

***FIRST* Vex Challenge Evaluation Summary**

Center for Youth Development Heller School for Social Policy and Management Brandeis University

Background

In order to assess the implementation and effectiveness of the *FIRST* Vex Challenge, the Center for Youth Development at Brandeis University collected survey and focus group data from FVC team leaders and participants/team members at each of the six FVC pilot tournaments. The final dataset includes 103 team leader and 577 participant surveys from 113 teams (approximately 86% of those participating), as well as information from focus group discussions with an average of 6-8 teams at each tournament.

In order to assess issues related to recruitment and potential barriers to participation, the Brandeis evaluation team also conducted interviews with the lead organizer at the six FVC pilot tournaments and collected surveys from 43 of the approximately 130 individuals who had indicated an interest in FVC (through the *FIRST* website), but who had decided to not participate in this year's pilot tournaments.

Key findings from the evaluation include the following:

Team and Participant Characteristics

- Most teams (83%) were school based (classroom and after-school). The large majority of team leaders identified themselves as either teachers (66%) or parents of team members (19%). Fifty-four percent of team leaders reported prior employment in science, technology or computer-related fields.
- Sixty-seven percent of participants reported that this was the first robotics program they had ever been involved in; 16% were on an FRC team; 10% had been in FLL; 8% were in FVC in 2005. Forty-one percent of team leaders reported no other current or prior involvement in *FIRST* programs (FRC, FLL or the 2005 FVC pilot).
- The majority of participants were male (75%) and in 9th-11th grades (79%). Sixty-four percent of participants were White; 12% were Asian-American; 17% were African-American; and 6% were Hispanic.
- According to team leader surveys, approximately one third of the teams had a majority of team members from low income families. Forty-eight percent of teams were suburban areas; whereas 33% were from rural, and 20% were from urban locations.

Decision to Participate in FVC

- Team leaders heard about FVC from a variety of sources: the *FIRST* website (28%); emails from *FIRST* (21%); Regional Directors or FLL partners (16%); and from seeing the event in Atlanta (18%). Team leaders also reported learning about the program from event coordinators, local school administrators, and area FRC teams/team leaders. Relatively few (10% or less each) reported hearing about FVC through a Radio Shack advertisement, Radio Shack website, or FVC brochure in the Starter Kit.

- Participants primarily learned about FVC from the team leader (54%), a teacher in their school (30%), or a student involved in *FIRST* (16%). Fewer than 4% reported learning about FVC from a Radio Shack poster, website, or brochure.
- Team leaders most commonly became involved as a way to get young people involved in science and technology (74%); while participants also tended to join (42%) because of a prior interest in science and technology. The next largest proportion of team members (11%) joined because they thought “it might be fun.”

Team Leader Assessments of the FVC Experience

- Most team leaders assessed the FVC experience positively. Virtually all team leaders agreed that their team members enjoyed building the robot (100%) and competing in the tournaments (98%) and that young people took the lead in designing and building the robot (94%). Most (80% or more) felt that the guides and materials were helpful, the tournaments were well organized, and that when they had questions, staff at *FIRST* were helpful in getting the answers.
- Fewer team leaders (though still a majority) were satisfied with the Kits and the time available to work on the robots. Sixty-two percent of team leaders agreed that the Starter Kit had enough parts to build a competitive robot and 60% agreed that team members had enough time during the tournament to make improvements to their robots. Only 51% reported that they had enough time prior to the tournament to test more than one robot design. When asked how the Kits could be improved, team leaders commonly requested more parts in the Starter Kit (in particular, more metal parts) and better quality (gears, chains, clutch, etc.).
- Team leaders also reported a positive impact on participants. Ninety percent or more reported that the program had increased participants understanding of basic science principles; how technology could be used to solve real world problems; and team members’ understanding of the engineering design process. Over 90% also reported gains in participants’ teamwork and problem-solving skills, and 90% reported an increased interest among team members in science and technology careers. Ninety-nine percent of team leaders rated FVC as “Somewhat” or “Very” effective in meeting *FIRST*’s goals of promoting interest in science and technology, with almost two-thirds (65%) of those rating it as “Very” effective.
- Overall, 92% of the team leaders reported being “Satisfied” or “Very Satisfied” with their FVC experience; 88% said they wanted to lead a team next year.
- In general, there were no significant differences in the assessments between team leaders with no prior experience in *FIRST* (“rookies”) and those who had current or prior experience with *FIRST* programs (“veterans”).

