Critical Review:
Is LEGO© Therapy effective as a social skills intervention for children with Autism Spectrum Disorder?

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Deficits in social competence seen in children with High Functioning Autism (HFA) and Asperger's Syndrome (AS) may lead to isolation from their peers and difficulty in the education system. In response, Speech-Language Pathologists (SLPs) have developed many diverse social skills interventions, few of which meet all the needs of those with HFA and AS. This critical review examines the effectiveness of LEGO© Therapy, a new holistic approach to improving social competence. Studies included: one repeated measures/waiting list design, one longitudinal case-control study, one randomized block design, and one qualitative design. Due to limitations in study design, results did not provide compelling evidence for the use of Lego© Therapy. However, in one's own clinical practice the use of LEGO©, itself, might be tailored to achieve a variety of speech and language goals. Implications for future research and clinical implications are discussed.

Introduction

Deficits in social competence are a defining characteristic in individuals with High Functioning Autism (HFA) or Asperger's Syndrome (AS) (American Speech-Language-Hearing Association, 2006). Both differ from other subtypes of Autism Spectrum Disorder because cognitive and linguistic skills are preserved (Rao, Beidel & Murray, 2008). To distinguish the two, one must look to their learning styles. Individuals with AS learn best from verbal decoding of nonverbal behaviours and play involving a verbal component. In contrast, those with HFA benefit from provision of static information and play involving a visual spatial component (Rubin & Lennon, 2004). In addition to these learning styles, persons with HFA or AS acquire and sustain skills through individualized treatment, peer interaction (Rao et al.) and high interest actitivities (Owens et al., 2008).

Historically, social skill interventions have been effective in what they target. However, targets are diverse and few approaches incorporate all needs and strengths of those with HFA and AS. A new social skills intervention using LEGO© attempts to take a more global approach. Daniel LeGoff's LEGO© Therapy involves constructing LEGO© in a group setting. By delegating specific roles, such as "engineer" or "builder", the participants use both verbal and visual spatial information to develop social skills. Alongside group therapy, individual sessions allow participants to improve personal deficits in a one-on-one manner (LeGoff, 2004). Not only is LEGO© a high interest activity, but its prevalence in society suggests skills learned in therapy would be generalized.

It is LEGO© therapy's holistic approach and strong theoretical basis that prompts one to believe it might be a superior and effective social skills intervention.

Objectives

The primary objective of this paper is to critically evaluate the recent literature examining LEGO© Therapy's effectiveness in children and adolescents with High Functioning Autism (HFA) or Asperger's Syndrome (AS).

Methods

Search Strategy
Computerized databases including PubMed, SCOPUS, CINAHL and ASHA were searched for entries using any combination of the following key terms: ((lego therapy) OR (lego play)) AND ((peer interaction) OR (social interaction) OR (social skills) OR (social competence)) AND ((autism spectrum disorder) OR (high functioning autism) OR (asperger's disorder)) AND (best practice).

Selection Criteria
Studies selected for this critical review directly examined or provided information relating the use of LEGO© in developing social competence in children and adolescents with HFA or AS. Selection was limited to studies containing participants 6 to 18 years of age. Only studies printed in English were used.

Data Collection
Results of the literature search yielded four articles examining LEGO©'s use in improving social competence. These include one repeated measures/ waiting list design; one longitudinal/retrospective

case-control study; one randomized block design; and one qualitative design.

Results

In an initial study, LeGoff (2004) used a repeated measures/waiting list design to determine LEGO© Therapy's effect on social competence. Forty-seven participants ages 6-16 years with differing Autism Spectrum Disorder (ASD) diagnoses participated in a three and/or six month trial of LEGO© Therapy. Participants acted as their own controls. Pre and post outcome measures included frequency of self-initiated social contact (SISC), duration of social interaction (DSI) and rating of behavioural characteristics using the Gilliam Autism Rating Scale-Social Interaction subscale (GARS-SI). Correlation matrices for inter-correlations of the three dependent variables provided data to support their use as a single construct, i.e. social competence. Primary statistical analysis made use of mean scores for all subjects taken at intake, completion of 12 week wait, completion of 24 week wait, completion of 12 week treatment and completion of 24 week treatment. Scores were converted into standard scores. The GARS-SI scoring was inverted to allow for direct comparison. Posthoc examination of cell mean differences showed the following: 1) DSI increased 74% in 3 months and 175% in 6 months with no significant change on the waiting list; 2) SISC increased 69% in 3 months and 8% in 6 months with a slight decrease on the waiting list; and 3) scores on the GARS-SI showed -1.38 improvement in 3 months and -2.81 improvement in 6 months with a large decrease on the waiting list. All were significantly higher in the treatment phase than in the waiting list control phase ($p<.01$). An analysis of variance (ANOVA) for matched samples was performed after having completed a Levene's test to ensure equal variance of populations. Results indicated a significant main effect of treatment on outcome data at 3 months, $p<.01$, and an even larger effect at 6 months, $p<.01$.

