



An evaluation of the TEACCH approach for teaching functional skills to adults with autism spectrum disorders and intellectual disabilities

Andrew M.H. Siu^{a,*}, Zuie Lin^b, Joanna Chung^b

^a Department of Rehabilitation Sciences, The Hong Kong Polytechnic University, Hunghom, Kowloon, Hong Kong

^b Hong Chi Association, Hong Kong

ARTICLE INFO

Keywords:

TEACCH

Autism

Adults

Evaluation

Functional skills

Intellectual disabilities

ABSTRACT

Background: The Treatment & Education of Autistic and Communication Related Handicapped Children (TEACCH) approach has been widely adopted around the world, but most previous studies focus on applying it to teaching children with autism spectrum disorders (ASD) who have high functioning or without intellectual disabilities.

Aims: This study evaluated the application and effectiveness of a TEACCH approach in teaching functional skills to young adults with ASD who have mild to moderate intellectual disabilities.

Methods and procedures: The study employed an experimental design which compared the training goal attainment of an experimental ($n = 32$) and a comparison ($n = 31$) group. We administered the TEACCH Transitional Assessment Profile (TTAP) to identify suitable areas of training and devised three individualized training goals for each participant using the goal attainment scaling (GAS) methodology. The experimental group participated in a standardized, individualized, 20-session training program based on the TEACCH approach, on top of their regular training in day activity centers.

Results: All the participants showed improvements in functional skills over the baseline, mid-program, and post-program assessments ($F = 146.66$, $p < .001$). The experimental group had significantly larger improvement in the GAS scores than the comparison group ($F = 15.40$, $p < .001$). There were no significant changes between the pre- and post-program TTAP scores of both groups.

Conclusions and implications: The TEACCH approach is effective in teaching specific functional skills to young adults with ASD and mild to moderate intellectual disabilities. The clinical and research implications of the study are discussed.

What this paper adds?

This study addresses the lack of research evidence for using the TEACCH approach in teaching functional skills to adults with ASD and mild to moderate intellectual disabilities. It is also one of the few studies of TEACCH that uses a quasi-experimental approach, characterized by using a comparison group, blinded assessments, standardized and individualized training program, and standardized outcome measures. Instead of using many outcome measures in many studies, the current study systematically applied the Goal Attainment Scaling (GAS) in setting up individualized training goals for participants, and these goals were used in evaluation of the

* Corresponding author.

E-mail address: a.siu@polyu.edu.hk (A.M.H. Siu).

<https://doi.org/10.1016/j.ridd.2019.04.006>

Received 17 September 2018; Received in revised form 30 January 2019; Accepted 6 April 2019

Available online 24 April 2019

0891-4222/ © 2019 Elsevier Ltd. All rights reserved.

approach. The results of the study showed that the TEACCH approach could effectively increase achievement of functional skill in people with ASD and mild intellectual disabilities. The study results contribute to evidence in support of the TEACCH approach in education and training with adults with ASD.

1. Introduction

Autism spectrum disorders (ASD) are a group of developmental disorders characterized by social impairment, verbal and non-verbal communication difficulties, restricted interest, and repetitive and stereotypical behavior (American Psychiatric Association, 2013). The cause of ASD is partly genetic but also involves a multitude of psychosocial and environmental factors, and the interaction of these factors can result in considerable diversity in the presentation of the disorder. While most persons with ASD have major difficulties in communication, building relationships with others, and emotion management, they also present a wide range of learning abilities and aptitudes that can either facilitate or become barriers to their functional independence at home and in the community. ASD can greatly disrupt the social and emotional development of the child, and caregiving and parenting is often a great challenge.

Over the past three decades, a range of educational, developmental, and behavioral intervention models have been designed for the education and training of people with ASD. Most systematic reviews suggested that interventions that are comprehensive, high-intensity, and start early (prior to the age of five) result in greater gains in adaptive performance in children and young people with ASD (Lovaas, 1987; Ozonoff & Cathcart, 1998). Among the various educational and training approaches presented in these reviews, the Treatment & Education of Autistic and Communication Related Handicapped Children (TEACCH) approach has been widely recognized by educators and therapists around the world as one of the evidence-based training models for people with ASD (Mesibov, Shea, & Schopler, 2005). TEACCH is a structured learning and service program designed specifically for individuals with ASD (Schopler & Reichler, 1971). The purpose of the TEACCH program is to develop the strengths, skills, interests, and needs of persons with ASD, in order to prepare them for maximal independence. The design of the TEACCH program addresses the neuropsychological deficits and strengths of persons with ASD using: 1) visual strategies and clear information, 2) a structured teaching-learning environment and curriculum, 3) use of clients' special interests to engage them in activities and as a reward for their learning, and 4) a "normalized" (social-pragmatic developmental) approach to develop meaning and self-initiated communication (Mesibov & Shea, 2009).

