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THE EFFECTIVENESS OF TEACCH INTERVENTION IN AUTISM SPECTRUM DISORDER: A REVIEW STUDY

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Este trabajo incluye una revisión de la literatura para analizar la efectividad de la metodología TEACCH, así como el efecto de esta metodología en el nivel de estrés de los padres y los maestros de niños con trastorno del espectro autista (TEA). Considerando los criterios de inclusión, se analizaron un total de 14 estudios. Independientemente del contexto de intervención, todos los estudios revelaron mejoras en el desarrollo de los niños y una reducción en los síntomas autistas y comportamientos maladaptativos. En 11 de los 14 estudios se obtuvieron mejoras estadísticamente significativas. En cuanto al efecto en el nivel de estrés de los padres o maestros, de los 7 estudios que evaluaron el estrés, 5 de ellos obtuvieron una disminución significativa entre las mediciones Pre y Post. Teniendo en cuenta estos resultados, la metodología TEACCH puede ser eficaz no sólo para mejorar el desarrollo del niño, sino también para mejorar el nivel de bienestar de los adultos.

Palabras clave: Autismo, Intervención, Revisión bibliográfica, TEACCH.

This work includes a review of the literature to analyze the effectiveness of the TEACCH intervention, as well as the effect of this intervention on the level of parental and teachers' stress of children with autism spectrum disorder (ASD). Considering the inclusion criteria, a total of 14 studies were analyzed. Regardless of the context of intervention, all the studies revealed developmental abilities improvements and a reduction in autistic symptoms and maladaptive behaviors. In 11 of the 14 studies, statistically significant improvements were obtained. As for the effect of the TEACCH intervention in the level of the parents or teachers stress, out of the 7 studies that evaluated stress, 5 of them obtained a significant decrease between Pre and Post measurements. Considering these results, TEACCH intervention could be effective not only improving the child's development, but also enhancing the adults' level of well-being.

Key words: Autism, Intervention, Literature review, TEACCH.

Autism Spectrum Disorder (ASD) is a lifelong neurodevelopmental disorder characterized by: 1) persistent deficits in social communication and social interaction across multiple contexts; and 2) the presence of restricted, repetitive patterns of behavior, interests or activities (DSM5; APA, 2013). This disorder affects people differently depending on the severity's degree and the possible co-occurrence with other disorders, but in any case, it involves a particular way of understanding and acting the world, what it is known as the 'Culture of Autism' (Mesivob, Shea & Schopler, 2005).

Different interventions have been used to improve people with ASD lifestyle. Mainly, literature reports two main approaches: 1) focused intervention practice, which are used for a limited period of time in order to produce specific behavioral or developmental outcomes; and 2) Comprehensive Treatment Models (CTM), which are multiple components interventions' used over an extended

period of time with the objective of achieving a broader developmental impact (Odom, Boyd, Hall & Hume, 2010).

Within CTM, ABA (Applied Behavior Analysis) and TEACCH (Treatment and Education of Autistic and Related Communication Handicapped Children) are the most used treatments. Some studies demonstrate a greater effectiveness of the ABA program (Eikeseth, 2009), whilst other studies highlight a greater effectiveness of the TEACCH intervention (Probst, Jung, Micheel & Glen, 2010). There is therefore no consensus on the best treatment. These two treatments are often viewed as exclusive, but both of them share common components and users indicate no clear preference for either model (Callahan, Shukla-Mehta, Magee & Wie, 2010).

Among these two treatments, this study focuses on TEACCH intervention, as it is the most influential special education program for children with autism. TEACCH was developed in the late 1960s by the Professor Eric Schopler's research team based at the University of North Carolina (USA). This approach focuses on working communication, cognition, perception, imitation and motor skills. It was traditionally used in segregated self-contained classrooms for children with ASD, but today it

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is being used in inclusive settings, showing that it can benefit both children with ASD and mainstream children (Benton & Johnson, 2014).

