LEGO-based therapy research outcomes summary

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There have been very few high-quality peer reviewed research articles published into LEGO-based therapy. This report summarises the outcomes of peer reviewed papers as well as unpublished dissertations and surveys exploring this field. A systematic review was not carried out due to time constraints so some studies may have been missed.

Literature Reviews

Lindsay, Hounsell and Cassiani (2017) conducted a scoping review of research into LEGO-based therapy. A total of 15 papers from 5 different countries met their inclusion criteria. The mean age of participants was 8.7 years. A range of outcome measures were used across papers, including standardised measures (e.g. the GARS Social Interaction subscale; the Vineland Adaptive Behaviour Scales) and several non-standardised measures such as observation, ratings of child enjoyment, and parental satisfaction. Fourteen of the papers reported progress in at least one outcome measure. Studies varied according to the duration of intervention, intervention delivery, location, and programme leader. The study concluded that outcomes appear to be best when delivered by a qualified professional, such as a clinician or educator for at least 1 hour per week. The authors stated that LEGO-based therapy is a promising intervention with an emerging evidence base for effectiveness, but that research studies are small scale and poorly controlled. The wide range of outcome measures and poor description of study participants makes it difficult to compare findings across studies. The authors also point out that the research papers typically did not outline the expertise and training of the interventionists.

Peer reviewed research papers

The first study into LEGO-based therapy was conducted by Dan LeGoff, the pioneer of the approach. He compared children receiving LEGO-based therapy to children on a waiting list for intervention (LeGoff, 2004). Thirty-four children with autism aged 6 to 16 years received weekly LEGO-based therapy for 1 hour in groups of 6 or 7. They also had 1 hour of individual intervention, for a total of 12 weeks. Outcomes included the duration and frequency of interaction with peers in unstructured play time at school, measured through observation. Outcome measures also included standardised questionnaires of social skills, namely the Social Interaction subscale of the Gilliam Autism Rating Scale (GARS- SI, Gilliam, 1995) and the Vineland Adaptive Behaviour Scale Socialisation Domain (Sparrow, Balla & Cicchetti, 1984). Results showed no change on the waiting list, but significant improvement after 3 months and again after 6 months of intervention in all outcome measures.

LeGoff and Sherman (2006) explored the long-term outcomes of LEGO-based therapy at a three-year follow-up. The LEGO® groups consisted of 60 children, with a mean age of 9 years, who participated in both individual and group sessions for at least three years.

Evaluations included the Vineland Adaptive Behaviour Scales and the Gilliam Autism Rating Scale. Children receiving LEGO-based therapy were compared to a group of 57 children who received a mix of typical mental health provision at the same intensity and frequency. Results showed that both groups improved during the course of the intervention, but the LEGO® group made more improvements in their social skills and repetitive and stereotyped patterns of behaviour. Children with higher Verbal IQ and higher adaptive behaviour were found to have better outcome scores on overall social adaptation, indicating that the approach appeared to work best with those with average language ability. Of note, however, the children in this study were not randomly assigned to either treatment group or control group. It was also not clear what interventions the comparison group received.

Owens, Granader, Humphrey and Baron-Cohen (2008) completed an independent assessment of LEGO® Therapy. The study was conducted with 31 children, between 6 and 11 years, with a diagnosis of either Asperger Syndrome, or high functioning autism. Children were matched on chronological age, IQ and autistic symptoms, before being randomly assigned to either a LEGO® Therapy group or to a comparison social skills programme called the Social Use of Language Programme (SULP; Rinaldi, 2004). A control group receiving no intervention was also included, though this was not randomly assigned. Weekly group sessions were run for 1 hour over 18 weeks. Outcomes were measured using the Socialisation, Communication and Maladaptive Behaviours domains of the Vineland, and the Social Interaction subscale of the GARS. Frequency and duration of social interactions in the school playground were also observed, though these observations were not blind, as they were carried out by the first author, so may be open to bias. Results showed that autism-specific social difficulties as measured by the GARS reduced following LEGO® therapy but not SULP or the no intervention comparison group. Both the LEGO® and SULP groups showed improvement in communication, social skills and maladaptive behaviours on the VABS following intervention, with no such improvement in the control group. Observations indicated that the LEGO® group showed a small but statistically significant increase in duration of social interactions while the SULP group did not. There was no difference in the number of social initiations with peers achieved between the LEGO® group and the SULP group. Overall it was concluded that both LEGO-based therapy and SULP were effective interventions.

