

# Engaging & Activating Young STEM Learners

*The Final Evaluation Report for the Junior FIRST® LEGO® League Evaluation Study*

## Executive Summary

Engaging in science, technology, engineering, and mathematics (STEM) learning during the elementary school years is important for inspiring and preparing students to understand, contribute to, and succeed in the world around them. Junior FIRST® LEGO® League (Jr.FLL®) addresses the need for high-quality STEM learning by offering youth (ages 6 to 9) experiences designed to promote STEM awareness, exploration and learning. Jr.FLL is an out-of-school (OST) program that offers a rich environment for STEM learning, which prioritizes building, teamwork and exploration, and activates children's interest in STEM.

This report describes the findings of an evaluation study of the Jr.FLL 2013-2014 Disaster Blaster<sup>SM</sup> season conducted by The Research Group at the University of California, Berkeley's Lawrence Hall of Science. The following questions guided the evaluation of implementation processes and participant outcomes of the Jr.FLL program:

- Do children's dispositions, skills, and knowledge related to STEM change during their experience in Jr.FLL? Are there differences in patterns of change across students from various demographic backgrounds?
- Does participation in Jr.FLL offer participating youth the opportunity to practice and learn 21<sup>st</sup> Century work skills (e.g. teamwork, problem solving, and communication)?
- How does participating in Jr.FLL impact team leaders (i.e. coaches and parents)?
- What does program implementation look like? How can Jr.FLL support strong and consistent implementation across sites?



Data collection and analysis included several strands of activities, including surveys, observations and interviews with youth participants, coaches and parents. This multiple methods approach helped to capture the program's complexity and gain a rich understanding of program implementation, participant experiences, and participant outcomes. The study also contended with methodological challenges including: low response rate of coaches representing randomly selected teams, parents, and children; ceiling effect of youth survey instrument; limitations on opportunities to interview participating children; and the lack of a comparative group in the study design. Despite these challenges, evaluation findings provide strong evidence of success and an opportunity to understand the benefits of participation to children, parents, and coaches.

This report considers the impact of the program on participant (i.e. children and coaches) outcomes, experiences, and satisfaction, discusses the implications of the findings for Jr.FLL, and provides some recommendations for future vision, implementation, and research.

## Profile of Participants

In the 2013-14 season, Jr.FLL served a total of 3,894 U.S. teams that included 23,364 children. Data from our random sample of 206 surveyed teams indicates that Jr.FLL teams mostly met in homes or afterschool settings. The majority (60%) of children who participated in the Jr.FLL study teams were boys, although a significant percentage (40%) were girls. The majority (66%) of children in the study were age 7 or 8. While Jr.FLL does serve children from diverse racial and ethnic backgrounds, the majority of youth study participants were White (62%). Most coaches were female (64%) and White (66%).

Study coaches and parents enrolled their children in Jr.FLL primarily because it provides STEM learning activities for their children. Coaches and parents reported predominantly positive experiences for participating youth who most enjoyed building with LEGO bricks. Most team members expressed a desire to return, and most parents intended to sign them up again for Jr.FLL next season. Most coaches also intended to return next season as well.

## Findings

### **Jr.FLL increases children's *activation* towards STEM learning by offering them opportunities to explore STEM, develop STEM awareness, and practice 21<sup>st</sup> Century skills.**

This evaluation study found that Jr.FLL is meeting its goal of providing participating youth STEM-based learning experiences and increasing awareness of and activation towards STEM. On average, youth *STEM learning activation* increased during the period in which they were involved with Jr.FLL. Analyses revealed that the pattern of increased scores was similar across all subgroups analyzed. Worthy of note, however, is that even though both girl's and boy's scores, on average, increased equally, their absolute levels of *STEM learning activation* differed; boys started and ended with higher scores than did girls. These findings suggest that children's experiences in Jr.FLL support the development of *STEM learning activation*—the dispositions, practices and knowledge that enable success in future STEM learning experiences.

This outcome was achieved by providing youth with opportunities to explore and develop their awareness of STEM as they work on the Jr.FLL annual challenge. They also benefit from exposure to STEM concepts, vocabulary, and careers. Throughout the season, teams practice *21<sup>st</sup> Century skills* (i.e. teamwork, problem solving, and communication) to support collaboration during Jr.FLL activities, particularly while building the model, making the

poster, and presenting at Expos. Coaches sometimes found it challenging to foster authentic teamwork, problem solving, and communication among their teams. Several did not have a clear vision of what high quality versions of teamwork, problem solving, and communication could/should look like in 6- to 9-year-olds and could benefit from further guidance.

Findings also indicate that *Expos* are an important element of the Jr.FLL experience because they bring together many aspects of the program in a single, culminating event. Most teams attend *Expos* where they can showcase, get feedback, and feel proud of their work. By participating in Expos, teams also get a sense of being part of a league and connection to a larger community that values STEM. Those who were not able to attend an *Expo* did not reap the benefits of this powerful experience. One challenge that some Jr.FLL teams and families faced was related to receiving the attention they expect and deserve during Expos, particularly in engaged interactions with reviewers and in sharing the spotlight at Expos where another FIRST program is present.

**Most coaches reported having positive experiences during the season and being excited and motivated about the Jr.FLL program.**

Overall, coach experience was positive and most coaches indicated their intent to coach again next season. Coaches liked seeing team members learn and have fun as well as develop in other important ways—socially, emotionally, and in their self-confidence. Although skilled and motivated with backgrounds in STEM, education, and/or youth-related areas, many coaches indicate needing help with specific aspects of program implementation. Specifically, they would like to have better organized coach materials in order to more easily access information they need when they need it. Jr.FLL faces the challenge of providing coach materials to both new and experienced coaches who have varying levels of experiences and backgrounds and may have different needs.

Coaches also indicated needing help managing team members during meetings. The process of leading a team can be demanding, and, in particular, coaches with younger team members requested help in providing age-appropriate activities and resources. In terms of planning, some coaches would like guidance in planning the overall season as well as knowing what to expect at each meeting.

## Recommendations

Lessons from this study can support Jr.FLL in improving aspects of program implementation and overall impact. The report offers recommendations for honing the Jr.FLL vision, strengthening implementation, and studying areas of potential interest.

**Honing the Vision.** Jr.FLL may consider (1) refining the Jr.FLL logic model (see Appendix E) to reflect lessons learned during the evaluation, (2) intentionally envisioning how to support participation and outcomes for girls, (3) and ensuring *Expo* participation is a part of every team’s Jr.FLL experience.

**Strengthening Implementation.** This report offers some specific suggestions for strengthening implementation and promoting consistent quality by improving coach materials (See Appendix D). Enabling coaches to access the information they need may help them to better support the learning experiences that might activate young STEM learners. Providing more guidance or exemplars of what teamwork, communication, and STEM learning could look like would offer coaches and participants a clearer vision of how to cultivate it among their own teams.

**Studying Areas of Interest.** Several aspects of this study warrant further study. In particular, future research could investigate: (1) why some children demonstrate decreases in STEM learning activation during the time that they are participating in Jr.FLL, (2) how to better support young children’s (ages 5-6) participation in the program, (3) how to increase enrollment and activation gains of girls within Jr.FLL, (4) how to broaden participation of underrepresented groups, and (5) the longitudinal trajectories of Jr.FLL participants within and without their participation in future *FIRST* programs. In addition, we recommend designing and launching a full-scale efficacy study to obtain causal evidence of the efficacy of the Jr.FLL program.

