

Cross-Program Evaluation of the *FIRST* Tech Challenge and the *FIRST* Robotics Competition

Executive Summary

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The *FIRST* Tech Challenge (FTC) and the *FIRST* Robotics Competition (FRC) are two national robotics competitions operated by US *FIRST* in which teams of high school-aged youth design and build robots that compete with other teams to complete a set of prescribed tasks. In 2010-11, the FRC program, which was the original program developed by *FIRST* and which serves as *FIRST*'s flagship offering, had approximately 2,000 teams of high school-aged youth competing in the United States through approximately 60 regional qualifying and regional championship tournaments, with an average of 25 participants per team. The FTC program, which was developed by *FIRST* to provide a lower-cost, entry-level high school program, had approximately 1500 teams in 2010-11, with up to 10 young people per team, competing in a similar national network of more than 100 qualifying tournaments, scrimmages, and championship tournaments. Though differing in the details of the competitions, both programs are designed to increase the interest of young people in science and technology and build practical teamwork and life skills (planning, problem-solving, communications, etc.) through an intensive, hands-on, team-based engineering experience.

As part of its ongoing evaluation efforts, *FIRST* asked Brandeis University's Center for Youth and Communities to conduct an evaluation of the 2010-2011 seasons of the FTC and FRC programs in order to provide an up-to-date assessment of the program experience provided young people in both programs and to document the short-term impacts of both programs on participants' STEM-related interests, knowledge, and skills. By including both programs in the 2010-2011 evaluation, the study provided an opportunity to generate results for each program on its own and to examine similarities and differences in participant experiences and outcomes for the two programs. The study was also designed to examine the relationship between participation in FTC and FRC, including the degree to which team members have participated or expect to participate in both programs. Finally, the study was designed to make use of survey items also used in *FIRST*'s evaluations of the *FIRST* LEGO® League (FLL) program, making it possible to compare results across all three of *FIRST*'s major programs.

Five major questions guided the evaluation:

1. **Who participates in the FTC and FRC programs?** What are the characteristics of the communities, schools, and participants involved in FTC and FRC? To what extent are there differences in who the two programs attract or reach in terms of demographic characteristics (age, gender, race, economic status) or interests (initial interest in STEM; prior program experience, etc.)? To what extent are there differences in the characteristics and backgrounds of the team leaders across the two programs?
2. **What are the similarities and differences in the program experiences provided by the FTC and FRC programs?** How do FTC and FRC differ in terms of key program characteristics, such as the opportunities for hands-on involvement, interaction with mentors/adults, participants' sense of belonging and identity with a team, and participants' sense of engagement and ownership of their *FIRST* experience?
3. **What are the short-term impacts of the FTC and FRC programs on participating young people?** To what degree are each of the programs meeting *FIRST*'s goals of introducing young people to science and technology concepts, inspiring their interest in science, technology and engineering, and building key life, workplace and academic

skills? In examining those impacts, are there significant differences in impacts between the two programs and/or among different groups of participants (in particular, among young women and men on the teams)?

4. **What is the relationship between FTC and FRC from the perspective of participating youth and adults?** To what extent do FTC participants want and expect to participate in FRC (and to what extent are they doing so concurrently)? Have FRC participants also had FTC experience, and if so, to what extent do they believe that FTC influenced their decision to participate in FRC? For team leaders, what influenced the decision to participate in FTC or FRC and to what extent do they expect to become involved in other *FIRST* programs?
5. **Finally, what are the strengths and weakness of the FRC and FTC programs from the perspective of participants and team leaders, and what steps, if any, could *FIRST* take to improve the programs?** How do participants and team leaders assess their experience in FTC/FRC? To what extent are they satisfied with the quality of the program experience (materials, tournaments, game design) and the support provided by *FIRST*? What suggestions do team leaders and participants have for ways of improving the FTC and FRC experience?

