

Impact of LEGO® Based Therapy on Skills Development and Quality of Life in People With Neurodevelopmental Disorders

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Abstract: This research sets out to evaluate the impact of LEGO® Based Therapy on the development of skills and quality of life for people with neurodevelopmental disorders, as well as for those close to them. Widely used in the United States and the United Kingdom for almost 20 years, LEGO® Based Therapy was developed by Daniel Le Goff, psychologist licensed in Florida and New Jersey who has practiced for over 20 years with children, adolescents and adults with developmental disabilities, including autism, Asperger's syndrome and congenital disabilities, as well as acquired and traumatic brain injuries. Daniel Le Goff has extensive experience as a consultant and expert witness, as well as in direct clinical services, including applied behaviour analysis, cognitive behaviour therapy and cognitive rehabilitation. In 2008, Gina Gómez de la Cuesta completed her PhD at the Centre for Autism Research at the University of Cambridge, where she led and evaluated LEGO® Based Therapy under the supervision of Daniel Le Goff, Simon Baron-Cohen and Ayla Humphrey. She is a teacher and psychologist by training and has worked at the National Autistic Society as Head of Action Research. She founded Play Included in 2018, with support from the Cambridge Social Ventures incubator programme, University of Cambridge to support children's development through play and promote LEGO®Therapy.

Initially designed to improve the social skills of people with autism spectrum disorders but no intellectual disabilities, its effectiveness has been demonstrated by studies targeting this specific population. However, no research has yet been carried out in France on its application to a wider population, including various forms of neurodevelopmental disorder. Furthermore, existing studies have not considered the impact on the quality of life of beneficiaries and their families, which this thesis sets out to examine.

Keywords: Neurodevelopmental Disorders, Therapy, LEGO®, Quality Of Life, Social Skills, Interactions.

1. Previous Studies

LEGO® Based therapy is a social skills intervention for school-aged children based on LEGO® collaborative play. It is based on the idea of using the child's natural interests to motivate learning and behaviour change. A typical LEGO® therapy project involves building a LEGO® game, with a social division of labour. In a group of three people (which can be made up of autistic children, peers and/or adults), one person is designated as the 'engineer', another as the 'supplier' and the last as the 'builder'. Individuals must communicate and follow social rules to complete the LEGO® construction. Each activity requires verbal and non-verbal communication, collaboration, joint problem solving, joint creativity and joint attention to task.

The idea of using LEGO® as a therapeutic tool in a structured and comprehensive way arose from a chance observation in the mid-1990s. Dr Daniel Le Goff noticed two of his patients, both aged eight and diagnosed with Asperger's syndrome, playing and chatting enthusiastically in his waiting room. These two children, previously reluctant to interact socially, showed a sudden and marked interest in each other thanks to their shared passion for LEGO®.

Faced with this promising clinical observation, Daniel Le Goff initiated an initial short-term study in the United States in 2004 to demonstrate the benefits of LEGO®-based therapy. He divided 47 individuals into five groups of seven and two groups of six, who received 60 minutes of individual therapy and 90 minutes of group therapy weekly for 12 or 24 weeks. Of these participants, 34 were boys and 13 girls, aged between 6 and 16.

Various scales were used, such as the Gilliam Autism Rating Scale (GARS-SI), the Vineland Adaptive Behaviour Scale (VABS) and the Wechsler Intelligence Scale for Children (WISC-III). The results showed a marked improvement in social skills, social contact, duration of social interactions, social behaviour, social cognition, and verbal and non-verbal language.

In 2006, Daniel Le Goff teamed up with Sherman to carry out a longer-term study involving 60 subjects who had received individual and group LEGO® therapy and 57 subjects who had undergone conventional therapy. All the participants, diagnosed with autism spectrum disorder (ASD), received 60 minutes of individual therapy and 90 minutes of group therapy per week for 36 months. The same assessment scales as in the first study were used, showing that the LEGO® therapy group showed significant improvements in social skills, a reduction in maladaptive behaviour, better communication and improvements in verbal and non-verbal language over the 36 months, unlike the group without LEGO® therapy.