Participant Assessments of the FVC Experience

- Team members also assessed their experience positively. Ninety-six percent agreed that they “really enjoyed” competing at the FVC tournament. Ninety-five percent noted that the kids on the team took the lead in designing their robot and 89% reported getting all the help they needed from their team mentor. Most participants agreed that the Starter Kit had lots of interesting parts to work with (86%) and that the Inventors Guide was a good guide to building the robot (79%). However, only 33% of the team members felt that there were enough parts in a single Starter Kit to build a competitive robot.

- Team members also reported liking the major FVC activities. Over 90% of team members reported that they liked being on a team, building the robot, their team mentor, and competing at the tournament “a little” or “a lot.” Over 70% reported liking each of those activities “a lot.” Eighty-eight percent enjoyed working with other teams, and 80% liked talking with judges at the tournament. The lowest rated activity was the Engineering Journal, with only 41% of participants liking it “a little” or “a lot”.
- Most participants reported a positive impact on their knowledge of and interest in science and technology. Ninety percent or more reported increased understanding of the value of working on a team, how science and technology can solve problems, and the engineering design process. Ninety-three percent reported wanting to learn more about science and technology. Eighty percent or more reported increased interest in science and technology careers and doing well in school, as well as an increased understanding of basic science and the role of “gracious professionalism.”
- Most participants reported a positive impact on their skills, with over 90% reporting that they learned “a little” or “a lot” about working in a team, using trial and error, working with team members to solve a problem, and managing their time. Seventy-six percent reported gaining presentation skills, while more than 80% reported learning how to use math to solve real-world problems, and being able to explain the scientific ideas used in building their robot.
- Overall, 89% of participants rated their experience as “good” or “excellent;” 73% reported that it was “more fun and interesting” than their other after-school activities; and 74% reported wanting to participate again next year. Of those who do not expect to return, just over half reported that they would be too old and/or graduating from high school. Ninety-one percent would recommend the program to their friends, although only 70% thought their friends would be interested.
- **Eighty-eight percent of participants indicated an interest in getting involved in even more challenging robotics programs as a result of being in FVC,** and of those familiar with the *FIRST* Robotics Competition (FRC), 78% report that involvement in FVC has made it “a little more likely” or “much more likely” they will participate in FRC.
- **In general, the ratings/responses from newcomers to robotics programs (those participants who had not been in any robotics program before FVC) and more experienced student were similar.** Newcomers were slightly more likely to agree that the kit had interesting parts and that the engineering journal was an important part of the Challenge. Newcomers were also slightly more likely to want to do FVC again, while veterans were more likely to want to do “a more challenging” robotics program. Most responses, however, including overall satisfaction ratings and assessments of program impact, were similar for the two groups.

Team Leader Assessments of Cost and Affordability

- The large majority of team leaders (84%) rated FVC as “affordable” or “very affordable.” Seventeen percent indicated that it was “not very affordable” and none reported that it was “not affordable at all.” Veteran coaches (those with prior *FIRST* experience) were more likely to rate the kits as “very affordable” (33% vs. 11%), while “rookie” coaches tended to rate the kits as “somewhat affordable” (70% vs. 52%). Nineteen percent of rookies and 15% of veterans thought the kit was “not very affordable.”
- Most teams made at least some additional purchases as part of their participation, with more than 60% reporting purchases of the “Easy C” programming software, extra batteries, and

extra motors or servos. Fifty-three percent bought one or more extra kits. Forty-two percent of team leaders reported wanting to buy additional parts, but not being able to afford to do so. Newcomers were significantly more likely to report that problem than veterans (55% vs. 33%).

- The average reported cost of participation was \$1835. Median cost was \$1200.¹
- When asked what aspects of FVC helped make it affordable and accessible, team leaders cited the overall cost of participation (Kit, registration, etc.) and the initial cost of the Kit as “very important” (62% and 57% of team leaders, respectively).
- While most team leaders rated FVC as affordable, when asked about barriers to participation, the most common response was “cost,” representing 45% of the responses. (The second most common response (16%) was time and scheduling issues.)

