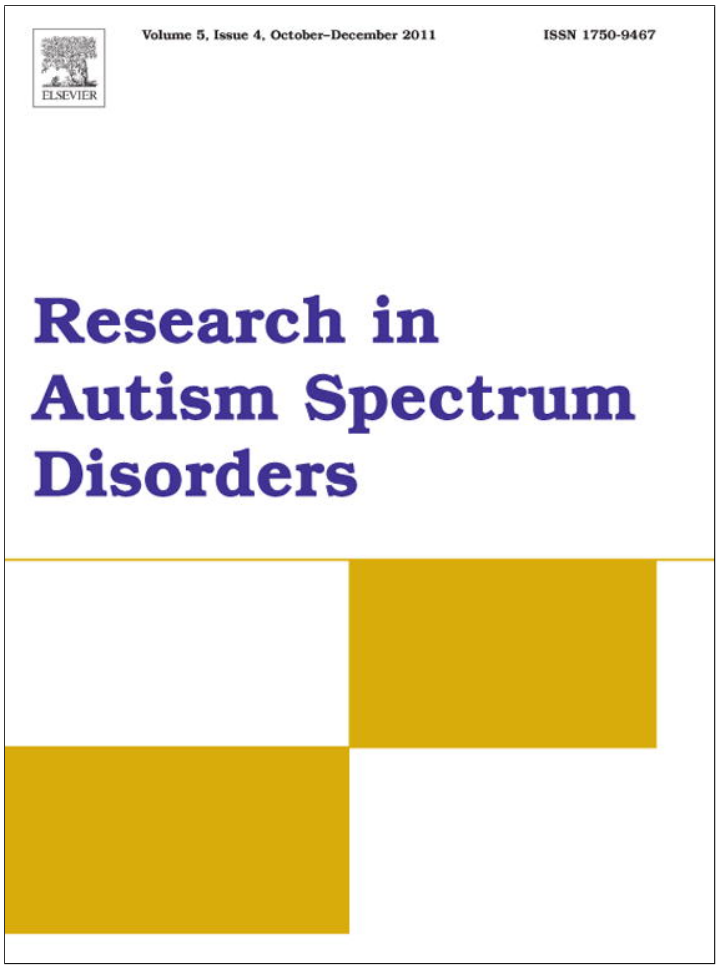

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The effectiveness of a cross-setting complementary staff- and parent-mediated early intensive behavioral intervention for young children with ASD

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ABSTRACT

We compared the effects of Early Intensive Behavioral Intervention (EIBI) and eclectic intervention in children with ASD on autism severity, developmental performance, adaptive behavior, language skills and challenging behaviors. Twelve children received cross-setting staff- and parent-mediated EIBI of centre-based one-to-one and play sessions as well as home-based sessions, including continuous parent training and supervision. A comparison group of 10 children received eclectic intervention. Standardized tests were carried out independent examiners at intake and after 6 months. The groups were equivalent on key variables at intake. The intervention group outperformed the eclectic group in measures of autism severity, developmental and language skills. Scores on adaptive behaviors revealed comparable changes in both treatment groups. Furthermore, the intervention group reduced challenging behaviors, a progress facilitated by parents that achieved treatment fidelity and gained competence to manage challenging behavior functions. Descriptive data of treatment progress showed that parental treatment provision and treatment fidelity gains indicated differential child progress in outcomes and skill mastery in learning environments. Our results show the effectiveness of a staff- and parent-mediated EIBI program for children with ASD. These findings highlight the importance of generalization across settings and persons for improving functional behavior in various learning environments that result in reduced problem behaviors and increased language and communication skills.

1. Introduction

Early intervention outcome of children with autism spectrum disorder (ASD) has been widely addressed. Meta-analysis and meta-analytic reviews agreed that there is substantial evidence for the effectiveness of Early Intensive Behavior Intervention (EIBI) in producing improvements in various skills (Eldevik et al., 2009; Makrygianni & Reed, 2010; Peters-Scheffer, Didden, Korzilius, & Strumey, 2011). In particular, intervention outcome studies found EIBI to be superior to an

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eclectic integration of several intervention approaches, in producing progress in cognitive abilities, adaptive skills (Eldevik, Eikeseth, Jahr, & Smith, 2006; Eikeseth, Smith, Jahr, & Eldevik, 2007; Eikeseth, Smith, Jahr, & Eldevik, 2002; Perry et al., 2008; Reed, Osborne, & Corness, 2007; Smith, Groen, & Wynn, 2000), and autism severity (Zachor & Ben Itzchak, 2010; Zachor, Ben Itzchak, Rabinovich, & Lahat, 2007). However, the efficiency of EIBI as an intensive application of Applied Behavior Analysis (ABA) principles over standard care ranges from not adequate (Spreckley & Boyd, 2009) to sufficient (Reichow & Wolery, 2009). Several other studies demonstrated early intensive behavioral intervention to be effective when provided in typical community settings (Cohen, Amerine-Dickens, & Smith, 2006; Howard, Sparkman, Cohen, Green, & Stanislaw, 2005; Remington et al., 2007). Remington et al. (2007) addressed two crucial questions: the influence of treatment on diagnostic autism core symptoms and the effects of intensive treatment on family core members. Although the authors demonstrated a lack of increased parental stress and relative improvements in pro-social behaviors, such changes on parent-reported child behavior problems and autistic behaviors were not found. Studies that compared the effects of early intervention implemented either in a clinic- or parent-directed model were not conclusive in identifying which approach was more effective. Smith et al. (2000) found weekly provided 25 h of centre-based treatment was more effective than a less intensive 5 h a week intervention based on parent-training. In contrast, Sallows and Graupner (2005) did not find marked differences between clinic- and parent-directed treatments. Overall, the fact remains that outcomes of effectiveness studies are strongly influenced by the inherent heterogeneity of autism spectrum disorder with a variety of variables likely affecting a child's response to treatment. Most studies focused on child factors and/or treatment factors. Well-established child factors includes the age at the initiation of treatment, with younger children yielding better outcomes (Granpeesheh, Dixon, Tarbox, Kaplan, & Wilke, 2009; Harris & Handleman, 2000; Perry et al., 2011), cognitive ability at intake with moderate relation of initial IQ to outcome (Eikeseth et al., 2002, 2007; Harris & Handleman, 2000; Hayward, Gale, & Eikeseth, 2009; Sallows & Graupner, 2005), adaptive behaviors at intake with children that have better initial adaptive levels tending to have better outcomes, and autism severity at intake accurately predicting "rapid responders" to treatment (Remington et al., 2007; Sallows & Graupner, 2005). In summary, research conducted on child factors as outcome predictors are inconsistent. Studies that address treatment itself for prediction of child outcomes mainly comprise treatment intensity with high-intensity treatments producing better outcomes (Reed et al., 2007). However, meta-analysis demonstrated that raising intensity above 25 h did not produce significant increases in the maintenance of developmental gains (Makrygianni & Reed, 2010), parental stress reduced positive child outcomes in high time-input treatments (Osborne, McHugh, Sounders, & Reed, 2008), and treatment fidelity demonstrated that parent's valid administration of teaching techniques leads to the maintenance of child's mastery of skills and lasting behavior changes in children with ASD (Vismara, Colombi, & Rogers, 2009).

Nevertheless, besides notions of methodological limitations that may reduce the internal validity of studies conducted such as group assignment and choice of outcome measures and, therefore, question outcome and its predictors (see Kasari, 2002), these results yield several practical considerations in treatment provision to be addressed and integrated in efficient treatment planning. The integration of treatment programs with different teaching strategies, environments and treatment providers in comprehensive EIBI is a necessary requirement for providing treatments across settings and persons. It is essential that any treatment should have effects which generalize in such a way as to maintain the outcome benefits in multiple settings. To do this it is essential not only to integrate a variety of treatment methods but to integrate them in a systematic way.