In 2008, UK doctoral student Gina Owens compared the effectiveness of LEGO® therapy with the Social Use of Language Programme (SULP). The study involved 47 children, divided into three groups: 16 receiving LEGO® therapy, 15 SULP training, and 16 forming a control group. All were diagnosed with ASD and received 60 minutes of weekly intervention for 18 weeks. Several scales, such as the Vineland Adaptive Behaviour Scale (VABS), the Wechsler Abbreviated Intelligence Scales, the Gilliam Autism Rating Scale (GARS), the Spence Child Anxiety Scale, the Child Behaviour Checklist and the Conner ADHD Index, were used. The results showed that LEGO® therapy improved interaction, socialisation and communication, while the SULP programme reduced maladaptive behaviour.

Since these three landmark studies, around ten others have been carried out in the United States, the United Kingdom and the Netherlands. Nine have focused on individuals with autistic disorder, while only one has looked at those with ADHD. Of these ten studies, eight showed moderate or high improvement in social skills following the implementation of LEGO® therapy. Two of them, which proposed a robot-mediated LEGO® intervention, showed no significant improvement after the sessions.

As part of our study, we addressed the following research questions:

1. **Effectiveness of LEGO® therapy on adults** : what are the effects of LEGO® therapy on adults, compared with its effectiveness on children and adolescents?
2. **Applicability of LEGO® therapy to other neurodevelopmental disorders or disabilities** : to what extent can LEGO® therapy be adapted and effective for subjects with neurodevelopmental disorders other than ASD, such as ADHD or dys, as well as for people with other disabilities ?
3. **Assessment of beneficiaries using alternative tools to the VABS** : can we find an alternative assessment tool to the Vineland Adaptive Behaviour Scales (VABS) to measure progress and changes in people receiving LEGO® therapy, while maintaining a similar level of validity and reliability
4. **Impact of LEGO® therapy on patients' quality of life** : what are the effects of participation in LEGO® therapy sessions on the subjective quality of life in terms of emotional well-being, social relationships and perceived relationships and perceived autonomy?

2. Development of LEGO® Based Therapy in France

Despite its international success, LEGO® therapy remains relatively unknown in France and is not well integrated into local therapeutic practices. I thought it would be interesting to explore the potential positive impact of this therapy in our country, as well as its effect on participants' well-being.

However, envisaging an exact replication of the initial study seemed compromised for several reasons:

- Professionals needed to be trained in the use of assessment scales such as the Vineland Adaptive Behaviour Scales (VABS) and the Gilliam Autism Rating Scale (GARS) to ensure accurate and consistent assessments, thus minimizing bias and guaranteeing the reliability of the data, as these assessment tools are expensive and difficult to access, sometimes reserved for certain professionals, thus creating financial and practical obstacles for institutions and families;
- The majority of participants had Autism Spectrum Disorder, but this is not the only neurodevelopmental disorder, suggesting that LEGO® therapy could be effective with other populations (for people with ADHD, intellectual disabilities or dyslexia, for example, as these are also neurodevelopmental disorders);
- Quality of life had never been studied in previous research carried out abroad.

Given the positive results of the studies carried out abroad and mentioned above, it seems crucial to facilitate access to this therapeutic model so that it can help a large number of people in France.

To overcome these obstacles, we decided to create a dedicated training module including an evaluation grid developed specifically for this therapeutic tool. The grid covers 4 areas of skills: pre-construction, construction, language and vocabulary, and social skills. This would make it possible to train as many people as possible so as to include as many participants as possible in the study.

