

Executive Summary

Evaluation of the *FIRST* LEGO® League “Senior Solutions” Season (2012-13)

The *FIRST* LEGO® League (FLL) is an international robotics program in which teams of young people aged 9-14 assemble and compete robots (based on the LEGO Mindstorms® technology) designed to accomplish tasks associated with a real-world “Challenge.” In 2012-13, the theme for the Challenge was “Senior Solutions,” which focused on creative solutions to issues faced by senior citizens as they age. Over 12,000 teams in North America competed in the 2012-13 Challenge, with up to 10 young people per team, led by one or more adults (teachers, parents, or other adults). During the competition season, teams design, assemble and program a robot to perform a set of defined tasks related to the Challenge theme for the year. Teams are also required to conduct a research-based Project related to the issue/theme for that year’s competition. The Challenge culminates in local, qualifying, and Championship tournaments in which teams present their Projects and compete with their robots for a variety of awards. Reflecting the program’s goals of promoting both interest in science and technology and a sense of “gracious professionalism” (i.e. the ability to work cooperatively, even with competitors), the judging and awards at the tournaments include a focus on core values, teamwork and cooperation, as well as on design and robot performance.

Since its first full season in 1999, FLL has shown a steady growth in the United States. By 2003, there were over 4,000 teams in the US; approximately 7,800 teams in 2008, and over 12,000 teams in 2012. As the program has grown, FLL has taken regular steps to evaluate its implementation and impact. In 2003-04 and 2008-09, Brandeis University conducted national evaluations of the *FIRST* LEGO League program. In each case, the studies drew on surveys of participants, parents and team leaders from a national sample of teams with the goal of assessing both program implementation and participant impacts.¹

In 2012, *FIRST* asked Brandeis to conduct a third national study of the 2012-13 FLL program with the goal of building on those earlier studies and providing an up-to-date assessment of FLL’s implementation and impacts as the program continues its growth and expansion. As in each of the two previous national studies, three major questions guided the updated evaluation:

1. **What is the impact of the *FIRST* LEGO League on participating youth?** To what degree is FLL continuing to meet its goals of introducing young people to science and technology concepts and in building key life, workplace and academic skills such as teamwork, project planning, or

¹ For the 2003-04 study see Alan Melchior, Tracy Cutter, Faye Cohen, “Evaluation of the *FIRST* LEGO® League.” Prepared by the Center for Youth and Communities, Heller School for Social Policy and Management, Brandeis University, July 2004. Available at: http://www.usfirst.org/uploadedFiles/Who/Impact/Brandeis_Studies/2004%20FLL%20Report.pdf. For the 2008-09 study see Alan Melchior, Tracy Cutter, and Abhijit Deshpande, “Evaluation of the *FIRST* LEGO® League “Climate Connections” Season (2008-09). Prepared by the Center for Youth and Communities, Heller School for Social Policy and Management, Brandeis University, September 2009. Executive Summary available at: <http://www.usfirst.org/aboutus/impact>. In this report, we refer to the 2003-04 study as the ‘2003 FLL study’ and the 2008-09 study as the ‘2008 FLL study’. The current study is referred to as the ‘2013 FLL study.’

time management? To what extent are participants inspired by their program experience and/or report increased interested in science or technology studies and/or future careers?

2. **What is the impact of the *FIRST* LEGO® League on participating adults and institutions?** To what extent is FLL successful in engaging and motivating or satisfying team leaders? Has participation in the program had an impact on teachers in terms of their own interest in or knowledge of science and technology or on the way in which they work with students in their classrooms? Has the program had any impact on the participating school or community organization – for example, in terms of increased visibility for the school or development of new partnerships in the community and with area businesses?
3. **What are the strengths and weakness of the FLL program from the perspective of participating adults and youth and what steps, if any, could *FIRST* take to improve the program?** To what extent are teams completing the major elements of the FLL model? What kinds of barriers and challenges do team leaders need to address to organize and run a successful FLL team? What suggestions do team leaders and participants have for ways of improving the FLL experience?