The purpose of this study was to describe the preliminary results of a subsample participating in a comprehensive cross-setting staff- and parent-mediated EIBI program (Fava & Strauss, 2011). This cross-setting EIBI program systematically addressed the question how correlated treatment features are successfully integrated to achieve: (a) treatment provisions in structured, quasi-naturalistic and natural settings, (b) treatment provisions across staff and parents, (c) intensive staff and parent training in order to gain treatment fidelity, and (d) integration of treatment strategies to target skill levels appropriately and to coordinate skill training across developmental domains.

Our preliminary findings were used to address the following questions:Did children within the first 6 months of a cross-setting staff- and parent-mediated EIBI program significantly change on diagnostic, developmental and language outcome measures, and what was the range of progress compared to a comparison group following an eclectic approach?Did problem behaviors significantly decrease because functional behavioral assessments of the child's challenging behaviors were systematically included in strategy planning?Since parents were constantly included in treatment provisions and, therefore, were intensively trained and supervised, did parents validly apply treatment strategies and to what extent did this training reduce parental stress?How was a child's direct measure of behavior change – namely mastery of behavior targets – influenced by parent inclusion in treatment provision and parent training gains in treatment fidelity?

2. Methods

2.1. Procedures

The participants were 22 children diagnosed with autistic disorder or pervasive developmental disorder—not otherwise specified (PDD-NOS). Potential participants in the cross-setting staff- and parent-mediated EIBI program were referred by a child neuropsychiatry unit of a regional pediatrician hospital. Diagnosis for all 22 children was made independently of the study by external neuro-psychiatrists and child psychologists who conducted additional cognitive, language and adaptive assessments at intake and follow-up after 6 months. After diagnosis and behavioral assessments, the decision of a child's treatment referral was dependent on parental preference. Children from parents that requested parental participation in

treatment provision comprised the intervention group and received EIBI. Parents of children in the comparison group were not actively seeking behavioral intervention or parental decision went toward another available treatment approach which mainly consisted of in-home treatment without active parental inclusion in therapy sessions.

2.2. Participants

Our study enrolled children according to the following criteria: (1) a diagnosis of autism or PDD-NOS, and (2) the absence of major medical issues other than autism or mental retardation. The intervention group, which received the cross-setting staff- and parent-mediated EIBI program, consisted of twelve children that: (a) completed the first 6 months of treatment progress and (b) were re-evaluated by the external neuro-psychiatrist after 6 months. Ten children were recruited by the pediatrician hospital as a comparison group who were diagnosed and re-assessed during the same time span of intake and 6 months as the twelve project participants. Table 1 summarizes developmental and diagnostic status of both study groups (EIBI and eclectic, as described in treatment section) at intake. The groups were not significantly different on all variables at baseline assessment; the EIBI intervention group of 12 children with ASD (10 males:2 females) had an age range of 26–81 months (mean age = 52.0 months, SD = 19.5) compared to the eclectic comparison group of 10 children with ASD (9 males:1 females) with an age range of 28–66 months (mean age = 43.7 months, SD = 26.9). Nevertheless, mean scores of VABS—ABC composite score indicate that children of the intervention group showed less pre-treatment adaptive functioning, although this difference was not significant.

2.3. Intervention

Two intervention approaches, comprehensive cross-setting staff- and parent-mediated EIBI and eclectic, were compared. Parents of both groups received the same amount of financial support from national services.

2.3.1. The cross-setting staff- and parent-mediated ABA-VB approach

The authors applied a comprehensive cross-setting staff- and parent-mediated EIBI program with the goal of implementing empirically supported teaching approaches (Fava & Strauss, 2011). It was aimed to integrate various treatment principles and teaching strategies that are proven to be effective. The model comprises the systematic use of discrete trail teaching (DTT) and more natural approaches such as incidental teaching (IT) and natural environment teaching (NET). DTT is understood as the systematic use of discrimination learning to build cumulative response repertoires (Maurice, Green, & Luce, 1996). The significant limitations which follow the exclusive implementation of this technique include limited stimulus and response generalization, a lack of spontaneous responding and prompt dependency. These limitations were overcome by the inclusion of more naturalistic strategies such as IT and NET, which allow the child to initiate and direct instructional interaction, and conduct training in natural and varied stimulus situations under the utilization of naturally occurring direct reinforcers. Within the comprehensive model no conclusions have been drawn regarding the superiority of

Table 1
Developmental and diagnostic status at intake.

	ABA-VB (n = 12)		Eclectic (n = 10)		Group difference	
	M (SD)	Range	M (SD)	Range	t(df)	p
Autism severity						
ADOS total	15.6 (4.03)	9–22	12.8 (5.0)	5–21	1.44 (20)	.165
Developmental state						
GMDS-ER GQ	62.1 (21.5)	38–103	69.8 (16.6)	44–87	−.75 (14)	.464
Language skills						
CDI comprehension	48.6 (32.5)	3–99	84.5 (4.9)	81–88	−1.50 (10)	.164
CDI production	33.7 (38.6)	0–89	29.0 (7.1)	24–34	.16 (12)	.872
Adaptive functioning						
VABS ABC	63.3 (25.9)	31–109	44.3 (16.4)	21–67	2.00 (20)	.059
Comorbid psychopathologies						
CBCL affective problems	58.0 (7.2)	50–72	56.8 (7.1)	50–70	.39 (19)	.704
CBCL anxiety problems	56.1 (6.8)	50–70	59.6 (14.6)	47–97	−.72 (19)	.482
CBCL pervasive developmental	69.0 (8.9)	50–81	67.7 (9.8)	57–89	.32 (19)	.754
CBCL attention deficit/hyperactivity	57.1 (5.3)	50–67	57.2 (5.8)	50–67	−.05 (19)	.965
CBCL oppositional defiant	54.1 (5.5)	50–67	55.9 (6.9)	50–67	−.14 (19)	.887
Parental stress						
PSI total	92.0 (13.1)	71–114	88.7 (2.3)	82–97	.90 (19)	.379
Program variables						
Age at intake	52.0 (19.5)	26–81	43.7 (26.9)	28–66	1.09 (20)	.288
Duration	6.4 (.7)	5–7	7.2 (1.2)	5–9	−1.90 (20)	.072

one component over another. Rather we have stressed the importance of providing the appropriate environment and teaching strategy for the behavior target chosen on the basis of each child's skill levels. Therefore, cross-setting requires both a structured environment such as one-to-one room where the child works in DTT-trails, and a quasi-naturalistic environment where the child works in a incidental manner, in order to learn new behavior targets and to generalize skills previously learned in DTT trails with different materials and staff. These treatment environments were provided at the centre and were alternated with treatment carried out in a naturalistic environment such as the child's home, with the involvement of the parent. This feature is designed to achieve maintenance and generalization of skills acquired in clinical settings toward a natural and everyday life environment of the children.