Andras (2012) carried out a waiting list control study of LEGO-based therapy with 8 students with autism aged 8-11 in mainstream primary schools. The intervention was delivered by teachers once a week for 45 minutes over the course of 10 weeks. Outcomes included observations during baseline, before and after intervention and at 10-week follow-up after the intervention had stopped. Findings showed that the children engaged in social interactions more frequently following the intervention. They made more meaningful friendships with their peers and used a wider range of strategies to interact with others around them. These gains were maintained after the intervention stopped. However, the small sample size, and possible observer bias limits the conclusions that can be drawn.

Evans et al (2014) reported their experiences of running LEGO-based therapy in a child and adolescent mental health service with 16 children with autism aged 6-8yrs. The sessions ran weekly for 8 weeks and were delivered by clinical psychologists. Children who had a special interest in LEGO were invited to attend the sessions (leading to a potential bias in the findings). Children and parents filled in a questionnaire after the end of the intervention to rate their satisfaction with the group. Almost all children reported LEGO-based therapy to be "really good" on a likert scale. They reported on what they liked best which included "We

got new friends". Parents strongly agreed that their child benefited from the club and stated that they thought more clubs should be run in the NHS.

Barakova et al (2015) and Huskens et al (2015) were two studies exploring the use of robots to facilitate LEGO-based therapy for children with autism. These studies used robots controlled by the researcher to facilitate collaborative LEGO building, rather than adults. They used repeated measures waiting list or multiple baseline designs. Sessions were delivered for 30 mins over 5 weeks. Video observation coding collaborative behaviours were carried out to assess outcomes. Barakova et al (2015) found increased social initiation in the presence of the robot, but these gains were lost at follow up when the robot was not there. Huskens et alk (2015) found no improvements as a result of the intervention. The intervention period was extremely short, and it is difficult to compare the outcomes from the use of LEGO with the use of robots, but on the whole these studies suggest that using robots to facilitate LEGO-based therapy sessions is not effective.

MacCormack et al (2015) carried out a community study of LEGO-based therapy with 17 children aged 3-10 years. This qualitative study explored perceptions of parents and children as well as observations of children after attending 4 weeks of LEGO-based therapy for 1 hour per week. Results indicated positive social gains, even after such a short intervention, but it is not a controlled study so it is hard to make clear conclusions.

Peckett et al., (2016) explored the use of LEGO-based therapy by parents at home with their children with autism. Five children aged 8-12 took part in the study, with parent-led intervention, supervised by clinical psychologists. The intervention lasted 6 weeks for 1 hour per week. Semi-structured interviews with parents showed themes of improved family relationships following the intervention. Parents also reported that they viewed their child differently (more positively) and that the intervention had a positive impact on the child. However, the found limited evidence of an impact outside of the home in other areas of the child's life.

Hu, Zheng and Lee (2018) examined peer-mediated LEGO-based therapy in a mainstream preschool with 3 boys with autism aged 4-6 years with average to high IQ. A total of 13 of their peers participated with them in the sessions and were taught the basic principles of LEGO-based therapy including how to provide prompts, and reinforce social behaviour. The intervention took place within the participants' classrooms twice a week, with each child participating in between 28 – 31 sessions, in which the participating child interacted with two typically developing peers. The researcher attended each group session and only intervened if interaction between peers and participant broke down. Data was collected by coding observed non-verbal and verbal social initiations and responses with peers in the groups. Teacher attitudes were sampled via administration of an eight-item questionnaire developed by the researchers. Results showed that 2 children improved in both social initiation and responsiveness and 1 child improved in social responsiveness only. Teacher surveys reported satisfaction with the approach and an increase in frequency of interaction with peers. This study is very small scale and combining LEGO-based therapy with peer mediation makes it difficult to distinguish the individual impact of either intervention approach.