Methodology

To address these questions, the Center for Youth and Communities replicated the core elements of the prior evaluation studies.² As in the earlier studies, the major sources of data for the 2012-13 study were end-of-season surveys distributed to FLL team members, their parents, and the FLL coaches/team leaders. The surveys were distributed to a national sample of 626 teams in the U.S. (approximately 5% of the teams participating in the 2012-13 Challenge) selected through a random sampling process using data from the FLL team registration system. The surveys included:

- **Team member surveys** designed to gather information on team members' experience in FLL and the program's impacts from the participant's point of view. The surveys asked about participants' involvement in key FLL activities, their assessment of the quality of the program experience, and the degree to which they believed that their FLL experience had influenced their attitudes, interests, knowledge and skills. The surveys also asked participants about their awareness of *FIRST*'s other programs and their interest in becoming involved in those programs in future years.
- **Parent surveys** designed to gather parent assessments of the impacts of FLL on their children, which was the major focus of the earlier surveys as well. In 2013, the parent surveys also collected information on parents' education and employment background; use of FLL's parent resources; their assessment of the FLL tournament experience; and awareness of *FIRST*'s other programs.
- **FLL coach/team leader surveys** designed to gather basic data on the implementation of the FLL program at the team level (team structure and activities, use of FLL materials, etc.); on each coach's assessment of the impact of the program on team members; and information on the

² The major differences between the studies were in the ways the national samples were chosen and in the survey collection process. In 2003-04 teams were sampled based on their participation in regional tournaments, in 2008-09 and 2012-13, teams were chosen randomly from the national registration data. In 2003-04 and 2008-09, team member and parent surveys were collected by team leaders for return to Brandeis; in 2012-13 team members and parents return their surveys directly to Brandeis in postage-paid envelopes.

impact of involvement in FLL on the coaches themselves and their satisfaction with their FLL experience.

As in the earlier studies, the goal of the survey process was to develop a comprehensive picture of FLL implementation and impacts from multiple perspectives -- coaches, team members, and parents -- and from a nationally representative sample of teams. The surveys for the 2013 study were based on the surveys used in the earlier FLL evaluations with the goal of being able to draw direct comparisons between studies whenever possible. The surveys were reviewed and revisions to update the surveys were made in cooperation with a working group of representatives from the FLL national program office.

Compared to the prior studies, the response rate for the 2013 study was disappointing. Out of the 626 teams contacted for the study, only 157 team coaches responded to the online Coach survey (25%), with only 137 coaches completing the full instrument. 525 team member and parent survey packages were returned, representing approximately 200 different teams, roughly 32% of the teams in the original sample. This is a substantially smaller response rate than for the earlier studies.³ Despite the lower than anticipated rate of return, however, the surveys still represent a substantial and representative body of data for the program. As noted above, the team member and parent data represents responses from approximately 200 different teams across 45 states and the coach survey includes responses for teams in 40 states - a broad cross-section of teams and locations. A comparison of descriptive data from the coach survey and national FLL registration system data also indicates that the teams in the study are broadly representative of FLL teams nationally. Finally, as the findings below show, the data from the 2013 teams are remarkably consistent with the studies that have gone before.

Summary of Key Findings

The results from the 2012-13 study largely parallel those from the two earlier studies, supporting a conclusion that FLL has continued to meet its goals of involving young people in an engaging learning experience that helps to build their STEM-related knowledge, interests and skills. As in both prior studies, the large majority of young people report actively participating in a wide range of FLL activities, and doing so in a supportive environment, resulting in increased interest in science and technology, a better understanding of the role of science and technology in solving everyday problems, increased interest in school, improved life and workplace-related skills, and a more positive outlook on themselves and their future. Most anticipate continuing with *FIRST* into high school. Team leaders also report positive impacts on team member attitudes and skills, on their own knowledge of science and technology, their appreciation of what young people can accomplish, and on the visibility and reputation of their organizations in the community. Finally, parents also report a positive impact on their children from participation in FLL, confirming that the program has helped to increase young people's interest and engagement in science and technology, their social skills, and their sense of self-confidence. While the surveys highlight several areas of the program needing further improvement, the primary message from study is that the program is continuing to provide a high quality and effective experience for participating youth.