While the TEACCH program was well received and has been implemented in educational and therapy settings, there are several research gaps. First, there are inconsistent results in the reviews of effectiveness of the TEACCH approach. Some recent systematic reviews suggest that the overall effects of the TEACCH program are negligible to small on a range of developmental and functional measures (Virues-Ortega, Julio, & Pastor-Barriuso, 2013). The effects of TEACCH appear to be greater on increasing social skills and reducing maladaptive behavior than in other areas. There is much evidence in support of the instructional principles and specific instructional strategies of TEACCH, such as how visual strategies and structure can be used to facilitate meaningful communication and function (Mesibov & Shea, 2009). However, there were few evaluation studies on the overall effectiveness and impact of TEACCH (Mesibov & Shea, 2009; Ozonoff & Cathcart, 1998; Schwartz, Garfinkle, & Bauer, 1998). Some studies also showed that the effects of TEACCH was comparable to approaches like Applied Behavior Analysis (ABA) (Callahan, Shukla-Mehta, Magee, & Wie, 2010) or Learning Experiences: an Alternative Program for Preschoolers and Parents (LEAP) (Boyd et al., 2014). There are clearly a need to further evaluate the impact of TEACCH programs.

Second, it is unclear if structured learning approaches like TEACCH can achieve the same impact in adults and children. Many studies in existing literature have focused on the efficacy of interventions among young children, reporting little to promising results (D'Elia et al., 2014; McPheeters et al., 2011; Tsang, Shek, Lam, Tang, & Cheung, 2006; Warren et al., 2011). For studies conducted on adolescents and adults, they focused mainly on young adults with high-functioning autism or Asperger syndrome, whose outcomes may not be generalizable to those with mild to moderate intellectual disabilities.

Third, it is likely that adults with ASD had different levels of exposure to structured learning approaches (like TEACCH) when they were children (Levy & Perry, 2011). It could be challenging to recruit a homogeneous sample with little or no exposure to TEACCH in previous learning.

Fourth, it is challenging to conduct a comprehensive standardized battery to capture developmental outcomes of TEACCH over time (e.g. Tsang et al., 2006). In fact, TEACCH uses an individualized approach to structured teaching, and it is necessary to evaluate learning outcomes through capturing progress in measurable goals.

Last, many reviews criticized that the quality of outcome studies for TEACCH is low (Anderson et al., 2003). A significant proportion of the current evidence-based literature takes the form of case studies and small *n* studies (e.g. Hume & Odom, 2007), and randomized controlled trials are rare (Levy & Perry, 2011; Warren et al., 2011).

This study aims to address the above research gaps in the current literature. First, it aims to evaluate the effectiveness of TEACCH for adults with ASD, to address the current research gap. Second, the subjects recruited have mild to moderate intellectual disabilities, and attend day activities centers or sheltered workshops. This addresses the lack of evidence for persons with ASD who have intellectual disabilities. Third, this study aims to implement TEACCH as a structured learning program for young adults with ASD, as many had little exposure to structured learning approaches (like TEACCH) to learn functional skills when they were young. Fourth, the service providers of the clinical settings involved are fully trained in use of TEACCH, including the training principles, procedures, and strategies. Fifth, this study used Goal Attainment Scaling (GAS) in program evaluation, so that individualized program plans set up for each subject and used in evaluation of progress. Last, the current study uses an experimental approach that aims to reach most standards of a clinical trial.

2. Method

This study aims to evaluate the TEACCH program's ability to enhance the life skills of adults with ASD.

2.1. Participants

A purposive sample of 63 participants was recruited, sixty two from eight day activity centers and one from a sheltered workshop operated by a Non-Governmental Organization. All subjects met the following inclusion criteria: 1) aged 21 to 40, 2) diagnosed with an ASD, 3) mild (IQ ranges from 50 to 69) or moderate (IQ ranges from 25 to 49) intellectual disabilities as measured by Weschler Intelligence Scales for Children during early development, 4) regular attendance to vocational, functional, or life skills training programs, 5) no participation in functional training programs using the TEACCH approach in the previous six months.