The program model had a duration of one year and was structured as follows: (1) three weeks of centre-based intensive child's functional assessment and parent-training alternately followed with (2) a 3-week parent-mediated home-based treatment, and (3) a 1-week follow-up in a clinical setting. Differential settings in the centre were accomplished using two curriculums: (1) one-to-one sessions targeting individual skills and problem behaviors and (2) small group sessions with 4 children using play rooms and a play garden targeting the child's individual skills favoring IT in order to promote inclusion in facilitated play and social interaction. Each child followed a daily rotation of 3 learning environments in the sequential order of facilitated play, social interaction session, and intensive one-to-one training three times a day (approximately 26 h a week). The structured setting activities were fundamentally taught by DTT and thus, were mainly driven by the teacher, using predefined selection of items and materials, utilizing most-to-least and prompt fading strategies needed to ensure errorless learning. Nevertheless, as soon as interaction was initiated by the child DTT was alternated with IT strategies in order to facilitate spontaneity. During the quasi-naturalistic setting in the group room mainly NET with IT strategies were applied, thus the child had an unlimited choice in activities and greater wait times for spontaneous productions of target behavior. Moreover, spontaneous approaching of the child was supported by teaching the functional use of toys in order to facilitate play routines and imitation during activities with adults and peers. Preferred stimuli were presented but remained unreachable in order to create the transitory motivation for the child to interact with the adult using communication skills. Successively, the child was prompted to request in a more appropriate way and received the desired object as a naturally positive reinforcement. During the alternating 3-week home-based phase, treatment was done by the parent for approximately 12 h a week. Home-based treatments followed an individual treatment plan. Parents were provided with targets to be taught including pre-defined material and procedures to be applied as well as video-reminders of treatment sessions during the child and parent training phase at the centre. Parents received two hours of weekly supervision with the child's therapist and supervisor.

While structured behavioral strategies usually identify a deficit skill and target it directly in subsequent task steps, naturalistic treatment strategies often target several correlated child behavior skill domains simultaneously. Systematic skills assessment and training is important to ensure that prerequisite skills for a new target behavior have previously been achieved. Therefore, prior to development of individual programs, the strengths and weaknesses of each child were evaluated on the basis of performance in the Assessment of Basic Language and Learning Skills (ABLLS-R; Partington & Sundberg, 1998). Interfering problem behaviors and their maintaining variables were examined applying functional behavior analysis that aimed to observe four behavior functions (attention, escape, tangible, and automatic non-social) in five conditions: free play (control condition), with attention provided, without attention provided, with restricted tangible reinforcement, and continuous request of task response.

In order to enhance the maintenance and generalization of any changes in child behavior the integration of various treatment environments, teaching strategies and treatment providers were implemented as described above. Appropriate application of treatment strategies over all available environments was controlled and verified by means of continuous and intensive staff and parent supervision as well as treatment fidelity checks. Parent training started out with a one week (15 h) of a theoretical work-shop, followed by 1 week of treatment observation in play rooms (6 h) and life video observations of one-to-one session under supervision (6 h), and conclude with participation in 1 week participation in one-to-one sessions of supervision (5 h) and direct treatment application (10 h), during which, 5 h of parent-directed treatment application in the centre under supervision was maintained during the alternating 12 months centre-home-based phases. Staff training was conducted in the same manner with the later addition of 2 h a week of supervision with the child's supervisor and 1 h a week with the program director. Four days of internal group supervision and workshops toward autism research were conducted three times a year.

A continuous record of treatment was performed on a trial-by-trial basis within each treatment session based on the target behavior to be learned. Data included motivational operation program applied, instructions, materials, prompts and reinforcers used, response obtained, and criteria of mastery. Two measures of skill acquisition were used for each educational program trained: the number of days to mastery of single programs and the number of days to mastery of complex domains (Weiss, 1999). Mastery of skills was determined by the supervisors on the achievement of 80% performance in at least 3 consecutive sessions. New programs were introduced after mastery in expanded trials. At monthly re-entry at the centre, parents conduct 2 evaluation sessions with their child's supervisor where maintenance and generalization of skills previously mastered at home were verified in a different environment.

2.3.2. The eclectic approach

Participants in the eclectic group received in-home developmental intervention and cognitive behavioral treatment for approximately 12 h a week (comparable to 14 h a week for the intervention group). Eclectic programs were different in several aspects: the teaching principles and procedures used, treatment intensity, the type of professional involved and their

responsibilities, data recording, and extent of parent involvement. Related services for these children varied from psychomotricity, speech therapy and music therapy. Each child's program comprised individual goals and treatment objectives but was mainly based on staff expertise and preferences rather than on treatment protocols and continuous measures of progress. Treatment procedures used in the eclectic group included: behavioral procedures that used selected programs from treatment manuals (such as Lovaas-ABA) but implementation would be restricted solely to DTT and a more stringent use of continuous reinforcement procedures rather than differential reinforcement and pivotal response procedures. Alternative communication included working on picture exchange communication (PECS) or sign based systems. Elements taken from the TEACCH approach involved making progress of sessions and daily routines predictable using visual supports and to separate tasks by applied task analysis. Unfortunately, it was not possible to determine the portion of time spent on a particular treatment strategy implemented for children in the eclectic group. Teaching sessions often integrated a mixed model of different treatment approaches and strategies. However, the organization of treatment programs for the eclectic group did not incorporate a teaching protocol specific to the developmental goals of the child nor particularly followed the specific application of continuous steps in the PECS training and joint attention training. In addition, the particular adaptation of the environment at home suggested by the TEACCH protocol was not carried out. In contrast with the weekly supervisions accomplished in the intervention group, staff of the eclectic group received monthly supervision or did not have access to a qualified supervisor. Thus, intensive and continuous staff training as well as parent training coordinated by specialized program directors offering sound theoretical and practical suggestions were absent.

2.4. Assessment and data collection

Matson (2007) has pointed out that guidelines regarding assessment for children with ASD tend to focus almost exclusively on differential diagnosis. Perry, Condilliac, and Freemann (2002) recommended "best practices" core assessment including severity of autism, cognitive and adaptive functioning. Kasari (2002) extended this point in recommending that outcome measures of interest in evaluation studies should reflect the focus of treatment and thus, a more comprehensive assessment of outcome should be applied. In addition to the diagnostic features of social, communicative and cognitive deficits found in individuals with autism, a number of related conditions such as challenging behaviors and maintaining variables (Matson & Nebel-Schwalm, 2007; Matson, Mahan, Hess, Fodstad, & Neal, 2010b) and comorbid psychopathologies (Matson, Hess, & Boisjoli, 2010a) have been examined, a need for including such measures is striking. Moreover, treatment may produce collateral effects that were not specifically targeted for intervention such as parental stress, that is included in our study since it remains unclear in research to what extent parental stress affects child outcomes (Brookman-Frazee, 2004; Keen, Couzens, Muspratt, & Rodger, 2010; Osborne et al., 2008). Targeted standardized assessments would provide a broad picture of treatment outcomes in a child's abilities after a specific period of time and produce results that are comparable across children in the population. However, direct measures of behavior targets guide moment-to-moment treatment decisions and capture the child's change in abilities in the very short-term (Granpeesheh et al., 2009). Therefore, as additional treatment progress measures were tracked, the number of behavioral targets mastered in various abilities, their change in difficulties over time as well as setting of mastery and number of treatment sessions done by parents at home can be determined. Given that the described EIBI program is provided by staff and parents, accuracy of training procedure application is salient and, therefore, treatment fidelity measures for staff and parents over time, were designed to address this issue.

One further procedural decision was to separate measures for group assignment from measures used for evaluation. Matson (2007) recommended, where possible to rely on DSM or WHO criteria with multiple raters for diagnostic categories and to use diagnostic checklists for pre–post test evaluation. Because all assessments in our study were provided from one child neuropsychiatry unit of a regional pediatrician hospital, there were no such independent multiple raters available. Therefore, to account for DSM diagnostic criteria and Autism Diagnostic Interview-Revised (ADI-R; Lord, Rutter, & LeCouteur, 1994) examination for initial diagnosis and group assignment, and to address severity of autism in pre–post test evaluation ADOS observation was used.

