Evaluation of
FIRST LEGO® LEAGUE
UNDERSERVED INITIATIVE

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Chapter One
Introduction

The FIRST LEGO® League (FLL) is an international robotics program in which teams of middle-school-aged youth (ages 9 through 14) assemble and compete robots they build using the LEGO® Mindstorms™ Robotics Invention System™ technology to accomplish a defined set of tasks in a "real world" scenario. With the help of a coach (a local teacher, parent or other adult), young people are organized into teams of up to 10 participants who work through the fall to build robots that can perform a specified set of tasks related to a real world issue in the annual Challenge. Teams may also conduct a research project related to the tasks in that year's competition. The Challenge culminates in local, state and regional tournaments in which teams present their research projects and compete their robots for a variety of awards. Begun in 1996, the FIRST LEGO League has grown to over 4000 teams in the United States and Canada in 2004-2005, with additional teams internationally.

The overall goal of the FLL program is to inspire interest in and increase understanding of science and technology among young people through hands-on, project-based experiences. Through the FLL season, team members have an opportunity to learn how to design, build, program and operate their robots to meet a set of defined challenges. Through the research project, they have opportunities to research a Challenge-related issue and to present their research as part of the tournament process. The FLL values of teamwork, creative problem-solving and gracious professionalism are emphasized throughout the season with the goal of reinforcing participants' social skills as well as their interest in science and technology. The topic of the Challenge changes each year, but the missions are designed to encourage real-world applications of science and technology. Finally, while the primary goals are increased interest and understanding of science and technology, the intent of the program is to accomplish those goals by creating a fun and engaging experience in which children have the opportunity to learn and grow in an atmosphere of friends, teamwork and friendly competition.

In 2004-2005, the FIRST FLL program undertook several initiatives aimed at increasing the involvement of young people from urban and low income ("underserved") schools and communities in FLL. Collectively known as the "FLL Underserved Initiative," these special programs efforts included: (a) direct grants (to cover registration fees and other costs) to approximately 45 teams in underserved communities, recruited by state and regional FLL operating partners; (b) a national partnership with Boys and Girls Club of America (BGCA) to sponsor and support 45 FLL teams; and (c) a pilot effort with the Houston (Texas) YMCA to sponsor up to 10 teams. In each case, the goal of the effort was to explore new ways of expanding the FLL program to better serve "underserved" youth.[1]

[1] At the time of the Initiative, the term "underserved" was undefined, though generally understood to mean schools serving predominantly low income and minority youth. Since that time, FIRST has been moving towards a more formal definition of the target audience for its "underserved" initiatives, with an emphasis on organizations serving predominantly low income youth (50% or more of an organization's youth eligible for the federal free or reduced cost lunch program).

Evaluation Background

The FLL Underserved Initiative evaluation was designed to assess the implementation and effectiveness of the Underserved Initiative and to begin to identify best practices and "lessons learned" that FIRST could use in strengthening its efforts to expand into more urban and low income communities. In late 2004, FLL contracted with the Center for Youth and Communities at Brandeis University's Heller School of Social Policy and Management to conduct the evaluation, building on the Center's assessment of the FLL program conducted during the 2003-2004 competition and using many of the same basic survey protocols and data collection processes so that, where possible, comparisons could be made between the results of the regular FLL (2003) and the FLL Underserved (2004) studies.[2] Several basic questions guided the 2004 FLL Underserved Initiative Study.

1. **To what extent was the FLL program able to successfully expand participation of urban and low income youth through the various grant programs and its work with community-based intermediaries such as the Boys and Girls Clubs of America and the YMCA?** Was FLL able to successfully recruit new teams and involve more low income and minority youth as a result of this year's efforts? How were those teams organized and operated, and to what extent did they differ in their operations and/or activities from the broader population of FLL teams, based on comparisons to the teams in the 2003 study?

2. **What was the impact of the FIRST LEGO® League program on participating young people in the various programs in the Underserved Initiative?** To what degree was FLL successful in introducing young people in those programs to science and technology concepts; motivating participants; helping to build key life, workplace and academic skills (such as teamwork, project planning, conflict or time management); or helping to shape young people's attitudes towards their communities and/or their sense of their own capacity to help address community problems? To what extent is the FLL experience consistent with those of a high quality youth development experience, as outlined in the research literature on effective youth development programs? How did the participant impacts for the 2004 FLL Underserved Initiative compare to those for the broader population of FLL programs, based on the data from the 2003 FLL study?

3. **To what extent was FLL able to successfully engage adults in support of the FLL teams in underserved communities?** To what extent was FLL successful in engaging and satisfying team leaders in the communities involved in the Underserved Initiative? Did participation in the program have an impact on team leaders in terms of their own interest in or knowledge of science and technology or on the way in which they work with young people? Were parents of team members actively involved with the FLL teams, and how did their level of involvement compare with that for the general population of FLL teams, based on the data from the 2003 study?

[2] Throughout this paper, the initial study of the FLL program that took place during the 2003-2004 competition season will be referred to as the "2003 FLL study" or the "2003 study." The FLL Underserved Initiative study conducted during the 2004-2005 competition season will be referred to as the "2004 FLL Underserved Study" or the "2004 study."

4. **What kinds of barriers and challenges did FLL teams in the Underserved Initiative experience, and what "lessons learned" or "best practices" did participating teams identify?** What specific kinds of barriers (time, access to resources, space or transportation issues, social or cultural issues) did teams in the Underserved Initiative and other FLL teams serving underserved communities experience in establishing their teams, recruiting participants, and participating in the tournament process? What unique issues or challenges do these teams face in sustaining an FLL team over time? Are there strategies that teams used this year or in the past to successfully address those challenges? Are there "lessons learned" that can be used to modify the program or to provide targeted assistance to increase participation in FLL in underserved schools and communities?

Methodology and Data Collection Issues

To address these questions, the evaluation design called for the collection of two major types of data: (1) surveys of team members, coaches and parents in teams funded through the FLL Underserved Initiative, as well as a sample of teams in underserved communities that did not receive funding, and (2) telephone interviews with team leaders from a sample of teams in the study. The goal was to collect data from all of the teams in the FLL Underserved Initiative in order to have a sufficiently large sample to look at differences between the various Initiative efforts (BGCA, YMCA,direct grants), and to have a sufficiently large sample of non-Initiative teams to provide a point of comparison.

Survey Administration. Packages of surveys that included a coach survey, 10 participant surveys, and 10 parent surveys per team were distributed to four major groups of teams beginning in December, 2004. The major groups consisted of:

- 45 teams that received direct grants from FIRST. Sites were selected by the FLL Partners (the state or regional organizations that organize and run the major tournaments) in response to a request for nominations from FIRST, and received grants of $500 to cover the costs of registration and the LEGO® Mindstorms Kit. FLL direct grant teams were located in four states: Illinois, Massachusetts, New York, and Virginia.

- 45 teams at Boys and Girls Clubs that were organized under a partnership between FIRST and the Boys and Girls Clubs of America. Thirty-one of those teams received grants to support their involvement in FLL; while 14 participated without special grant support from FIRST. Under that initiative, BGCA was responsible for identifying and recruiting teams for the Initiative and for providing support to those teams throughout the competition season.

- 10 teams located at YMCAs in the Houston, Texas region. The YMCA of Greater Houston was responsible for recruiting and supporting the teams that received grants under this initiative.

- 27 teams that were identified as serving underserved communities, but that were not participating in the FLL Underserved Initiative or receiving any form of grant support

through FIRST.[3] These teams were primarily located in northern and central California and New York City.

The surveys were modified versions of the surveys used in the 2003 FLL study, in order to make it possible to compare results from the teams in the 2004 Underserved Initiative with the broader sample of teams involved in the 2003 FLL study. The surveys solicit post-program assessments from team coaches, participating youth, and the parents of team members, providing multiple perspectives on the operation of the team and the perceived impacts on program participants. The major changes in the 2004 surveys were the elimination of some questions in an effort to shorten the surveys, and the addition of questions (on the coach survey in particular) that ask about barriers and challenges encountered in the process of recruiting and operating an FLL team in an underserved community. As in the previous study, the surveys were developed in consultation with FLL and FIRST staff at the national office.

Once teams were identified by FIRST, survey packets were sent directly to each team with delivery timed to coincide with their participation in a state or regional tournament. In some cases, additional packets were also sent to selected tournaments (for example, a special BGCA-sponsored event in Orlando, FL) in an effort to encourage participation in the study. As was the case for the 2003 FLL study, coaches were asked to have their team members complete their surveys and to have one parent per team member complete a survey as well. Coaches were sent reminder emails and postcards and received telephone reminder calls during the survey period. FIRST FLL staff and the intermediary organizations (BGCA and the YMCA) were also asked to contact teams to encourage participation in the study and to remind teams that participation in the evaluation was a condition of their grant.

Response Rate. Despite these efforts, the overall response rate for the surveys was a disappointing 26%. Altogether, 33 teams provided surveys. When teams that indicated that they had never formed or otherwise provided a reason for not participating are excluded, the response rate rises to 30% -- still substantially below the 47% response rate found on the 2003 FLL study. The response rate by major programs is shown in Table 1, below.

