

## Tertiary-preventive interventions for Autism Spectrum Disorders (ASD) in children and adults: An evaluative synthesis of two TEACCH based outcome studies

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### Abstract

*Results from the recent research literature indicate the urgent need for more intervention outcome studies for Autism Spectrum Disorders (ASD) worldwide, with available interventions commonly being considered a form of “tertiary prevention”. This paper presents a synthesis of two TEACCH-based intervention studies for children and adults with ASD, carried out in Germany: (1) The concept of the “Double ABCX Caregiver Stress-Coping model” (adapted from Pakenham, Samios, & Sofronoff, 2005) having guided our research is outlined and related to tertiary-preventive interventions; (2) based on a broad-category taxonomy adapted from the research literature, and considering recent systematic reviews, three comprehensive intervention approaches are outlined and discussed concerning construct, internal and external validity: (a) “traditional Applied Behavior Analysis (ABA)”, (b) “TEACCH” and (c) “contemporary ABA”; (3) the concept of “structured teaching” being a key component of TEACCH (Schopler, 1997) is outlined briefly. The present synthesis aims at examining the effectiveness of TEACCH based interventions within various social settings. The first study, using a controlled individual-subject design, reports on a social communication training with a 7-year-old girl with autism and intellectual disability living in a residential home. In the second, a small group study, the long-term outcomes of a*

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*TEACCH based intervention in a day care and vocational setting including three adults with ASD are examined. The synthesis of these two studies provides tentative support for the efficacy and effectiveness of TEACCH based interventions across different ages and life settings within the sociocultural context examined. For future evaluation of the TEACCH approach, methodologically sound both individual and group research is needed.*

*Keywords:* Autism Spectrum Disorders; TEACCH; Effectiveness; Evaluation study.

## 1. Theoretical background and aims of the present study

Autism Spectrum Disorders (ASD) are a group of developmental disabilities defined by (1) qualitative impairments in reciprocal social interaction, (2) qualitative abnormalities in patterns of communication, (3) restricted, stereotyped, repetitive repertory of interests and activities, (4) beginning before the age of three. ASD include (a) “Childhood Autism” (or “Autistic Disorder”), the most prototypic and severest form among ASD, (b) “Asperger Syndrome”, and (c) “Pervasive Developmental Disorder - Not Otherwise Specified” (PDD-NOS) including “atypical autism” (World Health Organization/WHO, 1992, ICD-10; American Psychiatric Association/APA, 2000, DSM-IV-TR; Centers for Disease Control and Prevention (CDC)/National Center on Birth Defects and Developmental Disabilities, 2010). In addition to the central features of impaired social interaction and communication, and narrowed interests and activities, a range of other problems are common, such as temper tantrum, hyperactive, aggressive, disruptive and self-injuring behaviors. Autism spectrum has been considered as a group of neurobehavioral disorders showing an estimated cumulative prevalence of 3.7 per thousand (Fombonne, 2005). As yet, primary prevention interventions for reducing the incidence of ASD or secondary prevention interventions for reducing the prevalence of ASD are available. The great majority of individuals with ASD need life-long education and caregiver support (NRC, 2001; Howlin, 2004). Thus, current interventions for individuals with ASD imply “tertiary prevention” (or “rehabilitation”), that aims at (1) preventing disease and “disability progression and attendant suffering” (Wallace, 2010), (2) alleviating and reducing obstructive behavioural symptoms, (3) strengthening autonomy and personal responsibility by fostering social-communicative, cognitive, language, adaptive and emotional skills, and (4) promoting social participation in the family, classroom, residential group home, day care setting, workplace, and community, and thus achieving the best *possible* level of health and “optimum adaptation” (Schopler, 2005). Tertiary prevention comprises interventions which address the individual person with autism directly, interventions which focus on caregivers, and interventions which combine both approaches. Most programs for tertiary intervention of individuals with ASD put a strong focus on education, training, supervision, and broad social support of caregivers (NRC, 2001; Roberts & Prior, 2006; Mesibov & Shea, 2009; Makrygianni & Reed, 2010).

### *1.1 Caregivers’ coping with demands and stresses and the role of tertiary-preventive interventions*

Caregivers of children and adults with Autism Spectrum Disorder, such as parents, teachers and educators frequently face stress in daily life situations as a result of both the autism-specific symptom pattern of challenging

behaviours and dysfunctional responses of the individual's environment (Van Bourgondien & Reichle, 1997; Marcus, Kuncze, & Schopler, 2005; Probst & Leppert, 2008). According to Marcus *et al.* (2005), the factors contributing to a unique and high level of stress in caregivers include: (a) diagnostic confusion, frequently caused by professionals' inadequate communication styles; (b) individual's uneven and atypical course of development, e.g., discrepancy between verbal and visuospatial abilities; (c) the "can't versus won't" dilemma, which is related to the uneven developmental profile, for example, questioning if the individual with autism is unable to respond to a simple verbal request or unwilling to do so; (d) individual's atypical social communication; (e) individual's (primarily child's) typical physical phenotype, which creates expectations of average age-related behaviour in the community, followed by frustration and negative emotions if the individual shows disruptive, embarrassing or other challenging behaviours; (f) social stigmatization of caregivers on common attributional biases, e.g. by attributing stable negative personality traits, such as rigidity, lack of empathy and compulsivity to parents in conjunction with a misinterpreted "broader autism phenotype theory", or educational inability to teachers; (g) detrimental professional-caregiver relationships, e.g., caused by excessive demands on caregivers through prescribing multiple treatments; (h) fads and unproven treatments disseminated by mass media: e.g., facilitated communication, that creates ungrounded hopes, later mostly followed by deep frustration and hopelessness; (i) vulnerability to simplified claims of treatment sellers like "the only proven therapy claim". Thus, considering Bronfenbrenner's ecological model (Huston & Bentley, 2010), caregivers are influenced by various societal contexts of individuals with autism, as its micro-system (e.g. health services), exosystem (e.g. mass media) and macrosystem (e.g. prejudiced attitudes of the culture).

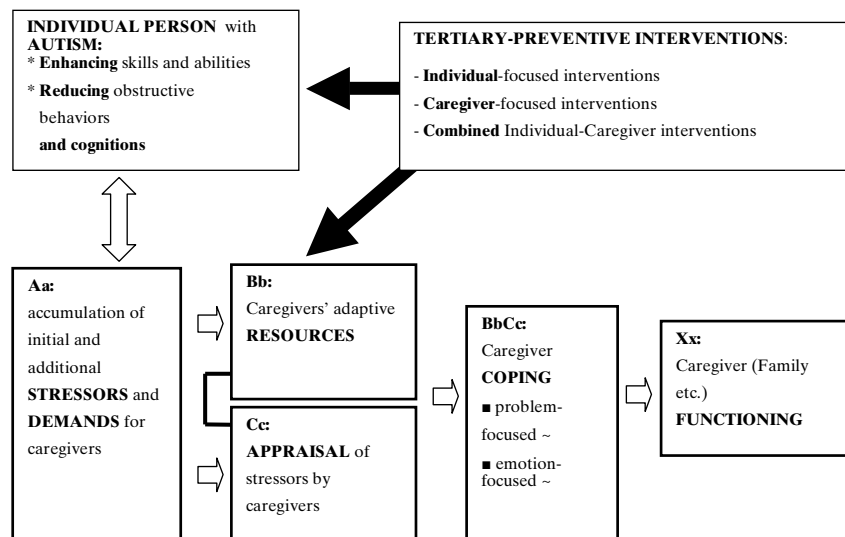
The Double ABCX Model of Family Coping with Stresses (McCubbin & Patterson, 1982) has proven to be beneficial in guiding research and clinical practice in families with a child with ASD (Pakenham, Samios *et al.*, 2005) and can heuristically be used for other caregivers and social environments, such as teachers in classrooms and educators in day care and residential institutions (Figure 1).

The Double ABCX model, an expansion of the former ABCX model, describes how families and other caregiver environments respond to stressors and a crisis associated with caring for or teaching a child with autism under a long-term perspective, whereas the "pure" ABCX model only focuses on the short-term perspective of the actual crisis. The specific temporal perspective in the Double ABCX model is symbolized by the combination of upper-case and lower-case letters (Aa, Bb, Cc, Xx, see Figure 1). The variables of the Double ABCX model include: (1) Aa, the accumulation of (mostly uncountable) demands and stresses in addition to the initial stressor A; (2) Bb, the long-term resources of family/classroom/residential

home/day care setting are for managing a crisis comprising psychological, economical and social resources; (3) Cc, the ongoing process of the family's/classroom's/residential home's/day care's definition and appraisal of the high-demanding situation (e.g., either perceived as a challenging life task and opportunity for growth or as an unbearable catastrophe); (4) BbCc, conceived as "bridging concept" which includes all coping strategies being applied by the family/classroom/residential home/day care to deal with the challenging situation. Coping (BbCc) brings together cognitive, emotional and behavioral components, so that resources, perceptions and behavioral responses interact in order to restore balance in family, classroom, residential home or day center; (5) Xx, family/classroom/residential home/ day center functioning refers to the outcome of parents', teachers' and other caregivers' efforts to achieve a balanced family, classroom and group home life. It includes variables such as care giving quality, social group coherence, and life satisfaction of the group members. As a rule, there is some interplay between all variables described.

