The light gray area would be within measurement error. White cells to the right and top quadrant reflect improvement beyond chance levels. White cells to the left and bottom quadrant reflects decrements beyond chance levels. In the table, of the 50 participants whose IQ scores were plotted, 2% were much poorer, 4% were slightly poorer but within measurement error, 40% stayed the same, 34% improved but within measurement error, and 24% improved greatly.

The far-right-hand column of Table 18 represents the percentage of students within each pre-test IQ range that ended up with post-test IQ scores in the average range or higher. Importantly, 5% of students who started out with IQ scores below 10, ended up with IQ scores of at least 90. At around pre-test IQ scores of 65, post test IQ of 90 occurred about 2/3 of the time.

Table 18. Pre- and Post-test Broad Cognitive Scores by Individ

Pre-program Broad Cognitive

Post-test Broad Cognitive

	0-14	15-24	25-34	35-44	45-54	55-64	65-74	75-84	85-94	95-104	105-114	115-124	125-134	135-144	Percent 90+
0-14						1		2	1						5
15-24															0
25-34		1						1							0
35-44			1		1										0
45-54								1							0
55-64							2		1						33
65-74								2	2	1					60
75-84					1							2			67
85-94										2	1	2			100
95-104											3	2			100
105-114													1		100
115-124															NA
125-134														1	100
135-144															NA

Question 7: Can the results be replicated across settings?

We worked with 2 replication sites, Omaha Public Schools, and Area Education Agency 7 in Iowa. We included 14 students in the evaluation of those sites. The data from the sites are displayed in Table 19.

Table 19. Results of Data from Replication Sites

Domain	N	Pre	Post	t	sig.
Woodcock-Johnson Broad Cognitive	10	45	55	2.51	.03
Engaged time	13	55	66	1.41	n.s.
Attending	13	35	35	.01	n.s.
Not attending	13	8	16	1.20	n.s.
Solitary Play	13	20	23	.361	n.s.
Parallel Play	13	19	23	.438	n.s.
Cooperative Play	13	13	11	.266	n.s.
Uncooperative Play	13	0	2	1.91	n.s.
Social Interaction	6	49	55	.471	n.s.
Personal Living	6	66	70	.25	n.s.
Community Living	6	68	60	1.06	n.s.
Broad Independence	6	52	55	.242	n.s.

Interpretation: The change on the Woodcock-Johnson Broad Cognitive was statistically significant. Changes on other variables were not significant. Importantly, data from the replication sites were obtained over a 1-year period, while the origination site reported results over a 5-year period. In addition, of the 13 children on whom data were available, 2 had gains over 20 Standard Score points, more than would be expected given regression to the mean of the estimated true score, and on the standard deviation and reliability of the measure itself. The other students' gains were within one standard error, and may or may not be attributable to measurement error or regression to the mean. Three students at the replication sites had post-test Broad Cognitive Standard Scores over 90 (1 of the students had a pre-test of 115, a post-test of 124. The other 2 students had pre-test scores of 74 and 85).

Qualitatively, the students showing the most gain on Broad Cognitive at the replication sites had lower treatment integrity. Similar to the explanation proposed for the original site, it may be that these students were higher functioning hence needed fewer strategies implemented for success. In addition, 2 of the lowest performing students at the replication site, both on post-test Broad Cognitive Standard Score and on difference post-pre on Broad Cognitive, had 2 of the highest levels of implementation, as well as the most minutes (over 300 per day) of direct instruction. This further underscores the need to explore the relationship between level of Autism or the degree of behaviors associated with Autism as predictive of best outcome on a cognitive measure, rather than how well or how many strategies with Autism is employed, how many hours of programming are provided, and how many minutes of direct instruction are used in the classroom. The implication to explore further is, IEP teams make decisions about programs based on individual needs, and that students with fewer behaviors associated with Autism can be successful in less intensive programs, and that students with more behaviors associated with Autism are likely to show the least amount of growth. However, the factors associated with the growth of the least successful students, has yet to be clearly identified. In addition, behaviors associated with Autism have not been established as a causal link in determining best outcome. The data only suggest that one predictor of best and not best outcome is severity of Autism at onset. Unfortunately, we did not obtain CARS scores from the replication sites, and could not further examine the link between reported levels of Autistic behaviors, and outcome.