Table 1-1: Response Rate from FLL Teams

Initiative	Number of Teams in Sample	Number of Teams Responding	Response Rate
Direct FLL (Motorola) Grants	45	14	31.1%
Boys and Girls Club Teams	45	12	26.7%
Houston YMCA	10	2	20.0%
Non-Funded FLL teams (NY &CA)	27	5	18.5%
Total Teams in Study	127	33	26.0%

There are a number of possible reasons for the low response rate. Many of the funded teams were presumably rookie (i.e., first-time) FLL teams and may have been overwhelmed by the other tasks associated with participating in the FLL competition. As one team leader told us, she

[3] It is important to note that, while not receiving grant support from FIRST, most of these teams did receive grants from other sources, as is the case for many FLL teams. The key difference is that they represented examples of teams operating in underserved communities without special support from FIRST.

was "very busy, and this was not her top priority."[4] Because the survey packages were sent directly to team leaders (rather than handed out at the FLL tournaments as had been the case in the 2003 study), there was also less opportunity for FIRST staff and FLL partners to reinforce the importance of completing and returning the surveys. In some cases, new teams were organized, but did not participate in the FLL tournaments and may have felt that they did not have anything to report; in others, a single coach worked with several teams, but may have only submitted data from one (or none). It is also clear that some of the teams that had signed up for the Initiative never actually formed a working team.

The evaluation team made an effort to gather additional information on the non-responding teams through follow-up telephone calls and review of the records on tournament participation. However, the information available on non-responders was limited. Records from the tournaments show, for example, that of the 24 teams that promised to return surveys but did not, 5 participated in tournaments, 6 did not, and there is no information on the 13 others. Similarly, of the 51 teams that failed to respond at all to the evaluation team (did not respond to messages, emails, etc.), records show that 11 participated in a local or regional tournament, 9 did not participate in any tournament, and there is no information available on 28 others. While this would suggest that there is no strong bias among responders and non-responders in terms of tournament participation, the fact that information is missing on so many teams makes it difficult to draw any firm conclusions about the representative nature of the sample.

The primary implication of the low response rate is the need to treat the findings from the 2004 surveys with a substantial degree of caution. While they provide data from a number of coaches, team members, and parents, it is important to recognize that they represent the views of only 25%-30% of the teams participating in the Initiative, and there is no simple way to know whether the views of the non-responding teams would be significantly different. At the very least, FIRST needs to consider that the surveys represent the experiences of the more organized teams in this year's Challenge, and may understate the barriers and challenges experienced by teams that did not respond for one reason or another. While the data can be seen as providing an initial assessment of the experience of teams involved in this year's FLL Underserved Initiative and can provide useful information for planning and program design, the findings on program effectiveness should be confirmed through other sources or additional research.

A second limitation on the study is that the small sample size limits our capacity to conduct the kinds of subgroup analyses that were one of the original goals of the study (for example, looking at differences in results between teams in different types of institutions, or between funded and non-funded teams). While the report does include some comparisons of results between "rookie" and "veteran" teams, as well as comparisons between the 2004 teams and those in the 2003 FLL study, the number of teams from each of the four types of teams in the Underserved Initiative (direct grants, BGCA, YMCA, and non-grant funded) are too small to permit useful comparisons between these groups.

The FLL surveys were supplemented by telephone interviews with a small sample of FLL coaches. Again, response was an issue, in part because the interviews were conducted at the end

[4] Twenty-four teams had promised to complete the survey packages when contacted by Brandeis, but did not follow-through, despite repeated reminder calls.

of the school year. However, 16 coaches were interviewed (from an initial contact list of 30+ coaches). This included a mix of coaches from teams that did and did not have grants, as well as teams that did not respond to the survey process. Interviews were also conducted with FIRST staff, staff at the BGCA, and FLL partners. The goal of the interview in each case was to learn more about the impact of the grant programs on the teams, the barriers and challenges faced, ways in which FIRST could improve its support for teams in underserved communities, and issues involved in the sustainability of the teams. The interviews provided an additional set of perspectives as well as the opportunity to gather more detailed feedback and suggestions on ways of strengthening the FLL program in underserved communities.

Key Findings

While recognizing the limitations of the data, the findings from the surveys and interviews generally indicate that the FLL Underserved Initiative was successful in expanding access to the FLL program to a more diverse group of young people in low income and minority communities; that the teams were able to provide participating youth with a high quality experience; and that the programs in the FLL Underserved Initiative were able to produce participant impacts that were comparable to those of the broader population of FLL teams, based on the data from the 2003 FLL study.

At the same time, it is important to recognize that the teams in the Underserved Initiative in 2004 did differ from the average 2003 FLL team in some important ways. In general, the the 2004 teams were less likely to participate in tournaments, less likely to have coaches with technical expertise, and less likely to have a high degree of parental involvement and support. These differences were also reflected in the outcomes, where, for example, teams in the 2004 Initiative were likely to score lower in areas related to tournament participation (for example, presentation skills) than their 2003 counterparts. To some degree, these kinds of differences may reflect the late start-up experienced by many of the teams in the Underserved Initiative. However, they also point to areas where new Underserved teams are likely to need additional support and assistance from FIRST. (It is important to note, however, that most of the differences in outcomes were not likely to be due to the high proportion of rookie teams in 2004. While there were more rookie teams in 2004, comparisons of 2004 rookie teams with 2003 rookie teams showed a similar pattern of similarities and differences.)

The results can also be placed into the larger context of effective youth development programs. For example, respondents were asked to assess aspects of FLL that are typically viewed as necessary components of programs designed to promote positive youth development, such as supportive relationships and opportunities for skill building[5]. The results show that the FLL experience in both the 2004 Underserved Initiative sites, and the broader group of 2003 FLL teams, provide the large majority of participants with the kinds of experiences that are recommended by the research on positive youth development. In that regard, the assessments of the FLL participants in both 2004 and 2003 not only reflect a positive overall assessment of the program, but help to show the relationship between FLL and a broader body of research on effective programs for young people.

[5] See Jacquelynne Eccles and Jennifer Appleton Gootman, Editors, *Community Programs to Promote Youth Development* (National Research Council and Institute of Medicine, 2002).

Though the outcomes were generally positive, the 2004 pilot also served to highlight some of the barriers faced by teams in the Underserved Initiative and several areas in which program improvements that could be made. As staff at FIRST have acknowledged, implementation of the Underserved Initiative's grant program needs to be strengthened, with clearer definitions of eligibility, and stronger expectations for and tracking of organizations and teams receiving grants. Similarly, agreements with intermediary organizations need to be spelled out and better strategies for follow-up with those groups should be implemented.

At the program level, key challenges included those of recruiting coaches and mentors with technical expertise; gaining parent involvement; maintaining the attention and engagement of team members; and accessing advice and technical assistance. Coaches and parents had a variety of comments and suggestions regarding these and other challenges, which point towards several practical steps that FIRST can take to better support teams in underserved communities. Two major recommendations in particular stand out: increased technical assistance and support materials from FIRST, particularly for first-time teams (video-based resources and better mechanisms for linking rookie and experienced teams were a strong priority); and better efforts to promote and raise awareness of FLL, both for recruiting purposes and as a strategy for building parent support and involvement.

Finally, what came through in interviews with FLL coaches and in the survey responses was the understanding that the challenges involved in creating and sustaining FLL teams in underserved communities were real and often difficult to overcome, but not insurmountable. The large majority of FLL coaches responding to surveys planned to return to FLL next year, and most had practical ideas and suggestions on how to make the process easier on the coaches that followed. Similarly, while most coaches agreed that the availability of grants made a difference in bringing new teams into FLL, they also reported that most teams expected to be able to generate their own support and sustain their involvement over time. In that regard – that it helped to establish new teams serving new populations, with a high degree of commitment from coaches to continue, the FLL Underserved Initiative was successful in meeting its fundamental goals.

Chapter Two
FLL Underserved Teams and Participants

The primary goal of the FLL Underserved Initiative was to begin to expand the involvement of youth in low income and minority communities in FLL by providing a degree of initial grant support to teams serving those populations. Grants were provided as an aid to teams in dealing with initial start-up costs and as an incentive for participation. As outlined in the introduction, the major elements of the Initiative included three loosely-related grant programs, providing a mix of direct grants from FIRST and grants through two networks of community-based organizations: Boys and Girls Clubs of America and the YMCA of Greater Houston. While the recruitment and selection process and grant strategies differed among the three sets of programs, all were designed to promote the creation of new FLL teams serving youth in "underserved" communities and, ultimately, to bring more low income and minority youth into the FLL process.

Based on the data from the teams that responded to the survey, the FLL Underserved Initiative was successful in creating new teams and expanding the involvement of low income and minority youth. Overall, nearly 70% of the teams in the sample were new to FLL and, when compared to the demographics of the prior year's FLL participants, young people in the teams in the Initiative were substantially more likely to be first-time participants and from low income and minority backgrounds. While the Initiative was successful in creating news teams, the teams did differ in some important ways from the FLL teams found in the 2003 study. Teams in the 2004 Underserved Initiative were less likely to have access to technical expertise, less likely to have participated in a tournament, and substantially less likely to report involvement in the team by other family members. In some cases, these differences may reflect the start-up problems experienced by this year's teams (late registration, shipping delays, etc.). However, they also highlight some of the differences in settings and context that are likely to be evident as FIRST expands into underserved communities, and as such, represent challenges to be considered and addressed by FIRST.

Finally, **while the team organization and activities differed, the FLL experience, as reported by program participants, continued to provide the major elements of an effective community youth development program**. While there are some important differences when compared with 2003 (most notably, associated with lower levels of tournament participation), FLL participants were able to report a high level of involvement in FLL activities and a positive response to their overall FLL experience.

Background

The FLL Underserved Initiative encompassed several separate initiatives by FIRST that were aimed at increasing the involvement of low income and minority youth. As noted above, each had its own process for identifying and recruiting teams, allocating grant funds, and providing support. What linked them together was the goal of increasing access to underserved youth.