Methodology

To address these questions, Brandeis conducted online surveys of team leaders and team members from a national sample of FTC and FRC teams. The surveys were developed in collaboration with *FIRST* staff from the two programs and drew, where appropriate, from surveys used in several earlier studies of the *FIRST* LEGO League program to provide a degree of comparability among all three of *FIRST*'s middle and high school offerings.

Survey materials were sent to team leaders at a random sample of U.S.-based FTC and FRC teams at the beginning of May, 2011, following the close of the 2010-2011 competition season. Approximately 20% of the teams in each program were included in the sample: 304 FTC teams (out of 1543 US FTC teams) and 382 FRC teams (out of 1912 FRC teams nationally). Team leaders were sent information on the study and direct links to the online surveys through an initial email invitation from *FIRST*; team leaders were asked to complete a team leader survey and distribute the link for the participant survey to their team members. Team leaders were also sent a package of materials in the mail that included instructions for the study and survey information for team members and parents. Several rounds of reminder emails were sent to team leaders through May and early June to encourage both team leader and team member responses. Telephone calls were also made to FTC team leaders asking them to contact team members to ensure an adequate response. Finally, teams were also told that as an incentive teams that completed both a team leader and 3 or more team member responses would be entered into a drawing for a \$250 waiver of registration fees for the 2011-12 FTC and FRC programs.

Ultimately, approximately half of the teams in the sample provided survey responses for the study (Table 1-1). Among the FTC teams, 170 team leaders, representing 150 teams (49% of the sample), responded to the team leader survey; 385 team members from 139 different teams (46% of the sample) responded to the team member survey. Among the FRC programs, 252 team leaders responded, representing 192 teams or half of the sample, and 710 team members

from 151 different teams (39% of the sample) completed a team member survey. In a number of cases, several team representatives from a team (presumably co-leaders) responded to the team leader survey. As is noted in the tables in the report, data in both the team leader and team member analyses were weighted so that teams were equally represented in the analysis.

Table 1-1: Survey Response Rates

	FTC	FRC
Team Leader Surveys	170 (150 teams)	252 (192 teams)
Team Member Surveys	385 (139 teams)	710 (151 teams)
Team Leader Response Rate (Percent of teams)	49%	50%
Team Member Response Rate (Percent of teams)	46%	39%

Key Findings

Based on the responses to the team leader and team member surveys, both the FTC and FRC programs provide an engaging, hands-on learning experience for participating youth and generate a wide range of positive outcomes. While there are a number of differences between the two programs, a large majority of participants and team leaders in both FTC and FRC report gains on key outcomes, including a better understanding of the use of science and technology in the real world; increased interest in STEM (Science, Technology, Engineering, and Math) and STEM-related careers; increased interest in school success and college-going; and gains in a number of 21st Century life and workplace skills (critical thinking, problem-solving, communications, teamwork, etc.). Team members and team leaders across both programs assess their program experiences positively, with large majorities of both young people and adults planning to continue their involvement in FTC and FRC next year. Team members also see a strong link between the two programs, with 62% of FTC members reporting that their FTC experience has made it more likely they will join FRC at some point in the future, and with 72% of FRC members with prior FTC experience reporting that FTC had increased their interest in joining an FRC team. While team leaders are more likely to see the FTC program as affordable for teams in communities like theirs, both FTC and FRC team leaders are concerned about their ability to sustain their teams without continued grant support through *FIRST*.