To sum up, family, classroom, residential home, and day care functioning (Xx) are dependent not only on the totality of the demands and burdens (Aa) but importantly also on moderator variables, including the caregivers' psychological, social and material resources (Bb), the interpretation of stressors and demands (Cc), and coping efforts which result from both (BbCc).

Figure 1 - Double ABCX Stress-Coping Caregiver Model (adapted from Pakenham et al., 2005)



As a consequence of their chronically heightened stress profiles, caregivers frequently express an urgent need for professional support (Marcus *et al.*, 2005).

Tertiary prevention within the framework of the Double ABCX-Caregiver Stress-Coping Model (Figure 1) addresses both the needs of individuals with autism by enhancing their skills, competencies and abilities and reducing their obstructive cognitive and behavioral habits, and the caregivers' needs by strengthening their adaptive resources and enhancing their problem-focused as well as emotion-focused coping abilities. Thus, both caregiver-based and individual-based interventions aim at changing the social systems of family, classroom and remedial institution by modifying cognitions, emotions and behaviors of significant actors interacting in the system.

Roberts and Prior (2006) emphasize in their review that a common core feature of efficient family-centred interventions for ASD has been the establishment of a good relationship between professionals and parents, which includes the competence of health-professionals to enhance the well-being of children with autism and their families by addressing the needs of the *entire* family. In fact, this conclusion can be generalized to caregivers working in classrooms and remedial institutions with individuals with autism of all ages (Schopler, 2005).

### *1.2 Comprehensive intervention approaches for ASD based on broad-category taxonomy*

Over the last three decades, a range of science-based treatment programs for children and adults with ASD have been developed in the English speaking world. This has been largely the work of university-based groups of scientists focused on pioneers and innovators of autism research and treatment. Using a taxonomy adapted from the recent research literature (Roberts & Prior, 2006; Ospina, Seida, Clark, Karkhaneh, Hartling, Josfold, Vandermeer, & Smith, 2008) for heuristic purpose, the large variety of currently existing intervention programs for ASD can be summarized into three broad categories reflecting their theoretical orientations: (1) Traditional Applied Behavioral Analysis (Lovaas); (2) TEACCH: Treatment and Education of Autistic and related Communication handicapped Children and (3) Contemporary Applied Behavior Analysis:

(1) *Traditional Applied Behavioral Analysis (Lovaas)*: The Lovaas program (Lovaas, 2003), developed by Ivar Lovaas at the University of California Los Angeles in the 1960s, is seen as the paradigmatic exponent of the Traditional Applied Behaviour Analysis approach (cf. Prizant & Wetherby, 2005), which is largely based on Skinnerian methods of operant discrimination learning within highly structured, directive, and externally controlled settings. A core feature of Lovaas-based ABA is the "Discrete Trial Format" (Bernard-Opitz, 2007), in which each trial within a series of trials comprises the four elements (1) "Therapist's Instruction (discriminative stimu-

lus)", (2) "Individual's Response - where appropriate, prompted by therapist", (3) "Therapist's Consequence" - e.g., if response correct, positive reinforcement (e. g. preferred toy or piece of food)", (4) "Pause" (intertrial interval) or "Play Break" at the end of a series of trials (Lovaas, 2003, pp. 62-68). Not until recently Lovaas and his research group have been beginning to open the program slightly to concepts that rely more on individual development, visual supports, and strengthening spontaneous behaviours, and to exclude any forms of corporal punishment (Bondy & Frost, 2003; Lovaas, 2003; Lovaas & Eikeseth, 2003).

(2) The TEACCH-program was established by Eric Schopler and Gary Mesibov at the Chapel Hill University of North-Carolina in the late 1960s (Mesibov, Shea, & Schopler, 2006). It is based on a developmental-behavioral and multidisciplinary framework focusing on (a) *Structured Teaching* in the individual's daily environment, with *visually* structured interventions playing an eminent role, and (b) close parent-professional collaboration; (c) comprehensive family, classroom and lifelong community-based service (Schopler, 2005). Autism is seen as a neurobehavioral disorder whose behavioural syndrome is the result of abnormalities in early brain development. A large proportion of autistic children have deficits in auditory-verbal information processing and relatively strong spatial-visual abilities (Tsatsanis, 2005). They also have a need for constant and predictable environments, and daily routines. Based on this knowledge, the TEACCH group created the concept of *Structured Teaching* (Mesibov & Shea, 2009), which includes components of visually structuring and further structuring components based on developmental, behavioural and cognitive-behavioural theories.

(3) *Contemporary Applied Behaviour Analysis*: There is a broad group of autism researchers whose approach has been described as contemporary ABA (NRC, 2001; Prizant & Wetherby, 2005; Roberts & Prior, 2006), based essentially on multidisciplinary fields of cognitive, developmental, individual differences and language pathology sciences, and derived developmental-behavioural, social-pragmatic developmental and cognitive-behavioural concepts, with a strong focus on the promotion of "pivotal skills", such as "self-initiated communication and communicative reciprocity" within naturalistic settings and "emotional regulation" (Prizant & Wetherby, 2005; Roberts & Prior, 2006). This broad group includes Robert Koegel and Lynne Koegel at the University of California, Santa Barbara; Laura Schreibman at the University of San Diego (Schreibman & Koegel, 1996); Vera Bernard-Opitz at the University of California, Irvine (Bernard-Opitz, 2007); and Patricia Howlin at the University of London (Howlin, 2004). However, it is worth noting, that traditional ABA methods, such as discrete trial format interventions are not excluded by a number of exponents of contemporary ABA, but have also been adopted into ASD programs in order to meet some individual needs for highly directive and prescriptive set-

tings, given specific levels of development and behavioural functioning (see Handleman & Harris, 2001; Howlin, 2004; Bernard-Opitz, 2007; Ospina *et al.*, 2008). Finally, it is worth mentioning that there is a conceptual overlap between TEACCH and the contemporary ABA Spectrum as both relying on a broad state-of-the-art multidisciplinary body of research identifying neurological, behavioral, and developmental characteristics of ASD (NRC, 2001; Volkmar, Chawarska, & Klin, 2005; Roberts & Prior, 2006).

### 1.3 Validity of ASD intervention approaches

For evaluating the overall quality of intervention approaches for ASD, it is necessary to consider three forms of validity: *theoretical* or *construct* validity, *internal* validity, and *external* validity of the studies on which the respective approach is based. *Theoretical validity* refers to the degree of integration of state-of-the-art scientific knowledge into the concept of the intervention study, and the degree that an explanation or interpretation developed from a research study fits the data. *Internal validity* refers to the quality of the study design and includes control for nonspecific factors, such as history, maturation, expectancy, and experimenter bias, making sure that between or within group differences can be attributed at least partially to the influence of the experimental treatment. Thus, providing evidence for a treatment's efficacy or effectiveness requires some positive level of internal validity. *External validity* includes control for selection bias, and describes the degree to which the results of the intervention study can be generalized to other individuals, situations, and historical periods (cf. NRC, 2001).

In a series of systematic reviews on interventions for ASD that have been reported, validity and effectiveness issues have been addressed (BCOHTA, 2000; NRC, 2001; Roberts & Prior, 2006; Singer, Ethridge, & Aldana, 2007; Ospina *et al.*, 2008; Rogers & Vismara, 2008; Spreckly & Boyd, 2009; Eldevik, Hastings, Hughes, Jahr, Eikeseth, & Cross, 2009; Mesibov & Shea, 2009; Reichow & Volkmar, 2009; Reichow & Wolery, 2009; Makrygianni & Reed, 2010; Virués-Ortega, 2010).

*1.3.1 Theoretical validity* (a) Considering the *traditional ABA* approach, there are some factors that weaken the theoretical validity. Firstly, also more recent studies of Lovaas and colleagues (Eikeseth, Smith, Jahr, & Eldevik, 2002; Lovaas, 2003; Sallows & Graupner, 2005) show a strong preponderance of “operant conditioning principles”, “discrete trial training” and “contingency management”, and thus indicating some lack of synthesizing current knowledge from cognitive, developmental and clinical disciplines sufficiently (NCR, 2001; Prizant, Wetherby, Rubin, Laurent, & Rydell, 2006). Secondly, Lovaas's claim to enable children with autism to achieve “normal functioning” (BCOHTA, 2000; Lovaas, 2003) is in contradiction to the current thinking of interdisciplinary research. In a systematic review from the University of British Columbia (Canada) Lovaas and col-



leagues are criticised for having not limited their effectiveness claims to achieving substantial developmental gains but having “permitted, and even fostered” the notion of normal functioning for as many as a half a given population of children with autism “throughout their published literature” (BCOHTA, 2000). Overall, because of these and further conceptual biases (cf. Roberts & Prior, 2006) the theoretical validity of the traditional ABA approach is considered to be severely limited.

(b) The theoretical validity of the *TEACCH approach* ought to be evaluated as high because interdisciplinary state-of-the-art knowledge has been taken into consideration, such as concepts of social-cognitive learning, individual differences (see “culture of autism”, Mesibov & Shea, 2009), neuropsychology, developmental psycholinguistics, cognitive-developmental, and clinical family psychology (NRC, 2001; Mesibov *et al.*, 2006).

(c) Similarly, considering well-known comprehensive programs for ASD to be subsumed under the umbrella term of *contemporary ABA* (Roberts & Prior, 2006; Ospina *et al.*, 2008), such as the Pivotal Response Training (Schreibman & Koegel, 1996), the Structured Teaching and Experience-based Program (STEP, Bernard-Opitz, 2007), and the Social Communication Emotional Regulation Transactional Support program (SCERTS, Prizant *et al.*, 2006), there is much evidence for high theoretical validity as current interdisciplinary knowledge as on social cognition, social-emotional abilities, natural language strategies, alternative communication, and intrinsic motivation has been integrated systematically and applied for serving individuals with autism.

