Title	Six reports of children with autism spectrum disorder following intensive behavioral intervention using the Preschool Inventory of Repertoires for Kindergarten (PIRK®)
Author(s)	McGarrell, Maria; Healy, Olive; Leader, Geraldine; O'Connor, Jennifer; Kenny, Neil
Publication Date	2009
Publication Information	McGarrell, M., Healy, O., Leader, G., O'Connor, J. and Kenny, N., 2009. Six reports of children with autism spectrum disorder following intensive behavioral intervention using the Preschool Inventory of Repertoires for Kindergarten (PIRK®). Research in Autism Spectrum Disorders, 3(3): 767-782.
Publisher	Elsevier
Link to publisher's version	http://www.sciencedirect.com/science/journal/17509467
Item record	http://hdl.handle.net/10379/214
DOI	http://dx.doi.org/doi:10.1016/j.rasd.2009.02.006

Elsevier Editorial System(tm) for Research in Autism Spectrum Disorders
Manuscript Draft

Manuscript Number: RASD-D-08-00067R1

Title: Six reports of children with Autism Spectrum Disorder following intensive behavioral intervention using the Preschool Inventory of Repertoires for Kindergarten (P.I.R.K.)

Article Type: Research Paper

Keywords: Keywords: autism, intensive behavioral intervention, PIRK®, CABAS®, integration

Corresponding Author: Dr. olive healy, PhD

Corresponding Author's Institution: National University of Ireland Galway

First Author: Maria McGarrell, M.A.

Order of Authors: Maria McGarrell, M.A.; Olive Healy, Ph.D.; Geraldine Leader; Jennifer O' Connor; Neil Kenny, B.A.

Abstract: The current study presents case reports of 6 children diagnosed with autism spectrum disorder who received intensive applied behavior analysis within the Comprehensive Application of Behavior Analysis to Schooling (CABAS®) system and successfully integrated into mainstream education. The participants' interventions followed curricular objectives from the Preschool Inventory of Repertoires for Kindergarten (PIRK®), an empirically validated assessment tool and curriculum which improves outcomes for children with ASD and prepares for mainstream integration. Each case study presents acquisition of curricular objectives, rates of learning annually and results of independent psychological measures throughout the intensive behavioral intervention. This paper examines the variables (age of treatment onset, duration of treatment, presence of stereotypy or challenging behaviors prior to treatment) which may have influenced the successful integration of these participants into mainstream education settings.

Keywords: autism, intensive behavioral intervention, PIRK®, CABAS®, integration

*** Cover Letter**

School of Psychology
Cairne's Building
Newcastle Rd.
National University of Ireland
Galway

16.2.09

Dear Dr. Matson,

Thank you for your feedback on the attached paper on November 13th 2008.
I would like to submit a revised manuscript based on your comments and recommendations.

Thank you very much for your time and consideration of this paper.
I look forward to hearing from you.

Yours sincerely,

Olive Healy, Ph.D., BCBA

*** Detailed Response to Reviewers**

The following is a list of the changes made to the paper:

1. Despite much effort to address the AB design of this paper, I was not able to gain permission from any school to provide matched participants or a control group. I have therefore addressed this significant limitation in the discussion section (p. 30, L. 12).
2. I have removed all Tables (11) from the paper and added the information into the body of the text (Results Section).
3. I have removed all of the detailed information describing the dependent variables. I simply listed them with their corresponding references (p. 14, L. 7).
4. I have reduced the introduction from 8 pages to 6 pages. I hope that this is a sufficient reduction.
5. I also reduced the text of the discussion. However, with the addition of a paragraph addressing the limitation of the design the amount of text has only changed by half of one page.

Running Head: SIX REPORTS OF INTENSIVE APPLIED BEHAVIOR ANALYSIS FOR CHILDREN WITH ASD

Six reports of children with Autism Spectrum Disorder following intensive behavioral intervention using the Preschool Inventory of Repertoires for Kindergarten (P.I.R.K.®)

Maria McGarrell

Olive Healy

Geraldine Leader

Jennifer O' Connor

National University of Ireland, Galway

Neil Kenny

National University of Ireland, Maynooth

This research was conducted by the first author under the supervision of the second author in partial fulfillment of the requirements for her MA degree in ABA at NUI, Galway.

Correspondence: Olive Healy, Ph.D., School of Psychology, National University of Ireland, Galway, Ireland. Tel: 00353 91581698, Fax: 00353 91 521355, olive.healy@nuigalway.ie

Abstract

The current study presents case reports of 6 children diagnosed with autism spectrum disorder who received intensive applied behavior analysis within the Comprehensive Application of Behavior Analysis to Schooling (CABAS®) system and successfully integrated into mainstream education. The participants' interventions followed curricular objectives from the Preschool Inventory of Repertoires for Kindergarten (PIRK®), an empirically validated assessment tool and curriculum which improves outcomes for children with ASD and prepares for mainstream integration. Each case study presents acquisition of curricular objectives, rates of learning annually and results of independent psychological measures throughout the intensive behavioral intervention. This paper examines the variables (age of treatment onset, duration of treatment, presence of stereotypy or challenging behaviors prior to treatment) which may have influenced the successful integration of these participants into mainstream education settings.

Keywords: autism, intensive behavioral intervention, PIRK®, CABAS®, integration

Six Reports of Children with Autism Spectrum Disorder following Intensive Behavioral Intervention using the Preschool Inventory of Repertoires for Kindergarten (P.I.R.K.®)

Autism Spectrum Disorder (ASD) is characterised by varying degrees of qualitative impairment in social interaction and communication along with restricted repetitive and stereotyped patterns of behavior, interests and activities (American Psychiatric Association DSM-IV-R, 2000). In Ireland ASD has received remarkable levels of public attention due to increased prevalence over the past ten years. The Centres for Disease Control (CDC) published a prevalence rate of ASD in Ireland of 6.7/1000 or a total of 10,419 based on national census figures for children at or under the age of 18 years (CDC, 2007).

To date there are numerous reported treatments of ASD, some empirically validated, many others which are not. It has been reported that parents of children with ASD attempt up to nine different therapies and that at least four of the different therapies being used are based on parent feedback (Goin-Kochel, Myers & MacKintosh, 2007). One of the most widely discussed treatments for children with ASD, largely due to its success, is intensive behavioral intervention (IBI), using Applied Behavior Analysis (ABA).

The effectiveness of behavior change techniques have been well documented. Matson, Benivadez, Compton, Paclawskyj and Baglio (1996) report 251 studies from 1980 to 1996 demonstrating effective behavioral treatment in the areas of social skills, aberrant behavior, academic skills, language and daily living skills. In the USA numerous governmental and private agencies have endorsed ABA as the preferred treatment for children with ASD (e.g. Surgeon-General, 1999; Maine administrators of

Service for Children with Disabilities, 2000; New York State Department of Health, 1999). The New York State Department of Health conducted an extensive 2-year review of the literature concerning young children with autism as part of best practice guidelines. Based on long-term treatment studies with adequate methodology they concluded that ABA possessed the strongest research support. The substantial amount of empirical support for the efficacy of ABA has not been replicated for the numerous alternative therapies and treatments available to those with ASD (Smith, 2005).

Much research has been reported on the effectiveness of early intensive behavioral intervention (EIBI) for children diagnosed with ASD. To date outcome studies have successfully demonstrated improvements in intelligence quotient (I.Q.) measures and other gains in children receiving ABA. In the last 20 years large scale comparison studies have been conducted by many prominent researchers (Eikeseth, Smith, Jahr & Eldevik, 2002; Howard, Sparkman, Cohen, Stanislaw & Green, 2005; Cohen, Amerine-Dickens & Smith, 2006; Eldevik, Eikeseth, Jahr & Smith, 2006; Remington et al. 2007; Eikeseth, Smith, Jahr & Eldevik, 2007; Zachor, Ben-Itzchak & Rabinovich, 2007).

The supportive research for EIBI has provided a general consensus that behaviorally based intervention is a superior means of intervention for children with ASD (Schreibman, 2000). In recent years, early intervention research in the treatment of ASD has focused on questions regarding specific aspects of the intervention. In particular studies are concerned with examining the variables that are likely to attenuate EIBI resulting in a highly cost-effective intervention.