The three major efforts included the following:

- **Direct Grants from FIRST**. Approximately 45 teams in the FLL Underserved Initiative were recruited and funded through a grant program operated directly by FIRST. In late summer 2005, FIRST notified its FLL operating partners that it had approximately $20,000 available as a grant from Motorola, to be used to form new teams from underserved communities. The guidelines for the grants were relatively open, with a clear emphasis on the establishment of new teams serving low income and minority communities, but without strict definition of those terms. FLL Partners were asked to identify and recruit potential teams and provide that information to FIRST. Teams funded under the process would receive grants of approximately $500 to cover registration fees and purchase of the LEGO® Mindstorm Kit.[6] Four of the regional Partners successfully recruited teams, with a total of 45 teams funded under the program. Once funded, teams largely operated as other FLL participants with no special supports provided by FIRST.

- **BGCA Grants**. Using funds from a U.S. Department of Commerce NIST grant, FIRST began working with the BGCA to pilot test the operation of FLL teams in Boys and Girls Clubs, all of whom target low income youth as part of their basic mission. Working with FIRST, BGCA staff identified 45 teams that had prior interest and experience working on technology projects, including 4-5 teams that had participated in FLL prior to 2005. Teams received a grant to cover the FLL registration fee ($150), but were expected to purchase their own LEGO Mindstorms and Challenge Kits, and pay their own tournament registration fees. BGCA's technology staff did provide a number of additional supports to their teams, including several rounds of "how to" conference calls that provided advice from one of the more experienced BGCA/FLL teams. BGCA and FIRST organized an eight team demonstration tournament in conjunction with the BGCA technology conference in Orlando, FL, and BGCA organized a pilot "virtual tournament" that linked competing teams by telephone, internet, and video.

- **YMCA Grants**. The YMCA of Greater Houston also received funds from FIRST to provide grants for up to 10 YMCA-based teams. Five YMCAs in the Houston network each received grants for two teams, including funding for the initial registration, purchase of the Mindstorms and Challenge Kits, as well as the purchase of additional parts and sensors from the competition catalog. Staff at the Houston YMCA were responsible for coordinating the teams and providing any extra support that they might need.

A fourth group of non-grant-funded sites were also included in the study as part of the effort to be able to establish a comparative analysis among several types of programs. While not part of the "Underserved Initiative" *per se*, we have included those sites that responded in the analysis as additional examples of and sources of information on teams serving a largely underserved population. As such, they help to illustrate the characteristics and experiences of young people from those communities in FLL. Overall, as shown in Table 1-1 in the Introduction, of the teams

[6] The LEGO Mindstorms Kit is approximately $250. The Challenge or "field set up" Kit (approximately $50) provides the playing field and specialized parts for the specific competition. Tournament registrations were paid directly to each tournament and generally averaged $50.

providing data for the study, 28 (85%) are from grant-funded sites (direct, BGCA and YMCA) and 5 (15%) are from unfunded teams.

By all reports, the start-up process for teams in the Underserved Initiative was challenging. In each case, the recruitment process began relatively late in the Challenge year (August and September), which meant that there was relatively little time to identify and recruit potential teams and to make sure that organizations that made a commitment to participate would be able to follow through in forming a team. The late start-up also meant that a number of the teams did not complete their registration and receive their Kits until October and November, a problem that was exacerbated by shipping delays for some of the kits. As a result, there were a number of teams that had organized, but decided that they were not ready to participate in a tournament, or had missed the opportunity to register for the tournaments serving their areas.[7] As such, one of the "lessons" learned from the pilot year is the need to provide a longer lead time so that clear criteria for recruiting teams can be established and to ensure that new teams have sufficient time to get organized.

Team Characteristics

Despite the start-up difficulties, the data from the 2004 surveys indicate that the teams that were formed were, for the most part, able to organize and operate successfully and to bring in a new and more diverse group of participants than the general FLL population. As Table 2-1 shows, based on reports from the team coaches, the characteristics of the teams in the 2004 initiative differed from the "typical" FLL team found in the 2003 Brandeis study in several important ways:

- A substantially higher proportion of 2004 teams were from community-based organizations, reflecting the influence of the Boys and Girls Club grants. In 2003, when there had been no special effort to recruit community-based organizations (CBOs), less than 2% of the teams had been based in community-organizations and 72% had been based in schools. In 2004, nearly 40% of the teams were from CBOs.

- A substantially higher proportion of 2004 teams were from urban and rural areas, and substantially fewer were from suburban communities. Altogether, 47% of the 2004 teams were from urban communities, compared to 21% in 2003; only 28% were from suburban towns – roughly half the percentage found in 2003.

- The 2004 Underserved Initiative grants also resulted in a substantially higher proportion of teams serving underserved youth. Based on coach reports, 45% of the team members on the average team in the 2004 Underserved Initiative were from low income families; approximately four times the figure for 2003. Similarly, 40% of the 2004 teams reported that at least half their members were from low income families, a figure again nearly four times the 11% figure reported for 2003.

Within that increased emphasis on serving low income urban and rural youth, it is important to note that teams still tended to attract the "best and brightest" of the available students. When

[7] In Virginia, for example, some teams did not receive their kits until October and had less than three weeks to prepare for the local qualifying events that took place in November.

asked to compare their team members' academic skills to those of other students in the schools, coaches for half of the teams reported that their team members were "above average" academically. Twenty-seven percent of the coaches reported that their students were "about the same" academically as the other youth in the school, and only 9% indicated that their team members were "below average" students. While this does not mean that teams excluded poor performing students, it does suggest that the teams provided more of an opportunity for more academically talented youth and did not particularly target or attract less accomplished students within their schools or community-based organizations.

Table 2-1: Characteristics of FLL Teams

	2004 FLL Underserved		2003 FLL
Program Type	**N**	**Percent**	**Percent**
School-based (part of after-school program)	15	45.5%	72.2%
School-based (part of a school class)	3	9.1%	8.6%
Home-school based	0	0.0%	4.9%
Community-based organization (YMCA, Scouts, etc.)			1.2%
Neighborhood-based	1	3.0%	8.6%
Part of a Boys and Girls Club	13	39.4%	
Part of a YMCA	1	3.0%	
Part of another community-based organization	2	6.1%	
Other	2	6.1%	8.6%
Community Type			
Urban	15	46.9%	21.4%
Suburban	8	28.1%	60.4%
Rural	9	25.0%	18.2%
Income Status			
Average Percent of Participants from Low Income Families on Team	23	45.2%	11.1%
Percent of Teams Reporting that more than Half of their Participants are from Low Income Families	22	40.9%	10.6%
Average Academic Status of Participants on Teams			
Above average	17	51.5%	
About the same	9	27.3%	
Below Average	3	9.1%	
Do not know	4	12.1%	

Note: Based on data reported by team coaches. Percentages reflect percent of teams reporting each characteristic. Blank cells indicate that the question was not asked in that year.

Participant Characteristics

The data on the demographic characteristics of team members, based on the participant surveys, show that teams in the 2004 Underserved Initiative involved a new and more diverse group of young people than the average FLL team in the 2003 evaluation. While the 2004 participants were similar in age to those from the prior year, reflecting FLL's emphasis on late elementary and middle school participants, participants on the 2004 Underserved Initiative teams were significantly more likely to be non-white, female, and first-time participants (Table 2-2).

- Half of the 2004 team members were non-white, compared to only 22% of the participants on FLL teams in 2003. The 2004 teams were significantly more likely to include African-American youth (23% of participants vs. 3.1% in 2003) and Hispanic youth (16.7% vs. 5.3% in 2003) and significantly less likely to have Caucasian youth on the team (50% vs. 77.8% in 2003);

- 40% of the participants on the 2004 teams were young women, compared to 30% on the FLL teams studies in 2003[8];

- 79% of the 2004 participants were first-time FLL team members, compared to 64% on the average FLL team in 2003.

All of these differences (gender, first-time participant, and race/ethnicity) were large enough to be statistically significant (i.e., unlikely to reflect a random variation between the samples).

Table 2-2: FLL Participant Characteristics

	2004 FLL Underserved		2003 FLL
Participant Characteristics	**N**	**Measure**	**Measure**
FLL Experience			
*First year**	119	79.3%	64.2%
Two or more years	31	20.7%	35.8%
Age (average)	156	11.2 years	11.4 years
Grade	**N**		**Percent**
2nd	1	0.6%	0.2%
3rd	8	5.1%	2%
4th	20	12.8%	13.7%
5th	45	28.8%	25.4%
6th	33	21.2%	21.5%
7th	29	18.6%	18.8%
8th	15	9.6%	15%
9th	4	2.6%	3.3%
10th and up	1	0.6%	0.1%
Total respondents	156		
Gender			
Male	93	60%	70%
*Female**	63	40%	30%

[8] One question that was raised in the initial review of the study was whether the proportion of girls increased because of increased involvement of girls through the community-based programs. Further analysis indicated that the girls in the 2004 sample were no more likely to be participating through the club-based teams, such as the BCGA or YMCA, than through the school based teams.

Race			
*African-American**	36	23.1%	3.8%
Asian	12	7.7%	7.9%
*Caucasian/White**	78	50.0%	77.8%
*Hispanic/Latino**	26	16.7%	5.3%
Native American/Alaskan	4	2.6%	1.1%
Other	9	5.8%	7.6%
Total responses	165		

Note: Blank cells indicate that the question was not asked in that year. In some cases (race/ethnicity) percentages may add up to more than 100 as respondents selected more than one response. Items with an asterisk (*) show a statistically significant difference between the 2003 and 2004 results at a .05 level or greater.

Characteristics of FLL Coaches and Parents on Underserved Teams

The data on the characteristics of FLL Coaches in the Underserved Initiative also show some important differences between the 2004 teams and the "typical" FLL team in the 2003 study (Table 2-3).[9] Coaches on the teams in the Underserved Initiative tended to be younger, are more likely to be female, and are from a more diverse racial and ethnic background than those in the 2003 study. Most were first-time coaches and had become involved in FLL as a part of their job at a school or community organization. As such, the 2004 Initiative appears to have succeeded in bringing a new and more diverse group of coaches to FLL than were found on the average team in 2003.

