



FIRST LEGO League Discover – Final Evaluation Report

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Executive Summary

Over the course of three school years (i.e., 2018-19, 2019-20, 2020-21), WestEd partnered with *FIRST* to conduct a developmental evaluation of *FIRST* LEGO League Discover, a *FIRST* LEGO League Division for students aged 4-7. The evaluation focused on *FIRST* LEGO League Discover class packs funded through the LEGO Foundation. This is the executive summary of the final evaluation report.

The *FIRST* LEGO League Discover Program

In fall 2018, *FIRST* launched *FIRST* LEGO League Discover, an introductory STEM program designed to spark young students' natural curiosity and build their habits of learning with hands-on activities in the classroom and at home using LEGO DUPLO bricks. The project provides participating sites with teacher training and support, and teachers receive class sets of supplies including the STEAM Park sets and a yearly themed Discover kit, Discover More sets consisting of two sets of 6 DUPLO Bricks, and instructional supplies such as the Engineering Notebook and Team Meeting Guide. Teachers are expected to deliver 9 core sessions to children that guide them through hand-on activities with partners and in small teams to build their understanding of both STEM and build positive habits of learning such as creativity, teamwork, posing and solving problems, and persisting through challenges. The 10th session is a culminating event that brings all the children together to celebrate their accomplishments. Sessions always include a time for children to build and test their ideas through play to encourage an understanding that when they build something that doesn't work the first time, what is important is that they continue to try. The project also aims to create a new learning experience for teachers that will provide the tools they need to create engaging and meaningful STEM experiences for their students.

The Evaluation

The objectives of the evaluation were to address the following questions:

1. What are the short and longer-term outcomes of participation in *FIRST* LEGO League Discover for youth?
2. What are the outcomes for participating teachers?
3. How do teachers implement the Discover program? Can teachers use the program as intended (referred to as "fidelity of implementation")? What modifications of the Discover program are required to maximize its potential (e.g., program model, delivery, training, resources, or monitoring)?

The evaluation study was carried out in general education classrooms, STEM classrooms, and robotics afterschool programs in elementary school and after school sites across the continental U.S. and Canada. Applying a mixed methods evaluation approach, WestEd collected both quantitative data through online surveys and logs, and qualitative data through interviews and classroom observations. Teachers were recruited to participate in the evaluation from LEGO Foundation grant-funded sites across the US and Canada, and the number of participants increased from 27 the first year to 31 in Year 2 to 62 in Year 3. Almost all of the teachers each year were implementing Discover for the first time; very few participated in the evaluation study for more than one year.

In the middle of Year 2, school closures caused by COVID-19 interrupted data collection, particularly classroom observations, and prevented the majority of teachers participating in the evaluation from finishing the Discover program with their students. The pandemic also resulted in modifications to the program so that it could be implemented remotely. The evaluation included teachers that implemented Discover in both remote and in-person contexts. Key findings are summarized below:

Key Findings

Most teachers thought that the program had a positive impact across different dimensions of student social-emotional and academic learning.

Social and emotional learning. Each year in post-implementation surveys, teachers were asked to indicate to what extent they felt students' exposure to STEM concepts embedded in the FIRST LEGO League Discover Division resulted in increases in the following aspects of social emotional learning: self-awareness, self-regulation, empathy, cooperation, responsibility, positive interaction with peers, and group participation. While ratings were relatively high for all aspects, those consistently receiving the top scores were group participation, positive interaction with peers, and cooperation. Teachers consistently thought the program had the least impact on self-regulation.

Teachers also reported improvement in students' confidence and persistence when facing challenges, as articulated by one teacher:

"When we talked about science and that science is all about making mistakes and trying something new each time, I found that their "stick-with-it" attitude grew. They weren't easily discouraged because something didn't work, but tried something new, looked at what others were doing and adapted that to their own project and learning. I found that they were also better able to explain what they were making, how they started, what they did, and also how they improved and learned from one lesson to another."

STEM Literacy. In post-surveys each year, the majority of the teachers reported that participation in the program affected students to a moderate or great extent in STEM literacy, use of science-based vocabulary, and ability to connect STEM learning and approaches to problems. Teachers also observed students engaging in scientific and critical thinking. As one teacher put it:

"Overall it got their minds thinking, it was just not randomly playing with LEGOs, it had that element for them to think like engineers."

While teachers saw STEM learning in their students, a common remark that came up over the course of the evaluation was that younger students needed a simplified curriculum and more scaffolding than was provided in Discover in order to gain literacy in STEM.

In sum, all of the student impact items were rated highly, on average, and all teachers indicated that the intervention was at least moderately effective on all student learning items. Teacher ratings were highest for its impact on social and emotional learning.

Most teachers reported using a variety of instructional strategies when teaching STEM content and saw a small increase in frequency and confidence in implementation of said strategies following program participation.