In order to account for miscellaneous nuisance variables, secondary analyses were performed. These included: canonical correlation analysis with IQ scores; multiple regression analysis for age and wait list duration; a student's t-test on differences between means for male and female subjects; and calculating difference scores for Language Impaired (LI) versus Non-Language Impaired (NI). LI was found to have a significantly lower score on SISC than NI. However, no differences were found on DIS and the GARS-SI. Overall, secondary analyses indicated LEGO© therapy is effective regardless of one's,

cognitive level, age, time spent on the waiting list gender or language abilities.

Strengths of the above study included its design (2c level of evidence) and attempts to rule out extraneous variables. Even though participants acted as their own control group, it was reported maturation effects were ruled out through difference scores obtained. Although researchers did their best to rule out maturation effects, use of a concurrent control group would have provided stronger evidence that it was not a factor. In addition, a concurrent control group gives the opportunity for randomization of participants and raises the level of evidence to 1. Other predicted nuisance variables were accounted for in secondary analyses.

In contrast, there are numerous limitations found within this study. Given that participants were not randomized, and some were rejected due to behavioural problems or lack of responsiveness, the representativeness of the sample to the larger population is flawed. Secondly, while SISC and DSI appear to have face validity, LeGoff's use of the GARS is problematic. Mazefsky & Oswald (2006) reported the GARS resulted in underestimates of autism and although the tool was not used in its entirety for this study, the social interaction subscale itself has not been established as a measure of clinical change. Thirdly, there was no blinding of observers at outcome leaving results vulnerable to subjective bias. Fourthly, treatment was never explicitly described and treatment fidelity cannot be implied from the fact that the author conducted all therapy sessions. Finally, one cannot be sure how precise the statistical results are, as confidence intervals were never reported.

Given all limitations, the evidence was determined to be equivocal in terms of validity and importance.

In a follow-up study, LeGoff and Sherman (2006) completed a longitudinal, retrospective, case-control study to determine if children provided with LEGO© Therapy would show greater and sustained gains in overall social competence, as well as decreased autistic behaviours compared to an active control group. Sixty participants (mean age of 9:3) attended LEGO© Therapy for a period of three years. Diagnosis included Autism Disorder (AD), AS and Pervasive Developmental Disorder (PDD). Fifty-seven matched comparisons (mean age = 10:1) received treatment from other providers. Pre and post outcome measures included the Vineland Adaptive Behaviour Scale- Social Domain (VABS-SD) to reflect overall social competence and the

GARS-SI to reflect autistic type social behaviours. LeGoff & Shermann (2006) used a 2 x 2 ANOVA to assess differences between the pre and post treatment scores of the two dependent variables. Within-group analysis showed significant gains on the VABS-SD ($p<0.001$) and the GARS-SI ($p<0.001$). However, between-group analysis showed LEGO© subjects made greater gains. Further analysis used binomial regression to illustrate positive changes were more strongly related with LEGO© therapy ($R=0.439$, $p<0.01$). Therefore, LEGO© therapy accounted for 19.3% of variance in the dependent variables.

Strengths of the above study are the design's 2c level of evidence and the use of a 2 x 2 ANOVA to determine if diagnosis had an effect on treatment outcome. No effect of diagnosis was found.