Levy & Dunsmuir (2020) carried out a non-concurrent multiple baseline single case design study of LEGO-based therapy for adolescents with autism in mainstream schools. Six male students aged 12 to 14 years took part in the study, with one dropping out of the research. Students received LEGO-based therapy in groups of 3 for 12 weekly sessions, with 1 student

on the autism spectrum alongside 2 typically developing peers. The intervention was delivered by school learning support assistants under the supervision of a trainee educational psychologist. Outcome measures included a social behaviour change video coding observation which showed duration of social interaction, frequency of social initiations, responses and positive social skills substantially increased for 5 of the 6 participants during the intervention. Visual inspection of the graphed data using PAND calculations showed a strong positive effect of the intervention, and that these were maintained following the completion of the intervention. Effect sizes were large and significant. Generalisation of skill was assessed using the Social Skills Improvement Systems Rating Scale (Elliot & Gresham, 2007) that was completed by parents and teachers. Results were mixed, and showed reliable change for improvements in social skills and problem behaviours for 3 of the 6 participants. Teachers reported reliable improvements in social skills for 1 participant and a reduction in problem behaviours for 2 participants, suggesting some skills are generalising to other settings (especially to home) but this is not consistent.

Unpublished Doctoral Thesis Research

These studies have not been published in peer reviewed journals, yet still give some helpful evidence about LEGO-based therapy. Known studies are summarised briefly here in date order.

Owens (2008) carried out a small second study for her doctoral thesis, which explored using LEGO-based therapy in an inclusion unit of a primary school, with sessions run by teachers. Nine children with autism aged 7-10 years took part. The study was a repeated measures baseline design, with 6 weeks of no intervention followed by 6 weeks of LEGO-based therapy for 1 hour per week. Results showed improvements in social skills after the intervention but not during baseline as rated by teachers but no improvements were seen by parents on the same measure.

Brett (2013) explored LEGO-based thearpy at school for her doctoral thesis in educational psychology. Fourteen children received 8 weeks of LEGO-based therapy, 45 mins per week, delivered by teachers. Results showed improvements in social skills as measured using the Vineland Socialisation domain, but that learning did not generalise to observations of social skills in other settings. Qualitative analysis of semi-structured interviews with the children showed that they enjoyed the social aspects of the group and were particularly motivated by freestyle LEGO activities.

Boyn's (2014) thesis was a single case experimental design evaluating LEGO-based therapy at school for 6 children aged 6-10 years. She used a reversal design to explore the impact of the intervention on social competence and school belonging. Results showed some improvements in social communication skills during the intervention.

Griffiths (2016) sought to investigate the perception of teachers and parents of LEGO-based therapy delivered in schools using a mixed methods approach. The clubs were attended by 13 pupils aged 7 to 12 years in 4 groups of 3-4 children. Children attended 6 weekly sessions 45 mins in duration. The Communication and Socialisation subscales of the GARS-2 were completed by the children's teachers and showed no improvement over the course of the intervention, perhaps due to lack of sensitivity of the measure or perhaps due to the short duration of the intervention. Focus groups were conducted with six members of staff representing each of the schools, while semi-structured phone interviews were conducted with seven of the participating children's parents. Teachers and parents reported pupils

enjoyed the sessions, and teachers saw improvements in social competence within the intervention. This improvement did not generalise to other aspects of school life. Parent reports indicated increased levels of communication and interaction at home, however, it is not clear whether this can be attributed solely to the intervention. This study is limited by it's small sample size, short duration of intervention and lack of a control group.

Nguyen (2017) looked at the mental health outcomes for children with autism as well as the social outcomes. These were clinician led groups with 25 children, mean age of 12 years, split into groups of 7 to 9 children. A repeated measures design with a waiting list control group was employed. LEGO-based therapy was delivered weekly for 1.5 hours over 8 weeks. Results showed significant gains in social skills, improvements in behaviour and mental health during the LEGO-based therapy intervention, with a medium effect size. Improvements were seen in both separation anxiety (as rated by parents) and social anxiety (as rated by children).