Day activity centers are funded by the government in Hong Kong to provide training in self-care, social skills and basic working skills for adults with moderate to severe intellectual disabilities during office hours from Monday to Friday. These centers aim to train participants to become more independent in their daily lives, prepares them for better integration into the community and transition to other training or vocational services like vocational training, sheltered workshop, or supported employment.

We determine the sample size required for the study based on the assumptions that α was 0.05, effect size was small (Cohen's d is 0.40), and there were two groups (of equal size), and three repeated measures – baseline, mid-program, and post-program. Sample size estimation software PASS12 (Hintze, 2013) indicated that the sample of 29 per group was required to achieve a power of 0.80 and so the sample pool had to have at least 58 subjects.

2.2. Instruments

Two assessment instruments were used. The TEACCH Transition Assessment Profile (TTAP) was used to screen the strengths and limitations of the subjects in six areas of functional skills. Using the goal attainment scaling (GAS) approach, case managers (who are occupational therapists or social workers) designed individual goals for each subject based on TTAP assessment results, as well as interview and daily observation. The training goals were evaluated at baseline, mid-program, and after the intervention program was completed.

2.2.1. TEACCH transition assessment profile

The TTAP is designed to provide assessment data for transition planning from school age to adolescence and adulthood (Mesibov, Thomas, Chapman, & Schopler, 2007). It is a criterion-referenced test designed for individuals with ASD who have mild to severe intellectual disabilities and are over 12 years of age. The research team translated the English test instructions to Chinese. An expert panel, comprising of occupational therapists, psychologist, social workers, and special education teachers reviewed the content validity and cultural relevance of the TTAP. Several test items were modified or revised to make the assessment tasks more culturally relevant.

We used the Direct Observation Scale of the TTAP in this study. Based on observation of the performance of participants in specific assessment tasks, professional rated participants' performance on a 3-point scale of P (Pass), E (Emerging), or F (Fail). The TTAP test items cover the six functional areas of Vocational Skills (VS), Vocational Behavior (VB), Independent Functioning (IF), Leisure Skills (LS), Functional Communication (FC), and Interpersonal Behavior (IB). The TTAP was conducted for all subjects before and after the completion of the intervention program.

2.2.2. Goal attainment scaling

GAS is an individualized, criterion-referenced approach that can be used to evaluate clinical service and educational outcomes (King, McDougall, Palisano, Gritzan, & Tucker, 1999; Turner-Stokes, 2009). GAS has been widely applied to the evaluation of the learning and training outcomes of therapy for children and adolescents with ASD (Pfeiffer, Koenig, Kinnealey, Sheppard, & Henderson, 2011; Ruble, McGrew, & Toland, 2012). The case managers set a maximum of three individualized goals for each subject in one to two areas of the six functional skills covered by the TTAP. For each training goal, the case manager defined a unique set of measurable behavioral goals for the client. The expected outcomes of the GAS training goal are defined on a 5-point scale from -2 (outcome much less than expected), -1 (less than expected), to 0 (expected outcome) to +1 (better than expected), and +2 (much better than expected). At the baseline, the goal attainment level of each training goal should be set at either -1 or -2.

We used three methods to ensure the reliability and validity of the goals set for each subject. First, we developed a GAS guidebook and provided training sessions on GAS for the case managers who wrote the training goals. Second, we recruited case managers who are not involved in this research to act as peer reviewers of the GAS. Peer reviewers are either social workers or occupational therapists, and they used a GAS Technical Proficiency Checklist developed by the research team (Kiresuk, Smith, & Cardillo, 1994) to evaluate the quality of GAS goals written by the case managers. The assessment criteria in the checklist cover areas like whether there were substantial overlaps or large gaps among the levels of goals, or if the outcomes indicators were concrete and measurable. After the case manager received feedback on the goals from reviewers, they would revise the goals. Third, case managers were required to consult the case social workers (and parents if necessary) to check that the proposed training goals were appropriate for the client.

Table 1

Sample Training Objectives designed using Goal Attainment Scaling (translated from Chinese to English).