³ For the 2003 study, 185 teams out of a sample of 394 returned team member surveys, a team response rate of 47%. In 2008, 188 teams returned team member surveys out of a sample of 440, a team response rate of 43%. Altogether, the 2003 study received 162 coach surveys, 919 team member surveys, and 699 parent surveys. The 2008 study received 118 coach surveys, 986 team member surveys, and 817 parent surveys.

Key findings include the following:

FLL Participant and Team Characteristics

- **Based on the participant, coach, and parent surveys, the “typical” FIRST LEGO League team in 2012-13 looked very much like the teams in the prior studies, though some, generally small shifts are evident.** The average team in 2012-13 is slightly smaller than in prior years (an average of 7 team members instead of 8), with an average of five boys and two girls (approximately 31%) per team. The large majority of FLL participants are White (67%) and most are between the ages of 10 and 13 (83%). Most young people had joined FLL (according to their parents) because of a prior interest in science and technology, though many also joined because they enjoyed playing with LEGOs or were encouraged to join by an adult. A growing percentage of participants (now 11%) report having been in Jr. FLL, and substantial majorities report that they hope to go on to participate in FIRST’s programs for older youth, FTC and FRC.
- **The adults involved in the FLL teams are also similar to those from the earlier studies, though the shift towards more female coaches that was noted between 2003 and 2008 continues.** Fifty-nine percent (59%) of FLL coaches were women in 2012-13. The large majority of coaches are still White (89%) and in their mid-forties; the majority of coaches bring a background in teaching (62%) and half have prior employment in a field related to science and technology (roughly the same as in 2008). A substantially smaller percentage of coaches in 2012-13 are “Rookie” (i.e., first-time) coaches than in previous years (29% compared to 40% or more in 2008 and 2003), and the average coach now brings nearly 3 years of prior experience in FLL. The ‘typical’ FLL coach worked with a single team; however, a third of the coaches in the 2013 study report working with two or more FLL teams.
- **The large majority of teams are school-based (either in-school or after-school), though a substantial number report that they are ‘neighborhood-based,’ operating outside of a formal organizational setting.** Whatever the context, teams do appear to be increasingly successful in recruiting adult support: the average number of mentors per team has increased from 2.3 in 2003 to 3.9 for 2012-13 and more than 60% of the teams had access to at least one technical mentor. Parents continue to be the major source of mentors or team volunteers, but more than a quarter of the teams report having at least one high school student as a volunteer.
- **Finally, while FIRST appears to be making some progress in the effort to create links between its “pipeline” of programs, clear gaps in awareness of and involvement in other FIRST offerings persist.** Among the FLL coaches, there is a relatively high degree of familiarity with other FIRST programs – two-thirds or more are ‘familiar’ with FRC, FTC, and Jr. FLL (though the percentage familiar with FTC dropped in this latest survey). Among FLL participants and parents, awareness of FIRST’s other programs continues to be less common. Roughly half of FLL participants and their parents reported being familiar with FTC and FRC, though a relatively high percentage of FLL participants express a desire to be involved in FIRST programs when they go to high school. In that regard, the data suggest a continuing need to spread the word, particularly to program participants and their parents.

Program Experience

In 2012-2013, FLL continued to provide an engaging, hands-on team experience for program participants, based on results from participant and coach surveys. While the number of teams has grown substantially over the years (from approximately 4,000 teams in 2003 to over 12,000 in 2012-13), team members and coaches continue to report a high degree of involvement in team activities and satisfaction with the program experience.