*1.3.2 Internal validity and effectiveness* (a) *Traditional ABA*: Concerning the *effectiveness*<sup>5</sup> mixed findings from various systematic reviews on interventions for children with autism have been reported. All effectiveness results which have been analyzed are based on group comparisons between traditional ABA and standard/ eclectic treatment or low-intensity traditional ABA treatment. Any comparative studies including comparisons to alternative comprehensive programs, such as TEACCH or contemporary ABA programs do not exist as yet.

Various meta-analyses (Ospina *et al.*, 2008; Eldevik *et al.*, 2009; Reichow & Wolery, 2009; Virués-Ortega, 2010; Makrygianni & Reed, 2010) including three (Ospina *et al.*, 2008) to eleven controlled clinical studies (Makrygianni & Reed, 2010), indicated effect sizes in the “medium” to “large” range<sup>6</sup>

<sup>5</sup> In this article, we use “effectiveness” in the broad sense as comprising both “efficacy” referring to effects of an intervention in controlled laboratory settings (Kazdin & Weisz, 2003) and “effectiveness” (in the narrow sense) referring to effects in real-life clinical practice (ibid., NRC, 2001).

<sup>6</sup> See effect size categorization according to Cohen, as cited in Ospina *et al.* (2008), where 0.2 indicates a small effect, 0.5 a medium effect and 0.8 a large effect size.

for intellectual functioning, language and adaptive behavior in favour of traditional ABA high intensity treatment (usually 25-35 h per week over 2-3 years). The results of a previous meta-analysis of the effects of ASD programs including the “Lovaas” approach (Probst, 2001) are congruent with the findings of the current analyses. In contrast, Spreckley and Boyd (2009) reported from their meta-analysis, based on four controlled studies only non-significant “small” effect sizes for intellectual, language and adaptive behaviour outcomes. Correspondingly, these reviews resulted also in mixed conclusions. Eldevik *et al.* (2009), Virués-Ortega (2010), Makrygianni and Reed (2010), and Reichow and Wolery (2009) evaluated traditional ABA unanimously positively as promising, effective, and superior to eclectic control programs, whereas Spreckley and Boyd (2009) concluded that there is no evidence for significant additional benefit of traditional ABA over standard care for intellectual functioning, receptive and expressive language, and adaptive behaviour. These authors assumed that the great majority of children examined showed progress caused by natural development rather than intervention. Notably, Ospina *et al.* (2008) have interpreted their meta-analytic findings showing multiple improvements in favour of traditional ABA with marked reservation. They summarized sceptically that this approach may improve some core symptoms of ASD, however with the limitation that these findings are based on pooling of only a few, methodologically weak studies, and consequently there is no definite evidence suggesting superiority of this approach over other interventions (Ospina *et al.*, 2008). There are also systematic narrative reviews addressing the effectiveness of traditional ABA. In their review on comprehensive treatments for early autism, based largely on four controlled studies, Rogers and Vismara (2008) conclude, that Lovaas’s intervention approach meets the Chambless *et al.* criteria (Chambless & Hollon, as cited in Rogers & Vismara, 2008) for “probably efficacious” (Rogers & Vismara, 2008, p. 30) concerning the overall outcomes including intelligence (IQ), behavioral outcomes, adaptive skills, and language skills. The authors evaluate the approach as “well-established” with regard to improving intellectual functioning in young children with ASD (*loc. cit.*, p. 25). In this context, it is worth mentioning that there is an ongoing controversy about to which extent the improvements in IQ are influenced by measurement instrument variation and related methodological problems (Roberts & Prior, 2006). Both the review of BCOHT (2000) and the review of Roberts & Prior (2006) emphasize consistently that there is strong evidence for traditional ABA improving and alleviating symptoms, however no evidence for recovery and cure. Roberts and Prior (2006) assume that, primarily due to claims relating to “recovery”, “exclusivity” (i.e. superiority), and “intensity”, the Lovaas approach is “among the most controversial interventions” for ASD.

Regarding the *internal validity* of studies on the traditional ABA method, factors supporting the internal validity include: (a) the existence of

a total of 7 controlled clinical trials, among them 2 randomized controlled studies (Ospina *et al.*, 2008, table 1, under “discrete trial” and “UCLA/ Lovaas), reflecting a “unique high level of scrutiny” compared to all other approaches (Roberts & Prior, 2006), (2) comprehensive manualization of the treatment program (Lovaas, 2003), and (3) use of standardized multimodal outcome measures. Factors threatening internal validity include: (1) lack of controlled studies including comparison groups based on TEACCH or equivalent programs of temporary ABA, rather than weakly defined eclectic treatment or non-treatment groups (Eldevic *et al.*, 2009), (2) lack of cohort studies or within-group studies addressing classroom functioning in preschools and schools, (3) interpretational biases, in raising claims deduced from research studies that are not supported by empirical evidence, such as recovery-and-normalization-claims, the alone-proven-method-and-superior-to-others-claim, and the high-intensity-intervention-for-all-children-and-families claim (cf. Roberts & Prior, 2006), and (4) lack of external evaluators being outside the traditional ABA researcher network.

(b) *TEACCH approach*: Concerning the effectiveness, evaluation is largely based on five controlled studies as documented in the narrative review of Mesibov and Shea (2009). (1) In the Bristol *et al.* study (as cited in Mesibov & Shea, 2009), the low-intensity TEACCH-based parent-child home program was superior to the no-treatment condition for reducing depression in mothers, indicated by a follow-up effect size in the medium range (Probst, 2001; Singer *et al.*, 2007). (2) In the Ozonoff and Cathart study (as cited in Mesibov & Shea, 2009), the group who received the low-intensity home-based TEACCH program improved significantly more in child developmental outcomes than the eclectic-standard care control group, with a single study effect size scoring in the “low” range (Probst, 2001). In addition, in the metaanalytic review of Ospina *et al.* (2008), the Ozonoff and Cathart study was pooled with another TEACCH-based study published by Tsang *et al.* (as cited in Ospina *et al.*, 2008), which, however, shows severe methodological flaws, so that the resulting pooled effect sizes reported for two developmental outcomes, scoring in the “low” and “zero” range, are difficult to interpret. (3) In the randomized controlled study of Welterlin (2009) with a wait list comparison group, the experimental group who received the low-intensity parent-child home-based TEACCH program improved significantly more both in child and parent outcomes. (4) In the Panerai, Zingale, Trubia, Finocchiaro, Zuccarello, Ferri, & Elia (2009) study (as cited in Mesibov & Shea, 2009), a moderate-intensity centre-based TEACCH parent training was significantly superior to a standard special educational treatment in terms of both child behavioural and developmental outcomes. (5) In the Bourgondien *et al.* study (as cited in Mesibov & Shea, 2009), the TEACCH-based residential program for adults was superior to residential and family standard care in terms of adult behavioral adaptation and parent satisfaction.

In their narrative review, Roberts and Prior (2006) concluded that the results of a small number of studies indicated positive outcomes for children affected by the TEACCH program. According to Ospina *et al.* (2008), individual evaluative studies consistently report significant findings for a variety of outcomes. Overall, however, Ospina *et al.* (2008) concluded that the evidence to support the effectiveness of “integrative programs” (comprising TEACCH and social skills programs) is limited.

*Positive* indicators of *internal validity* include (1) the partial manualization of the TEACCH program (Watson, Lord, Schaffer, & Schopler, 1989; Faherty & Hearsay, 1996; Mesibov & Howley, 2003) and (2) the use of real-life outcomes reflecting child-parent interactions. *Negative* indicators include: (1) a lack of prospective cohort studies, pre-post one-group studies, and controlled single-subject studies describing the effects of high intensity (about 25-30 h per week over 2-3 years) TEACCH-based interventions in preschool classrooms; (2) broad lack of prospective cohort studies, pre-post studies, and controlled single-subject studies examining the effects of Teacch-based programs in categorical and inclusion classrooms, and residential and workshop settings; (3) lack of controlled clinical studies comparing the effects of intensive and comprehensive TEACCH interventions with corresponding equivalent interventions of other approaches, such as the traditional ABA-approach of Lovaas; (4) the broad lack of controlled studies addressing the effects of low-to-moderate-intensity family and parent interventions characteristic for the TEACCH approach; and (5) a tendency to undervalue evidence-based intervention research methods as recommended in the literature (NRC, 2001; Ospina *et al.*, 2008) and instead primarily focus on “good clinical or service programs”, “habilitation effort” (Schopler, 2005), “clinical expertise” and “real world practice” (Mesibov & Shea, 2009).