Objective	Goal Attainment Scale
Increase skills in shopping	Six tasks involved in shopping are: a) looking for target items, b) take correct number of items from shelves, c) queue up for check out, d) complete payment, e) take the shopping item, f) collect receipt and collect change (if needed). 2: complete 4 or more tasks independently 1: complete 3 tasks independently 0: complete 2 tasks independently – 1: complete 1 task independently – 2: complete at least 1 task only with prompting or cueing, cannot complete independently.
Decrease inappropriate behavior during shopping trip	The types of inappropriate behavior during the shopping trip includes: a) touching rubbish, b) kicking or touching rubbish bin, c) turn off switches, d) move objects around for no reasons, e) leave the shopping party. 2: inappropriate behavior for once to twice, and all behavior continues for no more than 10 seconds each time. 1: inappropriate behavior for 3 to 4 times, and all behavior continues for no more than 10 seconds each time. 0: inappropriate behavior for 5 to 6 times, and all behavior continues for no more than 10 seconds each time. – 1: inappropriate behavior for 7 to 8 times, all behavior continues for no more than 10 seconds each time. – 2: inappropriate behavior for more than 8 times, at least one behavior continues for more than 10 seconds, or fail to complete shopping trip due to inappropriate behavior.

2.3. Procedure

The project was approved by the ethics committees of The Hong Kong Polytechnic University and the Hong Chi Association. We gave a briefing to the potential participants on the purpose and procedures of the study, how they could participate, and then invited them to join. We also obtained informed consent from the parents or guardians of participants.

We checked that all subjects fulfilled the selection criteria and assigned them to the experimental and comparison groups. As the settings conducted TEACCH program on an individualized basis and we are expected to conduct assessments and interventions in a short time after recruitment, it was not feasible for us to accumulate a large pool of subjects and implement random assignment of subjects. Thus we could only assign the first participant to experimental and then the next to comparison group as soon as they joined the study. Both the experimental and comparison group participants attend a regular day activity program which aimed to promote their function independent living skills, work skills, and social skills. The participants of the experimental group were released from their regular day training experimental group to join the TEACCH program. We assessed all participants using the TTAP, interviews and observation, and identified one or two domains (out of six) of the TTAP in which the participant had an emerging (E) grade. We set three training goals for each participant in the identified domains (a few examples of training goals are lists in Table 1). We intend to place training focus on one to at most two areas, as this is more likely to make an impact. We set only three training goals for each client, as we estimated that we have adequate manpower to cover twenty session of additional training using TEACCH on top of the regular program.

Once the individualized sets of GAS goals were formulated, the participants of the experimental group attended 20 one-hour sessions of training using the TEACCH approach over a period of 9 weeks, and they are released from their regular training program during the TEACCH training sessions. The participants of the comparison group attended their regular training program as usual.

During the TEACCH training sessions, the case managers (who are either social workers or occupational therapists) conducts training according to the GAS goals set in two out of the six domains: vocational skills, vocational behavior, independent functioning, leisure skills, functional communication, and interpersonal behavior. A range of activities are designed for training with consideration to the interests of each client. Examples of these training activities include simulated work tasks (assembly task, clerical, craft work), leisure and recreation activities (e.g. drawing and painting, horticulture, table games, work-out), independent living skills (e.g. cleaning, shopping, cooking). Teaching aid and materials that apply visual strategies are developed for use in training activities.

All the case managers involved had previously received training on the use of the TEACCH approach through both local courses in Hong Kong and/or in North Carolina, USA. The rehabilitation workers and assistants who are involved in the care of the participants had also received a half-day training session on TEACCH, as they were to help the participants practice the skills in daily training classes based on the goals set by the case managers. To ensure the quality of the delivery of the TEACCH program, case social workers and managers were invited to provide peer review of the quality of program delivery and how far the program adhered to the principles and strategies of the TEACCH approach.

The outcomes of the TEACCH training program were assessed by comparing GAS scores at baseline, mid-program, and post-program. All assessments were conducted blind by assessors who were research assistants trained in the clinical observation and use of GAS. To enable a more feasible schedule of assessment, all baseline assessments were conducted within 3 days prior to treatment, and mid-program were conducted in the two and a half days before or after the prospective date of assessment, and post-program

Table 2
Characteristics of subjects in experimental and comparison groups.