This is a promising intervention that focuses on understanding 'the culture of autism', modifying and structuring the environment to accommodate to autism deficits. The main components of this structured education include: 1) the physical organization of the environment by putting visual barriers and minimizing distractions; 2) visual schedules in order to allow students to know and expect the occurrence of events; 3) work systems that enables working independently, following a sequence of activities; and, 4) visual structure within activities, showing students clearly steps and using visual instruction and organization in order to complete a task. This structured education not only takes into account the child's deficits, but also their strengths, working through visuospatial abilities, since many of them process visual information better than auditory. It also considers the child's interests, making learning functional for them (Mesibov & Shea, 2010).

The main goals of this structured teaching are to increase the child independence, improving skills and preventing behavior problems (Howley, 2015). To use it, the teacher, therapist or parent of a child with ASD must comprehend their way of understanding and acting the world, and the strengths and deficits there are associated with the disorder, as their role is to serve as a cross-cultural interpreter: someone who understands both cultures and is able to translate the expectations and procedures of the non-autistic environment to the child with ASD (Mesibov et al., 2005).

The effectiveness of the TEACCH intervention has been previously synthesized by some studies across different ages and within various social settings, providing positive outcomes and high parental satisfaction (Eikeseth, 2009; Ospina et al., 2008). Nonetheless, to date, there is only one meta-analysis that has analyzed the effectiveness of TEACCH (Virues-Ortega, Julio & Pastor-Barriuso, 2013). In this meta-analysis, the results provided limited support for the TEACCH program owing to the limited pool of studies available, the shortage of randomized control trials and the small studies samples'.

Considering the limited pool of review studies and the elapsed time since Virues-Ortega et al. (2013) meta-analysis, the purpose of the present study was to provide an updated review to examine: 1) the effectiveness of the TEACCH intervention regarding the child's development; and, 2) the effect of this intervention in the level of the parents and teachers' stress of children with ASD, a novel aspect that has not been included in previous reviews. Literature reports high levels of stress in parents and

teachers of children with ASD due to the intrinsic characteristics of the disorder (Boujut, Dean, Grouselle & Cappe, 2016; Pastor-Cerezuela, Fernández-Andrés, Tárraga-Mínguez & Navarro-Peña, 2016). It is hypothesized that the use of the TEACCH intervention will improve the child's development and will reduce parents and teachers stress levels' significantly.

METHOD

The articles included in this review were selected taking into account the following inclusion criteria: a) search limited to the period from 2007 to 2017; b) empirical articles published in English whose goal was to evaluate TEACCH effectiveness; and, c) the inclusion of samples with children with ASD diagnoses. In the Orellana, Martínez-Sanchis & Silvestre (2014) study, the sample also included adults (aged: 19-41), but it was included considering the peculiarity of evaluating the effectiveness of the TEACCH intervention in clinical oral assessments. Descriptive studies, reviews and theoretical papers were excluded.

Three electronic databases were searched: PsycINFO, ERIC and Google Scholar. Publication years were from 2007 to 2017, as the Virues-Ortega et al. (2013) meta-analysis had reviewed the previous literature on TEACCH intervention and ASD. The search terms used in all databases were *TEACCH, autism and Autism Spectrum Disorder (ASD)*. To narrow the search and obtain a reasonable number of results, we restricted the search using filters and Boolean operators (Y/AND, O/OR and NO/NOT). A review of the abstracts of identified studies was used to determine the inclusion of a study. The reference lists of the included studies were also examined. Hand searches were completed for all of the journals in which the identified studies were published.

As a result of these search procedures, 14 articles were selected. The total number of participants with ASD in this theoretical review is 590, all aged between 2-41 years old. Excluding the study by Orellana et al. (2014) in which adults were involved, the children age ranged between 2-10 years old.

RESULTS

Table 1 includes information from the 14 selected articles ordered by year of publication. A summary of each study was generated in terms of: a) the study authors and year of publication; b) the country in which the study is carried out; c) a participants' description; d) methods; including kind of study, dependent variables, assessment tools and procedures; and e) results.