Limitations included lack of full randomization. By using matched comparisons one can only assume extraneous variables are accounted for. A miscellaneous nuisance variable found within this study is the use of different therapists. One cannot be sure change was due to treatment or therapist characteristics. Although the VABS has demonstrated excellent reliability and proven to be a valid instrument in assessing social deficits in ASD (Volkmar et al., 1987), the GARS has not (Mazefsky & Oswald, 2006). Finally, blinding was not employed at outcome, allowing results to be influenced by subjective bias.

In conclusion, validity and importance was found to be equivocal due to the multiple limitations found within the research.

Owens et al. (2008*)* used a randomized block design to compare the effectiveness of LEGO© Therapy to the Social Use of Language Programme (SULP). HFA made up over 50% of the 28 study participants, ages 6-11 years. Participants were randomly assigned to LEGO© therapy or SULP after being matched in terms of chronological age, IQ, VIQ, GARS and availability. Therapy lasted 1 hour/week over 18 weeks. A multitude of pre and post outcome measures were administered. These included: the VABS socialization, communication and maladaptive behaviour domains; the GARS-SI; SISC; and DSI. Parent satisfaction and child motivations ratings were also taken at the end of the treatment period. Due to the small sample size and the abundance of outcome measures non-parametric tests were used. The Kruskal-Wallis test for between group analysis indicated improvement on the GARS-SI for LEGO© participants, while the Wilcoxon Signed Ranks Test for within group differences illustrated improvement

on the VABS maladaptive behaviours scale and DIS for LEGO©. In contrast, SULP made greater improvements on the VABS socialization and communication scales. No difference in parent satisfaction were noted, whereas more children gave LEGO© therapy a 10/10 in terms of motivation.

This study has many strengths. The design provides 2a level of evidence, which could have been elevated to 1 by complete randomization of the group. A comparison treatment group was used. It is ideal to have a comparison group in order to benchmark performance. Test retest reliability of the VABS was reported to be $r = 0.81$, $r= 0.88$ for different domains. All observations were made with blinding and inter-rater reliability was strong (0.97). In addition, the social validity of treatment was accounted for with inclusion of parent satisfaction and child motivation ratings.

Limitations existed within this study. Although training was provided to the authors by LeGoff and manuals were provided, no fidelity measures were stated and only group therapy was implemented. As noted previously, reliability of the GARS is inadequate. Additionally, treatment therapists were aware of the research hypothesis creating subjective bias. There was also a different therapist for each group creating doubt as to what caused change, i.e. treatment or therapist characteristics. Finally, one major limitation was the lack of reported confidence intervals. Since only a small population was included, one might assume a wide confidence interval, making results less significant.

In conclusion, validity and importance was found to be suggestive. A suggestive level of validity and importance was given due to the use of a comparison group, reliable measures, and attempts to prove ecological validity through parent satisfaction and child motivation scales.

Noble (2001) addressed the educational impact of LEGO© materials using a qualitative design. Participants included four teachers and students ranging from 7-11 years of age, including special needs students (ages 8-9 years). Observations and interviews were conducted by members of the research team. Teacher's testimonials suggested improved social skills within the special needs population, increased engagement and motivation, and the development of collaborative skills. Teacher training and support was crucial to LEGO©'s effectiveness. Barriers included cost and experience. Given that the goals of the study were hard-to-measure characteristics (e.g. achievement,

motivation, attitude and engagement) and that it was stated to be a pilot study, a qualitative design was the most relevant choice. The study provides level 4 evidence.

In addition to a low level of evidence, limitations within the study were abundant. First, no explanation was given as to why this school or these grades were chosen. Furthermore, the author does not report the number of participants involved. Secondly, although the method of data collection was reported (e.g. observation, interview), no explicit details were given. Those observing behaviours and conducting interviews knew the objective of the study, making results vulnerable to subjective bias. The biggest limitation seems to be the lack of description for the statistical analysis. The article states that results were collected, collated and analysed, but gives no further details. Finally, the likelihood of LEGO© entering the schools seems to be low given barriers such as, time spent on training and implementation of the program, and cost.

The evidence provided by this particular study is not useful to a clinician within speech and language pathology given its limitations.

Discussion

Considering the limited research available to date, a review of the literature allows for easy comparison between studies. The research improves through the inclusion of valid and reliable measures over time and attempts to prove ecological validity. In contrast, statistical reporting is incomplete; there is consistent use of one unreliable measure; and randomized clinical trials have not yet been conducted.