FVC and the FIRST Robotics Competition

- The large majority of team leaders see FVC as a useful addition to the mix of *FIRST* programs. Of the coaches who have been involved in other *FIRST* programs (FRC or FLL):
 - 96% would recommend that other *FIRST* teams become involved in FVC;
 - 65% recommend FVC as an introduction to FRC;
 - 59% see FVC as a bridge program from FLL to FRC; and
 - 52% recommend teams do both FVC and FRC.
 - Only 15% would recommend doing FVC instead of FRC.
- Most veteran team leaders also believe other schools or organizations will be interested in FVC. Sixty-one percent think most will be interested in it as an introduction to FRC; 54% as a bridge program, and 48% as an addition to FRC. Thirty-five percent believe other schools/organizations will be interested instead of FRC.
- Most team members also see FVC as a complement to the *FIRST* Robotics Competition. Of those team members familiar with FRC:
 - 59% reported that they would like to do both FVC and FRC in the future; 26% reported they would chose FRC only; and 15% reported wanting to do FVC only. Only 2 of the 328 respondents to this question (0.6%) said they did not want to do either program.
 - When asked what choice they thought their friends would make, 35% of team members responded that their friends would want to do both programs (FVC and FRC); 19% said their friends would be interested in FRC only; and 32% would want to do FVC only.

Focus Group Comments/Finding

Focus group participants were asked what elements of the FVC experience they had liked and disliked; about their interest in a league approach with multiple tournaments; whether they expected to participate in FRC as well as FVC, and how they would characterize their FVC experience to others. Evaluation staff also talked individually with team leaders informally throughout each of the tournament days.

¹ The average and median cost figures excludes the response from the Singapore team, which included their costs for international travel.

In general, the focus group responses were positive, with enthusiastic responses to the overall FVC experience, balanced by moderate complaints about parts in the Kits and tournament logistics. The large majority of participants expect/want to participate in FRC in the future.

- **Likes.** Participants voiced a strong, positive response to the FVC experience. They liked the opportunity for more or earlier hands-on experiences than possible on many FRC teams (where older, more experienced youth often do the major work); the ability to quickly redesign and revise the robot; and the experience of working on a team. Both coaches and team members emphasized that the Kit made it easy to teach new concepts and test out ideas.
- **Dislikes.** Most of the complaints concerned Kit parts and the tight tournament schedules. As with the earlier Robovation Kits, team members and team leaders complained that gears and chains broke easily; motors burned out, and clutches were easily stripped. They asked for more sturdy parts. Team members also noted that the tightly scheduled tournament rounds left little time to make adjustments or repairs. At some tournaments, there were complaints that team members could not get close enough to the field to watch their teams. Many teams also struggled with the autonomous mode (in part because of the late delivery of the software) and did not like having a separate autonomous match because of its impact on their scoring.
- **League Approach.** In general, team members liked the idea of participating in multiple tournaments, though there were concerns about the time involved and the timing. Team members wanted to make sure that there was sufficient time between league matches; that missing one event or losing at one event would not disqualify a team from future events; and that the league timetable did not preclude participation in FRC. Team members were more divided over the question of whether the Challenge should change over the course of a season: some liked the idea of having to make adjustments; others felt it would become too time-consuming and expensive.
- **FVC and FRC.** Almost all of those in the focus groups wanted or expected to participate in FRC. Many of the teams in the pilot tournaments were associated with FRC teams, and participants and team leaders saw FVC as the “junior varsity,” allowing younger or new team members to gain skills and experience on the way to FRC. Most team members bought into that idea as well, seeing FVC as a way to gain hands-on experience, but also wanting to work with the larger, more challenging competition at some point.
- **Characterizing FVC.** Again, participants characterized their experience positively, emphasizing many of the key *FIRST* values: the benefit of the team experience; making something on their own that worked; learning problem-solving; and having fun working together. As one team member put it, the experience was “A great way and a fun way to learn.”

Recruitment and Affordability: Tournament Organizer Interviews and “No Show” Surveys

One of the questions that arose during the course of the pilot season was that of why fewer teams than expected participated in the pilot tournaments and whether there were major, unanticipated barriers to participation. In order to address those questions, the evaluation team conducted interviews with the organizers of the six pilot tournaments to learn more about the tournament outreach and recruitment process and conducted a web and telephone survey of individuals who had indicated an interest in FVC (on the *FIRST* website), but who decided to not register to participate (i.e., “no shows”). Forty-three of the 130 “no shows” (33%) completed a telephone or web survey.