Question 8: Of the "Best Outcome" students, does a review of their files and IEPs provide any suggestions as to why these students had more growth?

There were some consistent but not unanimous themes found in file review of the students who either (a) had post-test Broad Cognitive Index Standard Scores of greater than or equal to 90, or (b) Broad Cognitive changes of at least 20 Standard Scores. First, on the whole these students had verbal language. These students also tended to have functional use of gestures or other ways to communicate nonverbally. On the PEP-R, many of these best outcome students were within 2 years developmentally of their chronological age (note: the PEP-R was not available on all students, and we did not look at PEP-R scores for the students not defined by (a) or (b) above). When a Battelle was available, the cluster of scores was inconsistent across subjects. Many students had more difficulty with social situations and transitions, and not with communication with parents and teachers.

As was found with the discriminant function analysis, there does not appear to be an established relationship between: hours per week of school, components of training program implemented, minutes of direct instruction per day, length of school day, special education weighted factor, minutes per day of support from an associate.

Question 9: How do our results compare to what was found by McEachin, Smith, and Lovaas (1993)?

McEachin, Smith, and Lovaas (1993) provided WISC-R and Vineland Adaptive Behavior Scale Scores for the 9 students who had the best outcome in the study reported by Lovaas (1987). While we used different IQ and Adaptive Behavior measures, making direct comparison difficult, we thought it would be interesting to examine similarities and differences between the 9 students with the best outcome in our evaluation, and the data reported by McEachin et al.

Table 20. Comparisons on IQ, WISC-R as reported by McEachin et al., WJ from Heartland AEA 11 sample.

Subject	WISC-R Full Scale IQ	Woodcock Johnson Broad Cognitive Index
1	106	112
2	136	115
3	109	116
4	128	116
5	100	122
6	105	123
7	99	123
8	99	125
9	114	136
Mean	111	120
S. D.	13	8

An independent samples t-test was run on the data. The results suggested no difference between groups, t (8)= -1.877, p. > .05.

Table 21. Comparisons on Adaptive Behavior on the 9 Best Outcomes Students

Subject	Vineland Composite	SIB-R Broad Independence
1	92	-
2	98	76
3	105	58
4	108	50
5	88	58
6	80	97
7	98	97
8	83	80
9	-	74
Mean	94	73.75
S. D.	10	17.66

Independent t-test result indicates that the top 9 students of the experimental group in the UCLA follow-up study, using the Vineland composite Standard Scores, had higher reported adaptive functioning at the follow-up testing than did our group ($t(14) = 2.828$, $p. < .02$). However, the overall adaptive behavior score of the experimental group reported by McEachin et al. (1993) was 71.6.

Because our program did not have students randomly assigned to treatment, interpretations of our results are very difficult. On one hand, the post-test scores on the cognitive measure appear higher than was reported by McEachin et al. On the other hand, the follow-up adaptive behavior reports favor the 9 best outcomes students in the experimental group in the original UCLA study. Adding more difficulty is that our best outcomes group looks like, as a whole, were higher functioning than the groups on which intervention was applied at UCLA, but our not best outcomes group appears to be substantially lower in pre-treatment cognitive functioning, especially since the Woodcock Johnson is scaled to accurately reflect performances at 0 and 1 Standard Score units.

It was not the purpose of this project to evaluate effects against that obtained by the UCLA group. Nevertheless, one of our aims was to examine the growth rates, on similar measures, as was obtained by the UCLA group. It is unfortunate that we were not able to identify factors other than severity of Autism, that predict "best outcome," because our treatment effect, in particular on the cognitive measure, appears to be significant.