The main idea being the possibility of adapting LEGO® Based Therapy to meet the needs of people with neurodevelopmental disorders other than ASD, such as attention deficit hyperactivity disorder (ADHD) or dys disorders, as well as people with other disabilities. Dys disorders are specific cognitive disorders affecting skills such as reading (dyslexia), writing (dysorthographia), arithmetic (dyscalculia), coordination (dyspraxia) and language (dysphasia), unrelated to a general intellectual disability. This exploration will help determine the

extent to which LEGO® Based Therapy can be modified to be inclusive and accessible to a wider range of beneficiary populations.

In addition, there was the question of evaluation by proposing other alternative tools to the Vineland Adaptive Behaviour Scales (VABS), while maintaining a similar level of validity and reliability.

Finally, we wanted to study the impact of LEGO® Based Therapy on the subjective quality of life of beneficiaries, focusing on the dimensions of emotional well-being, social relationships and perceived autonomy.

3. Method

Our study involved French subjects only. Our aim was to gather a sufficient number of participants, children, adolescents and adults, in order to have a fairly significant sample and thus make this study reliable.

Recruiting a large number of participants who would be assessed and trained by just one person seemed compromised by the number of sessions involved and their duration.

We therefore created a training module that incorporated both the fundamental principles of LEGOTherapy and new and enriching perspectives from our professional practice, creating a dynamic and comprehensive educational content that would provide participants with an in-depth understanding of LEGO® Based Therapy whilst offering innovative and practical ideas for their own work in this field.

This 15-hour course has been developed to be delivered in several formats: face-to-face, synchronous distance learning and asynchronous distance learning. In the case of asynchronous distance learning, it also includes two live discussion sessions of 1.5 hours each in order to answer participants' questions. At the end of each module, trainees are invited to complete various activities and MCQs to check their understanding of the concepts taught. These tasks include designing practical tools and activities and planning future LEGO® Therapy sessions.

Each trainee receives an individual assessment of their work, with the opportunity to receive personalised advice if necessary. The main aim is to ensure that trainees acquire the knowledge they need to be competent and autonomous in the practice of LEGO® Therapy once in the field. By offering detailed feedback and personalised advice, we aim to support each participant's professional development and ensure that what is taught is put into practice effectively.

As part of the practical application of LEGO® Therapy, the trainees were given the task of conducting either individual or group sessions, adapting to the different audiences they encountered according to the types of support they usually offer. This approach involved several inseparable stages.

Firstly, the learners had to gather relevant information about each individual being assessed, which enabled them to gain a better understanding of their specific needs and challenges. Secondly, a preliminary assessment was carried out before the start of the sessions using the grid I produced, providing a baseline against which progress could be measured over time.

Planning the sessions was also an important stage, requiring thought to be given to the objectives to be achieved and the activities to be put in place to achieve them. This often involved preparing or even creating specific material adapted to the needs. Once the LEGOTherapy sessions were underway, the learners were responsible for running them with professionalism and sensitivity, taking care to create a safe and stimulating environment for the participants.

Finally, a reassessment was carried out after a certain number of sessions in order to measure the progress made and, if necessary, adjust the objectives and activities for the following sessions.

At the same time, each caregiver was asked to complete the PedsQL scale before and after each session. This scale was used to assess the quality of life of the beneficiary and their family, providing an objective measure of the impact of LEGO® Therapy sessions on their overall well-being.

4. Results of the Study

The study was conducted over 2 years, between 14 February 2022 and 9 June 2024. During this period, 317 learners were trained and a total of 76 practitioners, including both parents and professionals, implemented LEGO® Therapy with the service users they supported. Of these practitioners, 21 conducted group sessions involving 72 subjects, while 55 offered individual sessions with 55 subjects.

The subjects evaluated, aged between 5 and 88, presented with a variety of disorders, including neurodevelopmental disorders, psychological disorders and degenerative conditions. I will describe the different groups of participants and the scores they obtained below.

Some of the data collected proved unusable. In particular, the data from 19 practitioners could not be used (16 from the group sessions and 3 from the individual sessions). Reasons for this included incomplete evaluation grids or the absence of reassessments necessary to measure progress.