Harris and Handleman (2000) examined intelligence and age of treatment onset as possible predictors for outcome. Their findings indicated that children who were younger and had higher I.Q. scores at intake had better overall outcomes. Additional evidence to support a younger age at onset of treatment comes from research on the plasticity of the brain. Younger children have more neural and behavioral plasticity, which can be influenced by extrinsic factors (Perry, Cohen & De Carlo, 1995). Dawson (2008) describes how ABA has contributed to greater outcomes for children with ASD and has also helped with ameliorating the symptoms among very young children who may be at risk of developing the full syndrome.

Zachor, Ben-Itzchak & Rabinovich (2007) examiined I.Q. as a predictor of improved outcomes. They compared 25 children between 20-32 months of age and who received one year of EIBI. They divided the children into high and low I.Q. groups. Results for the high I.Q. were uniformly better on behaviors such as language and non-verbal behavior.

Studies examining the effects of the intensity of EIBI on intelligence outcomes have revealed diverse results (Gabriels, Hill, Pierce, Rogers & Wehner, 2001). Luiselli, Cannon, Ellis and Sisson (2000), suggest that children in studies improve regardless of the number of treatment hours per week, suggesting that other factors have a greater influence on outcomes. Reed, Osborne and Corness (2006) compared the effectiveness of home-based EIBI as an ASD intervention with a high-intensity (average of 30 hours weekly) group and a low-intensity (average of 12 hours per week) group. Although results showed that the high-intensity EIBI group made generally greater gains on all outcome measures than the lower-intensity group, these differences were not always

statistically significant. This is an important finding as it queries the emphasis placed on the temporal input of the program as key factor in the production of greater outcomes. Although the high-intensity group did show greater gains than the low-intensity group, a within group analysis of the high-intensity EIBI showed an inverse relationship between the temporal input and the overall gains. Further investigation of this finding is warranted.

With regard to duration of EIBI, the literature points towards 2-3 years of intervention for successful outcomes (Green, 1996). However, both Remington et al. (2007) and Howard et al. (2004) showed favourable outcomes following 14 months of behavioural intervention.

Other variables of interest which may predict the effectiveness of IBI in the treatment of ASD include children's level of functioning pre-treatment including presence of stereotypy and challenging behaviors, I.Q. measures and social skills and interests (Eikeseth et al., 2002, 2007; Eledevik et al., 2006; Harris & Handleman, 2000; Remington et al., 2007; Sallows & Graupner, 2005). The level of program supervision is another variable that has been shown to affect outcome (Eikeseth, Hayward,Gale, Gitlesen & Eldevik, 2008). Intensity of supervision by qualified clinicians in ABA was correlated with I.Q. gain in preschool children with ASD.

Treatment fidelity is rarely addressed in the literature but it is a very important factor in treatment outcomes for children with ASD. Symes, Remington, Brown and Hastings (2006) have examined treatment fidelity in EIBI. They highlighted that many factors can affect how accurately a treatment can be carried out. These include initial training, ongoing supervision, and therapist characteristics. Matson and Senatore (1981)

provide a model for assessing the accuracy of the application of behavioral interventions. In addition, Sallows and Graupner (2005) provide an example of assessing treatment fidelity in an early intervention program using video taped sessions and feedback along with written exams on curricula and procedures applied. Greer, Keohane and Healy (2002) describe several key applications within the CABAS® system that are used to ensure accurate applications of behavioral strategies. Some of these applications include: the Teacher Performance/Rate Accuracy Observation Protocol (Ingham & Greer, 1992), use of the learn unit at the student level (Bahadorian, 2000, Greer & McDonough, 1999), supervisor learn units for accurate use of terms (Nuzzola-Gomez, 2002), the CABAS® Decision Protocol (Keohane, 1997; Keohane & Greer, 2005), accurate supervisor learn units for decision protocol training, the use of comprehensive student measurement (Greer, McCorkle, & Williams, 1989; Selinski, Greer, & Lodhi, 1991), teacher performance measurement, supervisor/administrator performance measurement (Greer et al., 1989; Selinski et al., 1991), and the system-wide summary data (Greer et al., 1989; Greer 1997a, 1997b).

ABA treatment programs show varied characteristics in the published literature. However, such programs do share many common features including comprehensiveness in addressing all areas of skill, individualization of programs across curricular domains, a focus on teaching functional repertoires and the reduction of problem behaviors that interfere with learning (Green, Brennan, & Fein, 2002).

There are few empirically validated systems which integrate the goals of teaching children pre-requisite skills, with effective teaching practices. Waddington & Reed (in press) examined the Preschool Inventory of Repertoires for Kindergarten® (PIRK®;

Greer & McCorkle, 2003) as an effective tool for improving outcomes and teaching children a set of pre-requisite skills to prepare them for mainstream education. The PIRK® is a curriculum which has been used to prepare children for mainstream in CABAS® schools in Ireland, UK and the USA. The Comprehensive Application of Behavior Analysis to Schooling (CABAS®) was developed to teach an entire curriculum to students in schools using the application of behavior analysis (Greer et al., 2002). Outcomes from CABAS® schools have been shown to be four to seven times more effective than mainstream approaches to education (Albers & Greer, 1991). In addition, the PIRK® addresses all of the necessary skills for a child to be successful, in the school, home and community (Greer & McCorkle, 2003). Waddington & Reed (in press) investigated whether using the PIRK® resulted in improved outcomes, when compared to a provision that did not use the PIRK® as a curriculum. Overall findings suggest that applying the PIRK® as a curriculum for instruction is key to improved and maximum outcomes for the child.

The paper presents reports of 6 children with ASD who received intensive behavioral intervention within the CABAS® system, followed curricular objectives from the PIRK® (Greer & McCorkle, 2003), and successfully integrated into mainstream education. Each case report tracks the acquisition of the curricular objectives set out in the PIRK® for each of the participants and examines rates of learning per year throughout intensive behavioral intervention. It also examines some of the additional variables (e.g. age of treatment onset, duration of treatment, presence of stereotypy or challenging behaviors) which may have influenced the successful integration of these participants into mainstream education settings.

Method

Participants

Participants were six children aged between 8 years 9 months and 10 years 11 months at the time of case reviews (m= 9 years 4 months). Each participant was diagnosed with ASD and attended a CABAS® school in Ireland. All participants had been assessed using the PIRK® (Greer & McCorkle, 2003), and had individualized education programs based on curricular objectives from the PIRK®. All of the participants successfully integrated into mainstream school settings and no longer receive intensive behavioral intervention.

Inclusion criteria were as follows: (1) Each of the participants were required to meet the criteria for a diagnosis of autism according to the DSM-IV (APA, 1994) diagnosis of ASD, supported by psychometrically reliable and valid measures of intellectual functioning and adaptive behavior; (2) Participants were required to have attended a special school using the CABAS® system for a minimum of 30 hours per week; and (3) Participants were required to have received instruction based on the PIRK® curriculum.

At the time of onset of IBI participants' ages ranged from 3 years 10 months and 6 years (m= 4 years 7 months).

The CABAS® System

The CABAS® model of behavioral education is characterized by a 'systems' approach to teaching. Based on applying the principles of behavioral science to all students in a school, the focus is on teaching small, measurable units of behavior systematically. The CABAS® program develops and maintains quality in schools that

provides a system-wide application of behavior analysis to all of the components of education. This includes protocols to induce pre-requisite verbal developmental cusps, and curricula focused on teaching the skills a child lacks at a given time, followed by more complex skills (Keohane & Greer, 2005; Greer & Ross, 2008). An extensive data base of behavioral research has been used to ensure and maintain quality applications of the system.

According to Healy, O' Connor, Leader and Kenny (2008), participants enrolled in the CABAS® program avail of the following teaching practices: logical and empirically based curricular sequences; functional curricula based on an analysis of verbal behavior across domains; 1:1 teacher/student ratio of instruction with a progression towards small group instruction; logical curricular sequences based on research and educational standards; personalised System of Instruction (PSI) (Keller, 1968); peer tutoring; group instruction (e.g. use of direct instruction curricula and observational learning). A number of key tools are derived from ongoing research and include: the CABAS® Decision Protocol (Keohane, 1997; Greer (revised August 2001); Keohane & Greer, 2005); implementation of a parent education program; system monitoring and staff training (Greer, 1997b); the Teacher Performance/Rate Accuracy Observation Protocol (Ingham & Greer, 1992); and the use of learn unit instruction (Bahadorian, 2000; Greer & McDonough, 1999).