(c) *Contemporary-ABA*: According to Rogers and Vismara (2008), the Pivotal Response Training (PRT) program developed by Schreibman and Koegel (1996) addressing the enhancement of imitation, language, communication and play skills in as natural as possible environments, shows the best effectiveness evidence within the temporary ABA category. Based on multiple single-subject studies, it meets the Chambless and Hollon criterion of a “probably efficacious” intervention (*ibid.*). Correspondingly, in the meta-analysis of Probst (2001), a pooled “large” effect size of 1.2, based on two controlled PRT parent training studies, was reported for child-parent interaction in favour of PTR, compared to discrete trial-based parent training. Additionally, Ospina *et al.* (2008) report some evidence that PRT may be beneficial for communication and social interaction. In the review of Rogers and Vismara (2008) three further studies, based on RCT designs, are reported, which meet the “possibly efficacious” criterion of Chambless and Hollon: a Canadian program presented by Jocelyn *et al.* (as cited in Rogers & Vismara, 2008) comprising a child day care worker and parent training intervention resulting in positive caretaker and child outcomes; a

British program, evaluated by Drew *et al.* (as cited in Rogers & Vismara, 2008) addressing “pragmatic language intervention” in addition to community standard care; and a British program presented by Aldred *et al.* (as cited in Rogers & Vismara, 2008) including a home-based, parent-delivered developmental intervention, with parents having been trained in pragmatics of social communication and behavior management. Finally, the Scottish Centre for Autism Preschool Treatment program, presented by Salt *et al.* (as cited Rogers & Vismara, 2009) in a controlled study comprising parent-child small group interventions addressing imitation, joint attention, social reciprocity and play, was evaluated positively as “important initial finding” of a “developmental treatment approach”, however not yet meeting the “possibly efficacious” level (*ibid.*). In addition to Rogers and Vismara (2008), programs of the contemporary behavioral approach have been appraised positively by several reviewers, such as NRC (2001) as demonstrating effectiveness for speech, language and communication, and similarly also by Roberts and Prior (2006), and Singer *et al.* (2007). Further, Ospina *et al.* (2008) reported some evidence for significant improvements in various child domains and parent’s mental health for programs including cognitive behaviour therapy. Finally, Reichow and Volkmar (2009) in their review of social skills interventions, reported “established evidence-based practice” for social skill group programs, and “promising evidence-based practice” for video modelling programs, based on the evaluation category system of Reichow, Volkmar and Cicchetti (as cited *ibid.*). Presenting a more reserved and sceptical side, Ospina *et al.* (2008) concluded in sum, that the evidence supporting the use of contemporary ABA approaches is variable and there is no evidence of the superiority of one program over the other, and there is also limited evidence for “developmental interventions”.

To sum up, factors *positively* influencing the *internal validity* of contemporary ABA comprise: (1) use of controlled trial designs and (2) use of multiple measures including real-life outcomes. *Negative* factors include: (1) broad lack of replication studies, (2) lack of synthesis of targets, curricula, and measures, (3) lack of comparison and long-term studies, and (4) lack of manualization of treatments.

*1.3.3 External validity (a) Traditional ABA:* External validity is *positively* influenced by: (1) completion of multi-site clinical trials across different countries in North-America and Europe and (2) international provision of trainings for professionals and parents. *Negative* factors include: (1) lack of program flexibility concerning the prescribed high intensity of the early intervention program with a magnitude of at least 30 hr/week over two and more years for all children and families, which means a major burden for many families, and is also a problematic level of input for service providers in the communities (Spreckley & Boyd, 2009), and (2) setting false hopes and creating confusion in parents, individuals with ASD, and professionals

by exaggerated claims for treatment success in form of “recovery” or “normalization” (Marcus *et al.*, 2005).

(b) *TEACCH*: *Positive* indicators of external validity include the following: (1) Provision of a federal state-wide service in North-Carolina (USA) covering all ages from early childhood to late adulthood, and life settings from family to community life. (2) Provision of low-threshold continuum of parent and family support being mindful of different resources and abilities of parents and other family members. (3) Systematic training of caregivers in methods of *structured teaching* contributing to the generalization of the autistic person’s learning processes into different life environments (Schopler, 2005). (4) Provision of a continuum of TEACCH-assisted educational settings considering various individual needs, ranging from special education to inclusive general education classrooms offering graded levels of assistance for the child with autism. (5) Broad social acceptance of the program’s goals, methods and effects by caregivers, individuals treated, and the community (Schopler & Mesibov, 2000; Probst, Konstantareas, Leppert, Panerai, & Rampton, 2008), which constitutes “social validity” (Foster & Mash, 1999), a core aspect of external validity. Factors adding to the social validity of the TEACCH program include the avoidance of excessive technical-behavioural terminology, which many professionals and families are opposed to (Probst, Glen Spreitz, & Jung, 2010), and the “holistic orientation” (Schopler, 2005), seeing the whole individual within the context of a unique social group (e.g., family) rather than under the narrow perspective of a specialized discipline. (6) Focus on the “generalist” model of treatment that avoids splitting the treatment into many specialized services, acknowledged, in particular, by the health systems of developing countries. (7) Implementation of TEACCH programs in a number of countries North America, Asia, Australasia, and Europe (NRC, 2001; Mesibov & Shea, 2009) including adaptation to different social and family contexts as, for example, in Italy (Roberts & Prior, 2006). (8) Finally, on an international scale, provision of training programs for professionals in weeklong workshops with hands-on component. Factors *negatively* affecting external validity include (1) small sample sizes and (2) broad lack of replication studies.

(c) *Contemporary ABA*: The *external* validity is supported (1) by program flexibility taking into account variety of individual, family and community resources and (2) high social acceptance of curriculum aims of enhancing social communication in naturalistic settings and strengthening pivot competencies of motivation, attention and self-management. The external validity is *threatened* by (1) small sample sizes, (2) lack of replication studies, and (3) lack of program dissemination across various countries.

#### 1.4 Overall conclusions from validity analysis

Based on the preceding analysis of comprehensive reviews, the following overall conclusions can be drawn.

(1) There are numerous inconsistencies across the various meta-analyses and narrative reviews which have been analyzed. Possible reasons for this includes firstly the use of varying methods of study selection, varying standards of quality assessment, and varying methods of analysis and presentation of results by different reviewers and secondly some susceptibility to the Rosenthal effect, according to which reviewers' beliefs, biases, and expectations influence the phenomenon of investigation (Makrygianni & Reed, 2010).

(2) The traditional ABA approach is characterized by substantial limitations to theoretical and moderate limitations to external validity. The internal validity is moderately limited, mainly due to methodological and interpretational biases. Lovaas' and his colleagues' excessive claims like that of recovery and normalization might be founded in their belief in radical environmentalism as taught by Burrhus F. Skinner, which presupposes that man is largely controlled by his environment and that "it is an environment largely of his own making" (Skinner, 1971, p. 215). Despite these limitations, the reviews provide sufficient evidence for substantial effectiveness across developmental and behavioural outcomes for preschool children with autism, at least in the low-to-medium effect size range.

(3) The TEACCH approach has adequate theoretical validity and largely adequate external validity. The internal validity is moderately limited, in particular by the broad lack of controlled single subject and group studies in TEACCH-based preschools and schools. Based on the reviews, there is sufficient evidence on substantial effectiveness for low-to-medium intensity TEACCH interventions in families, across child developmental and behavioural outcomes and parental stress measures, at least in the low-to-medium effect size range.

(4) The contemporary ABA approach is characterized by adequate theoretical validity, moderate limitations to external validity, mainly due to the broad lack of replication studies, and moderate limitations to internal validity, in particular due to the lack of controlled group studies and manualization of programs. Regarding the Pivotal Response Training, the reviews provide substantial evidence for effectiveness across child and parent outcomes. Further, there is some promising but mixed and tentative evidence for a number of related programs presented in this category.

(5) All three approaches show some lack of comparison studies addressing an alternative comprehensive program instead of eclectic standard care programs. Thus, currently no conclusions about relative effectiveness or "the most effective" intervention approach (Roberts & Prior, 2006) can be drawn (cf. Dawson & Osterling, 1997; NRC, 2001; Ospina *et al.*, 2008). However, using the criterion of an overall validity assessment, based on the aggregation of theoretical, internal, and external validity ratings as pointed out above, TEACCH is superior to the other two approaches. Hence, we considered the TEACCH program the currently "best practice" approach

available and thus suitable for being tested in the German mental health care setting.

### 1.5 Concept of structured teaching

The concept of “structured teaching”, which is considered to be a key feature of the TEACCH program is briefly outlined. Table 1 summarizes the components und subcomponents of structured teaching.