Specific findings include the following:

Participants and Teams

- **While there are a number of differences between participants in FTC and FRC, both programs serve young people from a similar mix of communities and who are involved in the program because of a prior interest in science and technology.** Overall, the differences among participants in the two programs were small. FRC participants are slightly older and include more 12th graders than FTC participants; FRC teams also have a higher percentage of female team members (30% vs. 23% in FTC), though the large majority of participants in both programs are male. FTC participants are slightly more racially diverse (35% of FTC participants are non-white vs. 27% in FRC), but

the two programs serve an almost identical mix of urban, suburban and rural young people and similar percentages of low-income youth. Both programs also attract young people with a prior interest in science and technology: roughly 70% of the participants in both programs reported being “interested” or “very interested” in science and technology before joining *FIRST* and more than half of the team members (53% in FTC and 57% in FRC) reported that their primary reason for joining the program was an interest in science, technology and/or engineering. At the same time, a much smaller percentage of participants (approximately 30%) report prior involvement in STEM-related programs, suggesting that while *FIRST* may not be generating new interest in STEM per se, it appears to be providing a new opportunity to pursue STEM for those young people with a prior interest

- **FTC and FRC teams differ in important ways at the team level, reflecting the basic differences in program/team design.** While both FTC and FRC teams are predominantly school-based (approximately 85% of teams in both programs), FTC teams are more likely to be linked to a school class and FTC team leaders are more likely to be teachers (62% vs. 52% for FRC). FRC teams are larger (an average of 23 participants for FRC vs. 11 for FTC teams), are more likely to be led by a corporate volunteer (14% vs. 8%) and, on average, have access to greater number of mentors (6.5 per FRC team vs. 2.5 for FTC) and mentors with STEM backgrounds (4.6 per team vs. 2.2 for FTC). However, team leaders in FRC and FTC were equally likely to have been employed in a STEM-related field (approximately 55% in both programs) and were demographically similar -- predominantly White (82-85%), male (74-79%), and in their early 40s. Most (70%) became involved because they wanted to get young people interested in science and technology. Finally, FRC team leaders are substantially more experienced with *FIRST*: 26% of FRC team leaders in the survey were “Rookies” (in their first year as team leaders) vs. 46% of FTC team leaders. One implication may be a greater need for support and assistance among FTC leaders as they build their experience in the program.

Participant Program Experience

- **Both FTC and FRC provide participants with an engaging, hands-on learning experience, with a majority of participants reporting opportunities to be involved in key program activities.** Over 80% of the FTC and FRC participants in the surveys reported that they were involved in deciding on overall strategy, gathering information and reviewing rules, designing the team’s robot, and building the robot or a specific part. Roughly 70% of FRC team members and 85% of FTC participants reported working on or operating the robot at a tournament.
- **While both programs offered substantial hands-on involvement for most participants, there were significant differences in specific aspects of that experience.** Overall, FTC participants were substantially more likely to report hands-on engagement in building and operating the robot than participants on FRC teams. The largest difference was in involvement in programming the robots, with 63% of FTC participants involved vs. 37% of FRC participants. However, there were other differences as well: FTC participants were more likely to be involved in strategy (96% vs. 90%), in designing the robot (93% vs. 86%), in operating the robot at the tournaments (85% vs. 69%), in building a practice field (72% vs. 56%) and in making presentations to judges (85% vs. 66%). While the differences were not always large, clearly the smaller FTC teams provided more opportunities for team members to be directly engaged in the robot design and building process.

- **At the same time, both groups of participants reported a high quality experience, with FTC participants tending to emphasize team member leadership and FRC team members emphasizing the quality of the team experience and adult support and involvement.** Over 90% of participants in both programs agreed that team members made the important decisions; that they had a chance to do lots of different jobs on the team; that they had important responsibilities; that they got all the help they needed; felt like they really belonged; and felt like an important part of the team – all indicators of a quality program experience. Over 80% reported that they had a chance to play a leadership role; that the team learned how to work well together; and that they learned a lot from the adults on the team.

Within these strong results, there were some differences in responses. FTC team members were more likely to report that team members made the important decisions (97% vs. 93%) and to reject the idea that adults on the team did the most difficult jobs (87% vs. 78%). FRC team members, were more likely to report that they had a chance to get to know one of the adults on the team (93% vs. 90%); that they learned a lot from the adults (92% vs. 81%); that adults on the team talked about college (70% vs. 57%), and that they felt they belonged on their team (94% vs. 92%). While those differences were statistically significant (i.e., unlikely to have occurred by chance), in practical terms they are small and likely reflect differences in emphasis rather than major differences in program quality. Overall 97% of the FTC participants and 99% of those in FRC reported that they “had fun working on my *FIRST* team” – another important indicator of a quality program experience.