- **Most team members reported at least some involvement in all aspects of the FLL team experience.** Overall, at least 80% of the team members reported being involved in each of the activities related to designing, building and programming the FLL robot. Most (90% or more) also reported participating in key activities involved in researching and presenting the team's Project. As part of this year's Project, 67% reported getting information from a scientist or other outside expert.
- **Most team members (80%) also had an opportunity to work with an adult with technical expertise (a team leader or technical mentor).** Team members reported that mentors helped them think about what they needed to study if they wanted to become a scientist or engineer (88%); learn about the science involved in this year's Challenge (84%); learn about science and technology careers (72%), as well as solve problems in building and programming the team's robot (70%).
- **Almost all of the teams worked on the research Project this year (98%),** with coaches reporting that teams spent over 40% of their team time working on Project-related tasks. Eighty-seven percent (87%) of coaches reported that their team worked with a Senior Partner, and both coaches and team members rated that experience highly. Over 90% of coaches felt that the research Project was an important part of the FLL experience and a large majority felt that the real-world focus helped motivate them and their team members.
- **Almost all of the team members in the study attended at least one tournament (97%) and 65% attended two.** Both coaches and team members continue to rate the tournament experience highly (86% or more of both groups rated the tournaments as "Good" or "Excellent"). The mix of tournaments attended has changed since the earlier surveys, with fewer teams (based on coach survey data) attending Championship tournaments and fewer teams attending multiple tournaments than in earlier years.
- **Data from the team member surveys also point to a high quality program experience.** Most participants (90% or more) reported that they made important decisions on their team; had important responsibilities; felt they belonged and were an important part of their team; got the attention they needed from adults, felt safe; and had fun working on their team – all indicators of high quality youth development experiences.
- **Ninety-four percent (94%) of team members rated their experience as "Good" (29%) or "Excellent" (65%).** Eighty percent (80%) indicated that they planned to return in 2013-14. Most of those not expecting to come back indicated that they would be too old or would not have enough time.
- **As in earlier years, there were differences in the patterns of participation in FLL activities among girls and boys, though there are fewer differences than in prior years.** While girls continue to report greater involvement in the Project and team support activities, the differences between girls and boys in terms of involvement in the planning, building, programming and testing of the robot that were evident in earlier years have disappeared. Both boys and girls rated their program experiences positively and were equally likely to indicate an interest in continuing in FLL.

Participant Impacts

As in the earlier studies, the data from the 2013 coach, team member, and parent surveys indicate that FLL is having a positive impact on the interests, knowledge and skills of participating young people. From all three perspectives, FLL was seen as increasing participants' interest in science and technology, their understanding of the role of science in solving real-world problems, their engagement in school, and their teamwork, leadership, planning and management skills, among others. While parents were somewhat less likely than team members and coaches to report gains (as was the case in

prior years), high percentages of all three groups (coaches, team members, and parents) reported positive outcomes. Overall, the results for 2013 are remarkably similar to those in the 2003 and 2008 studies, providing additional validation to the findings.

- **As in 2003 and 2008, the large majority of FLL coaches reported that the program had a positive impact on participants' interests in science and technology, on their understanding of how science is used to address real-world problems, and on a variety of life and workplace-related skills.**

Over 90% of the FLL coaches reported an increase in team members' interest in computers and technology and their interest in how math and science were used in the real world. Eighty-six percent reported that their team members were more interested in jobs or careers in science or technology.

Two-thirds of the coaches (66%) reported that their team members were more interested in math and science classes as a result of FLL; 64% reported an increased interest in succeeding in school; and 59% reported an increased interest in going to college. (These figures are down slightly from 2008, but are similar to those in 2003.)

Most coaches also believed that FLL had increased team members' knowledge and skills: 80% or more of the FLL coaches reported increases in team members' understanding of how science and technology can be used to solve real-world problems; their understanding of basic science principles; and their understanding of potential careers in science and technology.

Finally, very high percentages of coaches reported gains in key life and workplace skills, and in many cases, indicated that those gains were substantial. Over 90% of the coaches reported that as a result of their FLL experience team members had increased their teamwork skills (94%), problem-solving skills (93%), leadership skills (93%) and their presentation skills (92%). Over 75% of the coaches reported gains on other program-related skills, including an increase in research skills (84%), planning skills (75%), and time management skills (75%).