The 'learn unit' which is defined as 'the least divisible component of instruction that incorporates both student and teacher interaction' (Greer, 2002, p.19) is used to teach all skills. It is a three-term contingency, which consists of the antecedent (or discriminative stimulus from the instructor), the behavior (from the student), and the

consequence (reinforcement or correction, from the teacher). Learn units taught to students by curricular area are vital in assessing whether the student is receiving essential and quality instruction.

Treatment Fidelity within the CABAS® System

All special school programmes in CABAS® schools are supervised by an appropriately trained supervisor, who has completed a 'master teacher rank' (CABAS® certification). Supervisors use the TPRA on a daily basis within classroom settings. This measures the accuracy and fidelity of teachers' data as well as their instructional speed and accuracy. The quality of the supervision of program delivery is maintained by close monitoring by doctoral level consultants who are certified by the CABAS® Board of Directors as 'senior research scientists'. Further in-service training in the procedures of ABA is provided by a Board Certified Behavior Analyst (BCBA®). All staff undergo a training program in the form of 'ranks' which teaches them skills in contingency-shaped teaching practices, verbal behaviour about the science and verbally-mediated skills to solve instructional problems in learning. Continual ongoing instruction and monitoring is provided for all instructors within the CABAS® system. A curriculum for the education of professionals, a continual monitoring of the system for maintaining quality applications by professionals, and a motivational system is provided within the entire system to ensure the highest standards of education (Greer, Keohane, & Healy, 2002). Other treatment fidelity measures included the decision analysis protocol, an analysis of system-wide summary data and daily comprehensive student measurement.

The PIRK® Curriculum

The PIRK® (Greer & McCorkle 2003) is comprised of the curricular objectives for teaching the repertoires necessary for a child to be successful in all settings including the home, school and the wider community, (Greer & McCorkle, 2003). In CABAS® schools the PIRK® is used as an assessment tool to provide an analysis of the current level of skills a child presents with. It also identifies the deficits in each repertoire and therefore identifies curricular objectives required. It is based on behavior analysis and pedagogical research and is a criterion-referenced instrument.

The PIRK® is categorised into six repertoires. These include: academic literacy and problem-solving; communication abilities; community of reinforcers; self-management skills; social self-management and physical/motor skills.

The academic literacy repertoire is comprised of objectives in literacy, reading, writing, and mathematical performance, described by Greer (2002) as the 'pillars of literacy'. Greer (2002) argues that such 'pillars of literacy' determine the students' eventual competence in science, social arts, and humanities.

The communication repertoire contains objectives based on the verbal behavior model (Skinner, 1957) and is divided into the listener and speaker repertoires. The listener repertoire teaches 'instructional control', a vital component for all learning. Functional communication is targeted in the objectives of the speaker repertoires. This is an essential component for learning, facilitating more access to reinforcement, often leading to decreases in challenging behaviors (Carr & Durand, 1985) and eventually leading participants to contact learning opportunities in a mainstream setting (Mesibov & Shea, 1996).

The community of reinforcers repertoire is comprised of curricular objectives which are individual responses that should eventually allow the participant to have greater access to reinforcement. These repertoires are skills which include reactions and non-reaction in certain environmental settings.

The self-management for school repertoire contains behavioral skills that a child requires to succeed in a mainstream school environment. Some of the curricular objectives include learning to follow rules, reduction and elimination of inappropriate behaviour, independent living and participation in school activities.

The social self management repertoire is responsible for teaching the social skills that will enable the student to be successful interacting appropriately with others in school, in their home and in their community. This repertoire also targets the reduction and elemination of stereotypy, self-injurious behaviour and aggressive behavior, which is critical for successful integration.

The physical/motor repertoire includes curricular objectives in the following three areas; grapho motor skills (e.g., using a pencil, printing their own name, and drawing simple pictures), classroom tool/manipulative skills (e.g., building blocks, painting, cutting and tying laces) and large muscle movement skills (e.g., hopping, jumping, skipping, catching and cycling a bicycle).

Procedure

All data for the current study were obtained through record review of extant data and interview with the director of education within the CABAS® school. The participants' independent psychological assessments and PIRK® assessments were collated. All PIRK® assessments had been conducted by senior CABAS® staff with a

minimum completion of two training 'ranks'. Consent was given by parents of each of the participants for access to their psychological reports and data for research purposes.

Case Review. A review of participants' psychological reports was conducted to obtain measures of I.Q. test scores, adaptive functioning, and autism severity throughout intervention. All psychological evaluations were conducted by an independent, self-employed educational psychologist registered by the British Psychological Society and qualified in the administration of diagnostic assessment tools. The measures contained in the psychological reports included some of the following assessments for each participant; the Bayley Scales of Infant Development (Bayley,1993), the British Ability Scales-II – General Conceptual Ability and I.Q. (Elliott, Smith, & McCulloch, 1996), the Stanford-Binet Intelligence Scales (Roid, 2003), the Weschler Preschool and Primary Scale of Intelligence (Weschler, 1989), the Reynell Developmental Language Scales (Reynell & Gruber, 1990), the Vineland Adaptive Behavior Scales (Sparrow, Balla & Cicchetti, 1998), the Gilliam Autism Rating Scales (Gilliam, 1995), the Autism Spectrum Screening Questionnaire (Ehlers, Gillberg & Wing, 199) the Peabody Picture Vocabulary Test (Dunne, 1965) and the Beery Developmental Test of Visual-Motor Integration (Beery, 1982).

Interviews were conducted in the participants' school to obtain additional background information, participant characteristics and further key outcome variables. Staff members acted as informants by providing the information required for each participant. Informants were required to have a minimum of one year of experience working with a participant.

Evaluation of Rates of Learning. Each of the participants' individual PIRK® assessments were obtained from the CABAS® school. Rates of learning per year were calculated for each participant from these assessments. For all of the participants, except Participant 3, the revised version of the PIRK® (Greer & McCorkle, 2003) was used. This version consists of 266 long term objectives (LTO's) and is categorized into six curricular areas. Each LTO contains a number of sub-objectives. In total, the 266 LTO's contained in the PIRK® can be broken down into 500 sub-objectives. These are divided by category as follows; the academic literacy repertoire – 236 sub-objectives, the communication repertoire – 101 sub-objectives, the community of reinforcers repertoire – 25 sub-objectives, the self-management for school repertoire – 43 sub-objectives, the social self-management repertoire – 38 sub-objectives, and the physical/motor development repertoire – 57 sub-objectives.

Participant 3 was assessed using the original version (Greer, McCorkle & Twyman, 1996). The format is identical to the revised version in 2003 except with a difference in the number of LTO's and sub-objectives contained in each category. The 2002 version of the PIRK® includes 254 LTO's which can be broken down into 374 sub-objectives. These differences are in the following three categories; the academic literacy repertoire which has 147 sub-objectives, the communication repertoire which has 81 sub-objectives, and the physical/motor development repertoire which contains 40 sub-objectives.

Baseline PIRK® assessments were conducted at the outset of IBI programs for all participants. Baseline assessment data for Participant 3 were not available to the experimenter at the time of case review. Year 1 contained data up to 12 months from

when the participant began their IBI program. Year 2 contained data from month 13 to month 24, and year 3 contained data from month 25 to month 36.

The acquisition dates of each sub-objective were recorded per year for each participant. Overall rates of learning per year were calculated by totalling the number of sub-objectives acquired during that year, dividing the total by 500 and multiplying by 100, to calculate a percentage of objectives acquired out of the possible total 500. For Participant 3 the total number of sub-objectives were divided by 374 and multiplied by 100, to calculate a percentage of objectives acquired during that year, out of the possible total 374 sub-objectives in the 2002 version of the PIRK®.

Percentages were also calculated for each individual to show rates of learning in each of the six categories of the PIRK®. These were calculated by totalling the number of sub-objectives acquired in a given year, dividing that number by the total number of sub-objectives in that category and multiplying by 100.

Results

The ages at intervention onset ranged from 3 years 10 months to 6 years with an average age of 4 years 9 months (SD = 1year). The ages of participants at the outset of teacher/student ratio fading, ranged from 6years to 9 years 5 months with an average age of 8 years (SD = 1year 4months). The age of participants at the end of their IBI program (i.e. the start of full independent integration into mainstream classes) ranged from 8 years 3 months to 10 years 11 months with an average age of 9 years 4 months (SD = 1year).