Apparent in the research is the incorporation of multiple reliable and valid measures over time. One such example is the inclusion of the VABS, a proven, valid and reliable measure of social skills in individuals with ASD (Volkmar et al., 1987). Owens et al. (2008) chose to include measures, such as child motivation ratings, which exemplify social validity of LEGO© Therapy. In addition, good inter-rater reliability for SISC and DIS scores were obtained (Owens et al., 2008). It is assumed that future research of LEGO© Therapy will continue to improve the use and reporting of reliable and valid measures, so that one might be confident in the results.

While valid and reliable measures demonstrate changes in performance, it is also important to note what these changes mean. SISC and DIS scores are

one ways researchers provided meaning to the results. Scores were obtained in the school yard at recess. As a result, improvement in SISC and DIS scores support generalization of skills outside of the treatment room. In addition, Owens et al (2008) measured the value of LEGO© Therapy by obtaining ratings of parent satisfaction and child motivation. High scores on both scales illustrate why LEGO©, an everyday play activity, might be best used in intervention. Finally, Noble (2001) worked to incorporate LEGO© into real life situations, (i.e. education within the school system.) Positive feedback from teachers was reported. All of the above situations provide ecological support and support generalization of skills learned during LEGO© Therapy.

Although, Noble's (2001) pilot study seeks to provide ecological validity of future research involving LEGO©- it cannot. This is due to the incomplete reporting of statistical analyses. This is an extreme example of a recurring theme within this review. Statistical reporting is incomplete in all studies. Omitting confidence intervals leaves one guessing as to the significance of the results. Furthermore, one cannot attribute the results to LEGO© Therapy itself, due to the fact that no treatment fidelity measures were used. The changes in performance might be a result of differing treatment providers, time in group therapy, or a multitude of other nuisance variables.

One statistic never reported was the reliability of the GARS. This outcome measure provided a good portion of support to LEGO Therapy's effectiveness. Unfortunately, the GARS has been proven to underestimate characteristics of autism and cannot be considered as valid or reliable (Mazefsky & Oswald, 2006). Consistent use of the GARS throughout the literature leads one to question the integrity of the research. Its use provides false information to the uninformed reader.

Finally, use of study designs other than randomized clinical trial might also lead one to question the integrity of the research. Randomized clinical trials are the gold standard in evidenced based practice. Some might argue research designs for LEGO© Therapy have improved over time, (i.e. from waiting list control design to randomized block design). On the other hand, one might argue results cannot be implemented into practice without a randomized clinical trial. In fact, in order to be considered practice standard two or more randomized control designs must have been carried out (Burgess & Turkstra, 2006).

Recommendations

The struggle to achieve success in social communication leads those with HFA or AS to be referred to Speech-Language Pathologists (SLPs). In clinical practice, SLPs must implement best practices. However, the evidence from previous studies examining social skill interventions for individuals with HFA and AS is insufficient to generate practice standards or guidelines (Burgess & Turkstra, 2006). In response, Rao et al reviewed past research and gave recommendations for increasing quality of future research. Recommendations included, but were not limited to, increased sample sizes, implementation of randomized clinical trials with long term follow up studies and adequate generalization attempts. While research surrounding LEGO Therapy takes into account some of these recommendations, it is insufficient to generate best practice guidelines. Future research should include:

- Complete reporting of statistical analyses and associated results

- Valid and reliable measures of social competence to attain results

- Randomized clinical trials to evaluate the effectiveness of LEGO© in treating children with ASD

Conclusion and Clinical Implications

Overall, validity and importance was found to be equivocal. No change to clinical practice is recommended at this time. However, given LEGO© Therapy's sound theoretical basis and ecological validity, clinicians should watch for future research. Presently, a study evaluating LEGO© Therapy is being conducted by Gina Gomes de la Cuesta, Ayla Humphrey and Simon Baron-Cohen.

In practice, SLPs might decide to incorporate LEGO©. As a high interest activity, its use can be tailored to target multiple skills. In the author's experience, LEGO©, in combination with the roles described by LeGoff (2004), improves descriptive skills and length of utterance in children with autism.

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