The 14 studies included in this review evaluated the effectiveness of the TEACCH intervention, but they were carried out in different contexts: 6 of them evaluated a

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Home TEACCHing Program effectiveness (Braidon, McDaniel, McCrudden, Hanes & Crozier, 2012; Ichikawa et al., 2013; McConkey et al., 2010; Probst et al., 2010; Turner-Brown, Hume, Boyd & Kainz, 2016; Welterlin, Turner-Brown, Harris, Mesibov & Delmolino, 2012); 3 of them evaluated the TEACCH effectiveness in the school context (Boyd et al., 2014; Probst & Leppert, 2008; Tsang, Shek, Lam, Tang & Cheung, 2007); 2 of them evaluated the TEACCH effectiveness in both contexts (home and school) (D’Elia et al., 2014; Panerai et al., 2009); 2 of them were developed individually in a clinical context (Fornasari et al., 2012; Orellana et al., 2014); and, 1 of them assessed the effect of the parents training in the family context (Probst & Glen, 2011).

The duration of the interventions varied from 5 to a total of 20 sessions. In most of the studies, the number of sessions was not specified, but the study duration vary from 10 weeks to 3 years. The sessions varied from a mean duration

of 30 minutes to an intensive intervention of 7 hours per day. With regards to the people who implement the intervention, parents or teachers were trained to implement the intervention in the home and/or school context.

Regardless of the context of intervention, the reviewed studies show that many of the affected areas in children with ASD can be enhanced with TEACCH-based interventions. Although in some studies the differences were not significant between the pre-post measurements (Probst et al., 2010; Turner-Brown et al., 2016; Welterlin et al., 2012), all of the studies revealed developmental abilities improvements, such as verbal and non-verbal cognitive functioning, language skills, imitation, perception, play engagement, social communication and interaction, eye-hand coordination or fine and gross motor skills. In addition to this, all of the studies obtained a reduction in autistic symptoms and maladaptative behaviors, like stereotyped, repetitive or ritualized patterns of verbal or

TABLE 1
CHARACTERISTICS OF THE STUDIES INCLUDED IN THE REVISION OF TREATMENT OUTCOMES OF THE TEACCH PROGRAM

Study	Country	Participants	Methods			Results
			Kind of study	Dependent variables and assessment tools	Procedures	
Tsang et al. (2007)	China	34 children with ASD participated in the study. They were divided in two groups: ✓ Experimental group: 18 children (17 boys and 1 girl) aged from 3 to 5 years. ✓ Control group: 16 children (12 boys and 4 girls) from 3 years to 5 years and 11 months. The experimental group had lower average intelligence and more educational challenges than the control group.	This is a longitudinal study to evaluate the usefulness of the TEACCH program for Chinese pre-school children.	CHILDREN: The children’s cognitive, social adaptive functioning and developmental abilities. ✓ <i>Developmental Scale of the validated Chinese version of PEP-R (CPEP-R)</i> ✓ <i>The Merrill-Palmer Scale of Mental Test (MT)</i> ✓ <i>The Hong Kong Based Adaptive Behavioral Scales (HKBABS)</i>	The study lasted 12 months. The participants were assessed at Pretest (baseline), Posttest 1 (after 6 months) and Posttest 2 (after 12 months). During the 12-months-study, children in the experimental group received 7 hours of TEACCH training per day. None of the control group children received TEACCH training.	Children in the experimental group showed gradual and significant improvement during the 12-month exposure to TEACCH training. The progress of the experimental group was more remarkable in the first 6 months of training, except for socialization domain which showed more progress in Posttest 2. The program improved children’s abilities such imitation, perception, fine motor, eye-hand coordination and gross motor skills, as well as cognitive functioning.
Probst & Leppert (2008)	Germany	10 students with ASD (7 males and 3 females) with a mean age of 10.0 years and their teachers participated in the study. According to the CARS: 6 children had severe autism, 3 moderate autism and 1 mild autism.	This study used a Pre-Post design to evaluate a teacher training program for ASD based on the TEACCH approach.	CHILDREN: Behavioral symptomatology. ✓ <i>Classroom Child Behavioral Symptoms Questionnaire (CCBSQ)</i> ; completed by the teachers) TEACHERS: Teachers’ stress. ✓ <i>Classroom Teachers’ Stress Reaction Questionnaire (CTSRQ)</i>	Teachers were divided in two small groups of five participants. Firstly, they received three training sessions and, after that, they received 6 individual training sessions in the classroom with a mean duration of 30 minutes each.	The overall behavioral symptoms of the children significantly improved and a significant reduction in the overall score of the teachers’ stress was obtained between the Pre and Post measurements. The Pre-Post effect size in both cases was in the medium range.