We also considered the validity of potential child outcomes concerning the reliability of measurement source. Observational measures applied by professionals yield a more reliable picture of child outcome. Therefore, we used the following measures as the main outcome: ADOS and GMDS-ER observations done by independent professionals, CDI language reports done under supervision of neuro-psychiatrists and child psychologist; as well as ratings of challenging behaviors and maintaining variables; and of treatment fidelity provided by external raters. Parent reports of comorbid psychopathology (CBCL), adaptive skills (VABS—interview edition) and parental stress (PSI) were reported for both study groups but were completed without professional supervision and, therefore, may be confounded by comprehension of child's ability particularly when the parents have just received the child's diagnosis.

2.4.1. Main outcome gained by professionals

Autism severity was measured using the *Autism Diagnostic Observation Schedule* (ADOS; Lord, Rutter, DiLavore, & Risi, 1999), a semi-structured, interactive schedule designed to assess social and communicative functioning. The new ADOS criteria have a two classification threshold, Autism and ASD, and were used at T0 and T1 (Gotham, Risi, Pickles, & Lord, 2007).

The child's mental developmental state was ascertained at T0 and T1 using the *Griffith mental developmental scales* for ages 2–8 (GMDS-ER 2–8; Luiz et al., 2006). We reported standard scores for five domains: locomotor, personal-social, language, eye and hand coordination and the general developmental quotient (GQ).

Early language abilities were measured, at T0 and T1, using the *MacArthur Communication Developmental Inventories* (CDI; Fenson, Pethick, Renda, & Cox, 2000), which is a parent-report checklist that measures a child's vocabulary comprehension and vocabulary production.

Challenging behaviors were assessed via video rating of their frequencies and function. The procedure for observation of challenging behaviors was adapted from Fava and Strauss (2010) and extended using operational items from the autism spectrum disorder-behaviors problems for children (ASD-BPC; Matson, Gonzalez, & Rivet, 2008) as well as from the Questions About Behavior Change (QABF; Matson, Bamburg, Cherry, & Paclawskyj, 1999) questionnaires. Video rating was favored over the use of a questionnaire to avoid possible bias differences between parental reports and professional observations, especially at the beginning of treatment when the parents have just received the child's diagnosis. Anyhow, both measures ASD-BPC and QABF were assessed at all measurement points using the questionnaire form. At a later step, the extent to which questionnaire data from professionals coincides with questionnaire data derived from parents will be analyzed. For both staff and parents, video sessions were analyzed at T0 at intake and T1 after six month. For each measurement point were taken randomly 2 sessions, each split into three parts (first six minutes [A], middle six minutes [B] and last six minutes [C] of each session) and rated by two independent raters. This strategy yielded 2×36 min of data for intake and 2×36 min of data for follow-up. Thus, there were ratings made for each child of 72 min of sessions done with parent and 72 min of sessions done with staff. The rating of challenging behavior categories and maintaining behavior functions are described in Table 2.

Treatment fidelity was rated by two independent raters based on video sessions done with staff and parents at T0 and T1. An identical procedure was used for challenging behaviors: for each measurement point were taken randomly 2 sessions that were split into three parts (first six minutes [A], middle six minutes [B] and last six minutes [C] of each session). This strategy yielded 2×36 min of data for intake and 2×36 min of data for follow-up, thus for each child were totally rated 72 min of sessions done with parent and 72 min of sessions done with staff. Raters used a checklist from Hayward et al. (2009) which specifies treatment skills and applications in four domains: data collection (3 items), facilitated play (8 items), discrete trail teaching with mastered skills (11 items), and discrimination training and introduction of new teaching objectives and new programs (5 items). We adapted the original checklist using a rating scale from 0–1–2/weak–sufficient–strong, to yield the following scoring ranges: data collection from 0 to 6, facilitated play from 0 to 16, discrete trail teaching with mastered skills from 0 to 22, and discrimination training and introduction of new teaching objectives and new programs from 0 to 10.

2.4.2. Outcome measures provided by parent rating

Adaptive behavior functioning was assessed at T0 and T1 based on the *Vineland Adaptive Behavior Scales, Interview Edition* (VABS; Sparrow, Balla, & Cicchetti, 1984). This interview assesses parental perceptions of the child's personal and social functioning. The instrument yields four broad domains indicative of communication (receptive, expressive, and written), daily living skills (personal, domestic, and community), socialization (interpersonal relationship, play and leisure time, and coping), and motor skills (gross and fine). Standard scores have a mean of 100 and SD of 15. The Adaptive Behavior Composite (ABC) score is based on the mean of the three principal domains without motor skills for all children older than 6 years.

Psychopathological comorbidities were examined at T0 and T1 using the Child Behavior Checklist (CBCL 1.5–5; Aschenbach, 1991). This parent-report of behavior concerns on seven different syndrome scales (emotionally reactive, anxious/depressive, somatic complaints, withdrawn, sleep problems, attention problems, and aggressive behavior) and five different DSM-oriented scales (affective problems, anxiety problems, pervasive developmental problems, attention deficit/hyperactivity problems, and oppositional defiant problems). In the present study the five DSM-orientated scales are reported based on *T*-scores for all children less than 6 years ($n = 20$) with a *T*-score of 70 and above being considered "clinically significant".

Parenting stress was measured at T0 and T1 based on the parental stress—short form (PSI; Abadin, 1999). A parental report that is comprised of three scales: parental distress, parent–child dysfunctional interaction, and difficult child characteristics, as well as a total stress score.

2.5. Data collection

Due to the assessment protocol of the child neuropsychiatry unit of a regional pediatrician hospital that referred the study participants, not all measures were available for all included children. Data for both groups was available at T0 and T1 for the following measures: a diagnosis based on DSM criteria and ADI-R, autism severity based on the ADOS observation, language skills based on the CDI, developmental state based on the general developmental quotient GQ of the GMDS-ER, adaptive behavior functioning based on the VABS, comorbid psychopathologies based on the CBCL, and parental stress based on the PSI.

Additional data was derived on the intervention group by the program director of the centre providing treatment toward challenging behaviors and maintaining variables, treatment fidelity and treatment progress variables. Thus, data for change analysis was only available in the intervention group.

2.6. Data analysis

Statistical analysis was performed using R software. Mean scores before and after therapy were compared using paired *t*-test or Wilcoxon paired test when necessary. The significance level was set at .05. Normality was checked using the Shapiro–

Table 2
Raters scheme on observation of challenging behaviors and maintaining behavior functions.