Table 1 - Key features of Structured Teaching

Components and subcomponents of Structured Teaching
<p>(A) <i>Visually Structuring</i>: Providing Visual Structure for the individual’s daily environment (Schopler, Mesibov, &amp; Hearsey, 1995; Mesibov &amp; Howley, 2003) is a central component of <i>Structured Teaching</i>. Interventions based on Visually Structuring include the subcomponents:</p> <ol style="list-style-type: none"> <li>(1) <i>Physical Organization</i>, for example, visually cued areas and boundaries for specific activities and objects;</li> <li>(2) <i>Schedules</i>, e.g., schemes on a daily or weekly basis, explaining which activity occurs next and in what sequence by means of visual, verbal or nonverbal symbols;</li> <li>(3) <i>Work and Learning System</i>, i.e. informing children of what is expected of them in independent work activities, assisted learning activities, and daily living and leisure activities, again by means of visualized nonverbal or verbal information;</li> <li>(4) <i>Task Organization</i>, which means selection and arrangements of visual materials used in various work systems in order to provide clear instructions to the child for completing the task as independently as possible;</li> <li>(5) <i>Behavioural Routines</i>, which imply visually structured and organized sequences of goal-directed behaviours, e.g., doing pre-academic tasks in a specified order.</li> </ol> <p>(B) <i>Further Components of Structured Teaching</i> include:</p> <ol style="list-style-type: none"> <li>(6) <i>Concise Verbal and Nonverbal Directions/ Instructions</i>;</li> <li>(7) <i>Behavioural Prompts</i>;</li> <li>(8) <i>Consequence-Based Interventions</i> (Bregman, Zager, &amp; Gerdtz, 2005) including (a) strategies of reinforcement emphasizing natural consequences and self-reinforcement and (b) methods of mild negative consequences, such as admonishing or reprimanding, whereas more restrictive methods, such as exclusionary and isolating time-out (cf. Probst <i>et al.</i>, 2010) have not been established in more recent versions of the TEACCH program (see Mesibov <i>et al.</i>, 2006)</li> <li>(9) <i>Behaviour Shaping</i> methods by means of gradual approximation towards target behaviours;</li> <li>(10) Additional cognitive-behavioural interventions, such as <i>Behavioural Contract</i> methods, or <i>Stress Management Training</i> (Mesibov <i>et al.</i>, 2006);</li> <li>(11) <i>Skill Enhancement Training</i> methods (Bregman <i>et al.</i>, 2005) for daily living, (pre)academic, social-communicative, and self-management skills (Schopler, 1994, 1997; Quill, 2000; for functional communication training components, see Watson <i>et al.</i>, 1989), based on the combined use of “antecedent” (e.g., <i>Visually Structuring</i>, <i>Giving Directions</i>, <i>Prompting</i>) and <i>Consequence-Based Interventions</i> (Bregman <i>et al.</i>, 2005) (e.g., enabling individuals to use self-reinforcement).</li> </ol>



### *1.6 Research context and aims of the present synthesis*

While a number of TEACCH-based programs have been implemented in German-speaking countries currently (Degner & Müller, 2008), there is a broad lack of formal evaluation of this intervention. However, evidence for effectiveness and social acceptance (“social validity”; Foster & Mash, 1999) is urgently needed for improving the quality of patient care (Kazdin, 2008) and supporting decision making of health care providers and policymakers. Thus, we started a multi-step research program addressing the effectiveness of TEACCH-based interventions for children and adults with ASD including various target persons and settings at the Department of Psychology of the University of Hamburg. In developing and implementing research strategies we were guided by: (a) recommendations of NRC (2001) for combining single subject and group studies, (b) guidelines of Dingfelder and Mandell (2010) for diffusion of novel interventions in public mental health and education systems recommending a stepwise strategy, beginning with more explorative and pilot-like single-subject and within-group studies within real-life clinical and educational settings, and continuing in following phases with more controlled studies, and (c) recommendations of Reichow and Volkmar (2009) highlighting the need for studies involving also adolescent and adult participants with autism and using outcome measures sensitive for meaningful, clinically and socially valid changes by interventions. In total, six studies were conducted, of which the first four, reported on other places, are outlined only very briefly in the following, the last two sharing common methodological features are reported in the present synthesis: The first study addressed the effectiveness of a three-full day, centre-based education and skills parent group training with 23 younger school-aged children and resulted in positive parent-reported child and parent outcomes (Probst & Leppert, 2007; Probst, 2010). The second, a descriptive case study (Probst, 2010), examined the effectiveness of a medium-intensity TEACCH-based home child-parent program with a five-year-old boy over two years and overall resulted in positive parent outcomes and beneficial child outcomes across family and classroom settings. The third, a within group study addressed the effectiveness of a three-full day centre-based special education teacher skills training including an classroom teacher support component, involving 10 young school-aged children and 10 teachers, showing teacher-reported significant child behaviour and teacher stress-reduction outcomes (Probst & Leppert, 2007, 2008). In the fourth, a descriptive-quantitative observational study, the effectiveness of a centre-based low-intensity social communication enhancement small group program which included in addition to the small group component a one-to-one child-therapist component and a parent tutorial component (Probst, 2010) involving two older school-aged children and one young adult, was examined with results providing tentative evidence for improved social-communicative behaviors within programmed high- and low-structured play activities.

The fifth study, an experimental single subject study addressed the effectiveness of a low intensity social communication training with a 7-year-old girl living in a remedial residential home. The outcomes are reported in section 3.1. The sixth study, a retrospective quantitative small group study, the effectiveness of a long-term TEACCH-based intervention in a residential and vocational setting was examined. The results are reported in section 3.2. Both studies have been included into the present synthesis because they share common features of design, measures, and outcome analysis. Further, they address target participants and settings frequently neglected in research for ASD (Reichow & Volkmar, 2009; NRC, 2010).

## 2. Methods of synthesis

Both studies reported were carried out by the ASD research unit of the Department of Psychology at the University of Hamburg between 2007-2008. In total, four persons with ASD (one child, three adults) participated, of which three had a diagnosis of child autism, and one a diagnosis of PDD-NOS including atypical autism.

One of the authors (P.P.) had formal training in the TEACCH approach (5-day intensive training). The other persons who participated in the two studies (J.M. and F.J.) completed internships of 500 or more hours duration at the ASD research unit (University of Hamburg) which included training in TEACCH methods as well as clinical-educational practice with children with ASD and their parents. The studies were supervised by the first author.

The evaluative instruments used in the reported studies included standardized tests, standardized caretaker questionnaires, semi-structured interviews, and behavioural observation measures.

## 3. Studies

The reports on the two studies are structured into (1) theoretical background and aims of the study, (2) methods, (3) results, and (4) conclusions. The overall conclusions for the synthesis are discussed in section 4.

### *3.1 Outcomes of a controlled single-subject social communication training study with a 7-year-old girl with autism and intellectual disability living in a residential home*

*3.1.1 Theoretical background and aims of the study* Interventions in children with ASD focus on enhancement of adaptive abilities, in particular social communicative and daily living skills (Schopler, 1997). The concept of

“social-communicative” refers to the individual’s ability to understand social events and to participate as a competent and cooperative partner in social activities using both verbal and nonverbal skills (Prizant *et al.*, 2006, p. 315). “Daily living skills” include domestic activities like personal hygiene, dressing, cleaning up et cetera. Enhancing these skills on the one hand and simultaneously delivering antecedent adjustments to the child’s environment on the other hand are likely to decrease behaviour problems (Schopler, 1995; Bregman *et al.*, 2005). The TEACCH-approach uses both components and has proven to be effective in treating children with autism both in families and residential settings (Schopler, 1997; Mesibov & Shea, 2009). However, there is a worldwide lack of formal evaluation of TEACCH-based interventions, for children in residential homes.

*Aims:* The aim of this single-case study was to evaluate a TEACCH-based intervention in a 7 year old girl with childhood autism. Treatment addressed massive behaviour problems and focused on enhancing social communicative skills. The program was implemented within remedial residential care.

### 3.1.2 Methods

3.1.2.1 PARTICIPANT The participant of the study was L, a 7-year old girl with childhood autism and with severe mental retardation. Diagnosis of autism was substantiated by results significantly above the cut-off in the Autism Diagnostic Interview-Revised (ADI-R; Lord, Rutter, & Le Couteur, 1994; German version Bölte, Rühl, Schmötzer, & Poustka, 2006) and the Autism Diagnostic Observation Schedule (ADOS, Module 1; Lord, Rutter, DiLavore, & Risi, 2001; German version: Rühl, Bölte, Feineis-Matthews, & Poustka, 2004) as well as the result of “severe autism” in the Childhood Autism Rating Scale (CARS; Schopler, Reichler, & Renner, 1993). Further, L showed a very low-level spontaneous communication rate, as assessed by behavioural observation (see Watson *et al.*, 1989). The Psychoeducational Profile-Revised (PEP-R; Schopler, Reichler, Bashford, Lansing, & Markus, 1990; German version: 2000) revealed a developmental age of 15 months. At the time of intervention L had been living in a remedial residential group for about two years, with sporadic contact to her mother on weekends. Caregivers reported massive behaviour problems (e.g., aggressive behaviour, self-injurious behaviour, problems in hygiene, Pica) and very low social-communicative competencies, characterized most notably by restricted and stereotyped solitary activities and aggressive reactions in socially demanding situations. Contingent on the caregiver/child ratio (between 2 and 3 caregivers, depending on morning and day shift, for 10 residents) L’s behaviour problems became unbearable and her continuing taking part in the group was in danger of being compromised.

Therefore, the following aims of the study were defined: 1) reduction of behaviour problems, 2) enhancement of social-communicative abilities: au-

tonomous handling of her picture schedule and her choice-board, 3) general improvement on developmental functioning, 4) teaching a disability concept to caregivers and parents in terms of functional analysis and explanation of behaviour problems.

3.1.2.2 DESCRIPTION OF INTERVENTION *Conceptual framework*: The intervention program is mainly based on principles of *Structured Teaching* (Schopler *et al.*, 1995) including these elements: (a) *Visualized Structure of Space and Objects* (Segregation of work- and recreation-space, e.g., a desk, identified via picture card as “work space”), (b) a *Picture Schedule* for program activities which contains the elements “work card” and “recreation card” in order to visualize the structure of each session and a *Choice-Board* which contains several picture cards representing recreation activities in order to increase the ability of social interaction, (c) *Visualized Work System* (tasks to do on left side of the desk, a finish box to put the processed materials in on the right side of the desk) and visually supported tasks (e.g., coloured materials in sorting tasks), (d) *Concise Verbal Instructions*, (e) guiding through *Physical, Gestural and Verbal Prompts*, especially in teaching the handling of the picture schedule and choice-board, (f) *Verbal and Nonverbal Reinforcements* (e.g., praise, plaudits, small pieces of salt sticks), and (g) *Mild Forms of Punishment*, such as admonitions or strict “No” in order to stop challenging behaviours. Following, Watson *et al.* (1989) the use of natural consequences was of particular importance in order to enhance the participants’ comprehension of the potential power of communication (e.g., L. gets her headphones in exchange for the music –picture card of her choice board).