Following record review and interviews with school staff, it was also reported that none of the participants had any co-morbid disorders, and each of the participants'

parents received ABA training from the CABAS® School. In addition, none of the participants were on any long-term prescribed medication during IBI.

The duration of IBI in a 1:1 setting ranged from 1 year to 4 years 6 months, and the average duration in this setting was 3 years 4 months (SD = 1 year 4 months). The duration of intervention spent fading the assistance of a 1:1 teacher/student ratio ranged from 9 months to 1 year 11 months, with an average of 1 year 5 months (SD = 6 months). The total duration of the intervention for participants ranged from 2 years 10 months to 5 years 10 months, with an average of 4 years 8 months (SD = 1 year 1 month).

Case Reviews

Participant 1. Participant 1 received a diagnosis of ASD at 3 years 4 months. At that time a General Conceptual Ability Score on the British Ability Scales II of 72 was achieved. At 5 years 3 months, the participant received an I.Q. score of 99 on the British Ability Scales II, an adaptive behavior composite of 67 on the Vineland Adaptive Behavior Scales, and an Autism Quotient of 82 on the GARS. At 6 years 5 months the 5 sub-scales of the BAS-II were administered showing advances in cognitive skills (e.g., age equivalent 6 years 4 months).

The participant was 3 years 10 months old at the onset of the IBI program. At this time he used the Picture Exchange Communication System (PECS) to communicate in two word phrases. At the time of fading 1:1 teacher/student ratio the participant was vocal verbal and spoke using complex sentences.

According to analysis of PIRK® scores and reports from school staff, Participant 1 exhibited high intensity of vocal stereotypy during the IBI program. Assessments showed the stereotyped behavior to be of low intensity at the time of fading 1:1

teacher/student ratio. At the initial stages and during IBI, it was also reported that the participant displayed high intensity challenging behavior in the form of physical assaults directed at adults and peers and also verbal assaults directed at adults. At the time of fading 1:1 teacher/student ratio no further incidences of challenging behavior were reported. The participant currently attends a mainstream class with typical peers.

Participant 2. A diagnosis of ASD was recorded in 2002 at age 2years 11months. At this time Participant 2 was functioning at 14 months (ratio I.Q.= 40) on the Bayley Scales of Infant Development and an demonstrated an overall Adaptive Behavior Composite of 54 (age equivalent 13 months) on the Vineland Adaptive Behavior Scale. The participant received three further assessments. At 4 years 11 months he was assessed using the BAS-II and scored a General Conceptual Ability of 96. At this time he scored an overall Adaptive Behavior Composite of 64. An assessment using the GARS showed an Autism Quotient of 90 which placed him in the moderate range of the autism spectrum. At 5 years 10 months, Participant 2 scored a General Conceptual Ability of 99, an Adaptive Behavior Composite of 65, and an Autism Quotient of 83 which placed him in the mild-moderate range of the autism spectrum. At age 7 years 2 months Participant 2 scored a General Conceptual Ability of 101, an Adaptive Behavior Composite of 70, and an Autism Quotient of 80 which placed him in the mild range of the autism spectrum.

The participant was 3 years 4 months old at the onset of IBI treatment. At this time he used PECS to communicate and was able to form two word phrases. At the time of fading 1:1 teacher/student ratio the participant was vocal verbal and spoke using complex sentences.

According to analysis of PIRK® assessments and reports from school staff, when the participant began the IBI program he exhibited high intensity of vocal and physical stereotypy. Following intervention and at the time of integration within the mainstream setting, the participant no longer exhibited any form of stereotypy. It was also reported that the participant displayed high intensity challenging behavior in the form of physical assaults at the outset of the program. At the time of fading 1:1 teacher/student ratio the participant no longer exhibited physical assaults but continued to exhibit challenging behavior in the form of verbal assaults. However, intervention continued and when fading 1:1 teacher/student ratio was complete and the participant was integrated fully into his mainstream class he no longer exhibited any form of challenging behavior.

Participant 3. Participant 3 received a diagnosis of ASD at 3 years 8 months. At 5 years 5 months he was assessed on the Stanford-Binet Intelligence Scales and he scored within the low end of the average range of ability. At 5 years 9 months an I.Q. test score of 93 on the BAS-II was recorded and an Adaptive Behavior Composite of 49 on the Vineland Adaptive Behavior Scales which was severely delayed for his age. An Autism Quotient was calculated at 80 on the GARS. This placed the participant in the mild-moderate range of the autism spectrum. A follow-up assessment was conducted at 9 years 5 months. At the time of this assessment the participant scored an Adaptive Behavior Composite of 88 and a General Conceptual Ability score of 100. These scores placed him within the average range for his age.

The participant was 5 years 2 months old at the onset of IBI treatment. The participant emitted vocal verbal behavior in the form of two word phrases and did not use

any other methods of communication. At the time of fading 1:1 teacher/student ratio the participant spoke using complex sentences.

According to analysis of PIRK® scores the participant did not exhibit any form of stereotypy during IBI. The participant did however exhibit challenging behavior in the form of verbal and physical assaults on peers and adults. At the time of fading 1:1 teacher/student ratio no further incidences of challenging behavior were reported. This participant is currently fully integrated in a mainstream class with same age peers.

Participant 4. At 3 years 8 months results from the WPPSI-R and the Stanford-Binet Intelligence Scales suggested functioning in the exceptionally low range of ability. The participant's Adaptive Behavior Composite was 58 (age equivalent = 2:1). At 5 years 2 months, Participant 4 received a follow-up psychological assessment. An I.Q. test score of 98 on the BAS-II and an Adaptive Behavior Composite of 60 (age equivalent = 2:9) were recorded. At the time of this assessment an Autism Quotient was calculated at 100 on the GARS which demonstrated a moderate degree of autism. A follow-up assessment was conducted at 7 years 8 months. Participant 4 scored a General Conceptual Ability of 92, an Adaptive Behavior Composite of 73 and an Autism Quotient of 83 which demonstrated a mild to moderate degree of autism. The final assessment was at 8 years 10 months. A General Conceptual Ability of 103 placed him within the average intelligence range. An Adaptive Behavior Composite score of 78 was recorded and an Autism Quotient of 80 was calculated which determined a mild degree of autism and represented a significant reduction in stereotypical behaviors.

Participant 4 was 4 years 10 months old at the onset of IBI treatment. The participant emitted sentences of 3-5 words using vocal verbal behavior and at the time of fading 1:1 teacher/student ratio the participant spoke using complex sentences.

According to analysis of PIRK® assessments and reports from school staff, when the participant began IBI he exhibited low intensity of vocal and physical stereotypy. This stereotypy was exhibited in the form of hand flapping and vocalizations. The participant also displayed high intensity challenging behavior in the form of physical and vocal assaults at the beginning of the IBI program. Following fading 1:1 teacher/student ratio and on the full integration of the participant into the mainstream setting, zero levels of challenging behavior were recorded.

Participant 5. At 5 years 1 month the participant was assessed on The Reynell Developmental Language Scales demonstrating a skills profile at the 30 months level of development. Assessments were conducted using the BAS-II and a General Conceptual Ability Score of 63 indicating an overall functioning in the low ability range was recorded. At 8 years 1 month the participant was re-assessed using the BAS-II. A General Conceptual Ability score was calculated at 101 and an Adaptive Behavior Composite Score of 90 on the Vineland Adaptive Behavior Scales was recorded. At 9 years 2 months, the participant's General Conceptual Ability was calculated at 105 and an Adaptive Behavior Composite from this assessment was calculated as 92 which falls within the average range for the participant's age.

The participant was 6 years old at the onset of IBI treatment and emitted sentences of 3-5 words using vocal verbal behavior. At the time of fading 1:1

teacher/student ratio the participant spoke using complex sentences which included in excess of 6 words per sentence.

According to analysis of PIRK® scores and reports from school staff, at the onset of the IBI program, Participant 5 emitted high rates of and intensive stereotypy in the form of hopping and hand flapping. In addition, the participant emitted intensive challenging behavior at the outset of IBI. This behavior was both vocal and physical in form and included physical and object assaults directed at both adults and peers. Following a fading of 1:1 teacher/student ratio no further incidences of challenging behavior were reported. The participant is currently fully integrated in a mainstream setting with same age peers.

Participant 6. At 4 years, results from the WPPSI-R suggest cognitive functioning within the low average range. In addition, Participant 6 was assessed using the ASSQ with 67% of responses on this questionnaire indicating ASD.