Question 10: What do the students' programs and services look like for the 2002-2003 school year?

Table 22. Students, grades, LRE, Services, IEP Goals, and Special Notes

Student pseudonym	Grade	Percent of time in general education	Percent of time in special education	Special Education Weighting	Services Received	IEP Goals	Services Exited From or Special Notes
Arthur	2	0	100	3.74	Self Contained, Speech, transportation		
Robert	5	40	60	2.35	Special class with integration, Speech		
Adam	4	76	24	1.68	Resource		Associate, transportation
John	3	16	84	3.74	Special class with integration, transportation		
Abby	5	1	99	3.74	Self contained special class, speech, vision	Language, vision	
Diane	1	15	85	3.74	Self contained special class, speech, transportation	Initial sounds, color identification, naming numerals, writing letters	
Josh	6	17	83	3.74	Self contained special class, speech, transportation, associate	Toileting, task completion, replying to "wh" questions	OT, Adaptive PE
Jacob	5	37	63	3.74	Self contained with little integration, associate	Following directions, turn taking, on-task	

Student pseudonym	Grade	Percent of time in general education	Percent of time in special education	Special Education Weighting	Services Received	IEP Goals	Services Exited From or Special Notes
Sergio	1	0	100	3.74	Self contained special class, PT, Speech	Mobility, task completion, turn taking	
Doug	4	0	100	3.74	Level 3 Resource, SLP, Associate		
Tyler	2	98	2	0.0	Speech only	Language	
Jalen	4	70	30	2.35	Level 2 Resource	On-task, retell, writing	SLP, OT
Myron	1	85	15	3.74	Self-contained with little integration, speech	Following Directions	
Trent	1	75	25	3.74	Self-contained special class, speech	Language, printing, math, initiation, coping	
Kent	2	30	70	3.74	Self-contained special class, speech, transportation, associate	Sit independently, play cooperatively, interact with peers	
Hannah	1	33	67	3.74	Self-contained special class, speech, OT, associate	Socially appropriate greetings, starting tasks, self help	
Sue	1	100	0	Regular ed	Full-time general education, no support		Level 2, SLP
Warren	5	8	92	3.74	Level 3 resource, SLP, Associate	Math, writing, engaging others	

Student pseudonym	Grade	Percent of time in general education	Percent of time in special education	Special Education Weighting	Services Received	IEP Goals	Services Exited From or Special Notes
Karen	5	75	25	3.74	Self-contained with little integration, SLP, associate	Writing stories, addition/subtraction, 4th grade reading	
Whitney	3	60	40	3.74	Level 3 Resource, SLP, transportation	Language, decoding, writing, counting, 2 digit addition, following directions	
Sonny	6	84	16	3.74	Special class with integration, SLP, associate	Organization, language, following directions	
Jerry	4	58	42	3.74	Self-contained special class, SLP, transportation		
Colin	5	0	100	3.74	Self-contained special class, SLP, associate	Attending, following directions, using communication pictures, identifying functional words	
Ozzie	3	69	31	2.35	Special class with integration, transportation, OT	Handwriting, behavior, 80 words per minute at grade level, math	

Student pseudonym	Grade	Percent of time in general education	Percent of time in special education	Special Education Weighting	Services Received	IEP Goals	Services Exited From or Special Notes
Erin	5	25	75	3.74	Self contained special class, SLP, transportation	Peer interactions, responding to questions, completing tasks independently	
Barb	7	0	100	3.74	Self contained special class, SLP, Associate, transportation	Expressive language, functional living, recreation, community access	
Dave	5	75	25	3.74	Special class with integration, SLP, associate	Language, reading comprehension, applied math	
Jose	4	88	12	3.74	Level 3 Resource, SLP, Associate	Language, Multi-step math problems, reading comprehension	
Junior	2	90	10	3.74	Self-contained special class, SLP, Assistive technology, Associate	Taking turns, language	
Barry	5	79	21	3.74	Special class with integration, OT, Associate	Math computation, oral reading fluency, writing, attending to task	
Alonzo	4	86	14	2.35	Resource, SLP		

