# Designing for Children 2019

## *Play and Learn*

### Investigating Six Bricks as an effective and affordable design for early skill development of communication through play

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**Abstract:** While play features in many early childhood pedagogies, practice often lags behind; similar to the importance of learning through play being less recognised, both at home and at school. Play and learning go hand-in-hand, one cannot exist without the other, which is why it is essential to redefine play as a central arena for learning. One important aspect to redefine play is by making it simple yet effective and affordable, hence, available for most early learners. The objective of this research is to investigate learning through play using Six Bricks as a simple, affordable & scalable tool for early skill development. 'Six Bricks' is a guided play approach that uses a set of LEGO® DUPLO® bricks in six colours to encourage children to construct and deconstruct ideas and concepts whilst working on developing various skills. Research has repeatedly shown that play has a critical and crucial role in learning and in preparing children for challenges in childhood and throughout adulthood. One challenge of child development is to build communication skills, which play a fundamental role in determining a young learner's ability to collaborate. This paper provides the background & findings of a research study conducted over a period of 10 hours investigating effects that play with the 'Six Bricks' approach has on the development of communication & collaboration skills for children of 4-5-6 years of age. Using our findings we also suggest guidelines to scaffold the communications skills in progressions for children across 4-5-6 years of age. With this, we investigate Six Bricks as an effective, affordable and scalable design for early childhood development through Play.

**Keywords: LEGO® DUPLO, Six Bricks, Communication, Collaboration, Play, Early Childhood**

# 1.Introduction

Considering the recent developments in technology and economy, it is important to reimagine learning to make sure the future workforce develop the skills needed to navigate through this complex and dynamic world. It is essential to develop academic competencies such as literacy, numeracy, and science, but other 21st century skills such as collaboration, critical-thinking, communication, persistence, and creativity are even more important (Lamb, S., 2007). Research shows that 'Play and Learn' is essential in the holistic development of children and develops the skills required to prepare for 21st century opportunities (Zosh, J. M., 2017) 21st Century skills are 12 abilities required for success in the Information-Age: Critical-thinking, Creativity, Collaboration, Communication, Information, Literacy, Media Literacy, Technology Literacy, Flexibility, Leadership, Initiative, Productivity, and Social skills. The first four Cs, also called learning skills, are by far the most popular 21st Century skills.

We aimed to understand the development of these four Cs through 'Play and Learn' in early learners. Since 'Play' directly corresponds to the development of creative and critical-thinking skills, there is ample supporting research corelating these skills and 'play'. However, less is known about the development of communication and collaboration through 'play' in early years. Communication supports thinking and problem-solving, which are competences used by children to understand language, a critical first step in literacy (Raising Children, 2017). It is important to build communication skills, which hold a fundamental position in determining a young learner's ability to collaborate. Without proper communication, students in the 21st Century will lack a pivotal skill required for future careers.

Numerous children struggle to develop communication skills due to lack of access to resources and other potential barriers they face. In areas of poverty, mainly in rural-India, more than half of children start school with delayed language competences and face the consequences of ineffective communication skills through adulthood. 'Play' can be redefined by making it simple yet effective and affordable, hence, available for most early-learners. In this paper we attempt to investigate the possible effects that guided play using the 'Six Bricks' approach might have in the development of communication and collaboration skills in children aged 4-5-6.

# 2. Literature Review

## 2.1. Communication skill development in Young Learners

Early childhood development is critical in cognitive development and learning, which majorly happens between the time of birth and 8 years of age (Piaget, J., 1964). During these years of life, the interactions which children have largely influence how they develop and learn. Thus, it is of prime importance to support childrens' growth and development by enhancing their communication skills.

Communication development is guided by the need for relevance (i.e., communicating what is important), discrepancy (i.e., seeking to establish consistency of information), and elaboration {i.e., learning more complex language skills (Bloom, L., 1998)}. Children develop initial communication skills at the age of 1 by vocalizing their intentions, at 2 years of age, they start following the body language in terms of facial expressionsand gestures - with this they start to socialize minimalistically. They are seen to be comfortable around the company of people, however, there isn't a lot of interaction involved. It is at the age of 3 that children begin using their imagination, socially seeking others and forging new friendships. They are able to understand emotions and show empathy; this is when they begin to listen and make short conversations. Communication along with collaboration begins at the age of 4, when children start showing interest in being a part of a group, are able to initiate a conversation and understand the dynamics of communication such as turn-taking. However, they speak broken sentences often with incorrect grammar (Diproperzio, 2013). Since it is the age of 4 when children begin developing the ability to collaborate and communicate effectively with the use of language, the focus of our study were children aged 4-5-6 years.