At 4 years 5 months, the participant was assessed using the BAS–II. General Conceptual Ability Score was in the Low Average range of ability overall (at the 12th percentile relative to his age group). At 4 years 9 months, this participant was assessed using the Reynell Developmental Language Scales. Results from this assessment show a raw score of 47 (age equivalent = 3:10) on the comprehension scale, and a raw score of 31 on the expressive scale (age equivalent 3:11). At this time he was also assessed using the Vineland Adaptive Behavior Scales. The participant's Adaptive Behavior Composite was calculated at 68 (age equivalent = 3:0). At 6 years 9 months, a follow-up assessment using the Vineland Adaptive Behavior Scales was conducted and a score on the Adaptive Behavior Composite of 75 was obtained which indicated the participant was mildly

delayed for his age. A General Conceptual Ability score was calculated at 107. At 7 years 9 months the participant was re-assessed using the BAS-II and the Vineland Adaptive Behavior Scales. A General Conceptual Ability score was calculated as 100; the Vineland produced a score of 101 in the communication domain, 99 in the daily living skills domain and 75 in the socialization domain.

Participant 6 began IBI at 5 years 3 months. He was vocal verbal and spoke using complex sentences of 6+ words. According to analysis of PIRK® scores and reports from school staff, at the outset of IBI Participant 6 exhibited low intensity stereotypy in the form of vocalizations. At the time of fading 1:1 teacher/student ratio the stereotypy behavior was at zero levels. The participant did not exhibit challenging behavior before or during intervention. The participant is currently fully integrated in a mainstream setting with typical peers.

Rates of Learning

Insert Figure 1 here

Figure 1 displays baseline assessments and the rates of learning per year for each participant based on results from PIRK® assessments. Percentages of objectives acquired from the PIRK® are shown for Participants 1, 3, 4, and 5 over three years, and for Participant 2 and 6 over two years.

Participant 1 presented with 2% of curricular objectives at baseline PIRK® assessment. At the end of Years 1, 2 and 3 acquisition of 44%, 82% and 88% of objectives were acquired respectively.

Participant 2 presented with 0% curricular objectives at baseline PIRK® assessment. At the end of Years 1, and 2, acquisition of 37% and 52% of objectives were acquired respectively.

Records of baseline PIRK® assessments for Participant 3 were not available to the experimenter. However, the experimenter did have access to all other PIRK® assessments for this participant. At the end of Years 1, 2 and 3 Participant 3 had acquired 26%, 57% and 64% of curricular objectives contained in the PIRK®.

Baseline PIRK® assessment for Participant 4 demonstrated an acquisition of 20% of curricular objectives at the outset of the IBI program. At the end of Year 1 41% of curricular objectives were acquired. Following Years 2 and 3, 79% and 94% of curricular objectives were acquired respectively.

For Participant 5, baseline PIRK® assessment displayed 33% of curricular objectives of the PIRK®. At the end of Year 1, 2 and 4 he had acquired 75%, 87% and 90% of curricular objectives respectively.

Participant 6 presented with 7% of curricular objectives at the start of the IBI program. Following Years 1 and 2 he had acquired 82% and 90% of curricular objectives contained in the PIRK®.

The mean acquisition of PIRK® objectives for all participants for the first year of intervention was 41% (SD = 18.9%), the mean acquisition of curricular objectives following two years of intervention was 64% (SD = 13.6%) and the mean acquisition of curricular objectives following 3 years of intervention was 70% (SD = 12.6%).

Figure 2 shows the rates of learning for each of the participants across the six PIRK® categories.

Insert Figure 2 here

For Participant 1, the percentage of curricular objectives acquired at the time of baseline assessment, ranged from 0% to 5% across each of the categories with the participant receiving highest scores in the Physical/Motor Development Repertoire, and scoring 0% in the Community of Reinforcers Repertoire, the Self-Management for School Repertoire, and the Social Self-Management Repertoire. At the time of this participants' assessment in Year 3, his scores ranged from 71% to 100%, with the participant acquiring all curricular objectives in the Community of Reinforcers Repertoire and 71% of curricular objectives in the Social Self-Management Repertoire.

For Participant 2, the percentage of curricular objectives acquired at the time of baseline assessment was 0% across all PIRK® categories. At the end of Year 2, the range of scores for Participant 2 across categories was calculated at 26% to 92%. The participants' lowest percentage acquisition of 26% of curricular objectives was in the Social Self-Management Repertoire and the category in which he achieved the highest percentage of curricular objectives was Community of Reinforcers Repertoire.

The experimenter did not have access to baseline assessments for Participant 3. The range of percentage curricular objectives acquired across categories in Year 3 was 53% to 73%. The participant acquired 53% of curricular objectives in the Self-Management for School Repertoire and 73% of curricular objectives in the Academic Literacy Repertoire.

For Participant 4, the percentage of curricular objectives acquired at the time of baseline assessment, ranged from 0% to 33% across each of the categories with the participant receiving highest percentage acquisition rates the Academic Literacy Repertoire, and scoring 0% in the Social Self-Management Repertoire. Assessments conducted at the end of Year 3 demonstrated an acquisition rate that ranged from 88% to 100%, with the participant acquiring all curricular objectives in the Community of Reinforcers Repertoire and 88% of curricular objectives in the School Self-Management Repertoire.

At the time of baseline assessment, the percentage of curricular objectives acquired across categories for Participant 5 ranged from 8% to 38%. The participant's lowest score of 8% was within the Community of Reinforcers Repertoire and the participants' highest score of 38% was in the Communication Repertoire. Percentages of curricular objectives acquired across categories at the end of Year 3, ranged from 61% to 99%. The higher score of 99% was obtained in the Academic Literacy Repertoire, and the lowest score of 61% was recorded in the Social Self-Management Repertoire.

For Participant 6, at the time of baseline assessment, percentages of curricular objectives acquired across categories ranged from 0% to 14%. The higher score of 14% was in the Communication Repertoire. The participant did not meet any of the curricular objectives from the Community of Reinforcers Repertoire, the Self-Management for School Repertoire, the Social Self-Management Repertoire, or the Physical/Motor Development Repertoire. At the end of Year 2 the percentage scores across the curricular areas for Participant 6, ranged from 87% to 100%. The higher score of 100% was shown

in the Community of Reinforcers Repertoire, and the lowest score of 87% was in the Academic Literacy Repertoire.

Discussion

The participants presented in this study all successfully integrated into full-time mainstream education after a 3-4 year period of intensive behavioral intervention. Each of the participants showed gains in both I.Q. test scores and scores on adaptive behavior scales. Inclusion criteria assured that each of the participants met diagnostic criteria for ASD prior to the onset of IBI. Though no causal inferences can be made, the outcomes presented and the clinical descriptions of the progress of children with ASD, particularly integrating into mainstream education environments and achieving gains in cognitive abilities, are extremely important. The current data demonstrates that these outcomes are possible for children with ASD, and that IBI, in particular the use of the PIRK® as an assessment tool and curriculum for preparation for mainstream education, helps to promote such outcomes. In addition, the data from the six participants in the current study contributes multi-dimensional information about the range of outcomes in specific curricular areas following intensive behavioral intervention employing the CABAS® system.

The data reported in this study supports the hypothesis that intensive applied behavior analysis for children with ASD results in substantial improvements in a range of areas. With regard to the participants reported in this particular study, it allowed them to integrate into a less supported learning environment, where they now access education with ‘typical’ same-age peers in a mainstream educational setting. The data also supports the hypothesis that intensive applied behavior analysis successfully decreases

inappropriate behavior and increases functional communication. Four of the five participants who exhibited stereotypy and challenging behavior showed complete elimination of these behaviors as reported in PIRK® assessments and confirmed by interviews with staff. The remaining participant showed a reduction from high to low intensity of these types of behaviors. With regard to communication each of the participants showed an increase in communication levels as reported in PIRK® assessments and, in addition to this both Participants 1 and 2 who initially used an augmentative form of communication at the outset of intervention, were no longer using this as their method of communication at the end of their program.