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non-verbal behavior, inflexible adherence to routines, highly restricted and fixated interests, and hyper- or hyporeactivity to sensory input or unusual interest in sensory aspects of the environment. In all cases, the outcome measurements improved more in the experimental

than in the control groups (D’Elia et al., 2014; McConkey et al., 2010; Panerai et al., 2009; Tsang et al., 2007; Turner-Brown et al., 2016; Welterlin et al., 2012).

Regarding the effect of the TEACCH intervention in the level of the parents or teachers stress, out of the 7 studies that

TABLE 1
CHARACTERISTICS OF THE STUDIES INCLUDED IN THE REVISION OF TREATMENT OUTCOMES OF THE TEACCH PROGRAM (CONTINUATION)

Study	Country	Participants	Methods			Results
			Kind of study	Dependent variables and assessment tools	Procedures	
Panerai et al. (2009)	Italy	34 male children with ASD and mental retardation around 9 years old were divided in 3 groups: ✓ TEACCH residential center: 11 children ✓ TEACCH home & school: 13 children ✓ Non-specific approach: 10 children	This study used a Pre-Post experimental design to evaluate the effectiveness of three different educational approaches.	CHILDREN: Adaptive behavior was assessed in various standardized scales: ✓ <i>Psycho-Educational Profile –Revised</i> (PEP-R) ✓ <i>Vineland Adaptive Behavior Scale</i> (VABS)	The TEACCH treatment was implemented by educators over a period of 3 years. Most of the parents continued the program at home after a training provided by the management team during 4 weeks and a 2-week follow-up on a 6-month basis. Each participant was assessed twice, with a three-year interval between evaluations.	Children who received TEACCH treatment obtained greater results than children who received non-specific approach. This treatment showed positive outcomes in the natural setting (home & school), revealing its inclusive value.
McConkey et al. (2010)	Northern Ireland	A total of 61 children (55 boys and 6 girls) between 2-4 years old with a confirmed ASD diagnosis and their parents participated in the study: 35 of them were part of the TEACCH program and 26 were part of the control group. Children should not be attending nursery school and they would not be in receipt of Speech and Language Therapy services.	This study used a Pre-Post experimental design to evaluate a home-based intervention to preschool children with ASD.	CHILDREN: Adaptive behavior was assessed in various standardized scales: ✓ <i>Psycho-Educational Profile –Revised</i> (PEP-R) ✓ <i>Vineland Adaptive Behavior Scale</i> (VABS) ✓ <i>Gilliam Autism Rating Scale</i> (GARS) PARENTS: Parental stress ✓ <i>Questionnaire on Resources and Stress</i> (QRS-F)	The program was delivered by two speech and language qualified therapists. It included around 15 home visits over a nine month period.	Children on the TEACCH program group showed significant improvements on all the PEP-R subscales (imitation, perception, fine and gross motor, eye-hand, verbal and non-verbal cognitive functioning). Problems with language, problems with play, relating to other people and difficulties to imitate also improved after the program. In the General Health Questionnaire, mothers improved significantly on the overall score, but the reduction in stress or anxiety was not significant.
Probst et al. (2010)	Germany	A 7-year-old girl with autism and intellectual disability.	This is a controlled individual-subject Pre-Post design to report the effectiveness on a social communication training.	CHILDREN: Adaptive behavior was assessed in various standardized scales: ✓ <i>Psycho-Educational Profile –Revised</i> (PEP-R) ✓ <i>Behavior Problems Inventory</i> (BPI) ✓ <i>Structured video behavior observation and informal conversations with caregivers</i>	Each session was subdivided into an up to 3 times reoccurring sequence of “work period” and “recreation period”. Intervention spanned 12 sessions (each 45-60 minutes) in 2 months.	Behavior problems improved after the intervention although the improvement was not significant. Caregivers stated the intervention was helpful and disburdening, and they were satisfied. The child was more communicative in everyday life, more predictable and less aggressive after the intervention.