## 2.2. The Statement of Problem

Communication and collaboration are the two of the four Cs of 21st century skills which are important to develop a workforce for the Information-Age. According to the LEGO® Foundation, content is not learnable if communication skills are not in place, hence before stepping into learning the curriculum at school, it is very important to learn communication skills, and following that, critical-thinking skills play a major role in constructing ideas from

the content learnt. In low-income areas, development of communication skills is not looked into due to a lack of unaffordable resources. Children start school with delayed language abilities which is the reason for their struggle to understand or to make themselves understood and their limited vocabulary dictionary, and poor listening and social skills (Communication Trust, UK). These children are at a disadvantage in learning and making friends before even starting formal education.

With the gap in developing communication skills in backgrounds with low income, it is important to explore an affordable and scalable way to develop the required skills during the early age development. It is for this reason that this study investigates the effectiveness of the Six Bricks "Duplo-Brick" approach to scaffold communication skills in children of age 4-5-6.

## 2.3 Six Bricks

'Six Bricks' are manipulatives used as a hands-on tool for learning for young children specifically for 'Play and Learn'(Lego Foundation, Six Bricks Booklet). It is a set of LEGO® DUPLO® 2x4-stud bricks in six bright colours (Figure 1), used to encourage children to construct and deconstruct ideas and concepts whilst working on developing various skills.

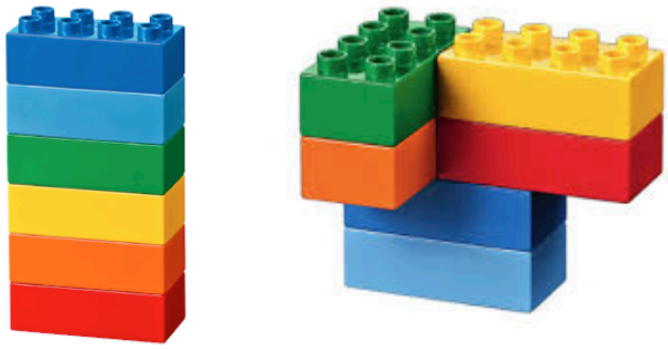


Figure 1: A representation of 'Six Bricks'

There are 900 million ways to connect this simple set of 'Six Bricks', through which children can create and invent endless combinations, practicing creative-thinking. There are now over 500 activities available for Six Bricks developed by Care for Education (Hutcheson, 2014)

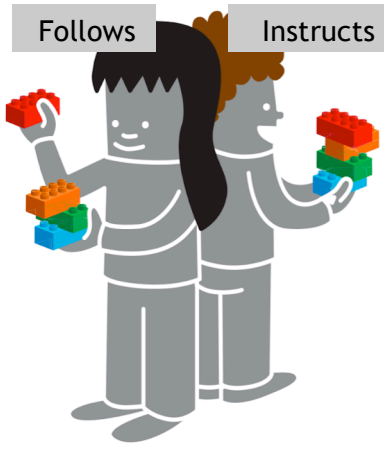
which include board games, templates and mats for individuals, pairs or groups to use. This paper focuses on understanding the development of communication skills, while children play with one of these activities called, 'Back to Back' adopted by LEGO® Foundation, which is intended to develop language, problem-solving and collaboration. The intention is to permanently have Six Bricks available on the desk of every child in schools and other informal learning settings. This way, children can involve themselves in self-directed learning through play and under the guidance of adult facilitators, they can practice some guided activities. As the idea is cost effective, simple to understand, train and implement, it is also easily scalable.

# 3.Study

## 3.1 Method

We studied three different groups: 4-5-6 year old children, as a part of a 10-hour long study to investigate the effectiveness of communication & collaboration skills, using an existing activity with Six Bricks called 'Back-to-Back' which is adopted by the LEGO® Foundation. We invited 6 students from each age group [4-5-6 years] to the TeachSTEAM Studio, Rajkot, Gujarat, India as participants of a weekend workshop to play the Back-to-Back activity, with different variations and combinations.