- **The large majority of 2013 FLL team members reported gains in their interest in science and technology, in their interest in doing well in school, in their understanding of the role of science and technology, and in a broad array of life and workplace-related skills.** As in other areas of the study, the results of the participant surveys are strikingly similar to those from the prior surveys, indicating that FLL continues to have a positive impact on participants' knowledge, interests and skills.

In terms of interest in science and technology, 89% of participants wanted to learn more about science and technology, 90% wanted to learn more about computers and robotics; and 89% wanted to learn more about how science and technology can be used to solve problems in the real world. Eighty-one percent (81%) of participants wanted to learn more about real-life projects like the Senior Solutions project and 80% were more interested in having a job that uses science or technology. Over two-thirds (67%) indicated that they want to be a scientist or engineer.

Participants also reported that they were more academically motivated as a result of FLL. Eighty-eight percent (88%) of team members indicated that they were more interested in going to college as a result of FLL, and 87% reported that they were more interested in doing well in school.

Almost all of the FLL participants also reported gains in their understanding of science, the role of education, and the importance of being able to work with others on their team and in the community. More than 90% reported learning how science and technology could be used to solve problems in the real world; 97% learned that the subjects they studied at school (like math or science) could help them solve real-world problems.

Nearly all of the FLL team members surveyed (over 90% on most items) indicated that they had gained a variety of life and work-related skills through their involvement in FLL, including how to work with others to identify and solve a problem (98%); how to brainstorm ideas with teammates (98%); how to offer suggestions to others (98%) and to accept suggestions about work on a group project (99%); how to solve disagreements among team members (95%) and how to work well with both girls and boys (91%). Ninety-eight percent (98%) reported learning to treat others with respect even when they are competing against them – in other words, Gracious Professionalism.

More than 90% of participants also reported gaining research, problem-solving and time management skills; how to make a presentation; and how to talk to people they do not know about something important. Ninety-eight percent (98%) learned to think about problems “in a new or creative way.”

- **As in the prior studies, parents also reported participant gains, though at somewhat lower rates than were reported by coaches and team members.** Providing results that paralleled those of coaches and team members, a majority of parents reported that FLL had a positive impact on their children in terms of increased interest in science and technology, attitudes towards themselves and their futures, and in terms of a variety of life and academic skills.

A high percentage of parents reported an increase in their children’s interest in science and technology. Eighty-eight percent (88%) of the parents responding to the survey reported their children’s interest in how science and technology were used to solve real-world problems increased, and 86% reported an increased interest in computers and technology. Just under three-quarters (73%) reported that their children became more interested in careers in science and technology.

Parents were somewhat less likely to report gains in their children’s academic interests and motivations. Sixty-eight percent (68%) reported an increased interest in math and science classes; 53% reported an increase in their child’s interest in doing well in school; and 52% reported an increased interest in going to college.

Most parents also reported gains in their children’s knowledge, skills, and attitudes about themselves as a result of the program. Roughly 80% of parents reported that the program had increased their child’s teamwork skills. Most (over 86%) reported improved critical thinking and problem solving.

Parents also reported gains in participants’ self-confidence and sense of belonging. Eighty-seven percent of parents (87%) reported that their child’s sense that he or she could succeed if they tried hard had increased; 82% reported increased confidence speaking in front of a group, and 71% reported an increased sense of self-confidence concerning school and school work. Eighty-four percent (84%) of parents said their child’s sense of belonging to a group had also increased.

Finally, parents reported gains on basic academic skills, though less frequently than in other areas. Fifty-five percent (55%) of parents reported gains on math skills and 50% on writing skills as a result of FLL. While these percentages are lower than for many other items, it is important to recognize that FLL was not designed to teach basic math and writing skills. In that context, the fact that half of the parents in the survey saw gains as a result of their child's involvement in FLL is an impressive result.