- On average, the FLL coaches in 2004 were younger and included a higher proportion of women than their counterparts in 2003, possibly reflecting the relative youth of many community-organization staff. The average age of coaches in the Underserved Initiative was 35 years old, compared to an average age of 43 for those on the 2003 teams. Nearly half of the 2004 coaches were women, compared to less than one-third in 2003.

- Coaches on the Underserved teams also appear more likely to be coaching as part of their job, though differences in the questions on the surveys in 2003 and 2004 do not always allow a direct comparison. Roughly 73% of the 2004 coaches indicated that they were involved in FLL as part of their role as a teacher or agency staff, with only 12% reporting involvement because they were a parent. Nearly half of the coaches indicated that their **primary reason** for coaching was because it was part of their job, compared to less than 5% of the coaches on the typical team in 2003.

- Coaches in 2004 were also much more likely to be involved in FLL for the first time. Nearly 70% of the coaches in 2004 were "rookies", working with an FLL team for the first time, compared with 43% of the coaches in the 2003 study. In that regard, the Underserved Initiative clearly succeeded in bringing new adults into the program, though it is important to note that a substantial group of coaches, even on the new Underserved Teams, had prior experience with FLL.

[9] Because of the small number of coach surveys returned for the 2004 study, statistical tests on the differences between 2003 and 2004 were not conducted for items on the FLL Coach Survey.

Less Access to Technical Expertise and Parental Support. While the background data on the FLL coaches in the 2004 study indicate that the Underserved Initiative brought a new and more diverse group of coaches into the program, it also highlights some of the challenges likely to be faced by teams working in underserved communities. In particular, teams in the Underserved Initiative were substantially less likely to have access to technical expertise, high levels of parental involvement with the team, or a strong connection to other FIRST programs (i.e., the FIRST Robotics Competition).

- Coaches were substantially less likely to have a background in science, engineering or technology than those on the "average" FLL team in 2003: 68% of the coaches on the 2003 teams had a science background *versus* 40% of the coaches on the Underserved Initiative teams.

Table 2-3: Coach Characteristics

	2004 FLL Underserved		2003 FLL
Coach Characteristics	**N**	**Measure**	**Measure**
Age	33	35.2 years	43.1 years
Gender			
Male	17	51.5%	68.5%
Female	16	48.5%	31.5%
Race			
African-American	5	15.2%	1.9%
Asian	2	6.1%	4.3%
Caucasian/White	22	66.7%	85.8%
Hispanic/Latino	3	9.1%	3.7%
Native American/Alaskan	0	0.0%	0.6%
Other	1	3.0%	3.1%
Total Responses	33		
Ever Employed in Engineering, Science or Technology Field	13	39.4%	67.6%
Child on FLL Team Currently	4	12.1%	59.0%
Familiar w/FRC	15	45.5%	76.3%
Involved with FLL as a:			
Teacher	12	36.4%	
Program/Agency Staff Person	12	36.4%	
Parent/Guardian	4	12.1%	
College Student	2	6.1%	
Corporate/University Volunteer	1	3.0%	
High School Student	1	3.0%	
Other	1	3.0%	
Experience with FLL			
Years Spent Coaching Team	32	1.6 years	2.1 years
First-time (Rookie) Coach	22	68.8%	43.0%
Primary Reason Coaching Team			
Part of job as teacher	15	48.4%	4.9%
Way to get children interested in science and technology	8	25.8%	54.3%
Like to learn new skills or take on challenges	3	9.7%	11.1%
Way to spend time with my child	2	6.5%	27.2%
Part of home school program	1	3.2%	2.5%
Way to support the school or community organization	1	3.2%	14.2%
Want to contribute to my community	1	3.2%	16.0%
Part of my company's community involvement program	0	0.0%	1.2%
Socialization/meet new people	0	0.0%	4.3%
Other	0	0.0%	14.8%
Total respondents	31		

Note: Based on data reported by team coaches. Percentages reflect percent of teams reporting each characteristic. Blank cells indicate that the question was not asked in that year.

- The 2004 coaches were also substantially less likely to be familiar with other FIRST programs (i.e., the FIRST Robotics Challenge (FRC)): 76% of the coaches were familiar with FRC in 2003, but only 46% in 2004.

- Finally, not surprisingly given the fact that most coaches were involved in FLL as a part of their job, the 2003 coaches were substantially less likely to have a child on the team than the "typical" coach in 2003: 12% of the coaches in 2004 had a child on the team, compared to 59% of the coaches in the 2003 study. It is not clear whether the relative absence of parents as coaches is necessarily a strength or a weakness for the teams in the Underserved Initiative; however, the shift from parent to staff leadership of the teams should be noted as an area to watch as FIRST expands its efforts to create new teams in underserved communities and through these types of community-based organizations.

Data from the surveys of the parents of FLL participants also highlight some of the differences in the context for the FLL teams in the Underserved Initiative. As with the coaches on the 2004 teams, parents of FLL participants were substantially less likely to have a background in science or engineering, and less likely to have a connection to other FIRST programs (Table 2-4).

- Parents of participants in the 2004 FLL teams were less than half as likely to have a background in science or technology as the parents involved in the "typical" teams studied in 2003: only 16% of the parents had a technical background in 2004 versus 37% in 2003.

- Parents were also substantially less likely to have other ties to FLL or the FIRST Robotics Competition. Less than 10% of the parents responding in 2004 ever had another child in FLL and only 20% indicated a familiarity with FRC. In both cases, these figures were less than half those for parents in the 2003 study.

Taken together, these data suggest that FIRST has been successful in expanding beyond its traditional "market" in terms of parents with backgrounds in science or technology becoming involved in FIRST. However, it also means that FLL team access to expertise from both the coaches and parents was likely more limited than on a traditional FLL team, and teams may have to work harder (as suggested in the discussion of barriers in Chapter 5 notes) to find the technical support they need in order to compete successfully. Similarly, as FIRST moves to create new teams in new communities, it clearly needs to work harder to build parent awareness and familiarity with the full sequence of FIRST programs. Until parents build that familiarity with FIRST programs, it may be difficult to gain the level of parent involvement that many teams need in order to succeed.

Table 2-4: Parent Characteristics

	2004 FLL Underserved		2003 FLL
Parent Characteristics	**N**	**Percent**	**Percent**
Background in Science or Technology	16	16.3%	37.2%
Have/Had other children in FLL	9	9.1%	20.0%
Familiarity with FRC	20	20.4%	58.9%

Note: Based on surveys of the parents of FLL participants on the Underserved Initiative teams.

FLL Team Operations

The survey data on the operations of the teams in the Underserved Initiative present a similar picture of teams that were able to establish a basic level of operations, but that also differed in important ways from the "typical" FLL team of the year before. While FLL Underserved teams in 2004 were able to recruit participants, meet regularly, and secure a basic level of outside support, the 2004 teams clearly found it more difficult to access outside mentors, gain a comparable level of family involvement or technical expertise, and to participate fully in the research projects and tournaments that are part of the FLL Challenge (Tables 2-5 and 2-6). At least some of the differences (most notably, the relatively low level of tournament participation), were likely the result of the late start-up and delivery delays that affected a number of teams in the Underserved Initiative. But, based on telephone interviews with team coaches, it seems equally clear that the issues of parent involvement and securing mentors with technical expertise were associated with the "underserved" nature of the communities being served and that these were issues that FIRST will need to continue to address as it expands to other low income communities.

Team Size and Mentors. At the broadest level, the survey data indicate that the teams were able to successfully recruit participants and establish a basic level of operations, though generally on a slightly smaller scale than the teams in the 2003 study.

- Teams in the Underserved Initiative were relatively successful in recruiting youth, averaging slightly more than 7 youth per team, 1 less than the typical 2003 team.

- Teams met on a regular basis, with 88% of the teams reporting that they met at least once a week during the Challenge period, and with a substantial portion (21%) meeting at least three times a week. However, perhaps because of the late start, the 2004 teams met less frequently than their 2003 counterparts. Coaches estimated that the teams met for an average of 3.1 hours per week, a figure about 30% lower than that for the teams in the 2003 study.

- A substantial number of the 2004 teams were also able to recruit outside support and/or mentors. 27% of the teams reported having some kind of corporate or university partnership, and roughly 55% had at least one adult or other mentor working with the team. Based on data from the participant surveys, 75% of the teams had at least one adult with a technical background working with the team, most commonly the team coach.

Table 2-5: Team Operations

	2004 FLL Underserved		2003 FLL
Team Characteristics	**N**	**Mean**	**Mean**
Avg. number of boys on teams	33	4.8	5.8
Avg. number of girls on teams	32	2.3	2.5
Avg. total number of participants on teams	32	7.0	8.3
Average Hours per week that team meets	30	3.1	4.5
Frequency of Team Meetings	**N**	**Percent**	**Percent**
Less than once a week	4	12.1%	0.0%
Once a week	13	39.4%	22.5%
Twice a week	9	27.3%	54.4%
Three times a week	7	21.2%	16.3%
More than three times a week	0	0.0%	6.9%
Recruitment Methods			
Announcements/posters/flyers at school	23	69.7%	63.6%
Referrals by teachers or guidance counselors	8	24.2%	25.9%
Recruit from gifted programs	5	15.2%	8.6%
Flyers/notices to parents	4	12.1%	19.8%
Internet/email/list-serve/website postings	2	6.1%	3.1%
Flyers/notices at community centers/other community locations	1	3.0%	1.9%
Target children with 'B' or 'C' averages in school (i.e., children other than the highest achieving students in the school)	0	0.0%	
Other	3	9.1%	26.5%
Leadership: Overall Challenge	**N**	**Percent**	**Percent**
Child-directed	12	37.5%	31.4%
Adult-guided	19	59.4%	64.8%
Adult-directed	1	3.1%	3.8%
Leadership: Research Assignment			
Child-directed	9	27.3%	42.2%
Adult-guided	14	60.9%	55.2%
Adult-directed	0	0.0%	2.6%

Note: Based on data reported by team coaches. Percentages reflect percent of teams reporting each characteristic. Blank cells indicate that the question was not asked in that year.