Marren (2019) explored the use of LEGO-based therapy and the Transporters DVD with preschool children with autism. She used a repeated measures, multiple case study AB reversal design, reversing the intervention children received (LEGO or the Transporters) to observe the impact of both interventions. Sessions were run by a clinician with 7 children with autism, aged 4 years. Children received 8 weeks of LEGO based therapy, 1 hour per week, and parents were allowed to observe sessions through a one way mirror. Measures included standardised questionnaires (VABS and GARS) as well as qualitative reports from parents. Results showed positive outcomes in reciprocal play, socialisation and expanded social circle as a result of LEGO-based therapy, with high levels of individual variation in response. Overall though, it was felt to be a helpful intervention even with such young children, and parents felt they learned a lot from observing the facilitation of sessions.

Survey Findings

We were asked to carry out a survey of practitioners using LEGO-based therapy in 2017 to submit to the LEGO Foundation (Gomez de la Cuesta & Weckstrom, 2018). The survey asked practitioners about their experiences of LEGO-based therapy. Amongst other findings, 88% of respondents who had used LEGO-based therapy said they would be very likely to recommend the approach to family or friends and other professionals. 87% of people using LEGO-based therapy were satisfied or extremely satisfied with the outcomes and improvements seen.

Conclusions

Whilst there are several studies in this field with promising results, the evidence base for this intervention is still very small. There are no large scale, randomised control trials, though we do know that one such trial is on the way (the I-SOCIALISE trial; Varley et al., 2019) with results expected in December 2020. Studies have typically been small scale, with poor control groups and a short duration of intervention. There are few girls included in the studies, little comparison of effects for different age groups and cognitive abilities, and no studies looking at outcomes for children who may have other difficulties, or typically developing children. No studies have compared outcomes when the intervention is delivered by different people (e.g. assistant staff, teachers, psychologists) and what level of

training leads to the most effective outcomes. Furthermore, there is only one study to explore the use of this intervention by parents with their children at home.

Table of LEGO-based therapy research studies

Author (year)	Publication type	Sample characteristics	Setting	Study design	Intervention duration and intensity	Outcome measure	Results	Limitations
Andras (2012)	Journal article	N=8 ; age 6-11	School, UK	Repeated measure/waiting list design. Teacher led.	10 weeks, 45 minutes per session	Coded behavioural observations	Greater gains in social interaction were reported during the intervention than during the baseline period, and the social gains were maintained at the follow-up period.	Small sample size. Use of different school staff to deliver groups. Lack of blind raters.
Barakova et al (2015)	Journal article	N=6 age 8-12	Clinic, Netherlands	Repeated measure/waiting list design. Robot led.	5 weeks, 30 minutes per session	Coded behavioural observations	Increase in frequency of social initiation during the intervention period but all social behaviour gains were lost in the follow-up period when the robot was absent.	Small sample size. Combination of robot and LEGO therapy puts doubt to what contributed to the social change.
Boyn (2014)	Unpub thesis	n=6; age 6-10	School, UK	Single case experimental ABA design	6 weeks intervention	Observations of social competence & school belonging	Improved social communication skills	Small sample size. Large variability in outcomes, some missing data, short length of intervention
Brett (2013)	Unpub thesis	N=14; mean age 9.1	School, UK	Study 1: Repeated measure/waiting list design. Teacher led. Study 2: qualitative design	8 weeks, 45 minutes per session	Study 1: observations & standardised measures: Study 2: Semi-structured interviews.	Improved adaptive social functioning and play Participants enjoyed the social aspects and freestyle building in the session. Participants were inherently drawn to LEGO.	Small sample size. Use of different school staff to deliver the group. Lack of blind raters.