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evaluated stress, 5 of them obtained a significant decrease between Pre and Post measurements (Braiden et al., 2012; D'Elia et al., 2014; Ichikawa et al., 2013; Probst & Leppert, 2008; Turner-Brown et al., 2016), whilst 2 of them obtained a reduction in the level of stress but this was not significant (McConkey et al., 2010; Welterlin et al., 2012). In some

studies, caregivers stated that they were highly satisfied with the intervention and with their child's progress (Braiden et al., 2012; Probst et al., 2010; Probst & Glen, 2011). An improvement on the parents' well-being and the family atmosphere was also reported (Probst & Glen, 2011; Turner-Brown et al., 2016).

TABLE 1
CHARACTERISTICS OF THE STUDIES INCLUDED IN THE REVISION OF TREATMENT OUTCOMES OF THE TEACCH PROGRAM (CONTINUATION)

Study	Country	Participants	Methods			Results
			Kind of study	Dependent variables and assessment tools	Procedures	
Probst & Glen (2011)	Germany	A total of 24 parents (83% mothers, 17% fathers) of 23 school-aged children with ASD with a mean age of 8.9 participated voluntarily in the study.	This is a within-group study aimed at examining the effectiveness of a three full day center-based education and skills parent group training.	PARENTS: ✓ <i>Parental Evaluation of Training Sessions Questionnaire</i> ✓ <i>Parental Evaluation of Training Effects on Daily Family Life Questionnaire</i> ✓ <i>Home Diary Experience Questionnaire</i>	Parents received three training sessions including three main parts: 1) a state-of-the-art concept of autism; 2) parent emotional and cognitive coping abilities by exchanging experiences with other parents of children with ASD; and, 3) teaching strategies and skills for enhancing on the Structured Teaching elements. Evaluation was assessed after the training and three months later.	Autism behaviors are stressful challenges for the majority of parents. The training was evaluated positively. Three months after the completion of the training, about 70 to 90% of parents evaluated the training outcomes positively. Beneficial effects on parental skills, parent health, and family atmosphere were reported. 12 of 16 responding parents reported the implementation of structured teaching. A significant percentage of parents were motivated to participate in parent education and training, assuming facilitator roles.
Braiden et al. (2012)	Northern Ireland	A total of 18 preschool children (17 males and 1 female) recently diagnosed with ASD, with an average age of 3 years 2 months and their parents participated in the study.	This study used a Pre-Post design to evaluate a TEACCH-based Early Intervention Home-Parent Program.	CHILDREN: Skills and behaviors. ✓ <i>Psycho-Educational Profile 3</i> PARENTS: ✓ <i>Parental stress. Parenting Stress Index (PSI)</i>	The program, delivered by trained facilitators, lasts 10 weeks and includes one-to-one support sessions. Parents are facilitated in understanding autism and implanting TEACCH methods. Each child is supported and encouraged to learn and develop appropriate skills.	Results indicate a statistically significant decrease in parental stress and increase in children's expressive and receptive language skills from Pre-testing to Post-testing. Parents also reported to be highly satisfied with the program and their child's progress.
Fornasari et al. (2012)	Italy	28 children (23 males and 5 females) with ASD between 23-97 months. Group I: children under 40 months; Group II: children between 40 and 60 months; and, Group III: children over 60 months.	Longitudinal study to evaluate the effectiveness and the best age to start a low-intensive TEACCH-orientated intervention.	CHILDREN: Developmental abilities. ✓ <i>Psycho-Educational Profile-Revised (PEP-R)</i>	Children attended individual TEACCH sessions twice a week lasting 45 minutes each. A psychologist also administered 5 sessions, lasting 1.5 hours each of training for parents and teachers. Developmental abilities were rated at baseline and after 6 and 12 months.	Developmental abilities significantly improved during the first 6 months with progressive amelioration throughout the 12-month follow-up period, obtaining moderate-to-large effect sizes. As for the age, children under 40 months of age had a greater improvement than those who started the intervention later.