- **There were also some differences in the program experiences of young men and women in the two programs.** In general, male and female team members differed in the types of activities that they were involved in within the programs, with male team members more likely to be involved in activities related to the designing, building, and operations of the robot than female team mates. Female team members were more likely to be involved in marketing and fundraising activities, community service projects, and making presentations. The differences were substantially more pronounced on FRC teams, suggesting that the smaller FTC teams provided more opportunities for young girls to get directly involved in the “technical” aspects of the program.

While there were differences in their engagement in program activities, there were few significant differences in the assessments of the program experience between male and female members. In the end, while their experiences differed, the large majority of young men and women on FRC and FTC teams tended to feel like the programs offered a positive, engaging experience.

Participant Outcomes

- **Participants in both FTC and FRC report strong, positive impacts on participant knowledge, interests, attitudes and skills.** More than 90% of the team members in both programs reported learning more about how science and technology can be used to solve problems in the real world; that the subjects they learned in school have real-world applications; and about the importance of being able to cooperate and compete with the same people and Gracious Professionalism; 85% or more reported learning about the kinds of jobs people do that use science and technology. Similarly, 80% of team members or more reported that, as a result of *FIRST*, they wanted to learn more about science and technology, were more interested in science and technology careers, and wanted to be a scientist or engineer. Eighty percent (80%) or more also reported that they were more

interested in doing well at school, plan to take more challenging math or science courses, and were more interested in going to college. A high percentage of participants in both programs – generally over 90% -- also reported learning critical life and workplace skills through the program, including teamwork, interpersonal/negotiation skills, planning and problem-solving, time management, and communications and presentation skills.

- **A high percentage of team leaders in both programs also reported positive impacts on participant knowledge, interest and skills.** Over 90% of team leaders in both programs reported that participation in *FIRST* increased team member interest in how science and technology are used, in computers and technology, and in careers in STEM-related fields. Seventy percent or more of team leaders also reported that, as a result of *FIRST*, a majority of their team members showed an increased interest in math and science classes, in school success and college-going, and in majoring in STEM-related fields. Team leaders also reported gains in team member understanding of basic science principles (90%+), computer skills (85%+), math skills(70%+), understanding of engineering design (95%), and potential careers in science and technology (85%+). Team leaders also reported gains across a range of life and workplace-related skills, including teamwork skills (95%), leadership skills (92%+), problem solving skills (94%+), planning and time management skills (75%+) and presentation skills. Slightly fewer, but still substantial percentages of team leaders also reported gains in writing skills (60%+) and research skills (64%+).
- **That said, there were also important differences in reported outcomes between the programs.** Across the board, FRC team members were somewhat more likely to report gains on a range of interest and attitude measures. FRC members were more likely to report increases in their interest in science and technology (97% vs. 95%), in their plans to take science or math courses (90% vs. 86%) and in their interest in going to college (92% vs. 87%). FRC team members were also more likely to report learning about key values, including Gracious Professionalism (96% vs. 90%) and volunteering in the community (83% vs. 74%). Team leaders reported a similar set of gains. FTC team members, on the other hand, were substantially more likely to report an increased interest in computer programming (91% vs. 78%) and were as likely as FRC participants to report that they were interested in science and engineering careers (85% vs. 83%). FTC and FRC team members were also equally likely to report gains on questions related to life and workplace skills (FRC members were more likely to report gains in communications and cooperation skills, but there were no significant differences between program on the responses to the other skill questions). Overall, while FRC team members and leaders tended to report somewhat stronger outcomes, the differences in reported outcomes for the two programs were not large, and in both programs a high percentage of young people and team leaders reported gains.
- **Finally, there were some differences in reported impacts between young men and women involved in FTC and FRC, though the differences were more pronounced in the FRC program than in FTC.** In the FRC program, girls were more likely to report impacts on a number of measures of knowledge and attitudes, for example, that both boys and girls can be good at computers or robotics and on the importance of gracious professionalism, and on teamwork and communications skills. Male FRC team members were more likely to report increased interest in science and technology and STEM-related careers and the skills related to designing and building their robot. There were fewer differences among young men and women on the FTC teams, but they followed a similar