Variables	Categories	Experimental (<i>n</i> = 32) <i>n</i> (%)	Comparison (<i>n</i> = 31) <i>n</i> (%)	Total <i>N</i> (%)
Sex	Male	29 (90.6%)	26 (83.9%)	55 (87.3%)
	Female	3 (9.4%)	5 (16.1%)	8 (12.7%)
Level of Intellectual Disability	Mild	5 (15.6%)	4 (12.9%)	9 (14.3%)
	Moderate	27 (84.4%)	27 (87.1%)	54 (85.7%)
Age	–	M (SD)	M (SD)	M (SD)
		28.7 (5.1)	30.5 (5.5)	29.5 (5.3)

assessments were conducted on the 20th session or within two and a half days after the prospective date of assessment. When the program was complete, we also conducted the TTAP to see if the subjects presented changes in the overall profile of functional skills.

2.4. Statistical analysis

We used the two-way Repeated Measure ANOVA to analyze the differences in outcomes between experimental and control groups, after taking into account that part of the changes are due to changes over time (within-group effects). We would test both the group by time interaction and between-group effects, to see if there are significant differences in progress between groups. The ANOVA could also provide estimates of effect sizes and statistical power of results. We would produce graphical plots of changes of the two groups over time, which provides a visual aid to present the results.

3. Results

Sixty-three subjects joined the study and were assigned to the experimental (*n* = 32) and comparison (*n* = 31) groups. Most of the subjects were male (*n* = 55, 87.3%) (Table 2). The mean age of the comparison group was 30.5 (SD = 5.5) and that of the experimental group was 28.7 (SD = 5.1). The majority (*n* = 54, 85.7%) of the subjects had moderate intellectual disabilities, and the rest had mild intellectual disabilities with challenging behavior or other disabilities (such as hearing impairment, movement limitations). There was no significant difference in mean age ($t = 1.36, p = .18$), in gender proportions ($\chi^2 = .44, p = .71$) or in level of intellectual disability ($\chi^2 = 0.07, p = .99$) between the experimental and comparison groups.

It is noted that more training goals were identified in the areas of Vocational Skills (25.8%), Independent Functioning (20%), and Functional Communication (20%) than Vocational Behavior (10.8%), Leisure Skills (11.7%), and Interpersonal Behavior (11.7%). All the GAS training goals were regarded as appropriate, relevant, and well written after modification with reference to the suggestions of peer reviewers. A total of 93 training goals were set for 32 participants in the experimental group, and 92 goals are set for 31 participants of the comparison group. We intend to set three goals for each participant, but a few participants in both groups only have two training goals. There was no significant difference in the goal attainment of the comparison and experimental groups at the baseline measurement ($t = 0.45, p = .66$).

The summary statistics of the GAS scores for the two groups are presented in Table 3, and a diagrammatic presentation of the mean scores is provided in Fig. 1. These show that both groups had a mean score close to -1.5 at baseline. Both groups showed improvement in GAS scores between the mid- (10th session) and post-program (20th session) measurements, but the experimental group showed a much greater improvement than the comparison group over time. This is also supported by the results of the repeated measures ANOVA (Table 4), which shows that between-subject and within-subject effects were all significant. The experimental group showed significantly greater improvement in GAS scores than the comparison group ($F = 15.40, p < .001$). The GAS scores of all subjects improved significantly over the three assessments ($F = 146.66, p < .001$), and there was also a significant interaction between group and time effects ($F = 13.85, p < .001$).

A further analysis of outcomes in different training areas showed that the experimental group had significantly higher GAS scores than comparison group in the training areas of Vocational Skills ($F = 4.01, p = .05$), Independent Functioning ($F = 17.77, p < .001$), and Functional Communication ($F = 5.67, p = .02$) (Table 5). The differences in outcomes in Leisure Skills was marginally insignificant ($F = 3.68, p = .07$), while changes in the Vocational Behavior ($F = 2.78, p = .12$) and Interpersonal Behavior

Table 3
Mean and standard deviation of GAS scores in stages.

Group	Baseline		Mid-program		Post-program	
	M	SD	M	SD	M	SD
Comparison (<i>n</i> = 92)	−1.45	.70	−.78	1.05	−.34	1.25
Experimental (<i>n</i> = 93)	−1.48	.64	−.10	1.12	.83	1.08
Total	−1.46	.67	−.44	1.14	.25	1.30