The average age of IBI onset in this study was 4 years 7 months. Fenske, Zalenski, Krantz & McClannahan, (1985) report that between 40% and 60% of children who had begun behavioral therapy before reaching the age of five improved to the point where they could be enrolled in public schools. Research has shown that the application of behavioural techniques is optimally effective when commenced with children between the ages of 2 and 5 years (Ramey & Ramey, 1998). Interestingly, three of the participants in this study began IBI after the age of 5 years. Further research is required in this area to determine the age for optimal effectiveness and how this interacts with other variables such as repertoires present pre-intervention.

It is important to note that the participants in this case study received only one additional therapy (occupational therapy) for the treatment of ASD other than the CABAS® intervention. There are many treatments available to parents that lack empirically derived and experimental research to demonstrate any effectiveness. Such treatments are very common in special education programs. In recent years the ‘eclectic’

model of education to the treatment of autism has gained popularity with numerous international governments. This model involves a multi-skills approach where a range of teaching methods are available e.g., Treatment and Education of Autistic and Related Communication Handicapped Children (TEACCH), Speech and Language Therapy, Occupational Therapy, Auditory Integration Therapy, Applied Behavior Analysis (ABA), Picture Exchange Communication System (PECS) etc. However, research to date demonstrates that behavioral interventions must constitute the primary and fundamental methodological framework in the treatment of autism (Remington et. al., 2007). The case reviews reported in this study have demonstrated significant gains in intellectual functioning, communication skills, adaptive behavior, and social skills. In addition, significant reductions in autism severity and challenging behaviors were demonstrated without the implementation of multiple therapies that are not empirically supported.

Accuracy of the implementation of behavioral applications was monitored closely throughout the intervention reported in this paper. Recent research has demonstrated the importance of supervision from highly trained behavior analysts as a factor in outcome data for the treatment of autism using Applied Behavior Analysis (Eikeseth et al. in press). Treatment fidelity measures through intensive supervision are an integral component of the CABAS® system. Program supervision by qualified behavior analysts with extensive experience in the application of behavior change procedures was evident for the duration of intervention. The CABAS® system applies a 'pyramid' training protocol with each layer of supervision ensuring mentorship and ongoing professional development across the entire staff body. The quality of the training program delivered to staff resulted in expected standards and continued improvement in the quality of the

professional service delivered to students and parents. This particular variable may have contributed to the outcomes reported and the rapid acquisition rates of curricular objectives across participants.

The results presented in this study add further support to the use of the PIRK® as a tool for preparing children for mainstream (Waddington & Reed, in press) and for improving rates of skill acquisition (Pérez-González & Williams, 2006). Waddington & Reed (in press) found that undergoing an educational program using the PIRK® lead to improvements in overall behavior and mainstreaming social skills in children with ASD, and consequently that the PIRK® was conducive to improved child outcomes, both in mainstream, and in special schools. The PIRK® was identified as a valid tool in the preparation for mainstream placement and education.

A significant short-coming of the current study involves the lack of either a comparison or control group. The nature and limitations of case reports to inform the literature in ABA have been previously documented. For example, Butter, Mulick, and Metz (2006) refer to the financial and ethical dilemmas in the implementation of a controlled study of the effectiveness of behavioral intervention. In the absence of a comparison group it may be argued that the outcomes reported in the present study may have been achieved based on the course of child development over time. However, case study reports can be valid when they include extensive baseline measures of each participant's repertoire prior to intervention; baseline and follow-up measures by an independent psychologist that provide objective measurement of treatment effects repeated over extended periods of time along with corroboration of diagnosis; intensive applied behaivor analysis is introduced systematically across many repertoires of

behaviours producing methodical improvements in skill areas over a period of time (Green, Brennan & Fein, 2002; Healy et al. 2008). The current study adheres to each of these important features in reporting outcomes for participants.

Another possible limitation is that the measures of I.Q. test scores and adaptive behaviors were not uniform for each of the participants in the study. Different measures were used across participants and these measures were taken at different intervals during intervention. Matson (2007) argues that varying I.Q. tests from pre- to post- test is problematic for the interpretation of outcome comparisons. However, given changes across time in skill areas such as language and cognition, increasingly complex tests are required to assess improvements in many areas of testing. The continuity of pre- and post- assessments to evaluate different skill levels was not controlled for in this study as such measures were reviewed as extant data within the participants' records. Further controlled studies, using the same standardized measures for each of the participants could look at the role that I.Q. test scores play as a predictor of successful outcomes.

This study provided an analysis of presence of stereotyped patterns of behavior and challenging behavior at pre- and post- intervention. Measures within the social self-management repertoire of the PIRK® along with anecdotal information gathered from informants provided evidence of the presence or absence of such behaviors. No additional use of behavior rating scales as a measure of these behaviors were available in participant records. Matson (2007) argues that while it is important to provide measures of changes in core symptoms of ASD, it is also important to provide a measure of challenging behavior over time, as such behaviors can be incapacitating in ASD.

The use of secondary data analysis in this study may also have been a potential limitation. Although the PIRK® assessments were administered throughout the intervention by senior CABAS® staff, with a minimum of two years experience and the completion of two training ranks, such secondary data relies on the accuracy of data collectors outside of the research investigation. The use of secondary data analysis is relevant when examination of extant data is necessary for the issue under investigation.

There are many interesting questions to be posed about possible relationships between some of the variables documented here and the successful outcomes of the participants, both with regard to the rate of acquisition of PIRK® objectives, increases in cognitive ability, as well as successful integration to a mainstream environment. Future research in the form of a controlled group study is needed to look at the impact of these variables on the use of the PIRK® and the CABAS® system, and to demonstrate causal inferences on successful outcomes, as well as the maintenance of these outcomes for participants in mainstream settings.

References

Albers, A., & Greer, R. D. (1991). Is the three term contingency trial a predictor of effective instruction? *Journal of Behavioral Education*, *1*, 337-354.

American Psychiatric Association (2000). DSM-IV-TR. Diagnostic and Statistical Manual of Mental Disorders. Fourth Edition. Text Revision. Washington, DC.: American Psychiatric Association.

Bahadorian, A. J (2000). *The effects of learn units on the achievement of students in two university courses*. (Doctoral Dissertation, Columbia University). Abstract from: UMI Proquest Digital Dissertations [on-line].

Bayley, N. (1993). *Bayley Scales of Infant Development: Second Edition.* San Antonio, TX: The Psychological Corporation.

Beery, K. (1982). *Revised administration,scoring, and teaching manual for the Developmental Test of Visual-Motor Integration.* Chicago: Follett.

Butter, E.M., Mulick, J.A., & Metz, B. (2006). Eight case reports of learning recovery in children with pervasive developmental disorders after early intervention. *Behavioral Interventions, 21,* 227-243.

Carr, E. G., & Durand, V. M. (1985). Reducing behavior problems through functional communication training. *Journal of Applied Behavior Analysis, 18,* 111–126.

Centers for Disease Control and Prevention (CDC, 2007). Prevalence of Autism Spectrum Disorders- Autism and Developmental Disabilities Monitoring Network, 14 Sites, United States, 2002. *Morbidity and Mortality Weekly Report, Surveillance Summaries* (February 9).

Cohen, H., Amerine-Dickens, M., & Smith, T. (2006). Early intensive behavioral

treatment: Replication of the UCLA model in a community setting. *Journal of Developmental and Behaivoral Pediatrics, 27*(2).

Dawson, G. (2008). Early behavioral intervention, brain plasticity, and the prevention of autism spectrum disorder. *Development and Psychopathology, 20,* 775-803.

Dunne, L. M. (1965). *Peabody Picture Vocabulary Test*. Circle Pines, Minnesota: American Guidance Service, inc.

Ehlers, S., Gillberg, C., Wing, L. (1999). Autsim Spectrum Screening Questionnaire (ASSQ). *Journal of Autism and Developmental Disorders, 29,* 129-141.

Eikeseth, S., Hayward, D., Gale, C., Gitlesen, J.P., Eldevik, S. (in press). Intensity of supervision and outcome for preschool aged children receiving early intensive behavioral interventions: A preliminary study. Research in Autism Spectrum Disorders.

Eikeseth, S., Smith, T., Jahr, E., & Eldevik, S. (2002). Intensive behavioral treatment at school for 4- to 7-year-old children with autism: A one-year comparison controlled study. *Behavior Modification, 26*, 49–68.

Eikeseth, S., Smith, T., Jahr, E., & Eldevik, S. (2007). Intensive behavioral treatment at school for four to seven year old children with autism: A one-year follow up. *Behavior Modification, 31(3),* 264-278.