Key findings from the organizer interviews are as follows:

- In most cases, outreach and recruitment efforts for the six pilot tournaments were limited. While two of the tournaments conducted relatively extensive outreach (mailings/emails to school districts, calls to schools, announcements at conferences, etc.), the other four undertook more limited or targeted efforts.
- The major constraints on outreach and recruitment, from the tournament organizers’ perspectives, were those of time and timing. Five of the six noted that outreach efforts were limited by the fact that tournament guidelines were not available until the fall – recruitment efforts in several cases did not begin until September and October. The late start limited outreach efforts and made it difficult for teams to get organized for the events. One site also noted that the overlap with the FRC build period limited involvement of some FRC-related teams.
- Cost was seen as an issue by tournament organizers, but not prohibitive. While the cost of kits was seen as a reasonable investment (i.e., a tangible asset), most of the tournament directors noted complaints about the registration fees. Four of the six tournaments subsidized all or some registration fees; several noted that a single, combined registration would provide fewer opportunities for teams to register and then drop out.
- In general, tournament organizers were enthusiastic about the response to FVC and felt that, with adequate lead time for recruitment, FVC had substantial potential for growth. All expected to run FVC next year if available; three of the five plan to establish local “scrimmages” or competitions. As one organizer put it: “the horse is out of the barn. We expect to move ahead with Vex one way or another.”

Survey responses from the “No Show” teams also indicate a positive response to FVC, even among those that decided not to participate in the pilot.

- Most “no show” teams had some current or prior involvement in other *FIRST* programs: 61% were involved with FRC and 42% with FLL. Only eight teams (18.6%) had no prior or current *FIRST* involvement other than the pilot tournaments.
- The “no show” respondents represented a mix of communities: 42% were urban, 33% suburban, and 26% rural. Slightly more than half (51%) characterized their communities as “low income.”
- The primary reasons cited by “no show” teams for not participating were related to time: 40% of the teams reported that they had found out about FVC too late to organize a team, raise the necessary funding, or get their robot built for the tournament. Another 15%

reported they did not have time to manage the team (or to manage both FVC and FLL or FRC teams). Only 9% of the teams reported that the program “cost too much.” Another 9% indicated that transportation issues were a barrier.

- The large majority of “no show” teams (86%) indicated that they believed FVC was affordable (26% “very affordable” and 60% “affordable”).
- When asked to rate specific elements of FVC in terms of their affordability, the major concern was with travel costs. 86% rated the initial cost of the Kit as “affordable” (i.e., “affordable” or “very affordable”); 79% rated the costs of additional parts as affordable; 74% and 59% rated the fee to *FIRST* and the tournament fees as affordable, respectively. However, only 38% rated the travel costs to tournaments as affordable. In the open-ended comments on the survey, 40% of the respondents indicated that the lack of a local tournament (and the cost of traveling to the pilot sites) was a major reason for not participating.
- The majority of “no shows” (79%) reported that they were at least moderately likely to participate in FVC next year if available (i.e., 3 or higher on a scale from 1 (not likely to participate) to 5 (definitely will participate)). Thirty-three percent reported that they would “definitely” participate.
- Ninety-five percent of the “no shows” reported that they would recommend FVC to friends or colleagues.
- The most common recommendations from respondents for increasing participation were for (a) more local tournaments (31% of respondents); (b) more information earlier (23%), and (c) lower costs and/or help with funding (18% of respondents). Respondents also suggested better publicity and easier access to information on the program to improve participation.

Tournament Design

Tournament organizers were also asked about their reactions to a “league” model for FVC (with multiple local competitions over a “season”) and the pros and cons of combining FVC tournaments with FLL or FRC.

- In general, the tournament directors responded positively to a local, “league” model, with several noting that they were already running or planning local “scrimmages” as a way of expanding involvement. The major concern was that league events be designed as low cost, easy-to-manage (“tournament in a box”) events that schools and other organizations could organize and run without major time and financial commitments from the local *FIRST* committees.
- Tournament directors varied in their perspectives on the pros and cons of combining FVC with other *FIRST* events. In general, the FLL tournament directors saw significant value in combined events, so that FLL participants could see “the next step up.” FRC directors generally opposed combining FVC and FRC, arguing that the combined events raised costs for FVC unnecessarily. They suggested that the goal of introducing FVC to other *FIRST* participants could be accomplished by demonstrations at FRC and FLL tournaments. The directors of the FVC “standalone” tournaments (who were both first-time organizers) liked the standalone model, arguing that it was easier to manage and less “confusing” than trying to manage a combined tournament. In short, there was no clear consensus on a “best” model for tournament design.