Definition of maintaining variables		Definition of challenging behavior		Frequency of challenging behaviors	Function of challenging behaviors
Attention	Engages to get attention	Aggressive behaviors toward others	Throwing objects	A	A
	Because likes to be reprimanded			B	B
	To draw attention to him/herself			C	C
			Aggression	A	A
	Seems to be saying "come to me" or "look at me" when engaging			B	B
Escape	To escape work or learning situations			C	C
	When asked to do something		Pulling hair	A	A
	When does not want to do something			B	B
	Try to get people leave him/her alone			C	C
	Seems to say "leave me alone" or"stop asking me to do this"		Yelling or shouting	A	A
Non-social/automatic	As form of "self-stimulation"			B	B
	Even if thinks no one is in the room			C	C
	Because there is nothing else to do	Aggressive toward the environment	Kicking objects	A	A
	In a highly repetitive manner, ignoring surrounding			B	B
	Seems to enjoy the behavior, even if no one is around			C	C
Physical	Because is in pain		Property destruction	A	A
	More frequently when is ill			B	B
	When something is bothering physically			C	C
	Because is physically uncomfortable	Self injury behaviors	Hitting, pinching, scratching	A	A
	Seems to indicate that is not feeling well			B	B
Tangible	To get access to items such as preferred toys, food or beverages			C	C
	When something is taken away		Pocking him/herself in the eyes	A	A
	When an adult has something he/she wants			B	B
	When a peer has something he/she wants			C	C
	Seems to say "give me that item (toy, food, etc.)"		Mouthing and swallowing objects	A	A
				B	B
				C	C
		Stereo motor	Playing with own saliva	A	A
				B	B
				C	C
			Banging on objects with the hand	A	A
				B	B
				C	C
			Repeated or unusual body movements	A	A
				B	B
				C	C
		Stereo vocal	Repeated or unusual vocalization	A	A
				B	B
				C	C
		Dysfunctional behaviors	Removal of clothing in inappropriate times	A	A
				B	B
				C	C
			Unusual play with objects	A	A
				B	B
				C	C
			Inappropriate sexual behaviors	A	A
				B	B
				C	C
			Playing with the feces	A	A
				B	B
				C	C
			Leaving supervision of caregiver	A	A
				B	B
				C	C

Wilk test. Simple linear regression models were fitted for different scores at T1 as dependent variables (ADOS total score, Griffith developmental quotient GQ, CDI comprehension and production, VABS composite score ABC, and PSI overall score) to test whether initial values of the scores at time T0, the age at intake and other variables of interest influence the outcome. The models were estimated using the maximum likelihood principle and the significance has been estimated using standard *t*-test.

2.7. Inter-rater reliability

Intra-class correlation between the paired ratings at both measurement points used to assess the consistency between raters' category codes, ranged from .85 to .91 for challenging behaviors, from .88 to .93 for maintaining variables, and from .92 to .97 for treatment fidelity.

3. Results

3.1. Child treatment outcome

Question [1]: Did children within the first 6 months of a cross-setting staff- and parent-mediated EIBI program significantly change on diagnostic, developmental and language outcome measures, and what was the range of progress compared to a comparison group following an eclectic approach?

Improvement for the intervention group compared to the eclectic group was found by differences in test scores as shown in Table 3. Paired *t*-tests revealed at follow-up after 6 months advantage for the intervention group over the eclectic group in three main measures derived from evaluation by an external neuro-psychiatrist: autism severity, mental developmental state, and early language skills. In detail, the intensive staff- and parent-mediated treatment group showed a significant decrease in autism severity ($t(11) = 3.64$, $p \leq .01$), social interaction ($t(11) = 3.17$, $p \leq .01$) and communication scores ($t(11) = 2.63$, $p \leq .05$), while the eclectic treatment group did not exhibit a significant change in any of the autism severity subscales. Significant group differences were further demonstrated whereby children receiving staff- and parent-mediated early intensive behavioral intervention were out-performing children in the eclectic treatment group by developing within the 6-month period improved functional communication and approaching a mental developmental state more appropriate to chronological level. Specifically, they had significant gains in mental developmental state ($t(11) = -3.44$, $p = \leq 01$), early language comprehension ($t(11) = -4.59$, $p \leq .01$) and early language production ($t(11) = -1.84$, $p \leq .05$). While data for subscales of the GMDS-ER for the eclectic group could not be derived, children in the intervention group significantly improved on personal-social skills ($t(11) = -2.92$, $p = .007$), language skills ($t(11) = -2.60$, $p = .012$), eye-hand coordination ($t(11) = -2.25$, $p = .023$) and performance ($t(11) = -3.68$, $p = .001$) and on locomotor skills ($t(11) = -1.80$, $p = .050$).

Data derived from parental reports, showed significant gains in adaptive behavior functioning for both intervention and eclectic groups. While it appears that the eclectic intervention group performed better in communication skills, socialization

Table 3
Changes in autism severity, child functioning and comorbidity for both, intervention and eclectic groups.

	Intervention group ($n = 12$) (M, SD)		Measure change over time		Eclectic group ($n = 10$) (M, SD)		Measure change over time	
	T0	T1	*t*	*p*	T0	T1	*t*	*p*
Autism severity								
ADOS social interaction	10.0 (2.9)	8.3 (2.1)	3.17	.004	8.6 (2.7)	8.1 (2.6)	1.10	.139
ADOS communication	5.8 (2.1)	4.0 (1.3)	2.63	.011	4.2 (2.7)	3.9 (2.2)	.669	.321
ADOS total	15.6 (4.0)	12.3 (3.2)	3.64	.001	12.8 (5.0)	12.0 (4.5)	1.10	.179
Developmental state standard score								
GMDS-ER GQ	62.1 (21.5)	76.4 (21.6)	−3.44	.005	69.8 (16.6)	95.5 (9.7)	−2.61	.121
Language skills								
CDI comprehension	48.6 (32.5)	59.4 (32.5)	−4.59	.001	84.5 (4.9)	72.6 (41.7)	−4.43	.141
CDI production	33.7 (38.6)	48.0 (39.7)	−1.84	.049	29.0 (7.1)	52.5 (28.6)	−4.58	.137
VABS standard scores								
Communication	77.3 (45.2)	89.3 (48.4)	−2.72	.010	49.3 (30.6)	66.0 (38.2)	−4.93	<.001
Daily living	74.5 (36.3)	101.5 (40.8)	−4.13	<.001	47.4 (16.3)	67.8 (17.8)	−4.53	<.001
Socialization	69.9 (24.5)	70.8 (24.7)	−.126	.451	44.9 (14.2)	57.0 (15.5)	−4.67	<.001
Motor	99.7 (17.9)	109.9 (14.6)	−2.87	.007	84.9 (14.2)	102.8 (11.2)	−4.14	.002
ABC	63.3 (25.9)	77.4 (34.4)	−2.47	.010	44.3 (16.4)	65.0 (23.0)	−5.45	.006
CBCL								
Affective problems	58.0 (7.2)	55.3 (6.3)	1.56	.070	56.8 (7.1)	59.9 (8.7)	−.99	.740
Anxiety problems	56.1 (6.8)	54.6 (5.6)	.75	.230	59.6 (14.6)	60.2 (11.7)	−.21	.300
Pervasive developmental	69.0 (8.9)	66.6 (7.6)	.79	.220	67.7 (9.8)	68.9 (6.7)	−.52	.240
Attention deficit/hyperactive	57.1 (5.3)	53.8 (3.6)	2.02	.030	57.2 (5.8)	56.8 (8.1)	.21	.350
Oppositional defiant	54.1 (5.5)	53.1 (3.6)	1.18	.130	55.3 (6.9)	53.8 (5.3)	.54	.200

skills, and motor skills, a significant between-group difference in score change was detected solely for socialization skills ($t(19) = -2.15$, $p \leq .05$) with the eclectic intervention group improved significantly more. Thus, parental reports showed a comparable level of benefits in either intervention and eclectics on adaptive functioning, improvements in communication, daily living abilities, and motor skills. Furthermore, parental reports on comorbid psychopathologies revealed a significant decrease solely on CBCL attention deficit/hyperactivity scores for the intervention group ($t(10) = 2.02$, $p \leq .05$); no other significant differences were found. This result seems redundant since none of the children exhibited a clinically significant score on any of the CBCL scales at intake. Nevertheless, such results provide information toward the absence of possible side effects. Observing mean scores of both groups revealed a consistent decrease of scores on all CBCL scales for the intervention group: affective problems ($M_{T1} - M_{T0} = -2.7$), anxiety problems ($M_{T1} - M_{T0} = -1.5$), pervasive developmental problems ($M_{T1} - M_{T0} = -2.4$), oppositional defiant behavior ($M_{T1} - M_{T0} = -1.0$) and attention deficit/hyperactivity ($M_{T1} - M_{T0} = -3.3$). Indeed, score changes in the eclectic intervention group indicated a slight increase of affective ($M_{T1} - M_{T0} = 3.1$), anxiety ($M_{T1} - M_{T0} = .6$) and pervasive developmental problems ($M_{T1} - M_{T0} = 1.2$), whereas decreases were found for oppositional defiant behavior ($M_{T1} - M_{T0} = -1.5$) and attention deficit/hyperactivity ($M_{T1} - M_{T0} = -.4$).

