FIRST LEGO LEAGUE JR.

Discovery Edition

PROGRAMME EVALUATION REPORT

EXECUTIVE SUMMARY

The University Of Sheffield.

FIRST

LEGO education

With special thanks to
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Supported by:

1. Background to the Project

The *FIRST* LEGO League Jr. Discovery Edition programme was a pilot programme, run in the UK and Ireland by the Institution of Engineering and Technology (IET), in collaboration with LEGO® Education. The project is aimed at children aged between four and six years old. The project involves children being engaged in team-based Science, Technology, Engineering and Mathematics (STEM) challenges.

This pilot project was undertaken in six schools and one library (partnered with a school) during November and December 2018. Two of the schools were located in Ireland; the rest were in England. Schools were located in urban and rural areas.

In total, 232 children aged 4-7 participated in the projects. Nine classes across the seven schools participating in the project completed the programme. Seven of the classes involved were Year 1 classes, with children aged 5-6. One was a Reception class, with children aged 4-5. The final class was a mixed year group of Year 1 and Year 2 children, aged 5-7. Fifty-three percent of the sample were boys, and 47% were girls. Across the six settings that reported relevant data, 23% of children received free school meals and 8% were identified as having specific needs, such as disabilities or Special Educational Needs.

On average, the settings ran the projects for 15 hours. This differed across the settings, with one spending ten hours on the project and another twenty-three hours on it. In addition to the project leads, each setting involved an average of three additional people. The library project involved a larger number of people because they were able to draw in both school and library staff, in addition to library volunteers. There was an average of 5 teams involved in each of the projects. One adult was responsible for 1-4 teams, with most having a ratio that allowed one adult supervising two teams.

The programme Challenge was called 'MISSION MOON℠.' Teams began by learning about the Moon, and exploring some of the challenges of living there. They took a journey to the Moon and built a Moon Base. Children were introduced to the Engineering Design Process, which consists of four stages: Explore, Create, Test and Share. Each session was structured as follows:

➔ A **Big Question** to help frame the session.

➔ An **Explore** section that introduced the context of the session.

➔ A section of the session in which children could **Create** and **Test** their models.

➔ An opportunity for children to **Share** their models, sketches and ideas.

The sessions promoted play and creativity, using the LEGO Education STEAM Park set. Each child was given an Engineering Notebook, which was used to record their ideas, design their models and reflect on their learning.

At the end of the programme, a Celebration Event was held in which children had an opportunity to showcase their work and receive feedback from parents, teachers and other attendees. Each child was presented with an Award Certificate.

Project leads in each setting completed an evaluation form. Observations of ten sessions run in the library setting were undertaken by University of Sheffield researchers. Other settings were visited by the IET team and LEGO Education staff. These data were analysed in order to identify the strengths of the programme, and to enable IET and LEGO Education to enhance the programme for future cohorts.

2. Outcomes of the project

The project was highly successful. On a scale of 1-10, the respondents on average rated the quality of the programme **9.2** (1= low quality; 10=high quality), their satisfaction with the programme **9.1** (1= low satisfaction; 10=high satisfaction) and the likelihood of them recommending it to others **9.4** (1=not at all likely; 10=very likely).

The project had a positive impact on children's learning and development and on practitioners' professional development.

2.1 Impact on children's learning and development

The project impacted positively on many aspects of children's learning. The practitioners felt that the biggest impact was on persistence and problem solving, with the application of knowledge and curiosity also increasing a lot during the programme. Four out of the six settings also felt that children's confidence and cooperation had increased a lot, with the other two stating that these had increased somewhat. Listening and teamwork had also been impacted positively. Areas where there appeared to be more of a mixed picture were responsibility, taking risks and empathy.

Observations of sessions and reports from the practitioners identified that children's STEM subject knowledge had increased as a result of being involved in the project. They had learned about space, forces, resistance, gravity, gears, sequencing, directional language, and so on. Teachers reported that children had also acquired scientific vocabulary as a result of being

engaged in the project, in addition to acquiring evaluative language through the opportunities the programme provided for children to reflect on their own work and the work of others. In addition to subject knowledge, children developed a range of transversal skills, such as communication, team work, problem-solving and so on. Importantly, the project also developed children's confidence in engineering and design, with practitioners reporting that the programme fostered children's interest in inquiry-based learning.

The programme was positive in terms of issues of inclusivity. Children came from diverse backgrounds, and girls were as engaged in the project as the boys. Given the concerns about how children from some BAME communities, and girls, do not always feel positive about STEM learning, the project offered a very positive experience of these disciplines through a play-based approach. The project also impacted positively on children with Special Educational Needs.

There was evidence that children were able to transfer learning from the programme to their everyday curriculum experiences. They also transferred learning to the home context.

2.2 Parental involvement

Settings sent home materials for parents to use with their children in the home (six LEGO DUPLO bricks, with accompanying guidance on a series of activities to be undertaken when using the bricks).

These materials were received very well by the majority of parents, with parents reporting that they had enjoyed using or undertaking the Six Brick Challenges with their children. Parents also reported that the project had had a positive impact on children's engagement with their LEGO sets, with children being more imaginative in their model building. They noted the transfer of knowledge from school/ library to home.