Evans, Sanders & Knight (2014)	Journal article	N=21 ; age 6-11	CAMHS/ Library, UK	Post-test only design. Clinician led.	8 weeks, 60 minutes per session	Group evaluation feedback form	Data indicated participant enjoyment and parent satisfaction with the group.	No child level measured was used pre- or post-intervention.
Hu et al (2018)	Journal article	n=26 (n=3 ASD); age 4	School, China	Multiprobe across participants design	2 sessions/week for 28-31 sessions, combined with peer mediation	Observations of social initiations and responses	Increased social initiations in 2 children; increased social responses in 3 children. Teachers satisfied with approach. Increase in frequency of interaction with peers	No control group, very small sample size. Combined with peer mediation
Huskens (2015)	Journal article	n=6; age 5-13	Clinic, research setting	Multiple baseline	5 weeks, 30 min sessions	Video observation rating collaborative behaviours	No improvements in collaboration	Low intensity of intervention. Inclusion of robot makes effect of LEGO hard to determine.
LeGoff (2004)	Journal article	N=47 ; age 6-16	Clinic, US	Repeated measure/waiting list design. Clinician led	24 weeks, 90 minutes per group session, 60 minutes per individual session	Structured playground observations Standardised measures: GARS- SI	Gains in autism specific social interaction during intervention but not during baseline period. Generalisation of social skills to school playground was observed.	Lack of blind raters. No report of confidence intervals or effect size.
LeGoff & Sherman (2006)	Journal article	N = 117 ; mean age= 9.3	School, US	A 36-month pre- and post-treatment series . Clinician led.	36 months, weekly sessions, 1hr individual, 1.5hrs group	Standardised measures: VABS-SD, GARS- SI	Both groups made significant gains on both autism-specific social interaction and adaptive social functioning, but the participants in the LEGO group made more gains than the non-LEGO group.	Limited information about comparison group . Non-randomisation of participants.

Levy & Dunsmuir (2020)	Journal article	*N=6; age 12-14*	School, UK	multiple baseline single case study. Teacher led	12 weeks; 1hr per week	Video observation of social interaction; Standardised measures SSIS	Increased duration of social interaction, frequency of social intitiations and responses in 5 of 6 students. Large effect size. Limited generalisation	Single case study
MacCormack, et al., (2015)	Journal article	*N* =17; age 3-10	Community-based, Canada	Qualitative design. Paraprofessional led.	4 weeks, 60 minutes per session.	Observations, Interviews	Both observation and interviews with mothers of the participants indicated positive social gains.	Only included the viewpoints from the mothers
Marren (2019)	Unpub thesis	n=7; age 4 yrs	Clinic, Ireland	Multiple case study,AB reversal desing	8 weeks LEGO, 8 weeks transporters DVD, 1hr/wk	Standardised measures: VABS-SD, GARS- SI; Griffiths development scales	Mixed outcomes, individual variance. LEGO showed positive outcomes in reciprocal play, socialisation and expanded social circle	Small sample size; no control group
Nguyen (2017)	Unpub thesis	N=25 , age 12	Clinic, UK	Repeated measure/waiting list design. Clinician led	8 weeks, 1.5 hrs per week	Standardised measures: VABS-2, GARS-2, RCADS	Significant gains in social skills, behaviour, and coping. Reduction in anxiety.	No comparison intervention or control group; small sample.
Owens (2008)	Unpub thesis	*N*=9; age 7-10	School, UK	Repeated measure/waiting list design. Teacher led.	6 weeks, 60 minutes per session	Standardised measures: GARS- SI, VABS-SD	Social gains were made on teacher reported social adaptive functioning but not on parent-reported autism specific social interaction skills.	Small sample size. Teachers completed the VABS-CD but were not blind.

Owens, Granader, Humphrey & Baron-Cohen (2008)	Journal article	*n=33; age 6-11*	School/ Clinics, UK	Randomised block design. Clinician led.	18 weeks, 60 minutes per session	Structured playground observations. Standardised measures: GARS-SI, V ABS- SD, V ABS-CD, Maladaptive behaviour.	Children in the LEGO group made significantly more gains than the other groups on autism-specific social interaction. Both the LEGO group and the Social Use of Language Programme group made more reduction in maladaptive behaviour than the no intervention group.	The main researcher was running both groups and observed the participants in the playground.
Pang (2010)	Journal article	n=1, ASD preschooler	School, US	Case study	clinician led	Observational measures	increased interactions with peers, eye contact, sharing, interest in playing with others, better verbal communication, less frustration	single case study
Peckett, MacCallum & Knibbs (2016)	Journal article	*N* = 5; age 8-12	CAMHS/ Home, UK	Qualitative design. Parent led.	6 weeks, 60 minutes per session.	Semi-structured interviews with parents.	Themes such as 'improved family relationships', 'positive impact on the child as an individual' emerged. In addition, mothers spoke about barriers and ambivalence with reference to implementing and the impact of LEGO.	Small sample size. Families made own adaptations. No pre- or post- intervention measures.

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