Although, it was not of direct relevance for the demonstration of preliminary effectiveness, regressions were computed to determine whether intake variables and measures were associated with child outcome measures. Age at intake was associated with better outcomes in adaptive functioning – VABS composite score ABC ($p = .001$) and early language skills – CDI production ($p = .043$). Autism severity at pre-treatment was negatively associated with outcome in early language skills – CDI production ($p = .030$) whereas adaptive functioning was associated with better outcome in early language skills – CDI production ($p = .020$). Overall, early language skills at pretreatment were a strong predictor for adaptive functioning and autism severity. Pretreatment language comprehension was associated with better outcome on adaptive functioning ($p = .001$) as well as with less autism severity at follow-up ($p = .010$). Equal relation was found for pretreatment language production being associated with better outcome on adaptive functioning ($p = .0001$) as well as with less autism severity at follow-up ($p = .009$).

Question [2]: Did problem behaviors significantly decrease because functional behavioral assessments of the child's challenging behaviors were systematically included in strategy planning?

Observation data available from recorded therapy sessions for the intervention group revealed at follow-up a significant decrease in challenging behaviors as shown in Table 4. Scores at intake show that challenging behaviors occurred more frequently in parent provided sessions. Group differences were significant for aggressive and dysfunctional behaviors in children showing significantly more aggressive behaviors ($t(22) = 2.28$, $p = .032$) and dysfunctional behaviors ($t(22) = 2.27$, $p = .033$) in parent provided sessions. After 6 months, virtually all children exhibited significantly less aggressive behavior ($t(11) = 5.73$, $p \leq .001$) and ($t(11) = 4.84$, $p \leq .001$), fewer stereotypes ($t(11) = 8.45$, $p = .001$) and ($t(11) = 7.82$, $p \leq .001$), and less dysfunctional behaviors ($t(11) = 7.21$, $p \leq .001$) and ($t(11) = 7.10$, $p \leq .001$) in parent-provided sessions and staff-provided sessions, respectively. Significant in-between group differences in frequencies of challenging behaviors in parent-provided versus staff-provided sessions were found at intake but, were not seen at follow-up.

3.2. Parent treatment outcome

Question [3]: Since parents were constantly included in treatment provisions and, therefore, were intensively trained and supervised, did parents validly apply treatment strategies and to what extent did this training reduce parental stress?

Prevention and management of challenging behaviors is closely attendant on maintaining variables. Thus, decreases in challenging behaviors are related to successful prediction of its antecedent's variables and handling of behavior consequences. Observation data from video-recorded sessions at intake revealed that maintaining variables are significantly more often demonstrated in parent-mediated sessions with parents providing more frequent access to escape ($t(22) = 2.84$, $p = .009$) and tangible reinforcement ($t(22) = 3.10$, $p = .005$) in a dysfunctional manner (Table 5). After intensive staff and parent training, behavior functions at follow-up decreased significantly for given attention ($t(11) = 6.23$, $p \leq .0001$) and ($t(11) = 5.01$, $p \leq .01$), access to escape ($t(11) = 7.15$, $p \leq .0001$) and ($t(11) = 7.34$, $p \leq .0001$), access to automatic reinforcement ($t(11) = 8.95$, $p \leq .0001$) and ($t(11) = 7.46$, $p \leq .0001$), and tangible reinforcement ($t(11) = 6.16$, $p \leq .0001$) and ($t(11) = 5.20$, $p \leq .001$) in parent-provided sessions and staff-provided sessions, respectively.

Table 4
Changes in challenging behaviors and maintaining variables for the intervention group.

		Intervention group ($n = 12$) M (SD)		Measure change over time	
		T0	T1	t	p
Categories of challenging behaviors					
Parent	Aggression	11.7 (6.6)	4.6 (3.5)	5.73	<.0001
	Stereotypes	17.0 (5.9)	7.8 (2.9)	8.45	<.0001
	Dysfunctional	14.5 (5.1)	5.9 (1.7)	7.21	<.0001
Staff	Aggression	6.5 (4.4)	3.0 (2.2)	4.84	.0003
	Stereotypes	12.3 (5.2)	6.0 (2.7)	7.82	<.0001
	Dysfunctional	10.1 (0.8)	4.2 (1.6)	7.10	<.0001

Table 5
Changes in challenging behaviors maintaining variables and in treatment fidelity for the intervention group.

		ABA-VB ($n = 12$) (M, SD)		Measure change over time	
		T0	T1	t	p
Treatment fidelity					
Parent	Data collection	2.3 (.9)	3.9 (1.2)	$V = 3.5$	.003
	Facilitated play	7.8 (1.8)	11.7 (2.7)	−4.51	.0004
	DTT with mastered skills	10.7 (2.9)	16.4 (4.3)	$V = 7.0$	.007
	Discrimination training and introduction of new programs	5.1 (1.3)	7.13 (1.7)	−3.26	.004
Staff	Data collection	3.7 (9.8)	5.1 (.9)	−4.62	.0004
	Facilitated play	11.7 (2.6)	13.8 (1.9)	−2.90	.007
	DTT with mastered skills	15.7 (3.3)	18.5 (2.5)	−4.11	.0008
	discrimination training and introduction of new programs	7.3 (1.5)	8.1 (1.5)	−1.68	.060
Maintenance variables of challenging behaviors (per 5 min)					
Parent	Attention	4.7 (2.3)	1.7 (1.3)	6.23	.0001
	Escape	11.5 (4.6)	5.2 (2.7)	7.15	.0001
	Automatic	19.8 (6.6)	9.1 (3.7)	8.95	.0001
	Tangible	7.1 (3.0)	2.3 (1.8)	6.16	.0001
Staff	Attention	3.2 (2.2)	1.1 (1.1)	5.01	.002
	Escape	7.1 (3.0)	3.2 (1.6)	7.34	.0001
	Automatic	14.8 (6.2)	6.9 (3.0)	7.46	.0001
	Tangible	3.9 (1.8)	2.0 (1.0)	5.20	.0001

The goal of intensive staff and parent training was to ensure appropriate treatment provision and application of teaching strategies. Therefore, observation data from treatment sessions provided information of treatment fidelity achieved by parent and staff prior to and following intensive training. As shown in Table 5, rating of treatment fidelity at follow-up revealed a significant increase for both parents and staff. As expected, scores at intake showed that, before parental training begins, parents exhibit much lower treatment fidelity than professional treatment providers. These group differences were significant on all scales with parents showing significantly less fidelity in data collection ($t(22) = -3.50$, $p = .002$), facilitated play ($t(22) = -4.32$, $p = .0001$), discrete trail training with mastered skills ($t(22) = -3.92$, $p = .001$), and discrimination training and introduction of new targets and teaching ($t(22) = -3.78$, $p = .001$). Paired t-tests and Wilcoxon-tests, when necessary demonstrated a significant increase in treatment fidelity within 6 months of parent-training and staff supervision. Increase in treatment fidelity was achieved for discrimination training and introduction of new targets solely for parents ($t(11) = 3.26$, $p \leq .01$) but not for staff, whereas fidelity in data collection increased in parents ($V = 3.5$, $p \leq .01$) and staff ($t(11) = -4.62$, $p \leq .001$) as well as in facilitated play (parents: $t(11) = -4.51$, $p \leq .001$; staff: $t(11) = -2.90$, $p \leq .01$), and in DTT with mastered skills (parents: $V = 7.0$, $p \leq .01$; staff: $t(11) = -4.11$, $p \leq .001$). Differences in treatment fidelity between parents and professional staff remained significant at follow-up with parents achieving less treatment fidelity solely in data collection ($t(22) = -2.70$, $p = .013$) and in facilitated play ($t(22) = -2.15$, $p = .043$).