- **Both boys and girls showed positive impacts from their involvement in FLL. While some differences were evident, those differences are relatively few in number and need to be seen in the context of reported gains by high percentages of both groups.** The differences between boys and girls were most evident on questions related to impacts on interest. In general, boys were significantly more likely to report increased interest in STEM-related topics: wanting to learn more about computers and robotics, wanting to learn more about science and technology, increased interest in jobs that use STEM, and wanting to be a scientist or engineer. Boys were also more likely to report wanting to solve problems in the community when they got older. Girls, on the other hand, were more likely to report an increased interest in doing well in school and in wanting to learn more about real-life projects like the Senior Solutions Challenge. Girls were also more likely to report increased confidence in their math and science abilities (i.e., that, as a result of FLL, they now thought they were better at math and science than before). It is important to note that on several of these items the differences were relatively small in percentage terms, and that large majorities of both groups reported gains on all of the items. But the gender differences here do suggest that to a degree there are differences in the responses of girls and boys to the program experience.
- **While there were some differences in impacts among boys and girls, there were few differences between older and younger participants.** As in the prior studies, both older and younger participants reported similar patterns of impact on what they learned, on their interests, and on their skills. Only one item across the three sets of questions showed a significant difference in responses, with younger students more likely to report wanting to learn more about real-life projects like this year's Challenge.

Benefits and Challenges of Coaching

As in prior years, most coaches were satisfied with their experience in FLL. Most rated the support they received and the materials provided by *FIRST* positively; and a large majority (82%) reported that they were "Satisfied" or "Very Satisfied" with their experiences as coaches, though the overall level of satisfaction was slightly lower than in prior years. Most coaches (84%) planned to return, and those who are not planning to return largely point to issues of time or the departure of their children from the FLL team as the reason.

- **The major challenges reported by coaches were around time and scheduling difficulties** (reported by 72% of coaches) and managing team meetings/keeping team members on task (68%). Sufficient resources, recruiting mentors and volunteers, and ensuring a child-directed program were mentioned by 25%-35% of coaches.
- **Most coaches were satisfied with the materials/resources made available by FIRST.** The most commonly used resource was the Coaches Handbook, used by 90% of the FLL coaches. The supplemental Challenge documents and other resources on the *FIRST* website, the Project Training DVD and the Team Resources web page were next most commonly used, all by more than 70% of the FLL coaches. Coaches were less likely to report using FLL's Social Media resources (57%) and the

Coach Conference calls (33%). Coaches generally rated the materials highly, with 90% or more rating most of the resources as “Somewhat” or “Very” helpful.

- **Approximately 55% of coaches were classroom or home school teachers, and approximately half of those coaches reported using FLL or the FLL kits in their classroom**, either as part of an elective robotics class, as a robotics module in a broader science or technology curriculum, or as a tool for teaching specific skills, such as design, programming, or problem-solving. Teachers reported that using FLL materials helped motivate their students and allowed them to teach critical thinking and other skills in context.
- **Coaches reported a variety of positive impacts on their own work.** As in prior studies, 80% or more of the coaches who were teachers reported that FLL had a positive impact on their knowledge of current science and technology; their emphasis on the application of science in real-world settings; and on their ability to teach STEM-related topics to their students. Teachers also reported an improved understanding and relationship with their students: more than 80% reported that their sense of connection to their students had grown as well as their understanding of what young people can accomplish and their respect for students’ capacity to work as a team. 84% reported that their own enjoyment and satisfaction in teaching had increased.
- **Coaches also reported positive impacts on their organizations:** 81% reported that involvement in FLL increased their organization’s visibility in the community, and 75% agreed that it had increased their organization’s reputation. Slightly more than half of the coaches (51%) reported that their involvement in FLL led to an increased involvement of employees at their organization in the community (perhaps as volunteers at FLL events), and just under half reported that FLL involvement had led to partnerships with other organizations in the community.

FLL Parents

FLL parents bring a variety of background experiences to FLL and differing levels of involvement. One focus of the 2013 study, in addition to gaining parents’ perspectives on the program’s impact on their children, was to learn more about the parents themselves and their involvement in the program.