Eldevik, S., Eikeseth, S., Jahr, E., & Smith, T. (2006). Effects of low-intensity behavioral treatment for children with autism and mental retardation. *Journal of Autims and Developmental Disorders, 36* (2), 211-224.

Elliott, C. D., Smith, P. & McCulloch, K. (1996). *British Ability Scales II.* Windsor: NSER-Nelson.

Fenske, E.C., Krantz, P.J., & McClannahan, L. E. (2001). Incidental teaching: A not-discrete-trial teaching procedure. In C. Maurice, G. Green, & R. M. Foxx (Eds.), *Making a difference: Behavioral intervention for autism* (pp. 75-82). Austin, TX: Pro-ed.

Gabriels, R. L., Hill, D. E., Pierce, R. A., Rogers, S. J. & Wehner, B. (2001). Predictors of treatment outcome in young children with autism: A retrospective study. *Autism, 5,* (4), 407-429.

Gilliam, J. E. (1995). *Gilliam Autism Rating Scale.* Austin, TX: Pro-Ed.

Goin-Kochel, R. P., Myers, B. J., & MacKintosh, V. H. (2007). Parental reports on the use of treatments and therapies for children with autism spectrum disorders. *Research in Autism Spectrum Disorders, 1,* 195–209.

Green, G. (1996). Early behavioral intervention for autism: What does research tell us? In C. Maurice (Ed.), G. Green, & S. Luce (Co-Eds.), *Behavioral intervention for young children with autism: A manual for parents and professionals* (pp. 29–44). Austin, TX: PRO-ED.

Green, G., Brennan, L. C. & Fein, D. (2002). Intensive behavioral treatment for a toddler at high risk for autism. *Behavior Modification, 26,* 69-102.

Greer, R. D. (1997a). The crisis in education: Contributing factors and solutions. In B Thyer & R. Mattaini, (Eds.). *Problems in society and solutions from the science of behavior*. Washington, D. C.: American Psychological Association.

Greer, R. D. (1997b). Acting to save our schools (1984-1994). In J. Cautela, & W. Ishaq (Eds.). *The science of behavior and the human condition.* New York: Praeger.

Greer, R. D. (revised August 2001). The CABAS® Cork Decision Protocol.

Unpublished manuscript. Columbia University Teachers College.

Greer, R. D. (2002). *Designing teaching strategies: An applied behavior analysis systems approach.* New York: Academic Press.

Greer, R. D., Keohane, D. D. & Healy, O. (2002). Quality and applied behavior analysis. *The Behavior Analyst Today, 3 (2),* 120-132.

Greer, R. D. & McCorkle, N. (2003). *Preschool inventory of repertoires for kindergarden (PIRK).* Yonkers, NY: CABAS® and the Fred S. Keller School.

Greer, R. D., McCorkle, N., & Twyman J. (1996). *Preschool inventory of repertoires for kindergarten.* Yonkers, NY: Fred S. Keller School.

Greer, R.D., McCorkle. N. P., & Williams, G. (1989). A sustained analysis of the behaviors of schooling. *Behavioral Residential Treatment, 4,* 113-141.

Greer, R. D., & McDonough, S. H. (1999). Is the learn unit the fundamental measure of pedagogy? *The Behavior Analyst, 20*. 5-16.` `

Greer, R. D., & Ross, D. (2008). *Verbal behavior analysis: Developing and expanding verbal capabilities in children with language delays.* Boston: Allyn & Bacon/Merryl.

Harris, S. L., & Handleman, J. S. (2000). Age and I.Q. at intake as predictors of placement for young children with autism: A four- to six-year follow-up. *Journal of Autism and Developmental Disorders, 30,* (2), 137-142.

Healy, O., O' Connor, J., Leader, G. & Kenny, N. (2008). Three years of intensive applied behavior analysis: A case study. *Journal of Early and Intensive Behavior Intervention, 5,* (1), 4-23.

Howard, J. S., Sparkman, C. R., Cohen, H. G., Green, G., & Stanislaw, H. (2005). A Comparison of behavior analytic and eclectic treatments for young children with autism. *Research in Developmental Disabilities, 26,* 359–383.

Ingham, P., & Greer, R. D. (1992). Changes in student and teacher responses in observed and generalized settings as a function of supervisor observations. *Journal of Applied Behavior Analysis, 25,* 153-164.

Keller, F. S. (1968). Goodbye teacher… *Journal of Applied Behavior Analysis, 1*, 79-90.

Keohane, D. D. (1997). A functional relationship between teachers' use of scientific rule governed strategies and student learning. Unpublished doctoral dissertation. Columbia University.

Keohane, D. D. & Greer, R. D. (2005). Teachers' use of a verbally governed algorithm and student learning. *International Journal of Behavioral and Consultation Therapy, 1,* 249-268.

Luiselli, J. K., Cannon, B. O., Ellis, J. T., & Sisson, R. W. (2000). Home-based behavioral intervention for young children with autism/pervasive developmental disorder. *Autism, 4,* (4), 426-438.

Maine Administrators of Service for Children with Disabilities (2000). Report of the MADSEC autism task force. Manchester, ME: Author. (Available online at www.madex.org).

Matson, J.L. (2007). Determining treatment outcome in early intervention programs for autism spectrum disorders: A critical analysis of measurement issues in learning based interventions. *Research in Developmental Disabilities, 28*, 207-218.

Matson, J. L., Benavidez, D., Compton, L., Paclawskyj, J. & Baglio, C. (1996). Behavioral treatment of autistic persons: A review of research from 1980 to the present, *Research in Developmental Disabilities 17***,** 433–465.

Matson, J. L & Senatore, V, (1981). A comparison of traditional psychopathology and social skills training for improving interpersonal functioning of mentally retarded adults. Behavior Therapy, 12, 369-382.

Mesibov, G. & Shea, V. (1996). Full inclusion and students with autism. *Journal of autism and developmental disorders, 26,* (3), 337-346.

New York State Department of Health, Consensus Panel (1999). Clinical Practice Guideline: The Guideline Technical Report. Autism/Pervasive Developmental Disorders, Assessment and Intervention for Young Children (Ages 0-3 Years), no. 4217, NYS Department of Health, Albany, NY.

Nuzzola-Gomez, R. (2002). *The Effects of Direct and Observed Supervisor Learn Units on the Scientific Tacts and Instructional Strategies of Teachers*. Unpublished Doctoral Dissertation, Columbia University, New York, NY.

Pérez-González, L.A. & Williams, G. (2006). Comprehensive program for teaching skills to children with autism. *Psychology in Spain, 10*, No. 1, 37-51.

Perry, R., Cohen, I. & De Carlo, R. (1995). Case study: Deterioration, autism, and recovery in two siblings, *Journal of the American Academy of Child and Adolescent Psychiatry 34***,** 232–237.

Ramey, C.T. & Ramey, S.L. (1998). Early intervention and early experience, AmericanPsychologist February, 109–120.

Reed, P., Osborne, L. A., & Corness, M. (2007). The real-world effectiveness of early teaching interventions for children with autism spectrum disorder. *Exceptional Children*, *73*, 1-18.

Remington, B., Hastings, R. P., Kovshoff, H., Espinosa, F. D., Jahr, E., Brown, T., Alsford, P., Lemaic, M. & Ward, N., (2007). A field effectiveness study of early intensive behavioral intervention: Outcomes for children and their parents after two years, *American Journal of Mental Retardation, 112*, (6), 418-439.

Reynell, J. K., & Gruber, G.P. (1990). *Reynell developmental language scales.* Los Angeles: Western Psychological Services.

Roid, G. H. (2003). *Stanford-Binet Intelligence Scales, Fifth Edition.* Itasca, IL: Riverside Publishing.

Sallows, G. & Graupner, G. (2005). Intensive behavioral treatment for children with autism. *American Journal on Mental Retardation, 110*, 417-438.

Schreibman, L. (2000). Intensive behavioral/psychoeducational treatments for autism: Research needs and future directions. *Journal of Autism and Developmental Disorders, 30,* 373–378.

Selinske, J., Greer, R. D., & Lodhi, S. (1991). A functional analysis of the comprehensive application of behavior

Skinner, B. F. (1957). *Verbal behavior.* New York: Appleton-Century-Crofts.

Smith, T. (2005). The appeal of unvalidated treatments. In J.W. Jacobson, R.M. Foxx,& J.A Mulick (Eds.). *Controversial Therapies for Developmental Disabilities.* New Jersey: Lawrence Erlbaum Associates, Inc.