Student pseudonym	Grade	Percent of time in general education	Percent of time in special education	Special Education Weighting	Services Received	IEP Goals	Services Exited From or Special Notes
Mike	K	0	100	3.74	Self-contained special class, SLP, transportation		
Mark	4	79	21	3.74	Self-contained with integration, SLP, Associate	Communication, articulation, reading comprehension	
Suzette	5	94	6	2.35	Self-contained with integration, Associate	Following directions	SLP
Marin	2	66	34	2.35	Level 2 resource, SLP	Language, following directions, interacting with peers, math	
Robin	4	83	17	3.74	Level 3 Resource, Associate	Reading	SLP
Kylie	5	94	6	3.74	Level 3 Resource, Associate	Following rules	SLP
Jon	4	36	64	3.74	Special class with integration, SLP, associate	Teacher directions, reading, math, answering "wh" questions	
Henry	4	8	92	3.74	Self-contained special class, SLP, Associate	Preferred activities, beginning work, preparing food, matching words to photos	

Student pseudonym	Grade	Percent of time in general education	Percent of time in special education	Special Education Weighting	Services Received	IEP Goals	Services Exited From or Special Notes
Ben	5	100	0	0.0	Speech	Language	Staffed out of Level 2 Resource
Amber	7	83	17	2.35	Self-contained with little integration, Associate, SLP	Math story problems, word problems, expressing self	Has addition and subtraction skills
Serena	4	0	100	3.74	Self-contained with little integration, Associate, SLP	Using communication system, matching concepts and pictures, turntaking, functional math	
Steve	5	97	3	3.74	Special class with Integration, Associate, SLP	Organization, language, social skills, articulation	
Erica	3	75	25	3.74	Self contained with little integration, Associate, SLP	Computation, Initiating social interaction	Student reads at grade level, has strong peer interactions
Eric	4	29	71	3.74	Self-contained special class, SLP, Adaptive PE	Language, reading, math, written language, imitation, behavior	

Student pseudonym	Grade	Percent of time in general education	Percent of time in special education	Special Education Weighting	Services Received	IEP Goals	Services Exited From or Special Notes
Ken	6	0	100	3.74	Self contained special class, Associate	Language, independent work completion	SLP
Trent	7	94	6	3.74	Level 3 Resource, Associate	Reading out loud	SLP, vision, OT
Cindy	3	87	13	3.74	Resource, SLP, Associate	Communication, fine motor, comprehension	OT

Interpretation: IEP teams are developing programs to meet needs of students with Autism. The variety of service delivery models reflects the individualization of each district in determining how to meet the needs of students with disabilities. Many students with Autism, while weighted at the highest level (3.74) and assigned to a roster of a teacher of a self-contained classroom, are in general education settings more than they are in special education settings. Some students have more functional IEP goals, other students have goals that are more academic in nature. Some students, while meeting the diagnostic criteria for Autism, have been staffed out of special education because they no longer need specialized instruction in order to receive a free and appropriate public education. Other students have associates assigned to them to support them in general education. Still others have had support areas dropped because they no longer needed support in that area. At each IEP annual review period, teachers make IEP conclusions of (a) is the student making progress compared to himself? (b) is the child more like peers or the accepted standards? (c) is the child more independent, and (d) what will be done in the goal area for the next review period? These conclusions are in our data-management system, but the reliability of the decisions has not been validated, hence their omission from this report.

Question 11: What is the reading level of students with Autism who participated in this project and who are now in school-aged grades?