Parent reports on parental stress revealed at intake that parents between groups did not initially differed in their parental stress standard scores. Percentiles of parental stress total scores indicated that parents of the intervention group had higher overall stress, with 66.7% of parents in the intervention group demonstrating clinically significant stress levels at intake compared to 44.4% of parents in the eclectic treatment group using percentile cut-off levels of <80 = normal, 81–84 = borderline, and >85 clinically significant. As shown in Table 6, paired t-tests on standard scores revealed that none of the parents in the intervention group showed a significant increase in parental stress over 6 months of treatment provision. However, parents of the eclectic intervention group, who have been less involved in treatment provision, exhibit a significant decrease in overall parental stress ($t(8) = 2.80$, $p \leq .05$). Furthermore, trends of mean scores on sub-domains in the eclectic

Table 6
Changes in parental stress for both intervention and eclectic groups.

	Intervention							
	ABA-VB ($n = 12$) M (SD)		Measure change over time		Eclectic ($n = 10$) M (SD)		Measure change over time	
	T0	T1	t	p	T0	T1	t	p
Parental stress PSI								
Parental distress	29.4 (10.4)	31.1 (9.5)	−.66	.740	26.1 (10.9)	28.3 (19.2)	−.25	.630
Parent–child difficult interaction	25.9 (5.9)	25.8 (5.9)	.08	.470	26.1 (5.9)	40.1 (25.5)	−1.88	.950
Difficult child	37.3 (8.2)	37.5 (10.8)	−.08	.530	39.3 (4.5)	49.6 (28.8)	−1.35	.894
PSI total	92.0 (13.1)	94.3 (9.7)	−.72	.760	88.7 (2.3)	81.0 (12.1)	2.42	.023

Table 7
Treatment progress in mastery of behavior targets.

	T0	T1	T2	T3	T4	T5
Difficulty of targets mastered (%)						
Base	75.1	62.7	61.0	51.8	51.3	51.4
Intermediate	21.3	30.3	32.2	40.4	35.3	34.5
Advanced	3.6	7.0	6.8	7.8	13.4	14.1
Mastered targets (%)						
At centre	59.4	34.5	36.9	48.2	46.2	53.5
At home	40.6	65.5	63.1	51.8	53.8	46.5
Parent involvement						
Average of weekly session at home	21.5	16.5	13.6	13.7	12.4	15.8

group showed an increase in parent–child difficult interaction ($M_{T1} - M_{T0} = 14.0$) and in difficult child scores ($M_{T1} - M_{T0} = 10.3$), casting doubt on the assumption that in exclusively professional treatment provision, parental stress decreases, where the parents direct difficulties with their child is not tackled.

3.3. Treatment progress

Question [4]: How did a child's direct measure of behavior change – namely mastery of behavior targets – influenced by parent inclusion in treatment provision and parent training gains in treatment fidelity?

Direct measures of behavior targets and its mastery over time captured progress of treatment (Table 7). Descriptive data demonstrated that the difficulty of mastered behavior targets increased over time with children starting early intensive treatment at a relatively low instructional level that was appropriate for their skill level. As a child's skill level increased with mastery of targets at a specific skill level, target difficulty was successfully adapted and raised in order to promote progress. Initially at the beginning of treatment, three-quarters of the behavior target were chosen from basic difficulty programs, whereas after 6 months almost half of the behavioral targets chosen to work on were derived from intermediate and advanced difficulty programs, thus indicating a steady increase in child's skill levels. Furthermore, and as shown in Table 6, behavior targets were successfully mastered and generalized in both a structured setting (centre) and a natural setting (home). The distribution of mastery of targets between settings remained stable over time as does the extent of in-home sessions provided by parents with an average of 15 sessions a week that corresponds to 11 treatment hours a week.

Preliminary descriptive data revealed a trend toward parent inclusion and parent treatment fidelity on mastery of behavior targets. Three-quarters ($n = 9$) of children in the intervention group mastered and generalized an average of 67.7% of their behavior targets at home with parents in a naturalistic setting, while one-quarter ($n = 3$) of children in the intervention group mastered an average of 37.5% of behavior targets at home. Children who showed more learning progress at home, mastered in the course of 6 months fewer targets ($M = 73.2$, SD = 27.5) than children progressing more in the clinical setting ($M = 94.3$, SD = 50.8). Nevertheless, the scope of the intervention program was cross-setting maintenance and generalization of mastered targets, which can reliably be achieved solely with targets mastered at home, that have been controlled for generalization at the centre. Thus, children who mastered targets mainly at home had a greater number of home sessions conducted ($M = 73.2$, SD = 27.5) compared to children that mastered more targets at the centre ($M = 11.0$, SD = 11.9), with parents that achieved major treatment fidelity in data collection ($M = 4.3$, SD = .9) respective ($M = 2.7$, SD = 1.3), facilitated play ($M = 12.2$, SD = 2.1) respective ($M = 10.2$, SD = 4.1), DTT with mastered targets ($M = 17.5$, SD = 3.2) respective ($M = 13.0$, SD = 6.0), and discrimination training and introduction with new targets ($M = 7.4$, SD = 1.2) respective ($M = 6.2$, SD = 2.8). Furthermore, those children who mastered targets preferably at a natural home-setting gained higher scores on the Griffith mental developmental quotient ($M_{T1} - M_{T0} = 16.3$) respective ($M_{T1} - M_{T0} = 13.7$), and on language comprehension ($M_{T1} - M_{T0} = 21.8$) respective ($M_{T1} - M_{T0} = 16.0$). Children who mastered targets preferably at the centre gained more scores on adaptive functioning Vineland-ABC ($M_{T1} - M_{T0} = 25.5$) respective ($M_{T1} - M_{T0} = 10.3$) and CDI language production ($M_{T1} - M_{T0} = 12.3$) respective ($M_{T1} - M_{T0} = 10.3$). Decrease in autism severity (ADOS total) was comparable for children that mastered targets mainly in natural home setting ($M_{T1} - M_{T0} = -3.1$) and children with mastery of targets preferably at structured setting ($M_{T1} - M_{T0} = -3.0$).