Recruitment. In terms of recruitment, the 2004 teams looked very much like their 2003 counterparts. The most common forms of recruitment in both years were posters and flyers posted at the local schools (70% in 2004, 64% in 2003), followed by referrals from teachers and/or guidance counselors (24% in 2004, 26% in 2003). The 2004 Underserved Initiative teams were substantially more likely to recruit from the "gifted" programs at the schools (15% in 2004, 9% in 2003) and somewhat less likely to recruit by sending flyers home to parents (12% in 2004 vs. 19% in 2003). Overall, however, the recruitment strategies were largely the same.

Team Leadership. The reported leadership was also very similar across the two years, with a strong commitment to youth leadership and adult guidance (as opposed to adult direction) in both groups of teams. In both years, more than 95% of the coaches characterized their approach as

either "Child Directed" or "Adult Guided" in describing the overall operation of the FLL team and their approach to the Challenge research project. Interestingly, the 2004 Underserved teams were slightly more likely to describe themselves as "Child Directed" in terms of overall team operations, perhaps reflecting the youth leadership orientation of groups like the Boys and Girls Clubs, but were more likely to be "Adult Guided" with reference to the research challenge.

Table 2-6: Mentor and Parent Involvement

	2004 FLL Underserved		2003 FLL
	N	Mean	Mean
Have Corporate or University Partners Working with Team (Coach Survey)	33	27.3%	
Had at Least One of the Following Types of Mentors Working w/Team (Coach Survey)			
Parents	14	42.4%	60.5%
High school students	9	27.3%	24.7%
College students	4	12.1%	4.3%
Teachers	4	12.1%	
Agency Staff	4	12.1%	
Corporate/University Volunteers	2	6.1%	
Other adults	0	0.0%	33.3%
No other adults working w/team	15	45.5%	13.6%
Parent/Family Involvement w/Team (Participant Survey)			
Parent/Guardian involved with the team	36	23.1%	64.8%
Grandparent, aunt/uncle or other relative	4	2.6%	
Brother or sister	14	9.0%	
Any family member involved	49	31.4%	
No family involvement	107	68.6%	
Team Had an Adult who was an Engineer/Scientist/ Programmer to Help (Participant survey)			
Team leader	78	50.0%	63.4%
Other team mentor or volunteer	55	35.3%	37.4%
No one like that	39	25.0%	15.6%

Note: Based on coach and participant surveys (as indicated). Blank cells indicate that the question was not asked in that year.

Focus of Team Instruction. To a great degree, the coaches reported focusing their instruction on key Challenge-related skills and attitudes at a similar level in 2003 and 2004 (Table 2-7). Virtually every coach in 2004 placed heavy emphasis on the development of leadership and teamwork skills and a sense of team identity, along with emphasizing the development of problem-solving strategies and an understanding of the importance of helping others. The 2004 coaches, however, were more likely to place an emphasis on the importance of doing well in school, on familiarizing team members with careers in science and technology, and on developing basic math skills. In some cases, that increased time and emphasis may have reflected a greater need on the part of program participants for help in those areas, but it also likely reflects a commitment on the part of the coaches to using FLL to reinforce the positive growth and achievement of their participants.

Table 2-7: Time Spent Working on Challenge-Related Skills/Attitudes

	2004 FLL Underserved				2003 FLL
	N	Percent 'A Little'	Percent 'A Lot'	Percent 'A Lot' or 'A Little'	Percent 'A Lot' or 'A Little'
Leadership skills	33	46.9%	53.1%	**100.0%**	93.7%
Teamwork skills	33	30.3%	69.7%	**100.0%**	98.1%
A sense of team identity or belonging to a group	33	30.3%	69.7%	**100.0%**	96.9%
The importance of helping others	33	39.4%	57.6%	**97.0%**	93.2%
Problem-solving strategies	33	27.3%	69.7%	**97.0%**	98.7%
Planning skills	33	60.6%	33.3%	**93.9%**	91.9%
The importance of doing well in school	33	36.4%	54.5%	**90.9%**	76.2%
Using science and technology to solve real-world problems	33	51.5%	36.4%	**87.9%**	94.4%
Presentation skills	33	51.2%	36.4%	**87.9%**	92.6%
Time management	33	42.4%	45.5%	**87.9%**	93.8%
An understanding of basic science principles	33	66.7%	18.2%	**84.8%**	90.1%
Basic computer programming skills	33	60.6%	24.2%	**84.8%**	96.2%
Research skills	33	45.5%	36.4%	**81.8%**	90.7%
An understanding of potential careers in science and technology	33	57.6%	15.2%	**72.7%**	61.9%
Basic math skills	33	57.6%	15.2%	**72.7%**	65.8%
Writing skills	33	48.5%	9.1%	**57.6%**	62.1%

Note: Based on data reported by team coaches. Percentages reflect percent of teams reporting each characteristic. Blank cells indicate that the question was not asked in that year.

Limited Mentor and Parent Involvement. While the 2004 teams were able to establish basic operations, they clearly faced a greater challenge, either because of time or location, in recruiting mentors with technical expertise and gaining a level of parent involvement comparable to that of the "typical" team in 2003.

- While 27% of the teams were able to secure a corporate or university partner and 55% reported involvement of at least one mentor, a large proportion of teams did without. Overall, 45% of the teams (nearly half) reported no additional mentor involvement, compared to 14% of the teams in 2003.

- The 2004 Underserved teams reported substantially lower levels of parent involvement. In 2004, only 23% of the participants on the teams reported that a parent or guardian was involved in the team, compared to 65% in the "typical" team in 2003. While the 2004 survey also asked about the involvement of siblings or other relatives, the figures on the level of family involvement remained relatively low, with only 31% of the team members reporting any family involvement, a figure still well below that for parent involvement in 2003.

- Teams were also less likely to have individuals with technical expertise involved, though the differences between 2004 and 2003 were less striking. Overall, 75% of the teams in 2004 reported the involvement of at least one person with a technical background (based on participant reports), compared to 85% of the teams in the 2003 study. The major difference was in the background of the team coaches, where half of

the 2004 coaches had a technical background vs. 63% of the coaches in the 2003 study.

Tournament and Research Project Participation. Perhaps the most important of the differences in the operations of the 2004 Underserved Initiative teams was a substantially lower level of participation in the FLL tournaments and research project among the 2004 Underserved Initiative teams (Table 2-7). Overall, the 2004 teams were roughly 25% less likely to have participated in one or another of the FLL local, qualifying or state-level events than the 2003 teams (73% vs. 97%). Reflecting that, 72% of the team members in 2004 reported attending at least one tournament, compared to 98% in 2003.

Participation in the research project was also substantially lower among the 2004 teams. Seventy percent of the 2004 Underserved Initiative teams reported participating in the research project, compared to 97% of the teams in the 2003 study. Data from the participant surveys show similar levels of involvement – 69% of 2004 participants reported doing the research project vs. 97% in 2003, a difference that was statistically significant.

Table 2-8: Tournament and Research Project Participation

	2004 FLL Underserved		2003 FLL
Tournament Participation (Percent of Teams-Coach Survey)	**N**	**Percent**	**Percent**
Local event	10	30.3%	41.4%
Qualifying event	4	12.1%	63.6%
State or provincial tournament	14	42.4%	90.1%
Attended any event	24	72.7%	96.9%
Team Research Project (Percent of Teams-Coach Survey)			
Worked on Research Assignment	23	69.7%	96.9%
Average percent of team time spent on research project	22	51.6%	29.7%
Participant Experience (Participant Survey)			
Attended at least one tournament/event	113	72.4%	97.9%
*Worked on a research project**	90	68.7%	96.8%

Note: Based on coach and participant surveys (as indicated). Blank cells indicate that the question was not asked in that year. Items with an asterisk (*) show a statistically significant difference between the 2003 and 2004 results at a .05 level or greater.

It is important to note that the difference in the reported level of tournament participation may be the result of differences in the survey administration process used in the two years. In 2003, most of the survey packages for the study were distributed to teams at the FLL tournaments. As a result, teams that did not attend the tournaments were less likely to be included in the study. In 2004, teams were selected for the study based primarily upon whether they were part of the Underserved Initiative, whether or not they had attended any tournaments. As such, the high rates of tournament participation in 2003, and the differences between 2003 and 2004 may be overstated in the survey results.

At the same time, the differences in participation rates are substantial, and are reflected at every level of the tournament process. Teams in 2003 were more than twice as likely to participate in a state or provincial tournament as were those in the Underserved Initiative, and more than five times as likely to participate in a qualifying event. While the difference in survey methodology

may explain these differences in part, it seems likely that there were real differences in the ability of the 2004 teams to participate.

Based on the telephone interviews with FLL Coaches, the other explanation for the relatively low level of tournament participation, and the similarly low levels of participation in the research project, was the delay in team start-up and registration. For a number of teams, by the time they were organized and operating, the opportunity to register for a nearby tournament had passed.

However, it is also clear from the interviews and survey notes that, as first-time teams, a number of the teams in the Underserved Initiative felt they were not ready to participate in a tournament. This is an area where FIRST needs to continue to look at ways of helping teams prepare for and feel confident about entering the tournament process.