Background: Research in the field of early literacy has suggested that a majority of growth in reading skills and fluency occur in the early years of a student's formal education. This field of study has established benchmarks of reading fluency rates that serve as indicators of later reading proficiency (Good, Simmons, & Smith, 1998).

An established ("good reader) reads at a rate of 120 wpm by the end of 3rd grade. Benchmarks have been established that serve as check points that allow a students reading growth to be monitored in relation to "average" progression toward the final goal of 120 wpm by the end of 3rd grade. At the end of 1st grade, students who are reading 40 wpm are considered "on-target" to becoming proficient readers. That is, they are on-target for reaching the goal of 120 wpm by the end of their 3rd grade year. Students, who are reading between 10 and 40 wpm at the end of 1st grade, are considered emergent readers, because some of them are on target, and some are not, and their growth warrants monitoring and instruction provided as necessary. Children who are reading at a rate of 10 wpm or lower are considered "at risk" of not becoming proficient readers and should receive intense instruction in deficit reading skill areas

Reading fluency probes and letter identification probes were administered to each of 34 of students who had entered Kindergarten by the spring of 2000. Data were analyzed in comparison with their district norms and measures of reading fluency.

First Grade:

Results of reading assessment during first grade are included in Table 23. Two of 8 first grade students (25%) were reading below 10 wpm indicating that they are at-risk of not becoming proficient readers. Two of 8 first grade students (25%) were reading between 10 and 40 wpm, indicating that they are emergent readers. One of the 2 emergent readers scores fall at the low end of his/her district norms suggesting that further evaluation and possibly skill instruction is necessary. Four of 8 first grade students (50%) were on-target to becoming proficient readers by the end of 3rd grade.

Table 23. Reading Fluencies, %ile, and Benchmark Levels for 1st Graders.

Student	Words Read/Min (Median of 3 probes)	Percentile Rank (District Norms)	Above or Below Benchmark
1	77	92	On-target
2	51	23	On-target
3	4	<1	At risk
4	24	25	Emergent
5	11	1	Emergent
6	40	53	On-target
7	32	42	On-target
8	0	0	At risk

At present, benchmarks have not been established through research for the end of second and third grades. However, Fuchs, Fuchs, and Deno (1982) have identified proficiency levels that correspond to instructional levels. In second grade material, reading 40-60 words out loud per minute is considered at the instructional level. In Grades 3-6, reading 70-100 words per minute out loud is considered instructional.

Results of second and third graders in this project are presented in Table 24. Five of 13 second and third grade students (38%) fall below the first grade benchmark of 40 wpm. In addition, district norms were available for 4 of 5 of these at-risk students and all 4 fell below the 1st percentile when compared to their peers. Seven of 13 students exceeded instructional placement criteria for their respective grade levels. In addition, five students read within the average range when compared to performance of nondisabled peers in their districts.

Table 24. Reading Fluency of Students in Second and Third Grade

Student	Grade	Words Read/Min (Ave of 3 probes)	%ile Rank (District Norms)	Above or Below DIBELS Benchmarks
1	2	71	27	Above
2	2	92	35	Above
3	2	170	97	Above
4	2	10	None	At-risk
5	2	39	11	Below
6	2	0	<1	At-risk
7	2	0	<1	At-risk
8	2	50	None	Above
9	2	125	85	Above
10	3	50	None	Below
11	3	5	<1	At-risk
12	3	121	45	Above
13	3	0	<1	At-risk

Interpretation: The reading skills of students with Autism vary. There are some students for whom more intensive reading instruction is needed for the students to read sufficiently fluent to gather meaning from connected text. Other students appear to be developing their reading skills, and may or may not need additional instruction. Another group has developed reading skills to the extent needed to participate in the general curriculum without supports in the area of reading proficiency.

Section IX. Project Impact

Products and Dissemination Activities

We have developed a training model that has been shared with several other agencies that have developed internal supports to maintain a training and autism support team. At present, we are conducting 3-4 on-site trainings per year, with up to 25 teachers being trained. We typically hold 4 spots for out-of-area or out-of-state teams who have committed to developing a training model similar to ours. Upon completion of a 3-year

skill-building cycle, training sites can use our materials to train teachers in their encatchment areas.