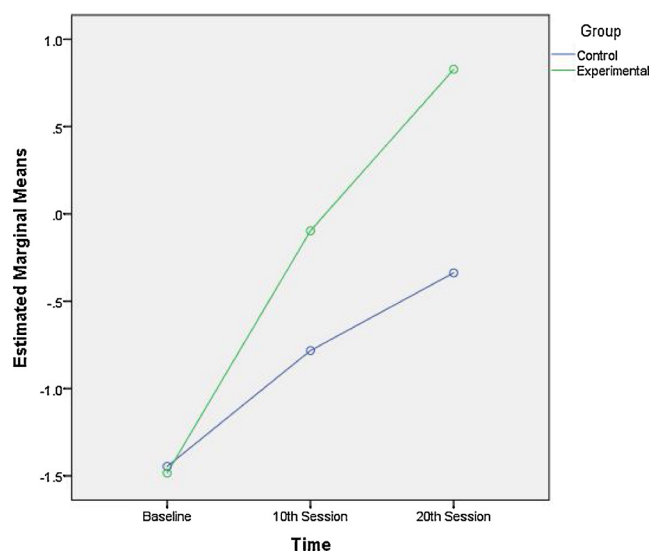


Fig. 1. Plot of estimated marginal means of GAS for comparison and experimental groups over three repeated measures.

Table 4

Analysis of changes in GAS scores using repeated measures ANOVA: experimental vs. comparison group.

Source	SS	MS	F	p	η^2
Between-subject effect					
Group	17.24	8.62	15.40	.001 >	.15
Error	101.86	.56			
Within-subject effect					
Time	192.21	101.59	146.66	.001 >	.45
Time x Group	36.30	9.59	13.85	.001 >	.13
Error	238.52	182.00	1.31		

Table 5

Analysis of changes in GAS scores using repeated measures ANOVA by training area.

Training Area	% of total number of GAS goals	Number of GAS goals in group (91 pairs)		Between-group effects		
		Experimental	Comparison	F	p	η^2
Vocational Skill	22.98	20	20	4.01	.05	.10
Vocational Behavior	8.24	9	6	2.78	.12	.18
Independent Functioning	23.62	22	21	17.77	.001 >	.30
Leisure Skill	11.54	11	10	3.78	.07	.15
Functional Communication	23.08	19	23	5.67	.02	.12
Interpersonal Behavior	11.54	10	11	1.63	.22	.08

($F = 1.63$, $p = .22$) domains were insignificant.

We also conducted a repeated measures ANOVA that compared the pre- and post-TTAP scores of subjects in the experimental and comparison groups. The results showed no significant differences in TTAP score changes pre- and post-test.

4. Discussion

4.1. Effectiveness of the TEACCH approach

The results of the current study support that a top-up TEACCH training program could enhance the learning of functional skills by adults with ASD. This is indicated by the significantly higher attainment of GAS training goals in the experimental group. The within-subject effects of repeated measures ANOVA showed significant improvement in the GAS scores of both the comparison and experimental groups. However, the experimental group showed much greater improvement than the comparison group. This result is an important contribution to the current evidence on the effectiveness of the TEACCH approach in training adults with ASD and mild to moderate intellectual disabilities.

When we examined the positive changes in the six training areas, we found that the goal attainment of the experimental group was significantly better than the comparison group in the areas of Independent Functioning and Functional Communication. The improvement in goal attainment was marginally insignificant in the areas of Leisure Skills.

The effect sizes in the four other functional areas, ranging from 0.10 to .30, could be considered medium to large (Miles & Shevlin, 2001). This indicates that TEACCH is more effective in teaching functional goals in certain areas. It appears to be harder to attain goals in the areas of Interpersonal Behavior, Vocational Behavior, and Leisure Skills. However, this finding should be interpreted with caution as different numbers of goals are set for different areas. The power of analysis is lower in areas with fewer goals. In further study comparing the effects of TEACCH on different functional areas, the researcher would need to ensure that a minimum number of goals are set in each area, which could provide adequate power for comparison.

It is noted that there were no significant changes in the subjects' TTAP scores, despite the significant improvement in GAS scores. This result could be attributed to the short-term nature of the current study - 20 sessions of TEACCH top-up training sessions over a period lasting less than 9 weeks, as well as the intended purpose of the TTAP. The TTAP is designed to capture progress in the development of functional independence over a longer period of time and is often expected to be conducted every 6–12 months. The TTAP would be more appropriate for evaluating the longer-term impact of the TEACCH approach if the training could be extended to a period of six to 12 months, and individuals could be evaluated only in the functional areas in which training goals have been set.