pattern, with girls somewhat more likely to report impacts on attitudes related to teamwork or communications skills, and boys reporting gains in technical skills. Again, the most important point is that overall the results were similar for both groups, but as *FIRST* continues to look at ways to increase the involvement of women in its programs (and STEM-related fields generally), it will be important to look at how to make sure that their programs engage girls in both the “technical” and the “social” aspects of the programs.

Team Member and Team Leader Satisfaction

- **Team members and Team Leaders in both programs rated their experience highly, with the large majority of team members and leaders expecting to return next year.** Overall, 93% of FTC team members and 96% of FRC team members rated their experience in *FIRST* as “Good” or “Excellent”. Over 70% of FTC and FRC team members reported that they planned to return next year. The most common reason given for not returning is that the team member was graduating high school; lack of time was the next most common reason. Only 1% of the FTC non-returners and 2% of those in FRC reported that they were leaving because they did not like the program.

Team leaders were equally positive. Eighty-two percent (82%) of FTC team leaders and 91% of FRC team leaders reported that they were “Satisfied” or “Very Satisfied” with their experience this year, and 84% of FTC and 92% of FRC coaches reported that they planned to lead a team again next year. Among the coaches, the most common reason for not returning was lack of time or other obligations (58% for FTC and 64% for FRC); however, it is worth noting that half of the FTC team leaders (50%) also pointed to “lack of funds” as a reason for not returning, a much higher percentage than among the FRC leaders (23%).

- **Team members and team leaders also rated specific elements of the *FIRST* experience highly.** Among FTC members, three-quarters or more rated the Kit of Parts and this year’s game design as “Good” or “Excellent.” Among FRC participants the ratings were similar: 83% rated the Kit of Parts as “Good” or “Excellent” and 80% gave the game design high ratings. In general, 80-85% of FTC participants gave “Good” or “Excellent” ratings to their tournament experiences (including scrimmages, qualifying tournaments, championships, etc.); between 87% and 94% of FRC participants gave their events “Good” or “Excellent” ratings. Team leader ratings were also positive, with high percentages (80% or more) rating the Kit of Parts, game design and overall experience as “Good” or “Excellent.”
- **A majority of team members also reported that their FTC and FRC experiences compared favorably with other non-*FIRST* science or technology programs.** Over half of the FRC participants who had been in other programs (54%) reported that FRC was “much better” than the other programs, and an additional 21% said FRC was “a little better” than their other experiences. Among FTC participants, 32% reported their experience as “much better” and 21% as “a little better.” FTC participants were substantially more likely to see their experience as “about the same” as other programs than were FRC participants: 34% vs. 20%.
- **As the data in the preceding paragraphs suggests, FRC participants and team leaders tended to report higher levels of satisfaction with their experience than those involved in FTC, though the ratings from both programs were very high.** FRC team members were significantly more likely to rate their experience as “Excellent,” to report that their experience was “much better” than that of other, non-*FIRST* programs, or to plan to

return next year. Among team leaders, FRC team leaders were significantly more likely to plan to return; the satisfaction ratings were not significantly different between the two groups. While the differences are important to recognize, it is clear that both programs provided highly satisfying experiences for team leaders and their participants.