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TABLE 1
CHARACTERISTICS OF THE STUDIES INCLUDED IN THE REVISION OF TREATMENT OUTCOMES OF THE TEACCH PROGRAM (CONTINUATION)

Study	Country	Participants	Methods			Results
			Kind of study	Dependent variables and assessment tools	Procedures	
Welterlin et al. (2012)	USA	Twenty 2-3 year old children (18 males; 2 females) with autism and their families participated in the study. They were randomly assigned to the treatment or waitlist group.	The group study was a randomized Pre-Post treatment design to evaluate a Home TEACCHing Program for Toddlers.	<p>CHILDREN: Behavior</p> <ul style="list-style-type: none"> ✓ <i>Mullen Scales of Early Learning (MSEL)</i> ✓ <i>Scales of Independent Behavior-Revised (SIB-R)</i> <p>PARENTS: Parental stress</p> <ul style="list-style-type: none"> ✓ <i>Parenting Stress Index (PSI)</i> 	Families were paired based on chronological and mental age and were randomly assigned to the treatment (Home TEACCHing Program; HTP) or waitlist (WL) group. The WL group received treatment after the 12 week wait period. Six families completed the multiple baseline single-subject design phase and the other 14 completed baseline and post-intervention assessments only.	<p>This study showed robust support for improvement in child and parent behavior.</p> <p>Participation in the HTP led to improvement in children's independent work skills and parents' ability to structure the environment as well as a reduction in the parents' stress. Effect sizes for the HTP group were medium to large.</p> <p>However, results revealed no statistically significant differences between groups.</p>
Ichikawa et al. (2013)	Japan	11 children with high-functioning autism (HFA) (9 males; 2 females), aged 5-6 years, and their mothers were randomly assigned to the TEACCH program (n=5) or a waiting-list control group (n=6).	This is a pilot randomized controlled trial (RCT) to evaluate the TEACCH program effectiveness in developing social skills of children with HFA.	<p>CHILDREN: The adaptive behaviors and social reciprocity of the children were assessed through:</p> <ul style="list-style-type: none"> ✓ <i>The Strengths and Difficulties Questionnaire (SDQ)</i> <p>PARENTS: Parenting stress, and parent – child interactions were assessed using:</p> <ul style="list-style-type: none"> ✓ <i>Parenting Stress Index (PSI)</i> ✓ <i>Beck depression inventory-II (BDI-II)</i> ✓ <i>Interaction Rating Scale (IRS)</i> 	The program involved 2-hour sessions, totaling 20 sessions over six months.	<p>The outcome measurements improved more in the TEACCH program group than in the control group, with moderate effect sizes.</p> <p>Results showed that this program is more beneficial for high IQ children and mothers with low stress.</p>
Boyd et al. (2014)	USA	A total of 198 children with ASD about 4 years old, and their families were included in the study: LEAP group (54 children)(165 males; 33 females); TEACCH group (85 children); and, control group (59 children). A total of 25 TEACCH, 22 LEAP and 27 control teachers were also enrolled.	Quasiexperimental study whose purpose was to compare high fidelity LEAP and TEACCH programs as well as a control condition in which non-model-specific practices was used.	<p>A large number of cognitive, behavioral, psychological, and social variables were measured:</p> <ul style="list-style-type: none"> ✓ <i>Autism Diagnostic Observation Schedule (ADOS)</i> ✓ <i>Childhood Autism Rating Scale (CARS)</i> ✓ <i>Leiter International Performance Scale-Revised</i> ✓ <i>Mullen Scales of Early Learning (MSEL)</i> ✓ <i>Pictorial Infant Communication Scales</i> ✓ <i>Preschool Language Scales, 4th edition</i> ✓ <i>SCQ</i> ✓ <i>Social Responsiveness Scale</i> ✓ <i>Repetitive Behavior Scales-Revised</i> ✓ <i>Vineland Adaptive Behavior Scales (VABS)</i> <p>Teachers also fulfilled the <i>Classroom Practice Inventory (CPI)</i> in order to self-report the type and frequency of teaching strategies used.</p>	<p>This study lasted one school year.</p> <p>Prior to the study, teachers attended a formal training in LEAP or TEACCH methodology. This was a 12-h training conducted across 2 days. In addition, they had been teaching in their respective classroom type (TEACCH or LEAP) for at least 2 years before the study took place.</p> <p>Parents did not receive any specific training. They only fulfilled the necessary questionnaires to evaluate their siblings' development before and after the program.</p>	<p>Children's performances improved across time irrespective of programming type.</p> <p>Nonetheless, there were no changes across time as for sensory and repetitive behavior reported by parents and teachers for any of the models. In LEAP methodology, significant change across time was not found for parent report of social interaction either.</p> <p>Children enrolled in TEACCH classrooms showed more improvements in autism severity.</p>