4.2. Implications

The results of the study support the effectiveness of the TEACCH approach for adults with ASD, and the organization involved is planning to implement the TEACCH approach on a larger scale for persons with ASD in day activity centers and vocational rehabilitation services. However, there could be some potential challenges to full implementation of TEACCH in these settings. First, day activity centers and vocational rehabilitation services are designed to provide services to a wide range of individuals with intellectual and developmental disabilities. The target populations of vocational rehabilitation services (including sheltered workshops and supported employment) may also include individuals with psychiatric issues and physical disabilities, in addition to intellectual and developmental disabilities. There are practical limitations that impede establishing a structured learning space dedicated for persons with ASD. Second, day rehabilitation services often employ behavioral coaching and work rehabilitation techniques that may not be wholly consistent with the teaching-learning strategies used in TEACCH. Due to these considerations, it is only possible for persons with ASD to join two to three specific TEACCH training sessions per week. Lastly, the service organization will need to conduct large-scaled staff training and environmental modification in order to extend TEACCH training to the service setting.

The results also supported that TEACCH approach could be successfully applied in functional training in adults with ASD and mild to moderate intellectual disabilities. The training of these participants is greatly hampered by their limited verbal communication skills, narrow interests, and disruptive behavior. The study demonstrated that we could still make use of visual strategies, structured learning and environment to engage adults with ASD and intellectual disabilities to learn specific functional tasks effectively.

GAS was used to monitor and demonstrate individualized functional training outcomes in this study and was able to demonstrate the outcomes of TEACCH. While individualized goal setting is commonly used in special education and rehabilitation services for persons with intellectual disabilities, the full implementation of GAS would require intensive staff training and continuous supervision. It is necessary to set up policies and quality assurance procedures to write concrete, relevant, and measurable goals using the GAS approach.

4.3. Limitations

There are several limitations in the current study. First, the service organization was only able to run a 20-session intensive training program, which is normally completed in less than 9 weeks. A substantial redeployment of manpower was required to conduct the intensive TEACCH training program, apply the GAS methodology in goal setting and monitoring, and research data collection. If the training and research period could be extended to six or 12 months, it would be possible to implement a longitudinal study design and evaluate the longer-term effects of TEACCH.

Second, while the GAS training goals provide concrete evidence of progress, it would be desirable to take some standardized developmental measurements to provide a second source of evidence. However, besides the TTAP, there are few appropriate measurement tools for capturing the functional training outcomes of adults with ASD. The limited resources of the current study also made it challenging to conduct further standardized assessment within the study period.

Third, we could only afford to set three training goals and conduct 20 sessions for each participant, given the manpower we have. It would be desirable to recruit more subjects and set more training goals in different functional areas in future studies. This would enable the evaluation of the effects of training in different functional areas, rather than evaluating improvement in certain areas.

Fourth, we could further examine the impact of the training on daily function of subjects, by asking parents, case managers, or staff members to report on skill applications and the functional performance of subjects.

5. Conclusion

The results show that the TEACCH approach is effective in teaching specific functional skills to young adults with ASD and mild to moderate intellectual disabilities. A short 20-session top-up training program can significantly improve the training effects of regular

training programs in day activity centers for persons with ASD and mild to moderate intellectual disabilities.

Acknowledgements

This work was supported by the Hong Chi Association, Chung Nga Rd, Tai Po, Hong Kong SAR. We would like to thank the staff members and clients for their participation in this study.