The selection of exercises for the “work period”, a range of assembling, sorting and fine motor skills tasks, based on indications of the PEP-R.

L’s *picture schedule* showed in a vertical order (from top to bottom) her picture and name card, followed by the work card, which led her to her desk where a respective twin card was installed. After work-phase, L picked her recreation card from her desk, which led her to her *choice board* and she put the card beside the respective twin card. The *choice board* showed again her picture and name card on top and two picture exchange cards beneath, whereas one represents the activity “listening to music” and the other “waving a rubber glove” (arranged from left to right).

3.1.2.3 MEASURES a) *Behavior Problems Inventory (BPI)*: The BPI by Rohjan, Matson, Lott, Esbensen, and Smalls (2001) was used in the German adaptation by Steinhausen (2005) to attain measures of the participant’s problem behaviour. It consists of 52 items scored on a 5-point frequency scale (0 = *never*, 1 = *monthly*, 2 = *weekly*, 3 = *daily*, 4 = *hourly*). The scale provides a *Full Scale Score* (internal consistency (Cronbach’s  $\alpha$ ) = .72) as well as scores for three subscales *Self-Injurious Behaviour* (internal consistency = .48), *Stereotyped Behaviour* (internal consistency = .68), and *Aggressive/Destructive Behaviour* (internal consistency = .86). As with Rohjan

*et al.* (2001) the severity data were excluded from this paper because of the high correlations with the frequency scales and hence become redundant.

b) *Structured video based behaviour observation of the amount of help in using the schedule and choice-board*: Target behaviours for both fields were defined. “Use of the picture schedule” comprised the steps: (1) she walks to her schedule; (2) she picks the “work card”; (3) she gets to her desk; (4) she pins the work-card next to the twin card on her desk; (5) she takes the “work card” and gets back to her schedule; (6) she puts the work-card in to the “finish envelope”; (7) she picks the “smiley card” (recreation). “Handling of the choice boards” followed the steps: (1) she pins the “smiley card” next to the twin card on the choice board; (2) she picks an activity symbol card; (3) she passes the card over to the therapist / caregiver. Each step was scored on a 4-point assistance scale (3 = *needs direct physical assistance / prompt*, e.g., hand-over-hand assistance; 2 = *needs reduced physical assistance*, e.g., less frequent hand-over-hand guidance; 1 = *needs gestural / verbal prompts*, e.g., pointing at the card next to be picked; 0 = *needs no assistance*).

c) *Psychoeducational Profile – Revised (PEP-R)*: The PEP-R (Schopler *et al.*, 2000) provides information on developmental functioning in the areas of imitation, perception, motor, eye-hand integration, cognitive performance, and cognitive verbal skills. An estimated developmental age can be indicated.

d) *Informal conversations/interviews with caregivers and the mother*: Over the course of intervention repeated informal conversations with caregivers were held regarding the effects of intervention on L’s behaviour and general concerns with regard to the program. In addition, telephone conversations concerning the course of the intervention and L in general were held with the mother at fortnightly intervals.

3.1.2.4 PROCEDURE Each session was subdivided into an up to three times reoccurring sequence of “Work period” (e.g., doing sorting and assembling tasks) and “recreation period” (“Use of the choice board”, e.g., choosing the “music card” in order to hear music as a reward). Intervention spanned 12 sessions (each 45-60 minutes) in 2 months.

3.1.2.5 DATA ANALYSIS Quantitative data were analyzed with Statistical Package for the Social Sciences (SPSS), version 15. Means for behaviour observation data (see 3.1.2.3 b) were computed for each session and visually analysed (Kazdin, 1982; Julius, Schlosser, & Goetze, 2000).

The qualitative analysis of verbal data was realized by methods described in the “Qualitative Content Analysis” by Mayring (2000).

The Reliable Change Index (RCI, Jacobson & Truax, 1991) was used to yield possible pre-post-gains. The RCI is calculated by dividing the difference of the participant’s post-test and pre-test score through the standard error of difference of the two test scores. The standard error of difference “describes the spread of the distribution of change scores that would be ex-

pected if no actual change had occurred. An RC[I] larger than 1.96 would be unlikely to occur ( $p < .05$ ) without actual change” (Jacobson & Truax, 1991, p. 14).

*3.1.3 Results* Changes in behaviour problems: Table 2 shows the results (means of 4 caregivers; integer values) on the BPI scales at the time of baseline assessment (“pre”) and the final assessment (“post”). The *Full Scale Score* decreased from 79 to 66. There was a reduction in all three sub-scales, though only minimally for *Self-injurious behaviour* (see Table 2). Still the scores are widely over the mean in an intellectual disability reference group of about 100 individuals in North America (Gonzales, Dixon, Rojahn, Esbense, Matson, Terlong, & Smith, 2009). The RCI (Jacobson & Truax, 1991) based on standard deviations and internal consistencies of that sample were computed for each scale. Although the RCI values were not statistically significant all reflected pre-post gains in the predicted way.

*Critical incidents:* There were three findings considered to be of special interest for every day life in the group home: Item “Pica” (craving for something not normally regarded as nutritive, e.g., dirt) reduced from “daily” to “weekly” occurrence. The items “Biting” and “Cruel” (e.g., taking something away from others) reduced from a “weekly” to “monthly” occurrence.

Table 2 - Results of the BPI in pre- and post-assessment

Scale	Pre <sup>a</sup>	Post <sup>a</sup>	RCI <sup>b</sup>
Self-Injurious Behaviour	14	13	0.24
Stereotyped Behaviour	51	41	1.60
Aggressive/Destructive Behaviour	15	12	0.85
Full Scale	79	66	1.33

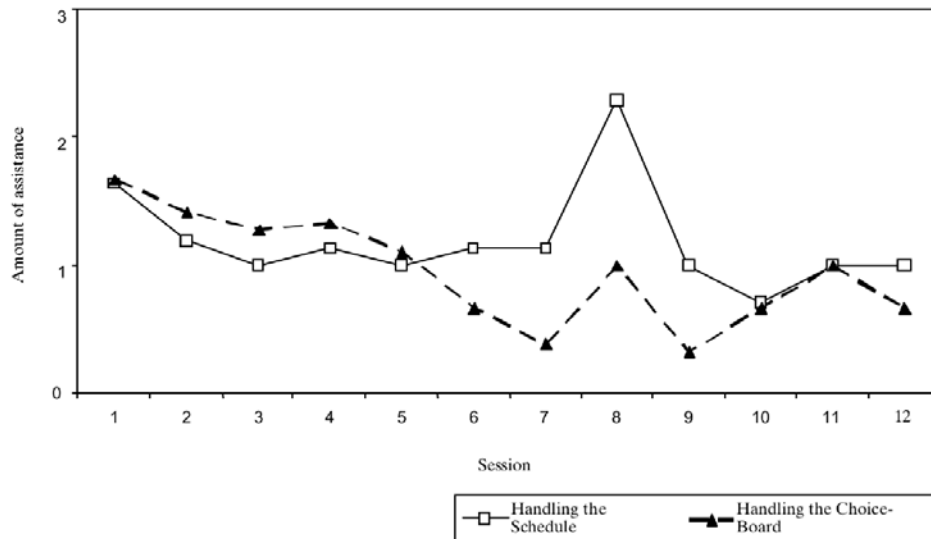
Note: RCI=Reliable Change Index.

<sup>a</sup> Means across 4 caregivers, rounded to integers

<sup>b</sup> All values reported indicate improvement but are not significant ( $p > 0.05$ )

*Enhancement of social communicative abilities: Autonomous handling of her picture schedule and her choice board:* Figure 2 shows the results of the video-based behaviour observation concerning the amount of help in using the schedule and choice board. The respective points of data indicate the amount of assistance needed per session (each session consisted of 1 to 4 sub-sessions in handling the schedule/choice board).

Figure 2 - *Social-communicative Training: Needed assistance in handling the schedule and choice board*



Legend: The curves indicate the course of assistance needed in handling the schedule/choice board over the 12 sessions of intervention. Data points indicate the mean amount of needed assistance per session (each session consisted of 1 to 4 sub-sessions). Session 1 is regarded as “Baseline”.

Range of Value for “Amount of assistance”: 3 = needs direct physical; 2 = needs reduced physical assistance; 1 = needs gestural/verbal prompts; 0 = needs no assistance.

**Schedule:** Session 1 served as baseline. Due to technical reasons, no formal video-based pre-treatment baseline measure was possible. According to informal interviews with caregivers and teachers at school, L had had no prior experience in handling visual schedules or the principal of picture-based communication. The curve (Figure 2) shows a decreased amount of help needed already in session 2. In 10 out of the 11 following sessions (92%) the amount of help needed was below the baseline. The curve shows a consistent trend to an autonomous handling of the schedule. In session 8 the needed help was above the baseline. In that session only one sub-session took place and the session had to be aborted subsequently because of unacceptable temperature in the client’s room.

**Choice-board:** Session 1 served as baseline. The curve reveals that the amount of help needed was above the baseline in all the subsequent sessions (Figure 2). Up to session 7 the curve showed a steady learning progress in handling the choice-board. The increased amount of help needed in session 8 reflected the unacceptable temperature in the clients’ room.