The parents who attended the Celebration Events had, in the main, participated productively in the event, talking to their children about their work and engaging in discussions and reflections with them. A few parents were not as confident as others in this, but the session offered excellent modelling of parental engagement in children's play and learning for these parents.

It was notable that the celebration events included a number of fathers who were engaged in talking about the programme with their children, which is valuable as fathers are often less visible at school events. In addition, the six brick challenge engaged mothers in the use of construction materials and in supporting STEM learning in homes, which is of great value in addressing issues relating to inclusivity.

2.3 School – Library Partnerships

One of the programmes took place in a library, which partnered with a local school. The project was very successful, and in addition to the benefits noted above, there were other positive outcomes of the project.

The first was that the project increased the level of communication between the school and library. Secondly, the children enjoyed being out of the school setting, and this led to more informal sessions taking place in the library. Thirdly, the project familiarised parents and children with the library and raised their knowledge of the out-of-school activities offered by the library, such as LEGO clubs and coding clubs, which some families now planned to attend.

There were some challenges experienced in the project. Library staff and volunteers were not trained teachers, and so did not have confidence in supporting all aspects of children's learning. They asked for additional support in this area in future programmes through the provision of materials on how to question children effectively, and how to respond to young children's imaginative responses to tasks. In addition, it was not clear at the beginning of the project whether the teacher or library staff would lead the lesson, and eventually the library staff took on the responsibility for overseeing the work of the groups and team leaders.

2.4 Impact on practitioners

The practitioners had found the majority of the programme materials to be very useful. All of the practitioners had found the Team Meeting guide to be the most useful, with praise offered for its clarity and appropriate structure of learning. The Engineering Notebooks were also very popular, as they enabled children to record their ideas, often through drawings, and refer to them as a means of reflecting on learning.

The practitioners felt that the tasks had been well-designed, with children able to complete the activities, sometimes with support. All of the respondents either agreed or strongly agreed that the programme had developed their knowledge about how to teach STEM and that they were more confident in facilitating STEM-based activities with their students. In addition, all of the respondents either agreed or strongly agreed that they were more likely to use hands-on activities in the classroom, and that they understood how to engage students in project-based learning. The programme, therefore, had a very positive impact on the practitioners' professional development in STEM teaching.

3. Challenges of the Project

There were few challenges faced by the project, and these tended to be of a minor nature. There was little consistency across the settings in terms of what they had found challenging. For example, two of the seven settings felt that the STEAM Park materials had not been conducive to the creation of space-themed models, whereas this was not felt to be a problem by the other settings. Indeed, one practitioner suggested that the fact that STEAM Park was not related to space was as an advantage of the programme. Further, different aspects of the programme had been adjusted by various settings to meet the needs of the children. Given that these adjustments were specific to the setting, and the full details of adjustments made were not provided, it is not possible to identify consistent challenges faced in this regard.

There was more agreement over the fact that two of the most challenging aspects of the programme were the ability of students to work together, and ensuring the participation of all students. Whilst team work was one of the areas that practitioners noted improved over the project, it was a challenge because of the age of the children.

A further challenge of the project had been the Six Brick Challenge for some settings, which felt that some of the challenges had not been as effective as others. In addition, paper moon mats had not provided a robust a mat for the children's work, becoming frayed and torn as the programme progressed.

Finally, some practitioners requested that in future programmes, additional materials could be provided to offer context for the activities, such as a guide to key resources, PowerPoint slides with key facts on the topic, links to web-based information about important aspects of the programme, and suggested readings.

4. Conclusion

The data from the evaluation feedback and observations indicate that the programme was extremely successful in meetings its aims. It was fun and enjoyable for children, practitioners and parents, and led to learning and development for all of these groups. Comments from the practitioners included the following:

> *"I thoroughly enjoyed teaching this and the children couldn't wait for each session. They learned a lot about make things work and gained lots of knowledge about space and STEM projects. I look forward to doing this again. Thank you for allowing us to have the opportunity to take part in this amazing program.*

> *We have really enjoyed taking part in the programme and feel that the children have thoroughly enjoyed these sessions! It has enabled us to develop more open opportunities for developing their problem solving skills and certainly enabled us to build on their communication and team work skills.*

> *The children love the freedom to explore the packs and initially to see what they could make and develop. Collaborative decision-making was challenging initially, [but] became a tool through which ideas were developed, evaluated, explored and modified. Ideas were extended, sophisticated links were made with the space theme as pupils extended their knowledge of this topic. We loved it!!!!!!!!!!*

The elements of the project that contributed to its success were as follows:

- ➔ The pilot project was very well organised by the Institution of Engineering and Technology. Settings did not raise any issues with regard to the overall organisation of the programme, and all of the logistics appeared to run smoothly.
- ➔ The quality of the programme was excellent, and the educational content was appropriate for the target age group.
- ➔ The programme fostered an approach that emphasised collaboration, team work, experimentation and play.
- ➔ The materials that provided guidance to settings were clear and enabled them to run the programme with relatively few adjustments.
- ➔ The programme recognised the value of involving parents and provided appropriate resources to facilitate this.

Overall, this pilot programme has been very successful and the team involved in its development are to be congratulated on its highly effective implementation.