Consequently, the results presented in this study will be based on a final sample of 108 subjects: 56 participants who took part in group sessions and 52 who took part in individual sessions. This selection guarantees the reliability and validity of the conclusions drawn from the study, by ensuring that all the data analysed comply with the rigorous methodological criteria established for this research.

The data reveal a predominance of children aged 8 to 12 benefiting from LEGO® Based Therapy sessions, whether in individual or group sessions. However, an interesting observation emerges when comparing the two types of session: in individual sessions, there is a more marked presence of children aged between 5 and 7, while adolescents aged between 13 and 18 are less represented. In group sessions, on the other hand, there were more teenagers aged 13 to 18, and fewer children aged 5 to 7. It is also noteworthy that no participants over the age of 25 attend group sessions, while a few attended individual sessions. It should also be noted that the 2-4 age group is not represented in this study, and that the 18-25 age group is under-represented.

Let's now move on to analysing the progress made after a LEGO® Based Therapy session by looking at the scores obtained by each age group, across all disabilities, individually and in groups. To do this, we will calculate the average points gained per age group in order to better understand the impact of LEGO® Based Therapy on these different groups.

Among children aged 5 to 7, we observed that pre-construction skills and social skills progressed more in groups than in individuals. On the other hand, language and vocabulary skills showed greater progress in the individual group than in the group. As for construction skills, they progressed in a similar way in both groups and individuals.

For young people aged 8 to 12, pre-construction skills, construction skills and social skills progressed fairly similarly, whether the sessions were conducted in groups or individually. However, progress in the area of language and vocabulary was more significant when the sessions were conducted in groups.

Among adolescents aged 13 to 18, progress in the areas of language, vocabulary and pre-construction was similar, whether the sessions were conducted in a group or individually. However, social and construction skills showed more significant progress in group sessions.

For young adults aged 18 to 25, progress was more significant in individual sessions, whatever the domain.

For the over-25s, no comparison was made between individual and group sessions, as this group did not participate in group sessions.

These initial data show that individual sessions appear to be more effective for young adults aged 18 to 25, as well as for children aged 5 to 7, particularly for improving language and vocabulary skills. For the other age groups, and in all the areas assessed, group sessions appear to be more beneficial.

I then examined the benefits of LEGO® Based Therapy sessions, both individual and group, depending on the type of disability or difficulty of the beneficiary.

In the case of individual sessions, we observed the following trends:

- Pre-construction: subjects suffering from epilepsy, dementia or ADHD associated with another pathology make greater progress in this area.
- Construction: the greatest progress is made by subjects with dementia, ADHD associated with a Dys disorder or another pathology. On the other hand, people with ADHD associated with IDD make slower progress;
- Language and vocabulary: the most significant progress was observed in people with ADHD and IDD, epilepsy, or autism spectrum disorder (ASD);
- Social skills: subjects with a Dys disorder or epilepsy make less significant progress, while those with ADHD associated with a Dys disorder, dementia or simply ADHD make considerable progress.

In group sessions, we observe the following trends:

- Pre-construction: subjects suffering from ADHD associated with another pathology, or ADHD or another pathology alone make greater progress in this area;
- Construction: the greatest progress is made by subjects with ADHD associated with another condition and by people with ASD;
- Language and vocabulary: subjects with ADHD associated with another pathology, or with ADHD or another pathology alone make greater progress in this area;
- Social skills: subjects with another pathology, Down's syndrome and ASD make considerable progress in this area.

It should be noted that people with schizophrenia who took part in group workshops made the least progress. This is not necessarily linked to their condition. In fact, these subjects obtained very high scores during the first evaluation, which could indicate that the proposed grid is not adapted to their level, as their skills were already sufficiently high.