*Changes in developmental functioning:* Table 3 indicates the pre-post results of the PEP-R for the 6 subscales and the developmental age score. Perception, Fine motor and Developmental age improved significantly. There were no decreases in developmental functioning in any subscale.

Table 3 - Results of the Psychoeducational Profile -Revised (PEP-R) in Pre- and Post Assess

Subscales	Pre <sup>a</sup>	Post <sup>a</sup>	RCI <sup>b</sup>
Imitation	14-15	20-22	1.80
Perception	7-8	16-18	2.09*
Fine motor	12-13	24-26	3.66**
Gross motor	23-24	25-27	0.60
Eye-hand integration	14-17	14-17	0.00
Cognitive performance	11-12	14-15	1.11
Verbal skills	16-17	16-17	0.00
Developmental age	15	18-21	2.26*

<sup>a</sup> Estimated developmental age in month; <sup>b</sup> RCI computed using standard deviations and internal consistencies based on a reference group of children with ASD (N = 33; age range: 6 – 9 years) reported by Villa, Micheli, & Villa (2010) \*p ≤ .05; \*\*p ≤ 0.01

*Social Acceptance:* Caregivers stated consistently the intervention as being helpful and disburdening. L was described as more communicative in everyday life, more predictable and less aggressive. In addition, caregivers reported a better comprehension of the functional relevance of her behaviour problems, as with challenging behaviour to gain attention or with aggressive reactions in demanding situations. Likewise, the mother stated her satisfaction with the intervention. The telephone conversations were informative and helpful, as stated by the mother and by the author as well.

*3.1.4 Conclusions* The TEACCH-based intervention has proven to be effective in reducing problem behaviour consistent with the literature (Schopler *et al.*, 1995). Results on the BPI revealed no statistical significance (in reference to an adult sample, as there were no children norms), but nonetheless a considerable trend of symptom reduction supported by the meaningful improvement in especially burdening behaviours (see *critical incidents*, 3.1.3).



The client showed a significant improvement in the autonomous handling of her schedule and choice board, although she needed minimal verbal prompts up to the end of intervention. The schedule was accepted by the client and improved her understanding of the course of each session. The choice board was used in a socially interactive manner and helped improve the client's understanding of communicative interactions. The results in the PEP-R indicate an overall positive trend in developmental functioning, particularly with regard to the subscales which were focused on in the intervention. Furthermore, enhanced cooperation as a result of the intervention had a considerable influence on the positive PEP-R results. The disability concept, in particular functional aspects of behaviour problems, was mediated to caregivers and parents, as shown in informal interviews.

*Limitations:* Baseline measurements of social-communicative abilities consisted only of data of the four sub-sessions of session 1. Furthermore, results of single-case studies in general only allow tentative conclusions to be drawn. Implementation of key aspects of the intervention (e.g., the choice board) in everyday life was only partially realised. A supportive pedagogical framework and respective organizational aspects could contribute towards a better everyday life implementation. However, given the acceptance of the program by both parents and professional caregivers a generalisation of intervention effects to everyday life might be obtained in future.

The study showed the successful implementation of chosen elements of the TEACCH-Program within remedial residential care in Germany under reasonable economical effort. Considering the relevance of evidence-based treatments in psychosocial health care in Germany and the given deficit of controlled studies in the German speaking world, more research is necessary.

### *3.2. Evaluation of a TEACCH-based intervention for adults with autism spectrum disorders in a residential and vocational setting*

*3.2.1 Theoretical background and aims of the study* Autism Spectrum Disorders persist through the life-span and carry the risk of developing additional emotional and behavioural disorders (Hutton, Goode, Murphy, Le Couteur, & Rutter, 2008). There are a number of studies which show the effectiveness of TEACCH, particularly for children with ASD (Mesibov & Shea, 2009). However, only a few studies exist which focus on the possible positive influence of TEACCH on adults with ASD in residential and vocational settings (Persson, 2000; Van Bourgondien, Reichle, & Schopler, 2003; Siaperas & Beadle-Brown, 2006). The present study is the first that evaluated possible influences of TEACCH on adults with ASD in a day care setting in Germany.

*Aims:* With regard to the goals of the TEACCH program (Mesibov *et al.*, 2006) and the aforementioned studies the following hypotheses were formulated: (1) There would be a substantial reduction in behaviour problems (e.g., disruptive and/or self-absorbed behaviour) as a result of the

TEACCH intervention; (2) participants would show more positive social-communicative behaviour and less negative social-communicative behaviour after the implementation of TEACCH; and (3) the social validity (Foster & Mash, 1999) of TEACCH is rated highly by the caregivers.

### 3.2.2 Method

3.2.2.1 PARTICIPANTS The sample consisted of two illiterate adults (T, male, aged 34 and M, female, aged 23) with diagnosed autism and severe mental retardation living in a residential home and one male literate adult (B, male, aged 30) with diagnosed PDD-NOS and moderate mental retardation living with his parents. All three participants attended a day care centre for adults with disabilities half-day in which parts of TEACCH were implemented 4 years ago. Three staff members, trained in TEACCH, who knew the participants for 5 years on average, rated them with following instruments.

3.2.2.2. MEASURES (a) *Developmental Behaviour Checklist for Adults (DBC-A)*: The German version of the DBC-A by Einfeld, Tonge and Steinhilber (2007) (original by Einfeld & Tonge, 2002) was used to attain measures of the participants' problem behaviour. Respondents are required to rate the presence or absence of specific behaviours on a 3-point scale (0 = *not true*, 1 = *somewhat or sometimes true*, 2 = *very true or often true*). The scale consists of six subscales (*disruptive, self-absorbed, communication disturbance, anxiety/antisocial, social relating, depressive*) whereof *disruptive* (e.g., "kicks, hits", "noisy", "impatient"; internal consistency (Cronbach's) = .88) and *self-absorbed* (e.g., "repetitive actions", "no sense of danger", "hits self"; internal consistency = .89) are reported in this study as well as the *Total Problem Behaviour* score (internal consistency = .95).

(b) *Matson Evaluation of Social Skills for Individuals with Severe Retardation (MESSIER)*: The MESSIER by Matson (1995) was used in a German translation by Martin, Jung, Micheel and Probst (2008) to assess the participants' social skills and social behaviour. Respondents rated on a 4-point Likert scale whether each of the 85 statement is true of the participant (0 = *never*, 1 = *rarely*, 2 = *sometimes*, 3 = *almost*). The items are grouped into six clinically derived subscales: *positive verbal* (e.g., "communicates most needs verbally"), *positive nonverbal* (e.g., "smiles in response to positive statements"), *positive general* (e.g., "shows interest in activities of other people"), *negative verbal* (e.g., "makes loud inappropriate noises"), *negative nonverbal* (e.g., "exhibits peculiar or odd mannerisms in public"), and *negative general* (e.g., "often does not attend to people or the environment"). An overall score, the *MESSIER Adaptive Scale Score (MASS)*; internal consistency (Cronbach's) = .94; Matson, Dixon, Matson, & Logan, 2005) is calculable. The scale is considered to be reliable (Matson, Leblanc & Weinheimer, 1999) and valid (Matson, Carlisle, & Bamburgh, 1998).

(c) *Behavior Problems Inventory (BPI)*: For description of the BPI by Rohjan *et al.* (2001) see section 3.2.1.3 in this paper.

(d) *TEACCH evaluation caregiver interview*: A semi-structured interview was conducted with each staff member (duration: about 20 min.). Questions included (a) general advantages and disadvantages of TEACCH, (b) the pro and cons of TEACCH regarding each participant, (c) possible influences on the participant-caretaker-interaction, and (d) possible relief or strain caused by the implementation of TEACCH for the staff members.

3.2.2.3 INTERVENTION Each of the three participants used individualised daily schedules and work systems following the principles of *Structured Teaching* (Schopler *et al.*, 1995).

(1) T used a *pictorial daily schedule*, which always showed a picture of T and the responsible caregiver on the far left. The picture cards were applied in chronological order from left to right. Each card represented an activity and told T what would be next and where it would take place (e.g., the card with a cup told T that it was time for breakfast and he had to go to breakfast room; the yellow card meant “Have a break, go to the break room!”). After an activity was finished, T put the card into the matching pocket on the far right and took another card from the left to start the corresponding activity. A typical daily-schedule, for example, consisted of a yellow break card followed by the work card and then a yellow break card, followed by the cup card, again yellow break card, followed by a scenery card (means going for a walk), plate and cutlery card (= lunchtime), and finally a yellow break card.

His *work system*, installed on an individualised work place, followed also a left-to-right routine whereas the working materials were organized in a shelf to the left (in a top-down-order). After completing one task, T put the object into the finished box to his right. Four cards with numbers from 1 to 4 (on the desk) assured that T knew which task to do next (the corresponding cards were installed on the according rack bay on the shelf to his left). T took one number card, placed it next to the corresponding one and took the working material to his place. Typical tasks for T were puzzles or file folder tasks. After all four tasks were completed, T took the last card which told him to go back to his pictorial daily schedule and take the next activity card.

(2) M used a *daily schedule* consisting of physical objects. These objects were also applied on a chronological order from left to right. Each object stood for a different activity (e.g., the red place mate told M to go to her work place and start working). After completion of an activity, M returned to her schedule and put the object in the finish box (on top of the schedule). At her workplace M followed a left-to-right routine, where the to-do tasks were provided on the left and were put into the finished box on the right after completion. M typically completed puzzles or shoebox tasks (Larsen, 2010).