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DISCUSSION

In line with previous research, regardless of the setting and the country, all of the studies included in this review revealed developmental abilities improvements and a reduction in autistic symptoms and maladaptive behaviors after using a TEACCH-based intervention (Eikeseth, 2009; Ospina et al., 2008).

Out of the 14 selected studies, 11 of them revealed a

significant improvement on the child's development. Regarding the other three studies in which the improvements did not reach the statistical significance: 1) in the Turner-Brown et al. (2016) study, no treatment effects were found for the global child measures, but there were significant treatment effects on social communication skills; 2) in the Probst et al. (2010) study, the sample was composed only by a 7-year-old girl with autism and

TABLE 1
CHARACTERISTICS OF THE STUDIES INCLUDED IN THE REVISION OF TREATMENT OUTCOMES OF THE TEACCH PROGRAM (CONTINUATION)

Study	Country	Participants	Methods			Results
			Kind of study	Dependent variables and assessment tools	Procedures	
D'Elia et al. (2014)	Italy	30 pre-school children (24 males; 6 females) with ASD between 2 and 6.11 years and their parents enrolled in this study, of which 15 were part of the TEACCH group and 15 were part of the control group. This was not a randomized study; the assignment to the groups was made by parents.	This is a longitudinal study in which different children and parents variables were assessed four times in order to evaluate the potential benefits of the TEACCH program.	CHILDREN: Autism severity, adaptive functioning, language skills and maladaptive behaviors were assessed. ✓ <i>The Autism Diagnostic Observation Schedule (ADOS)</i> ✓ <i>The Vineland Adaptive Behavior Scales (VABS)</i> ✓ <i>The McCarthy Communication Developmental Inventories (CDI)</i> ✓ <i>The Child Behavior Checklist (CBCL)</i> ✓ <i>Psycho-Educational Profile 3</i> PARENTS: Parental stress. ✓ <i>Parenting Stress Index (PSI)</i>	The study lasted 24 months. All participants were assessed four times: T0 (Baseline), T1 (after 6 months), T2 (after 12-15 months) and T3 (after 24 months). Participants in the TEACCH program group received treatment 2h at home and 2 h at school by one therapist who worked directly with each child.	The TEACCH program provided benefits for children with ASD by reducing autistic symptoms and maladaptive behaviors. Language skills improved significantly over time, both in comprehension and production. Adaptive functioning also improved over time. A progressive decrease in parental stress was also obtained.
Orellana et al. (2014)	Spain	72 people with ASD (and with or without intellectual disability) participated in the study: ✓ 38 children (33 boys and 5 girls), aged 4-9 years ✓ 34 adults (29 men and 5 women), aged 19-41 years.	This study used a Pre-Post quasi-experimental design to evaluate the effectiveness of a short TEACCH program to facilitate a 10-component oral assessment.	It was used the <i>Frank Scale</i> to evaluate behavior of patients with ASD. In this scale, data are divided in 4 categories: definitely negative (the patient rejects treatment), negative (unwilling to accept treatment, some evidence of negative attitudes but not very pronounced), positive (the patient tolerates treatment cooperating with the dentist), and definitely positive (good rapport with the dentist, enjoying the situation).	Parents of people with ASD were offered a basic clinical oral assessment without cost for their sons or daughters. The study consisted of a baseline oral examination, 5 training sessions and a final oral assessment. The training sessions were carried out in five 20-minute sessions, twice a week along three consecutive weeks.	The TEACCH program was effective in facilitating a full dental assessment by increasing compliance in participants with ASD. The improvement was not influenced by the cognitive level development, so both people with high functioning autism and people with associated intellectual disabilities can benefit from this intervention.
Turner-Brown et al. (2016)	USA	50 children (42 males; 8 females) with ASD under 3 and their families were randomly assigned to: ✓ Family Implemented TEACCH for Toddlers (FITT): 32 participants ✓ Services as Usual (SAU): 17 participants	This study used a Pre-Post experimental design to compare the effects between FITT and SAU.	CHILDREN: Autism severity and adaptive functioning were assessed. ✓ <i>The Autism Diagnostic Observation Schedule (ADOS)</i> ✓ <i>The Mullen Scales of Early Learning (MSEL)</i> PARENTS: Parental stress and health-related quality of life. ✓ <i>Parenting Stress Index (PSI)</i> ✓ <i>The RAND-36</i> .	Children and their parents participated in a 6-month intervention. FITT included 90-min in-home sessions (n=20) and parent group sessions (n=4). SAU included community interventions, such as speech, occupational, developmental, and behavioral therapy.	No treatment effects were found for global child measures, although there were significant treatment effects on social communication skills. Regards parents, results revealed significant differences between groups. Families in the FITT group showed decreased stress and improved well-being over time.