A Positive Participant Experience

Despite the challenges faced by the teams in the 2004 Underserved Initiative, most were able to provide their participants with a positive and engaging FLL experience, comparable in most regards (based on participant assessments) with that provided participants on the teams in the broader 2003 study. In providing a high degree of hands-on experience, team building, adult support, high expectations, and a sense of safety, the FLL programs in the Underserved Initiative also met the criteria for a high quality youth development program as outlined in the broader youth development literature.

As Table 2-9 shows, despite the late start, the large majority of participants on the 2004 Underserved Initiative teams were able to participate in the key activities associated with the FLL experience:

- More than 80% of the participants reported that they were involved in deciding how to accomplish the Challenge mission, and in designing, building and testing the robot.

- Slightly smaller percentages (70% or more) reported involvement in programming the team's robot, deciding on the research question to pursue, designing the research project and presenting the research project at the tournament. 73% also indicated that they had a chance to talk with other participants at the tournament itself.

The major areas where the FLL experience for the 2004 participants differed significantly from that of their 2003 counterparts were in the activities associated with participation in the tournaments and research project. 2004 participants were significantly less likely to report involvement in setting up and fixing the robot at the tournament (67% vs. 77% in 2003); in explaining how the robot works to a judge (61% vs. 84% in 2003) and in creating team materials (logos, etc.) – an activity particularly associated with tournament participation (62% vs. 72% in 2003). Similarly, participants in 2004 reported significantly lower levels of involvement in two research activities – doing Internet research (61% vs. 76% in 2003) and presenting the team's project at the tournament (72% vs. 84%).

Table 2-9: Participant Involvement in FLL Activities

	2004 FLL Underserved				2003 FLL
FLL as a Whole: How much were you involved in the following activities?	**N**	**Percent 'A Little'**	**Percent 'A Lot'**	**Percent 'A Lot' or 'A Little'**	**Percent 'A Lot' or 'A Little'**
Deciding which missions to do in the Challenge	155	54.2%	36.1%	**90.3%**	**91.8%**
Designing your team's robot or designing a specific part of the robot	156	44.2%	44.2%	**88.5%**	**88.5%**
Testing the robot	155	31.0%	57.4%	**88.4%**	**91.8%**
Building the robot	155	38.5%	46.8%	**85.3%**	**82.8%**
Programming your team's robot	155	39.4%	38.1%	**77.4%**	**77.2%**
*Setting up or fixing the robot at the tournament**	155	38.7%	28.4%	**67.1%**	**77.6%**
*Creating team materials (i.e., logo, t-shirt, buttons, team names, etc.)**	154	39.0%	23.4%	**62.3%**	**71.9%**
*Explaining how the robot works to the judges at the tournament**	155	37.4%	23.9%	**61.3%**	**84%**
Raising money for the team	154	14.3%	7.8%	**22.1%**	**26.9%**
Research Project: How much were you involved in the following activities?					
Deciding on the question for your research assignment	89	46.1%	33.7%	**79.8%**	**79.5%**
Designing the expedition for your team	89	39.3%	33.7%	**73.0%**	**71.3%**
*Presenting the team's research assignment at the FLL tournament**	89	30.3%	41.6%	**71.9%**	**84.0%**
*Doing research at the library or on the Internet for your research assignment**	89	31.5%	29.2%	**60.7%**	**76.2%**
Getting information from a scientist or other expert for the research assignment	89	36.0%	13.5%	**49.4%**	**36.7%**
Tournament Experience: How much did you do the following					
*Talk to kids on other teams**	90	52.2%	21.1%	**73.3%**	**87.3%**

Note: Based on participant surveys. Blank cells indicate that the question was not asked in that year. Items with an asterisk (*) show a statistically significant difference between the 2003 and 2004 results at a .05 level or greater.

What is notable, however, is that even in areas where there were significant differences between the 2004 and 2003 team experience, the differences were not overwhelming, and a large majority of 2004 participants were able to take part in most core FLL activities. In that regard, the data suggest that once the issues of start-up and timing are addressed, and/or teams receive some additional assistance in preparing for the tournaments, teams operating in underserved communities are likely to be able to provide a quality FLL experience for most participants.

The participant assessments of their FLL experience point to a similar conclusion. Overall, the majority of participants in the 2004 Underserved Initiative teams responded positively on a set of measures of the quality of their program experience, and their response was generally on a par with the assessments of the 2003 counterparts (Table 2-10).

Table 2-10: Participant Assessment of the FLL Experience

	2004 FLL Underserved				2003 FLL
	N	Percent 'Agree'	Percent 'Strongly Agree'	Percent 'Agree' or 'Strongly Agree'	Percent 'Agree' or 'Strongly Agree'
I had fun working on my FLL team	153	27.5%	68.6%	**96.1%**	**98.1%**
The adults working with my team expected us to act responsibly when we were together	153	30.7%	64.7%	**95.4%**	
My FLL meetings felt like a safe and friendly place for me to be	153	35.9%	58.2%	**94.1%**	
I felt I was an important part of my team	151	35.1%	57.6%	**92.7%**	**91.1%**
I felt like I really belonged on my team	152	42.1%	50.0%	**92.1%**	**93.1%**
The adults working with my team really know how to work well with us	152	36.8%	54.6%	**91.4%**	
*I had real responsibilities on my FLL team**	153	41.2%	47.7%	**88.9%**	**93.8%**
The adults working with my team paid attention to me	149	43.6%	44.3%	**87.9%**	**92.0%**
I got all the help I needed to do my jobs on the team	153	41.2%	46.4%	**87.6%**	**90.8%**
My team learned how to work well together	152	42.8%	43.4%	**86.2%**	**89.4%**
*The kids on my team made the important decisions, not the adults**	154	41.6%	42.2%	**83.8%**	**92.8%**
I got really interested in learning more about space exploration/disability issues	152	36.2%	46.7%	**82.9%**	**82.4%**
I had a chance to do lots of different jobs on my team	154	44.2%	37.0%	**81.2%**	**86.8%**
*My team really listened to my ideas**	151	46.4%	27.8%	**74.2%**	**81.1%**

Note: Based on participant surveys. Blank cells indicate that the question was not asked in that year. Items with an asterisk (*) show a statistically significant difference between the 2003 and 2004 results at a .05 level or greater.

- Over 90% of the participants, for example, indicated that they had fun working on their team; that they felt like they were an important part of the team; that they really belonged; and that the adults knew how to work well with them and had high expectations for their behavior while on the team.

- 80% or more of the participants reported that they had real responsibilities; that adults paid attention to them; that they got all the help they needed; and that they learned to work together as a team.

While the ratings were generally positive across the board on these questions, there were significant differences between the 2004 and 2003 responses on three items: the 2003 participants were more likely to indicate that they had real responsibilities on their team, that the kids on the team made the important decisions, and that their team "really listened to my ideas." Though the differences were statistically significant, it is important to recognize that on both the 2003 and 2004 teams, more than 75% of the participants felt that their teams had been responsive and important decisions had been made by the participants.

FLL and Positive Youth Development. While the items in Table 2-10 reflect a generally positive assessment by participants of their experience, they also help to highlight the extent to which the FLL program experience meets a set of research-based criteria for effective youth

development programs. In 2002, the National Research Council (NRC) conducted a review of the research on effective youth development programs and found that effective programs were those that provide young people with some or all of the following characteristics:[10]

- A safe environment (a physically and socially safe setting)
- Appropriate structure (clear rules and expectations)
- Supportive relationships (caring, support, guidance)
- Opportunities to belong
- Positive social norms (including obligations for service)
- Support for efficacy and mattering (youth decision-making, making a real difference, responsibility and challenges)
- Opportunities for skill building
- Integration of family, school and community.

Other studies of positive youth development, resiliency, and youth asset development have identified similar factors as associated with positive long-term outcomes for youth.[11]

The survey items in Table 2-10 were designed, in part, to correspond with the NRC study findings. Taken together, they show that the FLL experience in both the 2004 Underserved Initiative sites, and the broader group of 2003 FLL teams, provide the large majority of participants with the kinds of experiences that are recommended by the research on positive youth development – interactions with caring adults, a sense of responsibility and challenge, opportunities for skill building and authentic learning, and appropriate structure and a safe environment. In that regard, the assessments of the FLL participants in both 2004 and 2003 not only reflect a positive overall assessment of the program, but help to show the relationship between FLL and a broader body of research on effective programs for young people.

Participant Satisfaction. One final measure of the quality of the participant experience in FLL is that of participant satisfaction – the degree to which participants have enjoyed their overall experience and want to continue their participation. In general, participants in the 2004 Underserved Initiative teams rated their FLL experience positively, with a large majority of participants indicating an interest in returning to the program the following year.

- Overall, 86% of the 2004 participants rated their experience in FLL as either 'Excellent' or 'Good,' and 81% indicated that they expected to return the following year (Table 2-11).

- When asked to rate different aspects of the FLL experience in terms of what they liked or disliked, between 75% and 90% of participants rated being with their friends, being

[10] See Jacquelynne Eccles and Jennifer Appleton Gootman, Editors, *Community Programs to Promote Youth Development* (National Research Council and Institute of Medicine, 2002).

[11] See, for example, Bonnie Benard's work on resiliency. "Fostering Resiliency in Kids: Protective Factors in the family, school, and community." (Portland, OR: Northwest Regional Educational Laboratory, 1991) and "Resiliency: What We Have Learned" (San Francisco, CA: WestEd, 2004). Research in that field has identified three major criteria for the development of resiliency among young people: presence of caring and supportive adults, high expectations, and opportunities to participate and contribute/make a difference, a formulation that is consistent with the factors associated with effective youth development programs.

part of a team, their coach and going to the FLL events as the parts of the program that they liked "a lot" (Table 2-12). (The research project, on the other hand, was liked "a lot" by only 46% of the participants.)