(3) B used a pictorial daily schedule as well as a written work system. His schedule was a folder in which the activities (each presented as a picture

card with the appropriate word) were chronological organized from top left to bottom right. After completing an activity he reversed the corresponding card so it showed a blank card. B's work system was similarly designed: Ten work steps, each presented as a sentence on a card, where chronologically organized in a folder. After completing each task B turned the card around and went on with the next work step. Guided by this system B built complete pocket books.

**3.2.2.4 PROCEDURE** Each participant was rated by two staff members with each of the aforementioned questionnaires two times: The first referred to the "point in time of investigation ( $t_2$ ), and the second to "before the implementation of TEACCH" ( $t_1$ ) and was thus a retrospective rating.

**3.2.2.5 DATA ANALYSIS** Although each participant was evaluated by two raters, the data of only one could be analysed for B and T. The qualitative analysis was obtained by methods analogue to the "Qualitative Content Analysis" by Mayring (2000). Because of the high similarity of the statements, no anchors are reported. A mean Reliable Change Index (RCI; Jacobson & Truax, 1991) for all three participants as well as an individual RCI was calculated to reveal possible pre-post gains.

**3.2.3 Results** Results for the quantitative measures are summarized in Table 4. A dependent t-test for paired samples revealed the following: The following results in the DBC-A could be shown: (a) a significant reduction in disruptive behaviour; (b) self-absorbed behaviour decreased significantly; (c) the *Total Problem Behaviour* score dropped from  $t_1$  to  $t_2$  significantly; (d) the *MESSIER Adaptive Scale Score* improved from  $t_1$  to  $t_2$  significantly; and (e) no significant changes could be shown in the *BPI Full Scale Score* and for the subscales of the BPI though the results were all in the predicted way (e.g., aggressive/destructive behaviour decreased. The RCI revealed significant changes for the mean RCI (*M-RCI*) as well as for the individual RCI of all 3 participants for the *DBC-A Disruptive Scale* and the *DBC-A Total Problem Behaviour*. Further, the *M-RCI* showed significant reduction of the *BPI-Stereotyped Behaviour Score*, whereby the stereotyped behaviour of 2 participants decreased significantly from  $t_1$  to  $t_2$ . The RCI for the *BPI Full Scale Score* revealed a significant reduction of problematic behaviour over time for 1 participant.

Table 4 - Results of quantitative measurements

Scale	t <sub>1</sub> M (SD)	t <sub>2</sub> M (SD)	T	M-RCI	n RCI (+)
DBC-A Disruptive	20.67 (4.51)	12.83 (4.01)	17.76**	2.43 <sup>a</sup>	3
DBC-A Self-Absorbed	27.33 (14.15)	20.50 (14.29)	15.50**	1.12 <sup>a</sup>	0
DBC-A Total Problem Behaviour	75.50 (21.64)	55.17 (22.67)	16.92**	2.55 <sup>a</sup>	3
MASS	98.39 (64.14)	116.78 (66.80)	-11.98**	1.32 <sup>b</sup>	0
BPI-Self-Injurious Behaviour	11.33 (9.87)	8.16 (7.08)	1.82	0.75 <sup>c</sup>	0
BPI Stereotyped Behaviour	35.67 (20.26)	30.17 (17.55)	2.69	2.44 <sup>*c</sup>	2
BPI Aggressive/Destructive Behaviour	12.83 (7.85)	4.16 (3.25)	2.50	0.88 <sup>c</sup>	0
BPI Full Scale	59.83 (37.90)	42.50	2.37	1.78 <sup>c</sup>	1

Note: DBC-A = Developmental Behaviour Checklist Adults; MASS = MESSIER Adaptive Scale Score; BPI = Behaviour Problem Inventory; M-RCI = Mean Reliable Change Index; n RCI (+) = individual significant RCIs; t<sub>1</sub> = before the implementation of TEACCH; t<sub>2</sub> = point in time of investigation

<sup>a</sup> calculation of individual RCI-Scores based on R (internal consistency) and SD reported by Einfeld and Tonge (2009)

<sup>b</sup> calculation of individual RCI-Scores based on R (internal consistency) reported by Matson *et al.* (1999) and SD by Matson and Boisjoli (2008)

<sup>c</sup> calculation of individual RCI-Scores based on R (internal consistency) and SD reported by Gonzales *et al.* (2009).

*Interview content analysis:* All three staff members reported as general advantages (a) the principles of *Structured Teaching*, for example, implemented by using individualized daily schedules, leading to reduced uncertainty by the participants and less misunderstandings, (b) enhanced communication between caregivers and participants, (c) reduction of the dependency of one particular caregiver with an increase in participant's independence and autonomy at the same time. As a possible disadvantage all three caregivers named the reduction in flexibility through *Structured Teaching*. But they also noted that it was their responsibility to keep this in mind. At first, the implementation of TEACCH meant more effort for the caregivers but then was seen as a relief. Achieved individual milestones through the implementation of TEACCH that were reported concordantly

where (a) T behaves significantly less aggressively, (b) M goes now to the toilet by herself, and (c) B engages now in meaningful action instead of sitting around and starrng at the wall.

*3.2.4 Conclusions* The applied qualitative and quantitative methods show coherent results consistent with the tested hypotheses. (1) There was a significant reduction in disruptive and self-absorbed behaviour as well as general behaviour problems following the intervention. (2) Participants showed more positive social-communicative behaviour and less negative behaviour after the implementation. (3) All three caregivers reported a high acceptance of the intervention's goals, methods and effects. Thus, the social validity is high.

The major limitations of the study are the retrospective design as the ratings could be biased in a number of ways (Gilovich, Griffin, & Kahnemann, 2002). Additionally, the sample was not attained randomly and was very limited.

Despite the methodological limitations, the results of this study are in accordance with other TEACCH evaluation studies and support the assumption that TEACCH is an effective evidence-based intervention method to help people with ASD take part in daily life.

#### 4. Overall conclusions

In the present synthesis, two TEACCH-based tertiary prevention studies with individuals with autism were presented. Common aims of tertiary intervention included: (a) reducing behavioral symptoms, enhancing social-communicative abilities and thus strengthening autonomy and social participation in persons with autistic disorders, and (b) enhancing behavioral and emotional coping abilities of caretakers in family, classroom and residential-vocational institutions.

*Theoretical framework:* Research and clinical practice were guided by a theoretical framework comprising the “expanded ABCX-stress-coping model” (adapted from Pakenham *et al.*, 2005) and the *Structured Teaching* concept, developed by the TEACCH group (Schopler, 1997) and based on the integrated use of behaviour and cognitive theory (Schopler, 2005). The various settings included a residential group home for children and a day care centre for adults. The theoretical framework selected proved to be useful for deriving aims and methods for performing interventions in both settings, and for evaluating the outcomes.

*Methodology:* The evaluation methodology followed a multimethod strategy. The broad spectrum of methods used for evaluation included behavioral observation, standardized tests, questionnaires, inventories and interviews. This methodological approach turned out to be useful for estab-

lishing a “holistic” perspective (Schopler, 2005) of understanding the needs of individuals with a long-life disability rather than focussing on singular domains and deficits.

*Results:* Overall, the results of both studies provide evidence for positive outcomes of TEACCH-based interventions across multiple individuals, ages, settings and measures. These findings are in congruence with a number of international evaluative studies (Probst & Leppert, 2008; Mesibov & Shea, 2009; Panerai *et al.*, 2009).

Further, the caregivers’ satisfaction with the programs was generally high, and the demands on caregivers appeared to be adequate and realistic. This positive finding is also consistent with the literature (Mesibov & Shea, 2009).

*Limitations:* There are however limitations to the experimental validity of the presented studies. Threats to the *internal validity* include small sample size and lack of control groups in the second study, and lack of extensive baseline assessment in the first study. In addition, experimental control in the second study is reduced due to the absence of a real-time pre assessment measurement of outcome variables.

Threats to the *external validity* include the small and selective sample in the second study. Further, the effects of the single-subject study can be generalized only with caution.

*Final conclusions:* Under consideration of the restricted internal and external validity, which are not unusual for first-step evaluations of comprehensive programs in new sociocultural contexts, the following conclusions can be drawn:

(1) The present synthesis supports the assumption that TEACCH-based interventions lead to clinically and educationally *relevant effects* with regard to child outcomes in group home settings, and adult outcomes in residential and day care settings.

(2) Both studies showed the feasibility of the TEACCH-approach in various settings. Overall, the outcomes support the assumption that TEACCH-based interventions are also practicable in German-speaking countries. They are compatible with local approaches of tertiary prevention that emphasize holistic methods enhancing the individual’s autonomy and social participation. Further, highly technical terminology opposed by the majority of health professionals is avoided, and TEACCH-based interventions allow low-threshold access for caregivers of children with autism, and thus are in accord with common personal and social resources of families, classrooms, and related social institutions. Thus, TEACCH-based interventions, as examined in the current studies, largely proved to be compatible with strategies of local health care systems in Germany.

*Future research:* Further research should include (a) controlled group studies with individuals with autism, and caretakers as mediators, (b) stricter controlled single subject studies using multiple baseline designs,

and (c) studies systematically examining the impact of symptomatology, developmental functioning, and personality on intervention outcomes. Research strategies of this kind will hopefully increase the implementation of empirically supported interventions for the treatment of children and adults with autism

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