Following is the description of the activity as per the LEGO® Foundation Six Bricks Booklet:

| | |
|---|---|
| ***Back-to-Back Activity***<br><br>1. Children sit or stand in pairs with the same number of bricks.<br>2. One child builds a model, and then explains to the partner how to build the same model.<br>3. The partner follows instructions and builds (replicates) without looking or asking questions.<br>4. The pairs compare their models and discuss how it went.<br>Guiding questions<br>• How did you explain how to build the model? |  <br>Back-to-Back |

| | |
|---|---|
| • What instructions are clear and helpful?<br>5. Children swap roles and repeat the activity. | |

After a trial round of the activity with each age group, the studies were conducted in progression of difficulty level in order to understand the scaffolding of communication skills.

- Study 1 (Age:4) : 6 children (GG, GB, BB)[1], 3 bricks per child. 3 times.
- Study 2 (Age: 5) : 6 children (GG, GB, BB), 3 bricks, 4 bricks. 3 times [3 bricks twice, 4 bricks once]
- Study 3 (Age: 6) : 6 children (GG, GB, BB), 3 bricks, 4 bricks, 5 bricks. 3 times.

4-years were given only 3 bricks due to a limited cognitive ability to visualise structures with more than three bricks. 5-years were given three bricks and four bricks. 6 years were given 3,4 and 5 bricks as their developed visualisation skills allow them to imagine and interpret structure with up to 5 bricks clearly, based on the instructions given by their partners.

[1] GG: girl-girl, GB: girl-boy, BB: boy-boy.

## 3.2 Analysis

Qualitative analysis of the video and audio data was carried out. First, the transcripts of collaborative interaction,reacording verbal conversations, the gestures, and interactions with bricks, were prepared from the video recordings. We then analysed the transcripts.

To understand how communication is processed, developed and leads to successful collaboration for pairs of 4-5-6 years, we realised that we need a set of rubrics as milestones. Based on the Back-to-Back activity rules, we identified the rubric and listed our observation according to Table 1:

| **Rubrics** | **Observation** |
|---|---|
| Demo shown by adults | Y/N |
| Following the rule: “You can speak, not show” | F/NF |
| “Pair 1 builds the model completely with given bricks and then instruct” | F/N |
| Construction Type | Stack/Freebuild |
| Able to describe the order according to colour | F/NF |
| Able to describe the position | F/NF |
| Able to describe the orientation | F/NF |
| Success: The partner understands and replicates the model | Y/Partial/N |
| Y: Yes, N: No, F: Followed, NF:Not Followed | |

Table 1. Rubric used during Back-to-Back study observation

In order to scaffold our analysis, we applied the method of 3 attempts for each pair. We identified different variations of Back-to-Back activity on the basis on number of bricks, order of the colour and construction type (Free build/Stacking).

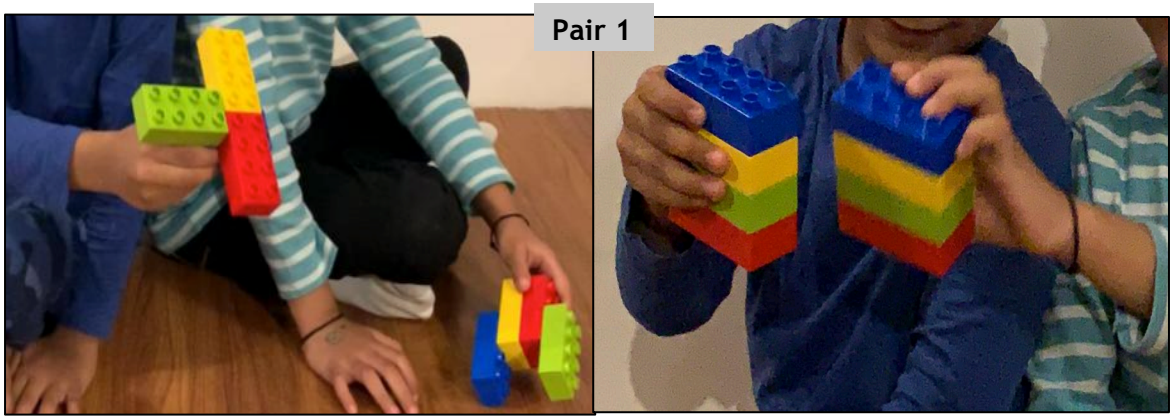
# 4. Findings and Discussion

Across three different age-groups, the implementation of Back-to-Back gave us different outcomes, which reflected the progressive levels at which children develop their communication skills.  In general, we observed that they are very comfortable in instructing in their first-language (Gujarati), rather than communicating in English. However, they often mixed English and Gujarati to construct complete sentences. Since they were falling short of positional words and prepositions in English, the children used their first-language to fill the gap.