It is important to note that, consistent with some of the other differences between the 2004 and 2003 FLL experience, participants in the 2003 programs were significantly more likely than the participants in the 2004 teams to rate their program experience as "Excellent." The proportion of participants interested in continuing in FLL, however, was virtually identical. In this case, the difference may be on more reflection of the fact that the 2004 participants had less time in the program and/or were less likely to have gone to the tournaments. Still, the difference in how participants rated their experience was not large enough to influence their interest in coming back.

Table 2-11: Overall Participant Rating of FLL Experience

	2004 FLL Underserved		2003 FLL
Overall student rating of FLL experience:	**N**	**Percent**	**Percent**
*Excellent**	122	46.7%	62.8%
Good	122	39.3%	30.6%
Fair	122	13.1%	5.8%
Poor	122	.8%	.8%
Plan to participate again next year:			
Yes	146	80.8%	82.2%
No, I didn't like the program	146	3.4%	1.5%
No, I don't have the time	146	10.3%	5.4%
No, I am too old	146	5.5%	10.9%

Note: Based on participant surveys. Blank cells indicate that the question was not asked in that year. Items with an asterisk (*) show a statistically significant difference between the 2003 and 2004 results at a .05 level or greater.

Table 2-12: Participant Likes and Dislikes

	2004 FLL Underserved	
Liked/Disliked	**N**	**Percent Liked a Lot**
Being with my friends	149	87.9%
Being part of a team	145	82.1%
My team coach	148	78.4%
Going to an FLL event	136	75.7%
Building the robot	148	75.0%
Programming the robot	149	63.1%
Working with both boys and girls	147	61.9%
No Limits Project	125	45.6%
Other	41	65.9%

Familiarity with the FIRST Robotics Competition. Lastly, as FIRST moves towards the development of a full sequence of programs for young people from late elementary school through high school, one critical concern is whether participants in the FLL program are aware of other FIRST programs and the opportunities to participate through high school. The data from the participant surveys for the 2004 Underserved Initiative teams indicated that, for most

participants, that connection had not been made during the Challenge season (Table 2-13). Less than 40% of the 2004 participants indicated that they had heard about the FRC program (the high school robotics competition), suggesting that FIRST needs to make a more deliberate effort to acquaint this group of FLL participants with the opportunities for participation in robotics programs as they grow older.

Table 2-13: Familiarity with FIRST Robotics Competition

	2004 FLL Underserved	
Familiarity with FIRST Robotics Competition:	**N**	**Percent**
Yes, I have heard about the program	151	37.1%
Yes, someone in my family is involved	151	5.1%
No, I am not familiar with the program	151	62.9%

Summary

Three broad conclusions emerge from the review of the data on the characteristics and operations of the 2004 Underserved Initiative teams. The first is that the 2004 FLL Underserved Initiative was successful in expanding the participation in FLL to a new, more diverse group of young people, coaches and institutions. While the process of identifying, recruiting and registering teams needs improvement, the basic conclusion is that the process succeeded in its primary goal of establishing teams that served substantially greater proportions of low income and minority youth, and that it successfully introduced the FLL program into a new group of community-based institutions.

At the same time, the pilot year of this Initiative highlighted some important differences in the operation of the FLL teams and the experience they provided program participants. Teams in the 2004 Underserved Initiative appear to have less access to outside mentors and technical expertise than the traditional FLL teams, and substantially lower levels of parent involvement. Teams were also less likely to participate in the tournament process and the research project – critical components of the FLL experience. In that regard, FIRST needs to continue to look at ways to help rookie teams and teams in underserved communities (these teams were both) to link up with individual mentors and organizations with technical expertise, and to find ways of helping teams prepare for the tournament process.

Finally, despite the challenges in this pilot year, it is also clear that the Underserved Initiative teams were able to provide a quality FLL experience for most of their participants, one that matched the major criteria for effective youth programs. As such, it seems likely that, as those teams gain in experience and as FIRST strengthens the supports available to them, they will be able to provide quality FLL experiences to a broader, more diverse group of program participants.

Chapter Three
Participant Impacts

While the expansion of FLL into new communities and new populations was a critical goal for the FLL Underserved Initiative, in order for that expansion to be successful, FLL also needs to be able to show that it can continue to have a positive impact as it begins to work with a more diverse, and often disadvantaged, group of young people. As noted in the Introduction, one of the key questions for this evaluation is the extent to which teams in the Underserved Initiative were able to achieve FIRST's goals of increasing interest in science and technology while also helping to build important life, workplace, and academic skills. Given the challenges faced by teams and participants involved in the 2004 Underserved Initiative, including start-up delays, limited access to technical expertise and parental support, and lower participation in tournament and research project activities, the question of impact becomes particularly important.

Based on the data from the coach, participant, and parent surveys generated by the 2004 teams, FLL was successful in having a positive impact on participating team members. In looking at participant knowledge of and interest in science and technology, and at a broad array of practical problem-solving and teamwork skills, a high proportion of coaches and participants reported at least small gains by team members on virtually every measure as a result of participation in the FLL program. On most measures of impact used in the study, 75% or more of coaches and program participants (and generally 85% or more) reported that interests, skills and attitudes gained either "a little" or "a lot" as a result of program participation. Parents also consistently reported gains in interest, skills, and attitudes among their children in the program, though generally at a somewhat lower rate than reported by coaches and participants.

Equally important, on most of the measures used in the study, the results of the coach, participant, and parent assessments were comparable to those found among the "typical" or "traditional" FLL teams in the 2003 study. While there were some statistically significant differences between the participant assessments in 2004 and 2003, on most measures participants in the regular FLL programs and those on the Underserved Initiative teams reported similar gains as a result of being in the program. Where there were differences, they were generally on measures closely related to participation in the research project and/or tournaments and, as such, reflected one of the major variations between the 2004 and 2003 teams in terms of their program experiences.[12] As a whole, however, the results suggest that the teams serving youth in underserved communities are able to have a positive impact on the young people in their programs.

Finally, where it was possible to compare outcomes for subgroups within the 2004 teams there was little sign of variation from the results for the 2004 teams as a whole. A comparison of

[12] As noted in earlier chapters, we conducted tests of statistical significance in making comparisons among groups of participant surveys (most notably in examining the differences between 2004 and 2003 teams) and parent surveys. However, because of the small sample size in 2004, we did not perform tests of significance on the coach surveys in the study.

results from "rookie" teams in both 2004 and 2003 found few variations from the overall pattern of outcomes for the 2003 and 2004 teams as a whole and few differences between the outcomes for rookie teams in 2003 and 2004. That is, rookie teams in both years produced similar outcomes – among both new and more established teams, the outcomes for teams in the Underserved Initiative and the 2003 teams were more similar than different. In the same vein, a comparison of the two largest groups of grant recipients in 2004 – the direct FLL grant recipients and the BGCA teams -- found few differences in outcomes: both "models" produced similar levels of impact. The one analysis of the 2004 teams that did produce significant differences was a comparison of results between teams that did and did not participate in an FLL tournament, with tournament teams showing significantly stronger impacts on a number of different measures. In this instance, the data suggest that doing the full set of FLL activities – and particularly participation in a tournament – makes a difference in the outcomes generated for program participants.

The "bottom line" in terms of impacts is that the FLL Underserved Initiative teams were able to generate a positive set of outcomes for their participants, and that despite the added challenges involved in operating the team, these new teams were able to promote FIRST's mission and make a difference for the participating youth.

Interest in science and technology

One of the primary goals of FLL and for FIRST in general is that of inspiring interest in science and technology. Based on the data from coach, participant and parent surveys, FLL largely accomplished that goal with a sizeable majority of each group indicating that team member interest in computers and technology, jobs in science and technology fields, and interest in school and college increased at least "a little" as a result of being in the program. The overall results were also consistent with those found in the 2003 study, though a higher proportion of respondents in the Underserved Initiative teams reported that interest increased "a little" (rather than "a lot") than was the case for the 2003 teams.

The data on participant interests comes from three sources: coach surveys, participant surveys, and parent surveys, where in each case, the respondents were asked to assess the degree to which participant interests increased as a result of FLL. Table 3-1 shows the results from the coach survey, Table 3-2 for the participant surveys, and Table 3-3 for the parent surveys.

In all three sets of surveys, the majority of respondents saw increased interest with the most frequently reported gains in interest in computers and technology and how science and technology are used in the real world.

- Among the coaches, the most frequently reported gains were in participant interests in science and technology, reported by 94% of the coaches, with 57% reporting that interest among team members had increased "a lot."

- More than 80% of the coaches also reported gains on the other science and technology-related items (interest in and awareness of how math and science are used in the real world and interest in science or technology careers).

- More than 60% of the coaches reported increased interest in math and science classes at school, interest in succeeding in school, and interest in college. Coaches for the 2004 Underserved Initiative teams were also somewhat more likely to report gains in interest in math and science classes and in going to college than their counterparts on the 2003 FLL teams. For school-based programs, the fact that nearly two-thirds of the coaches or more reported increased interest in school and/or college may be particularly important.

Table 3-1: Impact on Participant Interests – Coaches Perspectives

To what extent has FLL had an impact on the following:	2004 FLL Underserved				2003 FLL
Interests	**N**	**Percent 'A Little'**	**Percent 'A Lot'**	**Percent 'A Lot' or 'A Little'**	**Percent 'A Lot' or 'A Little'**
Team members' interest in computers and technology	33	36.4%	57.6%	94.0%	93.1%
Team members' interest in or awareness of how math or science is used in the real world	33	66.7%	24.2%	90.9%	93.1%
Team members' interest in jobs or careers in science and technology	32	65.6%	21.9%	87.5%	80.6%
Team members' interest in their math or science classes at school	32	50.0%	21.9%	71.9%	65.2%
Team members' interest in going to college	32	37.5%	31.3%	68.8%	60.0%
Team members' interest in succeeding in school	31	41.9%	22.6%	64.5%	63.2%

Note: Based on data reported by team coaches. Percentages reflect percent of teams reporting each item. Blank cells indicate that the question was not asked in that year.