STEM Instructional Strategies. In annual surveys, teachers were asked how often they engaged in certain instructional strategies associated with high quality STEM instruction (e.g., having students work in pairs or small groups, encouraging active student engagement, fostering student agency). In years 2 and 3, when pre- and post-surveys were administered, teachers reported increasing their use of STEM instructional strategies over the course of the school year.¹

STEM Attitudes and Confidence. In years 2 and 3, pre-survey data showed that teachers started the Discover program with very positive beliefs about STEM and most items showed increased confidence at the end of the year in the post-survey data. In Year 2, some first-year teachers reported that having other teachers at their school also participating in the program helped them. In Year 3, teachers were directly asked how participating in Discover had impacted them. In response to the survey question, “Do you feel that your confidence in teaching STEM content or practices has changed as a result of the FIRST LEGO League Discover Program?” 87% of respondents (about 9 in 10) answered “Yes.”

The Discover Program meets the diverse needs of all students.

Implementation. It is clear from observations and teacher feedback that the activities in the Discover program are highly engaging for all groups of students. Students demonstrate sustained interest and ability to stay on task, and many are motivated to collaborate and help one another. Moreover, the program benefits all students in the classroom, as these teachers explained:

Creativity has no boundaries...There is freedom to think, create, and be truly individuals. The activities can be done in a chair, standing up, in a wheelchair, or on the floor. Very accommodating for all.

Students with IEP'S GREATLY benefitted from this program, because of the hands-on learning. Working in groups also gave them the chance to improve their social-emotional skills.

Several teachers also shared that the emphasis on hands-on learning, and relatively little reliance on written word made the program more accessible for students who are learning English as a second language, or who have language associated learning needs. However, teachers also noted that the Year 1 curriculum, which was based on space exploration, was a little advanced for preschoolers. One teacher explained:

Overall, this was a fantastic program. However, working with children aged 3-4, many concepts of what tasks needed to be completed were too complicated. Materials did not correspond with the "moon" topic, besides the spaceship. This caused a major distraction to many children's learning needs. Socially the program met the needs of this age group. It was appropriately set up group-wise and demonstrated lots of opportunity for social development.

¹ In Year 1, only a teacher post-survey was administered.

Direct professional development helped teachers feel comfortable and confident implementing the program with their students, and they appreciated flexibility to modify Discover to meet their students' needs and interests.

FIRST began developing professional development for implementing the Discover program during the course of Year 1, and as such early teachers did not receive training prior to running the program. FIRST provided initial professional development relating to Discover during summer 2019, prior to the start of Year 2. The initial rounds of training were conducted largely in person, to local partners and site liaisons in a train-the-trainer model. As such 61% of Year 2 teachers who completed the post-survey received any sort of professional development, and only 25% received training directly from FIRST. Given the remaining confusion over certain elements of the program, in particular 6 Bricks and the Engineering Notebook, more teacher level training was recommended for subsequent years.

The professional development was substantially modified by FIRST prior to the start of Year 3 in response to feedback from the previous year. In part due to COVID-19, FIRST was able to offer entirely online webinars that included both site liaisons and classroom teachers. Of the teachers who completed the post-survey in Year 3, 92% had participated in professional development related to Discover program implementation, and of those teachers 61% could identify that the training had come directly from FIRST. Teachers felt that the training was helpful and provided tools for managing student interactions. They also reported feeling more confident in facilitating the program following the training and reported much higher understanding of the importance of learning through play. However, teachers still noted a need for more support with engaging families. In comments, teachers asked for more modeling of lessons and suggested connecting content to national learning standards.

Many teachers expressed deep appreciation for being allowed the freedom to tailor activities to meet their individual circumstances and student needs, as this teacher described:

Nobody's saying you better make sure that you do task three the way it says because that's the way it's designed and that's the way we really want you to do it. So it's flexible and I'm glad about that because it needs to be flexible, because a lot of times I really needed to change it because there were things that [students] just weren't grasping just because of where they lived, the experiences they had, stuff like that

Summary of Conclusions

The FIRST LEGO League Discover program worked well when the focus was a theme young children could relate to. Teachers believed their students benefited socially, emotionally, and academically as a result of participating in the program. A subset of teachers also believed that they themselves learned or gained confidence implementing new instructional strategies. In Year 3, teachers greatly appreciated the professional learning they received and the flexibility to implement the program in a way that met their needs. Overall, the evaluation concludes that the FIRST LEGO League Discover fosters teacher confidence in STEM teaching as well as STEM literacy and social and emotional learning in students of all backgrounds.

Summary of Recommendations

Based on the evaluation findings, WestEd has the following recommendations to optimize the program going forward:

- Keep a virtual option for trainings because this resulted in higher attendance rates.
- Continue to include training on Six Bricks; teachers gained valuable understanding of the versatility and potential impact of this part of the Discover program.
- Provide recommendations to teachers for how to organize and store materials.
- Continue to provide teachers with instructions and tips for how to use the Discover materials in a distance learning environment.
- Make sure that key materials, such as the implementation guides, are easy to find on the website.
- Choose themes that young children can imagine and relate to. (The Year 1 theme of space exploration was not sufficiently familiar to very young students, and they lacked the experience to come up with ideas for what to build.)
- Provide activity booklets and ideas for how teachers can involve parents in both in-person and remote instructional environments.