Though the activity focused on developing communication skills, children - especially 4 years- were oriented towards building an object something relevant in the real world: “I’ll make an aeroplane”, “I’ll make a bird”. This shows that children are extremely creativity-oriented, and hence need to be directed for following the rules of the activity. For the same, the adults gave a demo of building the model and describing the colour, position and orientation. The study used standerdized simple building structures such as stacked towers because the focus was on effective communication and not creativity.

Pairs mainly needed to process the three main elements of the instruction: Colour, Position and Orientation. So, the children had to describe the colour of the brick, its position and orientation before stacking the next brick. However for all three age groups, we found that lesser the elements, the better the communication i.e. narrating only colourwise, narrating only position-wise and narrating only orientation-wise are methods which worked best. When a combination of elements (colour+position and colour+orientation) was used, communication was effortful but not always accurate. We observed that with stacking-type construction, communication works well and leads to successful replication, irrespective of the number of bricks - across all age groups. Moreover, the cognitive ability also determines the extent to which communication skills develop.

**For 4 years,** it was difficult to keep attention and resist distraction; children could not follow the rules: “Just speak, don’t show”, despite being aware of their role. While instructing the partner, the children could only say the colours and the order. If the first brick was a red brick and then the second brick was oriented on the third and fourth peg of the red brick, thie children could only communicate, “1 red, 2 blue” . Their gestures showed that they knew prepositions but could not convey them. In one case, we observed that rather than the colours, the child associated the stair-like structure and just repeatedly said, “Steps”. They could explain the process while making the structure, but could not describe it once it was constructed. This shows that they can explain one step at a time because of their ability to process only one instruction at a time. The procedure was followed for three pairs and the third time, the pairs could instruct properly because they were asked to narrate their process while simultaneously building the model. 4 years were able to communicate instructions when working with three bricks and simple stacked structures but could not describe the process when the orientation of one brick was changed, showing that they cannot visualise complex structures with changed orientations. Therefore, for 4 years, communication skills are developed more effectively when the building technique is stacking and when they are asked to narrate one instruction at a time, while working with three bricks.




4 years: Model type did not match with free build, but did when asked to make a tower

Figure 2: Models built by 4 years

**For 5 years,** following the rules of back-to-back was not a problem, they could process and implement two instructions. Unlike 4-years, 5 year-old children could explain the model once it was built, showing that they were able to process and communciate multiple instructions together. They could accurately mention the colour, position and orientation when the task was simple stacking. However, when the orientation of bricks was changed, they could not communicate the position due to a lack of vocabulary to describe the orientation. When asked to change the orientation of the middle two out of the four bricks, the other pair reversed the positions of the top and bottom brick because they confused the colour and position instructions. Therefore, for 5 years, communication skills are effectively developed using Six Bricks as they can clearly communicate instructions after building the model, but only when the building technique is simple stacking without changed orientations, with up to four bricks.