5. Quality of Life Study

Secondly, I used the PedSQL scale to measure the beneficiaries' quality of life. This measurement tool is mainly used in medicine to assess health-related quality of life in children and adolescents. Developed by Dr James W. Varni and his colleagues, this scale consists of specific questionnaires adapted to different age groups, making it possible to assess different aspects of the daily lives of children and adolescents, including their physical, emotional, social and academic functioning. The questionnaires are designed to be completed by the children themselves or by their parents, depending on the age and ability of the respondent. Responses are scored on a multi-point Likert scale. The scores obtained provide an overall measure of the child or adolescent's health-related quality of life, as well as individual scores for each dimension, offering a more in-depth understanding of their overall well-being and specific needs.

In the course of our study, 37 professionals had the PedSQL scale completed by the people they cared for and their families, representing a total of 67 subjects. Of these, 40 took part in group sessions and 27 in individual sessions.

For the individual sessions :

- 9 children completed the 5-7 years grid
- 12 children completed the 8-12 years grid
- 5 adolescents completed the 13-18 grid

For the group sessions :

- 9 children completed the 5-7 years grid
- 17 children completed the 8-12 grid
- 4 teenagers completed the 13-18 grid

Some data could not be used. A group of four people and one individual who attended the individual sessions were over 25 years old, and there was no adapted grid for their age. In addition, two professionals were unable to assess two young people in individual sessions because they were non-verbal and, despite adaptations, they were unable to communicate their feelings. Finally, three professionals who offered individual sessions did not reassess the young people or their parents at the end of the session.

In our analysis, we focused on the scores obtained on the PedSQL scale during the reassessment after the sessions, distinguishing between individual and group sessions and differentiating between the opinions of the children and their parents for each area of the grid.

The data analysed in this study are based on the feelings of children and their parents, as assessed by the PedSQL scale. This feeling, which is crucial to understanding the impact of interventions, encompasses various aspects of children's quality of life, such as their physical, emotional, social and academic well-being. Children's perceptions offer a direct and personal perspective on their own experience, while their parents' perceptions provide a complementary, often more global and observational, view of the changes perceived in their children. By analysing these perceptions separately, it is possible to gain a clearer picture of the effectiveness of the sessions, whether group or individual, and to identify the areas where the interventions have been most beneficial or where adjustments are needed. The feelings of children and their parents, although subjective, are

an essential dimension in assessing the results of support programmes and in guiding future professional practice.

Overall, whether the sessions were conducted individually or in a group, and whatever the age of the children, we observed improvements in all areas. However, when broken down by domain, it appears that the children who attended individual sessions reported a moderate improvement in the physical and academic domains. Indeed, a significant proportion of subjects observed no change before and after the sessions in these two areas. On the other hand, over 70% of the individuals questioned reported a significant improvement in the areas of emotions and social relationships.

The parents of children who had attended individual sessions seemed to have more mixed feelings than their children. In the physical and social areas, a significant proportion of parents did not observe any significant change after the sessions. However, more parents noted improvements in the academic and emotional areas. These observations suggest that, although parents perceive benefits from the interventions, these are felt more in the emotional and academic aspects of their children's lives, rather than in their physical and social well-being.

This divergence in perception between children and parents highlights the complexity of measuring the impact of interventions and the importance of including the perspectives of all those involved in order to obtain a complete and nuanced view of the effects of the sessions.

6. Discussion

The results of our study show that, regardless of age or type of disorder or pathology, all audiences benefit from LEGO® Based Therapy sessions. Participants, whether children, adolescents, young adults or adults, show significant progress thanks to this model.

Although some groups progress more rapidly than others, the overall data confirm the effectiveness of LEGO®-based therapy in improving various skills, such as pre-construction, construction, language, vocabulary and social skills. These results underline the importance and versatility of LEGO®-based therapy as a therapeutic tool for a wide variety of profiles and needs.

Concerning the assessment of participants' quality of life, children who had benefited from group sessions felt an overall improvement in every area, with fewer areas where they observed no change. Over 80% of individuals reported an improvement in the area of emotions, over 70% saw an improvement in the area of social relations, and over 65% perceived progress in the area of schooling.