Sparrow, S., Balla, D. & Cicchetti, D. (1998). *The Vineland Adaptive Behavior Scales.* Circlepines American Guidance Service.

Surgeon-General (1999). Mental health: A report of the surgeon general. Washington D.C. Department of Health and Human Services.

Symes, M. D., Remington, B., Brown, T., & Hastings, R. P. (2006). Early intensive behavioral intervention for children with autism: Therapists' perspectives on achieving procedural fidelity. *Research in Developmental Disabilities, 27,* 30–42.

Waddington, E. M. & Reed, P. (in press). The impact of using the "Preschool Inventory of Repertoires for Kindergarten" (P.I.R.K.®) on outcomes of children with Autistic Spectrum Disorders, *Autism.*

Weschler, D. (1989). *Manual for the Weschler Preschool and Primary Scale of Intelligence-Revised (WPPSI-R).* San Antonio, TX: The Psychological Corporation.

Zachor, D.A., Ben-Itzchak, E., Rabinovich, A.L., & Lahat, E., (2007). Change in autism core symptoms with intervention. Research in Autism Spectrum Disorders 1 (2007) 304–317.

Figure Caption

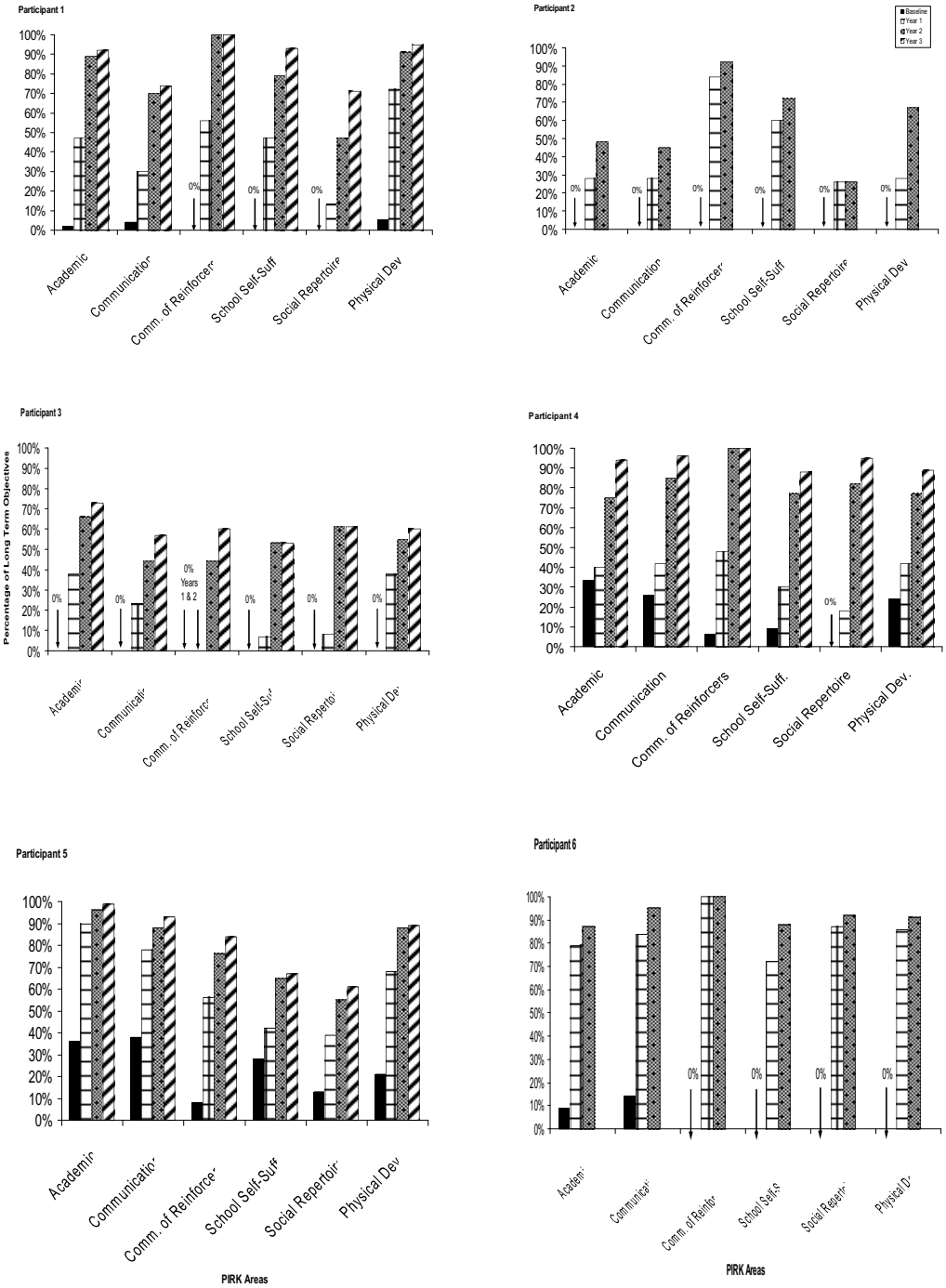
Figure 1.

Baseline assessments and rates of learning for all participants across PIRK® areas.

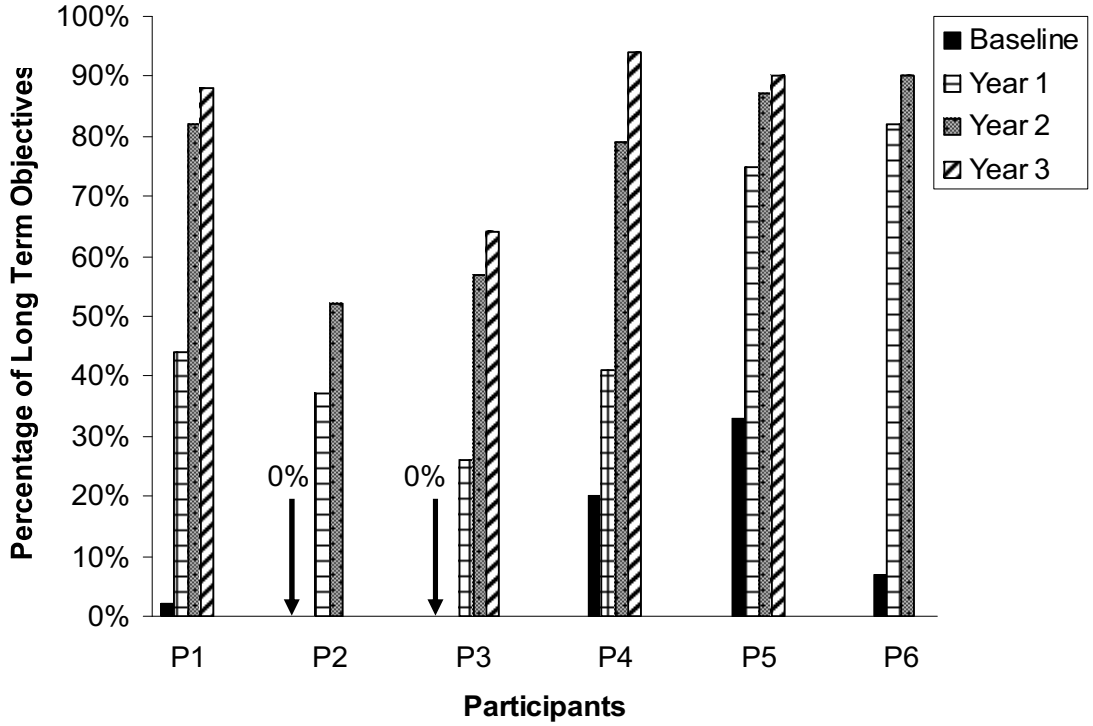
Figure 2.

Individual differences in rates of learning for each participant annually.

Figure


Participant 1
Participant 2
Baseline
Year 1
Year 2
Year 3
Participant 3
Percentage of Long Term Objectives
Years 1 & 2
Participant 4
Academic
Communication
Comm. of Reinforcers
School Self-Suff.
Social Repertoire
Physical Dev.
Participant 5
Participant 6
PIRK Areas

Figure


100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Percentage of Long Term Objectives
0%
0%
P1
P2
P3
P4
P5
P6
Participants
Baseline
Year 1
Year 2
Year 3