References

- American Psychiatric Association (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Arlington, VA: American Psychiatric Publishing.
- Anderson, L. M., Shinn, C., Fullilove, M. T., Scrimshaw, S. C., Fielding, J. E., Normand, J., et al. (2003). The effectiveness of early childhood development programs: A systematic review. *American Journal of Preventive Medicine*, 24(3), 32–46.
- Boyd, B. A., Hume, K., McBee, M. T., Alessandri, M., Gutierrez, A., Johnson, L., et al. (2014). Comparative efficacy of LEAP, TEACCH and non-model-specific special education programs for preschoolers with autism spectrum disorders. *Journal of Autism and Developmental Disorders*, 44(2), 366–380.
- Callahan, K., Shukla-Mehta, S., Magee, S., & Wie, M. (2010). ABA versus TEACCH: The case for defining and validating comprehensive treatment models in autism. *Journal of Autism and Developmental Disorders*, 40(1), 74–88.
- D'Elia, L., Valeri, G., Sonnino, F., Fontana, I., Mammone, A., & Vicari, S. (2014). A longitudinal study of the TEACCH program in different settings: The potential benefits of low intensity intervention in preschool children with autism spectrum disorder. *Journal of Autism and Developmental Disorders*, 44(3), 615–626.
- Hintze, J. (2013). *Pass 12*. Available at: Kaysville, Utah, USA: NCSS, LLC. www.ncss.com.
- Hume, K., & Odom, S. (2007). Effects of an individual work system on the independent functioning of students with autism. *Journal of Autism and Developmental Disorders*, 37(6), 1166–1180.
- King, G. A., McDougall, J., Palisano, R. J., Gritzan, J., & Tucker, M. A. (1999). Goal attainment scaling. *Physical & Occupational Therapy in Pediatrics*, 19, 31–52.
- Kiresuk, T. J., Smith, A., & Cardillo, J. E. (1994). *Goal attainment scaling: Applications theory, and measurement*. Hillsdale, NJ: Lawrence Erlbaum Associates 34–36.
- Levy, A., & Perry, A. (2011). Outcomes in adolescents and adults with autism: A review of the literature. *Research in Autism Spectrum Disorders*, 5, 1271–1282.
- Lovaas, O. I. (1987). Behavioral treatment and normal educational and intellectual functioning in young autistic children. *Journal of Consulting and Clinical Psychology*, 55, 3–9.
- McPheeters, M. L., Warren, Z., Sathe, N., Bruzek, J. L., Krishnaswami, S., Jerome, R. N., et al. (2011). A systematic review of medical treatments for children with autism spectrum disorders. *Pediatrics*, 127(5), 1312–1321.
- Mesibov, G. B., & Shea, V. (2009). The TEACCH program in the era of evidence-based practice. *Journal of Autism and Developmental Disorders*, 40(5), 570–579.
- Mesibov, G. B., Shea, V., & Schopler, E. (2005). *The TEACCH approach to autism spectrum disorders*. New York, NY: Springer Science + Business Media, Inc.
- Mesibov, G., Thomas, J. B., Chapman, S. M., & Schopler, E. (2007). *TEACCH transition assessment profile* (2nd ed.). Austin, TX: Pro-Ed.
- Miles, J., & Shevlin, M. (2001). *Applying regression and correlation: A guide for students and researchers*. London, UK: Sage.
- Ozonoff, S., & Cathcart, K. (1998). Effectiveness of a home program intervention for young children with autism. *Journal of Autism and Developmental Disorders*, 28(1), 25–32.
- Pfeiffer, B. A., Koenig, K., Kinnealey, M., Sheppard, M., & Henderson, L. (2011). Effectiveness of sensory integration interventions in children with autism spectrum disorders: A pilot study. *American Journal of Occupational Therapy*, 65(1), 76–85.
- Ruble, L., McGrew, J. H., & Toland, M. D. (2012). Goal attainment scaling as an outcome measure in randomized controlled trials of psychosocial interventions in autism. *Journal of Autism and Developmental Disorders*, 42(9), 1974–1983.
- Schopler, E., & Reichler, R. (1971). Parents as co-therapists in the treatment of psychotic children. *Journal of Autism and Childhood Schizophrenia*, 1(1), 87–102.
- Schwartz, I. S., Garfinkle, A. N., & Bauer, J. (1998). The picture exchange communication system: Communication outcomes for young children with disabilities. *Topics in Early Childhood Special Education*, 18(3), 144–159.
- Tsang, S. K. M., Shek, D. T. L., Lam, L. L., Tang, F. L. Y., & Cheung, P. M. P. (2006). Brief report: Application of the TEACCH program on Chinese pre-school children with autism – does culture make a difference? *Journal of Autism and Developmental Disorders*, 37(2), 390–396.
- Turner-Stokes, L. (2009). Goal attainment scaling (GAS) in rehabilitation: A practical guide. *Clinical Rehabilitation*, 23(4), 362–370.
- Virues-Ortega, J., Julio, F. M., & Pastor-Barriuso, R. (2013). The TEACCH program for children and adults with autism: A meta-analysis of intervention studies. *Clinical Psychology Review*, 33(8), 940–953.
- Warren, Z., McPheeters, M. L., Sathe, N., Foss-Feig, J. H., Glasser, A., & Veenstra-VaderWeele, J. (2011). A systematic review of early intensive intervention for autism spectrum disorders. *Pediatrics*, 127(5), 1303–1311.