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intellectual disability, what could have mediated the results; and 3) in the Welterlin et al. (2012) study, the results of the multiple baseline design showed robust support for children improvement, but according to the researchers of the study, the results did not reach significance due to the sample size and short time frame.

As for longitudinal studies, the progress of the experimental group was more remarkable in the first 6 months of training with progressive amelioration throughout the 12-month follow-up period (Fornasari et al., 2012; Tsang et al., 2007). As an exception, in the Tsang et al. (2007) study, the socialization domain showed more progress after 12 months of training, probably because of the intensity of the intervention, receiving 7 hours of TEACCH training per day. Fornasari et al. (2012) also evaluated the best age to start the intervention, obtaining that children under 40 months of age had a greater improvement than those who started the intervention later. This result shows the importance of the early intervention in children with ASD.

As we have hypothesized, the reviewed studies show that the use of the TEACCH intervention improves not only the child's development, but it also reduces their parents and teachers stress levels'. Although in some studies, the stress reduction was not significant, this is a promising result since this intervention can improve not only the child's development, but also the child and adults' interaction, and the adults' well-being (McConkey, 2010; Probst & Glen, 2011; Turner-Brown et al., 2016).

Some limitations have been found in this review, such as the low number of experimental studies that met the inclusion criteria, an aspect that was already pointed out in the Virues-Ortega et al. (2013) meta-analysis; the heterogeneity of the participants characteristics; the use of different assessment tools; the wide variety of the intervention duration; and, the implementation of interventions by parents and teachers who may not be sufficiently trained to do so. In addition to this, despite some parents or teachers can report an increase in their competence after receiving TEACCH training, not all of them may be able to influence the students' behavioral problems because of TEACCH intervention needs time to have an effect and the duration of the interventions tend to be short (Probst & Leppert, 2008). In most of the studies reviewed, the degree of the ASD severity and the possibility of a co-occurrence with a comorbid disorder were not specified; two important aspects taken into account that ASD includes a very heterogeneous spectrum of symptoms, so that each person presents unique characteristics and the treatment requires being different in each case. This is why recent research

suggests that it is better to adopt an eclectic approach based on evidence-based treatments (Aiello, Ruble & Esler, 2017).

Due to the limited pool of experimental studies, more research is needed in order to prove the TEACCH intervention effectiveness. Samples should also be bigger to allow the extrapolation of the results. Considering the high heterogeneity of the ASD characteristics, it would be advisable that these studies took into account the ASD severity of the participants and the possibility of a co-occurrence with a comorbid disorder. In addition to evaluate the child's development, it would also be interesting to analyze the effects of TEACCH intervention upon the child's well-being and their quality of life. Finally, it would also be interesting to unify criteria in the application of interventions, delimiting the optimal duration and intensity.

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CONFLICT OF INTERESTS

There is no conflict of interest

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