4. Discussion

Our study compared two intervention approaches—using a comprehensive cross-setting staff- and parent-mediated EIBI and eclectic interventions to examine their preliminary effectiveness in producing developmental gains in young children with ASD. The data from this preliminary comparison shows significant advantages for the intervention group. After 6 months of treatment the intervention group outperformed children receiving eclectic intervention in three out of four outcome measures: autism severity, mental developmental state, and early language skills. In all cases the mean score differences between groups were substantial and statistically significant. A number of studies have compared ABA with eclectic Intervention and demonstrated significantly higher gains on cognitive, language and adaptive skills in intensive

behavioral interventions over eclectic interventions. A direct comparison of score change in the present study with those of previous studies is difficult because of methodological differences: inclusion of different treatment settings, inclusion of different treatment providers, short-term outcome at 6 months versus outcomes at 24 months or longer. Nevertheless, we found that the intervention group achieved a significant decrease in autism severity (namely social interaction and communication), gains in mental developmental state (namely personal-social skills, language skills, eye-hand coordination and performance) as well as on early language comprehension and production. A major finding of the study was, that cross-setting parent- and staff-mediated EIBI could produce appreciable results within 6 months, absent for the eclectic group where mean score differences with a professional provided evaluation of child behavior change did not reach significance. eclectic intervention lead to clinical important child behavior change that might become statistically significant within timeframes of one year and more, which has been previously reported (Eikeseth et al., 2002, 2007; Eldevik et al., 2006; Perry et al., 2008; Reed et al., 2007; Smith et al., 2000; Zachor & Ben Itzchak, 2010; Zachor et al., 2007). However, it should be stated that cross-setting parent- and staff-mediated EIBI produced such changes to child behaviors much more effectively in a shorter timeframe. These results not only demonstrate the superiority of the inclusion of both structured and natural settings in teaching children with autism but also the usefulness of generalization probes which were performed (monthly with parents and children at the centre), to ensure that progress on the choice of behavior targets is appropriate and that previously mastered targets are maintained. This is made possible particularly through the assessment and utilization of the early learning skills and their continuous functional assessment, the planning of appropriate targets for each level of skill and the promotion of skill acquisition across skill domains by considering the developmental order of prerequisite and higher order skills.

Child behavior changes in adaptive functioning were found to be comparable between cross-setting parent- and staff-mediated EIBI and the eclectic intervention, with the eclectic group having significant improvements to socialization skills. This result was anomalous considering that children of the intervention group significantly improved on the social interaction scale of the ADOS observation and may be a result of differing data sources – professional observation versus parent report – whereas professionals may more consistently apply the same criteria when evaluating children compared to parents who followed different approaches and may base their judgment on different criteria. For example, parents of the intervention group may be more critical of their child's current interaction skills, due to parental training that aim to increase knowledge of teaching progress of prerequisite skills that are necessary to achieve higher level spontaneous social interaction. Nevertheless, the research results which are the best indicator for clinical practices were adaptation forward progress and therefore, the aim is to integrate more specific social interaction training in the current cross-setting parent- and staff-mediated EIBI in order to tackle the found divergence in child outcomes of social interaction skills. Quasi-natural environment sessions were used to teach certain behavior targets with more natural strategies such as incidental teaching, to teach children to comply with peers, to teach daily routines and to facilitate functional play and social interaction. However, program change will be accomplished by reducing adult dependency and facilitate engagement with peers because peers serve as prompt and reinforcement providers that are necessary to shift learned initiation of social interaction from adults to peers.

We also found that parents following eclectic intervention benefitted from decreased parental stress that contrarily remained unchanged in parents from the intervention group. This result agrees with previous research findings, that stress decreases in parents in low-intensity parent-provided treatment, but increases when parents are involved in high-intensive treatment provision (Brookman-Frazee, 2004; Keen et al., 2010). Our finding broadens the current understanding toward the relationship of parent inclusion in treatment provision and levels of parental stress. Our data indicates that treatments with lower parental inclusion such as the eclectic intervention may lead to significantly decreased parental stress, but worse parent–child interactions and increased difficulties with own child. It is questionable whether treatment deliveries applied in a child's natural environment may support a reshaping of parent–child relationship and difficulties experienced with its own child without direct parent inclusion in training.

Our study also extends earlier research by including a detailed analysis of challenging behaviors, their maintaining variables and treatment fidelity. Additional data for children in the intervention group revealed that initially high challenging behaviors such as aggression, stereotypes and dysfunctional behaviors decrease significantly during intervention. It was shown at the beginning of treatment that aggression and dysfunctional behaviors occurred significantly more with parents than with staff however, this difference was absent after 6 months. This result emphasizes the need to include parents in treatment provision because challenging behaviors are more likely to occur in the presence of parents, due to the fact that parents provide significantly more access to escape, to automatic and tangible reinforcement, sustaining challenging behavior functional rather than an appropriate use of functional communication. However, it was demonstrated that inclusion of parents in treatment provision accompanied by a intensive parent training and supervision leads to changes in parent's management of challenging behaviors providing significantly reduced access to dysfunctional maintaining variables but, instead, teaching more functional communication, thus leading to a subsequently diminishes occurrence of challenging behaviors. This is a controlled progress that is readily taught, when comprehensive and continuous functional analysis of challenging behaviors and its function are conducted, as it has been done in the current EIBI program.

To summarize, the present study found that cross-setting staff- and parent-mediated EIBI in conjunction with thorough training and supervision of parents is effective for young children with autism showing significant gains in a very short timeframe. However, parent training and supervision must be to the same extent as professionals in order to ensure proper implementation of teaching strategies. It has been demonstrated that parents with significantly less treatment fidelity prior

to treatment start, can make up an initial deficit and achieve a comparable level of treatment fidelity as a professional treatment provider, for DTT techniques with mastered skills and discrimination training and introduction of new targets by the end of 6 months. The data shows the need to engage parents more intensively in facilitated play and to supervise more effectively data collection and, fidelity skills in parents which are significantly behind professional treatment providers.

Exploratory analysis of treatment progress variables identified two trends of children profiles: children who reliably mastered and, therefore, generalized the majority of their targets at home, and children who mastered targets mainly at the centre with staff. The group of children that progressed mainly in their natural environment mastered fewer overall behavioral targets but received more home sessions by parents that achieved better treatment fidelity. This pattern was reflected in better child outcomes in mental developmental state and early language comprehension. In contrast, children that progressed more in the clinical setting, had less involved parents with less treatment fidelity, overall mastered more behavioral targets and gained higher scores on adaptive functioning and early language production. Although these results were descriptive and derived from trends, it still relates to the impact that choice of treatment provider and teaching environment have on child outcome. The trends indicated that behavioral targets toward adaptive functioning and functional communication are somewhat difficult to approach for non professional treatment providers. This is, likely because of the use of less structured highly incidental teaching strategies and, reveals the need to deepen parental training and supervision in order to ensure that children may proceed successfully in all skill areas, when treatment is applied in a natural environment.

There are limitations to this study which constrain the interpretation of our results. First, the sample size was relatively small and some measures were not available for both study groups. Second, assignment to treatment groups was parent-determined rather than random. However, the two study groups were comparable on dependent measures at pre-treatment which is the main purpose of random assignments and thus, the significant outcome differences found between groups were likely to be due to differing treatments rather than to a selection bias or pre-treatment differences among participants.

A noteworthy strength of the study was that in addition to measurements of child outcome via performance on standardized, norm-referred assessments, there was repeated direct observational measurements of behavior in situ utilizing ABA. Finally, treatment integrity was not available from the eclectic group, so any lack of efficiency in this kind of intervention may be accounted for either by the eclectic approach itself or because of a lack of treatment fidelity of treatment providers.

Nevertheless, our results provide evidence that cross-setting staff- and parent-mediated EIBI produces substantial gains on diagnostic, developmental, language, adaptive and behavioral measures in children with ASD. The inclusion of natural environment as a treatment setting and the inclusion of parents in treatment provision leads to lasting behavior changes, and the use of intensive and continuous parent training and supervision reliably achieves treatment fidelity in the application of teaching strategies and management of challenging behaviors found in children with ASD.

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