Implications of Findings

Given the data, it would be inappropriate to conclude any other than the following. First, teachers can be trained to support students with Autism, so that categorical placement of students with Autism into "Autism" rooms is not needed. Second, support staff trained in Autism can support teachers in implementing programs for students with Autism. Third, IEP teams have the capacity to write IEPs that confer FAPE on students with Autism. Fourth, not every student with Autism will need special education in order to be successful, although it appears that the vast majority will receive special education based on the eligibility prong of entitlement in IDEA. Fifth, students with fewer behaviors associated with Autism tended to have the highest IQ scores at post-test as well as demonstrate the most gain. There were exceptions to this, but on average, the lower the CARS score, the better the measured outcome. Sixth, we did not find significant relationships between things like minutes of direct instruction, engaged time, hours per week of educational programming, and minutes of support from an associate, and outcomes on the IQ measure. The relationship we found related to age of onset was that the better outcomes students were "found" for inclusion in the evaluation component of this project, at older ages. The hypothesis is that these students were higher functioning, hence discrepancies between their and peer behaviors were not apparent until Kindergarten or 1st grade, whereas the more severally impaired students have communication deficits that were noticeable at an earlier age. Seventh, the types of programs and IEP goals for students with Autism vary depending upon the individual needs of each student. Eighth, the amount of inclusion in general education varies depending upon the individual student. Ninth, the training model and effects on cognitive scores was replicated across sites. Tenth, IEP teams cannot assume that low performance is indicative of future low functioning, as measured by IQ tests: our data had 19% of the students (n=4) with beginning IQ scores below 15 (N=21) ending up with IQ scores in the severe through average ranges. Eleventh, many students entering the elementary grades are reading fluently in grade level material. The data on placement in the current school year indicate that many students have sufficient academic skill to have

instruction in the general curriculum. Lastly, we were not able to identify instructional, curricular, or environmental factors that predicted best outcome. This is unfortunate, for our "best outcome" predictors were things that lead to a circular argument. For example, one might hear as a result of this report, something like this:

> "This child has Autism, therefore needs special education. Because this student was reported to have fewer characteristics of Autism, we might expect more gains from this student. Because this student has fewer characteristics of Autism, we (the IEP team) have decided to place him in X program."

Such an approach detracts from the individual needs of each child, and of the possibility that, given opportunity to learn and support from educational professionals, some students who are reported to be most impaired on cognitive measures or most impaired on Autism checklists, can and do show significant growth on primarily the cognitive measure.

It would be important to investigate if, focusing more on the behaviors with Autism that are problems for each individual, a more sensitive metric of growth could be obtained, and if predictors of success that are in the control of teachers, such as instruction, curriculum, and environment, can be found, rather than on the within-child factor of "Autism." Alternatively, if conditions could better be identified to suggest levels of support needed given severity and "type" of Autism (for example, primarily social, primarily communicative, primarily behavior), then schools would have better information upon which to base programmatic decisions.

Until those relationships are investigated by the Autism research community, IEP teams are left with case-by-case determinations of programs, in a field in which aptitude X treatment interactions, or program by default given a diagnosis, is more the rule rather than the exception.

This project provides evidence that teacher training and ongoing support is an important component of supporting students with Autism. The data from this project were not helpful in determining which particular training components were most beneficial in impacting student performance. In addition, even if school-based outcomes are improved, this project and others have not demonstrated a significant impact on the

day-to-day adaptive behaviors of students with Autism, nor have we examined the long-term effect of early intervention services on students with Autism.

Section X. Further Information

At present, this report details the findings of this project. We have not yet submitted results of this project to others for peer review and citation as part of the professional literature. A copy of this report is being provided to ERIC.

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