- **FTC and FRC Team Leaders see their programs as effective strategies for engaging young people in STEM.** When asked to rate their programs in terms of their effectiveness in engaging young people *for the first time* in science and technology, 65% of FTC team leaders and 72% of FRC team leaders rated their programs as “Very Effective;” 97% of the team leaders in both groups rated the programs as “Very” or “Somewhat” effective. Both groups also rated their programs highly in terms of their effectiveness in engaging young people who were *already* interested in science or technology, with 72% of FTC team leaders and 85% of FRC team leaders responding that they believed their program to be “Very Effective”. Here, as elsewhere, FRC team leaders were somewhat more likely to rate their programs in the highest category, but virtually all of the team leaders in both programs (98%) saw their programs as effective vehicles for engaging young people in STEM.
- **In response to a series of open-ended questions, team members and team leaders also provided additional perspectives on what they saw as the strengths and challenges of the FTC and FRC programs.** In general, both team members and team leaders pointed to the design and build process, the competition experience, the sense of community and teamwork experiences when asked what they liked or saw as strengths in the program. Logistical issues, game design, and problems within teams headlined team members’ list of what they liked the least; financial issues, inequalities in team resources, and the limited role of girls on teams were other issues of concern. For team leaders, the greatest challenge was cost, with access to mentors and support for Rookie teams and quality of parts (FTC) also identified as issues.

Relationship Between FTC and FRC

- **Team members and team leaders in both programs see a strong connection between FTC and FRC, with the general expectation that FTC helps to generate interest in FRC and that a high percentage of FTC participants will become involved in FRC at some point in the future.** Sixty-two percent (62%) of FTC team members reported that their involvement in FTC had made it “a little more likely” or “much more likely” that they would participate in FRC in the future. In the short run, 61% of FTC members reported that they wanted to continue in FTC next year, 8% wanted to switch to FRC, and 32% wanted to participate in both programs.

FRC participants who had been in FTC also report a connection between those experiences: 72% of the FRC team members with prior FTC experience reported that FTC had made it more likely that they would participate in FRC.

- **Team leaders also believe that involvement in FTC leads to FRC participation.** Sixty-two percent (62%) of FTC team leaders believed that it was “Somewhat” or “Very” likely that a majority of their members would become involved in FRC in the future. Approximately 26% thought it unlikely that their members would make the transition, and approximately 8% reported no opinion since there were no FRC teams in their area.
- **Team members and team leaders provided a range of answers to the question of what they would do if the FTC program was not available in their area.** Among FTC team

members, 56% indicated that, if FTC was not available, they would try to start an FRC team; 73% would join an existing FRC team (assuming one was nearby); and 63% would consider joining a non-*FIRST* robotics team. Thirty-one percent (31%) said they would likely not be involved in robotics. When FTC team leaders were asked what they would do, they provided a similar mix of answers: 34% reported that it was “Somewhat” or “Very” likely that they would start an FRC team; 50% would try to work with an existing team; and 56% would start a non-*FIRST* robotics team. Thirty percent (30%) would not be involved in robotics. It is worth noting that 44% of the FTC team leaders noted that they had considered becoming involved in FRC or starting an FRC team before getting involved in FTC and 36% had investigated other non-*FIRST* programs, suggesting that for a substantial number of FTC leaders, the decision to join FTC was a very deliberate one.

The data from the team member and team leader surveys suggest that, for team members and team leaders, there is a clear connection between FTC and FRC, with FTC seen by many as a stepping-stone towards the more complex and demanding FRC program. At the same time, for others, FTC represents its own important niche, providing an opportunity to engage in many aspects of the *FIRST* model without the costs and time commitments that FRC entails. Should the program not exist, according to the survey responses, some FTC participants and team leaders would become involved in FRC, but a substantial proportion would explore other robotics programs or end their involvement in robotics entirely. In that context, FTC and FRC can be seen as meeting several different sets of needs and broadening the opportunity to participate in the *FIRST* community.