***Pair 1*** ***Pair 2***

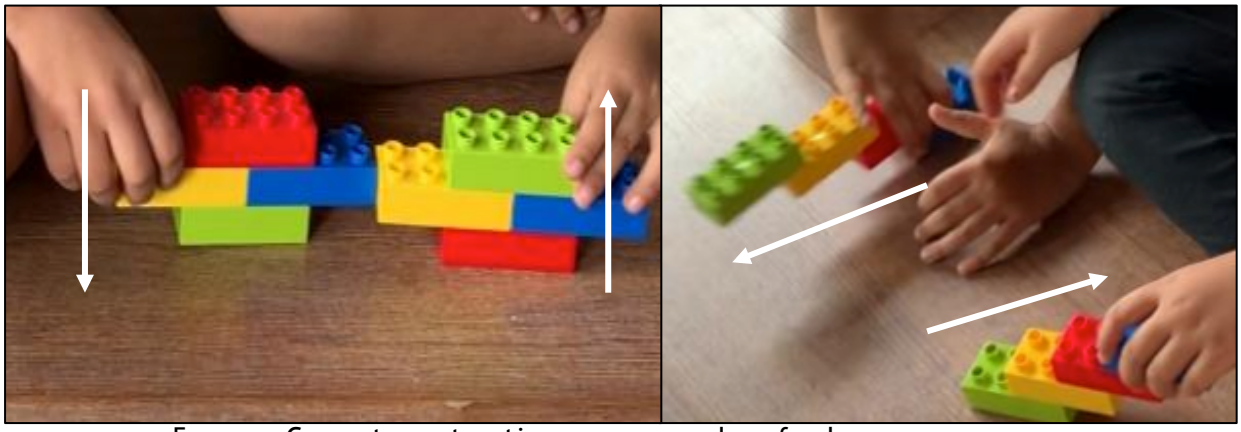


Figure 3: 5 years: Correct construction, reverse order of colours

Models built by 5 years

The learning objective of Six Bricks activity to develop communication and collaboration is most effective for **6 years old**: they follow, process and deliver instructions accurately, while using up to 5 bricks. However, a proper demonstration helps them articulate better. They could process more than one instruction at a time, they tried to explain colour+position in most of the cases, but sometimes they could not use positional words like “Standing”. By the age of 6, they followed turn-taking and had a better listening ability i.e. wanted the other one to finish and were able to think from others perspectives. They could also clearly narrate instructions when the orientation of upto two bricks was changed, unlike 5 years who faltered

to communicate instructions when the orientation of one or more bricks was changed. However, with this age group, changing the orientation of more than two bricks led to them communicating wrong instructions about the orientation of other bricks, when using 5 bricks, as shown in figure 4. Nonetheless, this result can be expected as the visualisation abilities of 6 years are limited to an extent, which could be preventing them from successfully conveying instructions when complex structures with altered orientations of more than 2 bricks are constructed. Thus, 6 years could successfully communicate instructions about colour, position and orientation after the entire structure was constructed when stacking and free-building with changed orientations of upto two bricks, using appropriate positional vocabulary. This suggests, that 'Six-Bricks' helps develop communciation skills. By having better communication skills, 6 years were also better collaborators because they waited for the partner to finish speaking. We observed that while better builders were not necessarily good communicators, better builders with good communication skills were better collaborators.

B🡻 🡻A

Transcript:
A to B:
*"First take the green colour one brick, then keep it in the ground, then take the red one brick and keep it in two holes and fix it and then take the blue one and then keep it in* ***standing direction*** *four holes in green, then take the yellow one and keep it in two holes in green. Is it done? Let's see"*

6 years: Processed multiple instructions and instructed using positional and orientational

Figure 4: Models built by 6 years.

Taking into account our observations, we formulated a scaffolding framework for 4-5-6 years ages. Table 2 shows how back-to-back was scaffolded in progressions of three attempts, across various 4-5-6 years.

| Age | Attempt 1 | Attempt 2 | Attempt 3 |
|---|---|---|---|
| 4 years | 3 Bricks - Free build | 3 Bricks - Free Build | 3 Bricks - Stacked |
| 5 years | 3 Bricks - Stacked | 4 Bricks - One in different orientation | 4 Bricks - Free Build |
| 6 years | 6 Bricks - Stacked | 6 Bricks - Two different orientation, 4 in same | 6 Bricks - Free Build |

Table 2. Scaffolding Back-to-Back in progressions for three attempts, across 4-5-6 years

# 6. Conclusion

In this paper we investigated the effectiveness of 'Six Bricks', a simple set of 6 different coloured LEGO® Duplo bricks as a manipulative to develop communication skills across ages 4-5-6 years. The design of the 'Back-to-Back' activity is a fun way to help kids articulate their thoughts and learn to communicate through processing instructions. We analysed that a very few early childhood products help develop all developmental areas: Physical, Social, Emotional, and Cognitive. With its simple design, wide applicability and cost-effectiveness - only Rs. 30 per brick- Six Bricks is effective for educators, designers, teachers and parents working in learning spaces across all economic sectors. Moreover, Six Bricks is scalable since it is simple, affordable and effective. There are 900 million ways to connect them which adds on to the wide scope of designing & customising activities involving the use of Six Bricks. Furthermore, holistic child development can be reinforced by developing a breadth of skills using activities which fall beyond the available 500 activities. If constructed considering the cognitive ability of the child's age group, activites can help develop communication and collaboration skills to a large extent. Sometimes children feel limited to play with just 'Six Bricks', however, with its enormous potential for an educator to creatively update the method of play from time to time, children are bound to enjoy and engage in 'play' & 'learn', by all means.

**Acknowledgements**

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