- **The FLL parents represented in the 2013 FLL survey are a relatively well-education group of adults, many of whom have prior experience in STEM-related fields and other children involved in FIRST programs.** 93% of the families included in the survey had at least one parent with a postsecondary degree; nearly half of the families had at least one parent with a graduate degree. Many brought a background in STEM: 54% of families reported that one or both parents had been employed as an engineer, scientist, computer programmer or another field related to science and technology.
- **Relatively few FLL parents are alumni of FIRST programs (2%); however, nearly 30% of the families report having other children in FIRST programs.** Those families clearly represent a strong, core constituency for FIRST. Not surprisingly, the families with children in other FIRST programs are also significantly more likely to be familiar with FTC and FRC, highlighting the need to inform FLL parents about other FIRST programs, particularly those who do not already have other children in the “pipeline.”
- **Parents vary widely in their involvement with the FLL program**, with approximately 43% of parents reporting they are “Very” or “Moderately” involved (that figure is similar to that in 2003 and slightly higher than 2008). The most common form of involvement for parents was attendance at one or more tournaments: 87% of parents reported attending at least one tournament. Of those that attended a tournament, the large majority rated the tournament experience highly. Parents were

much less likely to report having used the parent resources created by the FLL program: only 25% of parents reported that they had used either the FLL Parent's page or the "Team Up" website.

- **The major suggestions on how to increase parent involvement were to improve communications with parents and raise awareness of the program generally.** Parents asked that coaches and FLL keep them better informed about upcoming events and key dates in the program and more actively ask for help: "just ask me" was a not uncommon response. Parents also suggested advertising and promoting the program more generally at the schools and other organizations where FLL teams are based as a way of encouraging more parents and more students to become involved.

Improving FLL

In response to questions about how to improve the FLL program, coaches, parents and team members pointed to several areas for improvement. Unlike prior years, the Project was not a major area of discussion (in 2008, for example, dropping or revising the Project was a major focus for coach, team member and parent comments), nor were there as many comments about judging and scoring as in previous years. Instead, many of the comments focused on adjusting the season schedule to provide more preparation time for teams (starting earlier or moving the tournaments to later in the year), particularly as work on the Project grows more complex. Suggestions also included managing the tournament days more efficiently; providing better/more training resources, including examples of successful projects and more how-to materials on building the robots; better training for judges, with the goal of more consistent judging; better/"more interesting" Challenge topics; and more opportunities for cross-team learning and collaboration. Taken as a whole, however, the suggestions come from a fundamentally positive perspective – ways of taking a successful and satisfying experience and making it better for both youth and adults.

Continuing Challenges

In the context of the positive findings from the study, the study's findings point to several continuing challenges to be addressed by FIRST. These include:

- **Bringing more young women and young people of color into the program.** Boys continue to comprise 70% of FLL participants, a figure that has not changed since the 2003 study. While girls report positive experiences and impacts in FLL – results generally comparable to those for boys – the challenge of recruiting girls into the program in greater numbers remains. Similarly, children of color remain under-represented among FLL participants. According to the 2013 participant surveys, approximately 68% of FLL participants are White; 11% are Hispanic and 4% are African-American (the national figures for all students in public schools are 51% White, 24% Hispanic, and 16% African-American).
- **Continuing to refine the balance in FLL between the Project and the robot competition and to look at ways to adjust the schedule for the season to allow teams more time to prepare for the tournaments.** While the survey results in relation to the Project were positive in 2013, the open-ended comments by coaches and others suggest that teams are feeling squeezed in terms of the time available to prepare both Project and robot for the tournaments. Interestingly, most of the survey comments from coaches, parents and students suggested rethinking the schedule to provide teams with more time to prepare as a solution, rather than cutting down on the Project requirements.
- **Team members and adults (coaches and parents) continue to ask for additional training and technical assistance resources,** including training sessions for coaches, examples of successful

projects, online curricula to teach programming and other technical topics, and a better introduction for new coaches to the key tasks involved in competing over the course of a season. These materials may already exist and are not sufficiently promoted or accessible through the FLL website.

- **Finally, the data from the team member and parent surveys suggests that many FLL participants are still unfamiliar with the other *FIRST* programs** that are available to them as they move into high school. To the extent that *FIRST* wants to build the pipeline from FLL to other programs, a more consistent effort to raise awareness among FLL families may be needed.