Affordability and Growth

- **Team leaders in both programs are concerned about affordability, with FTC team leaders substantially more likely than those in FRC to see their program as affordable in communities like theirs.** When asked to rate their program in terms of its affordability, 78% of FTC leaders and 53% of FRC leaders see their programs as “Somewhat” or “Very” affordable, with FRC team leaders substantially more likely than FTC leaders to rate their program as “Not Very Affordable” (39% vs. 19%).
- **Teams in both programs also reported that a substantial portion of their team budgets depend on support received through *FIRST*, and that those grants were seen as important for their sustainability.** Between 40% and 50% of the teams in both programs reported that they currently receive some support for their teams from *FIRST* (through team grants), with FTC teams reporting that, on average, 44% of their team budget came from *FIRST*; FRC teams reported that 52% of their funding came from *FIRST*-related grants. Among the teams receiving grants, the grant support was seen as important for sustainability. Only 10% of the FTC team leaders and 16% of the FRC leaders thought it “Very Likely” that their teams could continue without the grants from *FIRST*; roughly half of the teams in both programs (52% in FTC, 50% in FRC) thought it was “Somewhat” or “Very Likely” that they could continue. Conversely, 49% of the teams in both programs reported that it was “Not Very Likely” or “Not Likely at all” that they could continue without financial support through *FIRST*. Interestingly, while FTC team leaders are much more likely to see their program as affordable, they are as or slightly more concerned than FRC team leaders about the sustainability of their teams. This may reflect the fact that a substantially higher percent of FTC team leaders are “rookies” and may feel less prepared for the fundraising involved in maintaining a team.

- **Team leaders in both programs agree that new teams and the growth of the programs would be aided by the availability of additional robotics curriculum, more training and assistance for team leaders and mentors, assistance in recruiting mentors and accessing equipment and workshops, and lower registration fees.** Among FTC team leaders, the top two priorities (rated as “Somewhat” or “Very Important”) were more workshops for team leaders and mentors and more robotics curriculum for classroom use. Among FRC teams, lower registration fees and assistance in recruiting mentors were the highest rated requests. At the same time, in the responses in the “Other” category, cost also remained a major concern. While a high percentage of team leaders in both programs (generally 75% or more) thought that additional curriculum and technical assistance resources would make it easier for new teams to become part of *FIRST*, lowering costs and helping teams find sponsors are also seen as critical steps to growth across both programs.

Team Member and Team Leader Feedback

- **As part of the survey process, team members and team leaders were asked for suggestions on how to improve the Kit of Parts, game design, tournaments/competitions, and (for team leaders) support provided by *FIRST*.** In each case, team members and team leaders provided a variety of suggestions, which included greater choice, flexibility and reliability of parts in the Kit of Parts; new and more creative game designs and, in some cases, simplified game designs to provide a more level playing field among teams; improved scoring and clearer rules, plus better organization (scheduling, logistics, etc.) at tournaments; and more instructions, manuals and workshops, plus help with fundraising and recruiting mentors as priorities for team support.

The data from the FTC and FRC surveys provide a wealth of information on the participants, program experience, and outcomes of the FTC and FRC programs, as well as data on the perceived relationship between the programs, questions of affordability and growth, and the perceived strengths and weaknesses of each program model. Taken as a whole, the data show both programs as providing a high quality, engaging program experience for high school-aged youth and effectively contributing to *FIRST*'s goals of increased interest in science and technology and engineering and building key life, workplace and academic skills among participating youth. Team members and team leaders in both programs report a high degree of satisfaction with their program experience, and a high percentage of both groups expect to continue in the programs next year. While the data highlight some of the differences between the FTC and FRC program experience (FTC tends to provide a smaller-scale, more hands-on experience; FRC brings a more intense and demanding experience, more contact with technical mentors, and perhaps a greater sense of engineering in the real world) and point to somewhat stronger outcomes for the FRC program, the primary finding is that both programs are generating a high level of engagement among participants and consistently positive results.