Parents of children who had benefited from group sessions were more likely to agree with their child. Over 70% saw an improvement in emotional skills, and over 65% saw an improvement in social and academic relationships.

These results underline the importance and positive impact of the interventions, from both the children's and their parents' point of view, on the emotional and social dimension of children's lives, aspects that are often crucial to their overall development and well-being.

Group sessions have a more favourable impact on children's development, particularly in the areas of emotions and social relationships. The children taking part in these sessions feel significant improvements in these areas, with over 80% reporting an improvement in their emotional state and over 70% observing improvements in their social relationships. This perception is also shared by the parents, who see similar progress in their children, confirming the effectiveness of the group sessions. However, the individual sessions also showed significant progress in these areas, although the perceived improvements were slightly less pronounced. This shows that, although group sessions are particularly beneficial for children's emotional and social development, individual interventions remain effective and also make a positive contribution to these essential aspects of their quality of life.

With regard to the rating scale, although we have previously established graded rating criteria that enable us to automatically calculate a base score and an evolution score, the assessment does not allow us to know whether or not there is a problem.

Indeed, to establish an appropriate rating, it is important to determine in advance the prompts to be presented to the person being assessed. These prompts are essential if we are to support people with special needs.

Prompts are defined as instructions, gestures, demonstrations, guidance or prompts that we offer to increase the likelihood of a correct response. The use of prompts offers many advantages, not least helping students to progress by encouraging their learning.

Furthermore, during training sessions or when completing the grid, learners have told us that they don't always know whether they should take into account the denomination or the receptive. It's important to clarify this distinction to avoid any confusion. Naming refers to the act of naming or designating something accurately, using exact and appropriate terms. This includes the ability to identify concepts, objects or situations and to express them clearly and comprehensibly. Receptive, on the other hand, refers to a person's ability to receive, understand and interpret information transmitted by others.

Some areas of the grid could be evaluated taking into account both receptive and naming. However, only one box is provided for scoring, and I haven't specified how to proceed in this case. Let's take the "Language and Vocabulary" domain as an example: do numbers need to be known in order to be recognized, or do they need to be named? Ideally, both, but the current grid does not allow these two aspects to be rated separately.

Finally, some participants, depending on their age or pathology, already validate a majority of skills during the first assessment. For these participants, the aim is to work on more specific and detailed skills than those currently offered.

The grid will therefore have to be updated to take these elements into account, and to refine the results and objectives to be worked on.

7. Conclusion

The study carried out in France, with a sample of French participants only, confirms that it is entirely feasible to offer an alternative assessment tool that is accessible to the general public. The results show that participants who benefited from LEGO® Based Therapy sessions showed significant progress, both in individual therapy and in groups, regardless of their disability or pathology.

In addition, quality of life assessments revealed a significant improvement in the well-being of both the participants and their parents. These findings reinforce the idea that LEGO® Based Therapy may be a promising and beneficial therapeutic approach that deserves to be more widely integrated into clinical practice in France.

References

- LEGO®, D.B. (2004). Use of LEGO® as a therapeutic medium for improving social cCompetence. *Journal of Autism and Developmental Disorders*, 557–571.
- LEGO®, D.B., & Sherman, M. (2006). Long-term outcome of social skills intervention based on interactive LEGO® play. *Autism*, 317–329.
- Owens, G., Gordon, K., & Baron-Cohen, S. (2008). Treating autism spectrum conditions. In J. Trafton & W. Gordon (Eds.), *Best practices in the behavioral management of health from preconception to adolescence* (Vol. 3). Los Altos, CA: Institute for Brain Potential.
- Varni, J. W., Seid, M., & Kurtin, P. S. (2001). PedsQLTM4.0: Reliability and validity of the Pediatric Quality of Life InventoryTM Version 4.0 generic core scales in healthy and patient populations. *Medical Care*, 800–812.