Program participants reported a similar pattern of outcomes, with the greatest numbers reporting increased interest in science and technology-related topics (Table 3-2):

- More than 90% of participants reported an increased interest in learning about computers and robotics, science and technology, and how science and technology are used to solve problems in the real world as a result of their participation in FLL.

- 89% of the participants also reported an increased interest in doing well in school, and 88% wanted to learn more about the topic that was the focus of the 2004 Challenge – how to make communities more accessible for participants with disabilities. Though the topic was different in 2003 (Mission to Mars), the proportion of participants reporting an increased interest in the Challenge topic was similar in both years.

- Finally, over 70% of participants reported an increased interest in science and technology careers.

For most of these items, the results for 2004 were similar to those from participants on the 2003 teams. The one exception was a significantly higher proportion of participants in 2004 reporting an increased interest in how science and technology could be used to solve problems in the real world.

Table 3-2: Impact on Participant Interests – Participant Perspective

Did FLL help change anything else about how you think or what you want to do:	2004 FLL Underserved				2003 FLL
Interests	**N**	**Percent 'Agree'**	**Percent 'Strongly Agree'**	**Percent 'Strongly Agree' or 'Agree'**	**Percent 'Strongly Agree' or 'Agree'**
I want to learn more about computers and robotics	151	45.0%	48.3%	93.4%	92.6%
*I want to learn more about how science and technology can be used to solve problems in the real world**	152	52.0%	39.5%	91.4%	84.5%
I want to learn more about science and technology	150	44.0%	46.0%	90.0%	88.1%
I am more interested in doing well in school	148	41.9%	46.6%	88.5%	85.3%
I want to learn more about how to make my community accessible for people with disabilities	152	46.1%	41.4%	87.5%	
I want to learn more about real-life projects like the Mission to Mars					86.6%
I am more interested in having a job that uses science or technology when I am older	152	40.1%	32.2%	72.4%	77.3%

Note: Based on participant surveys. Blank cells indicate that the question was not asked in that year. Items with an asterisk (*) show a statistically significant difference between the 2003 and 2004 results at a .05 level or greater.

Parents were asked about a similar set of outcomes for their children (Table 3-3). Again, results were very similar to those from coaches and the participants themselves, though the proportion of parents reporting gains was generally lower. There were also several notable differences in parent responses for 2003 and 2004. Parents from the 2004 Underserved Initiative teams were more likely to report that their child was more interested in going to college (53.2% in 2004 vs. 39.5% in 2003). Also, fewer parents thought that their child's interest increased in the science involved in access and disability (66.6%) than with the science associated with the Mission to Mars Challenge (82.3%).

- Overall, roughly 80% of parents in 2004 reported an increased interest among their children in computers and technology and in how science and technology were used to solve real-world problems.

- 60% of parents or more reported an increased interest in the science and technology related to disability issues and in careers in science and technology. Perhaps more striking, 60% also reported an increased interest among their children in their math and science classes at school.

- Finally, 50% or more also reported an increased interest in two other education-related outcomes: interest in school and interest in attending college. Again, these impacts on education-related interests may be particularly important for school-based programs serving young people in underserved communities.

Table 3-3: Impact on Participant Interests – Parents Perspective

Based on your own observations, what kinds of impact has FLL had on your child:	2004 FLL Underserved				2003 FLL
As a result of FLL:	N	Percent 'A Little'	Percent 'A Lot'	Percent 'A Lot' or 'A Little'	Percent 'A Lot' or 'A Little'
Your child's interest in computers and technology	97	52.6%	29.9%	82.5%	85.1%
Your child's interest in how science and technology are used to solve problems in the real world	96	56.3%	22.9%	79.2%	85.0%
Your child's interest in the science and technology involved with access and disability	96	45.8%	20.8%	66.6%	
Your child's interest in the science associated with the Mission to Mars Challenge					82.3%
Your child's interest in jobs or careers in science and technology	97	49.5%	13.4%	62.9%	64.7%
Your child's interest in his/her math or science classes at school	97	41.2%	18.6%	59.8%	59.1%
*Your child's interest in going to college**	94	27.7%	25.5%	53.2%	39.5%
Your child's interest in school generally	96	33.3%	16.7%	50.0%	45.4%

Note: Based on surveys of the parents of team members. Blank cells indicate that the question was not asked in that year. Items with an asterisk (*) show a statistically significant difference between the 2003 and 2004 results at a .05 level or greater.

Knowledge, Skills and Attitudes

In addition to its goal of inspiring interest in science and technology, FLL's goals also include increasing participant understanding of the role of science and technology, development of a variety of life and workplace-related skills, and development of a set of attitudes and beliefs (such as a sense of confidence and belonging) that are associated with healthy development of young people.

As with the data on interests, large majorities of coaches, participants and parents report participant gains in the knowledge, practical skills, and attitudes associated with FLL, with over 75% of the FLL coaches reporting gains in almost every area and 80% or more of participants reporting gains on most measures as well. As before, a majority of parents also reported gains in knowledge, skills and attitudes, though in somewhat lower proportions.

In general, the results from 2004 were similar to those for the teams in the 2003 study, though a number of differences were worth noting. Substantially fewer coaches noted gains in presentation and research-related skills in 2003 than in 2004, likely reflecting the lower participation in the tournaments and research projects; and participants were also less likely to report gains in presentation skills. On the other hand, coaches were substantially more likely to report gains on basic math skills for participants on the 2004 teams (also noted by parents), and participants were significantly more likely to report gains in their writing skills. Finally, participants in 2004 were significantly more likely to report wanting to solve problems in their community as a result of FLL, but were less inclined to want to pursue a career in science or engineering.

Table 3-4 presents the results from the coach survey. As noted, 75% or more of the coaches reported gains of "a little" or "a lot" on every measure of program-related knowledge, skills and attitudes, with the one exception of participant writing skills.

Table 3-4: Impact on Knowledge, Skills and Attitudes – Coach Perspectives

To what extent has FLL had an impact on:	2004 FLL Underserved				2003 FLL
	N	Percent 'A Little'	Percent 'A Lot'	Percent 'A Lot' or 'A Little'	Percent 'A Lot' or 'A Little'
Knowledge					
An understanding of how science and technology can be used to solve real-world problems	33	42.4%	51.5%	93.9%	94.4%
Team members understanding of basic science principles (for example, force, momentum, etc.)	33	69.7%	15.2%	84.9%	91.3%
An understanding of potential careers in science and technology	33	63.6%	21.2%	84.8%	78.1%
Skills					
Teamwork skills (negotiating roles, compromise, giving feedback, etc.)	33	45.5%	48.5%	94.0%	94.4%
Leadership skills (working with a group, running a meeting, assigning tasks, solving conflicts)	33	45.5%	48.5%	94.0%	91.9%
Basic computer programming skills	33	51.5%	42.4%	93.9%	98.8%
Problem-solving strategies (for example, steps to use in thinking through a problem)	33	39.4%	54.5%	93.9%	96.9%
Presentation skills (talking to groups, presenting information to others)	33	45.5%	30.3%	75.8%	91.2%
Time management (planning so that the work gets done on time)	33	57.6%	18.2%	75.8%	80.6%
Research skills (using the library, Internet, interviewing skills)	33	51.5%	24.2%	75.7%	83.8%
Basic math skills (computation)	32	75.0%	0.0%	75.0%	58.5%
Planning skills (developing action plans, budgeting, etc.)	33	51.5%	21.2%	72.7%	79.3%
Writing skills (example: writing brochures or letters)	33	30.3%	15.2%	45.5%	48.8%
Attitudes					
A sense of team identity or belonging to a group	33	33.3%	60.6%	93.9%	93.2%
Belief in the importance of helping others	33	39.4%	51.5%	90.9%	86.6%
Team members' sense of having somewhere safe and friendly to go after school	33	36.4%	39.4%	75.8%	

Note: Based on data reported by team coaches. Percentages reflect percent of teams reporting each item. Blank cells indicate that the question was not asked in that year.

- 80% of coaches or more reported increases in participant understanding of the role of science, basic science principles, and potential careers in science and technology, with slightly fewer coaches reporting gains in basic science than their 2003 counterparts, and somewhat more reporting an increased understanding of science careers.

- 70% or more of the coaches also reported gains on a variety of teamwork, problem-solving, and research skills, with the greatest numbers (90% or more) reporting gains in areas such as teamwork, leadership skills, and problem-solving strategies (as well

as basic computer programming skills). Smaller, though still substantial proportions (70% or more), reported gains on presentation, time management, research and planning skills. As noted, improved writing skills were reported by the fewest coaches (45%), though the figures were comparable to those reported by the 2003 teams.

- A high proportion of coaches also reported improved attitudes among their program participants, including a sense of belonging, the importance of helping others, and a sense of a safe and friendly place to go. All three of these, as noted in the previous chapter, are considered important elements of healthy youth development in the literature on effective youth development programs.

- As noted above, the coaches' assessments of the impact of the program in 2004 differed in several areas from those of their 2003 counterparts. Coaches in 2004 were substantially less likely to report gains in presentation, time-management, and research skills for young people on the Underserved Initiative teams, though they were more likely to see gains in basic computational skills. In part this may reflect real differences in the program experience between the two years (in terms of tournament participation) and/or differences in emphasis among the coaches of the teams: for example, coaches in 2004 were more likely to report spending time teaching basic math skills. Again, however, the pattern that stands out most clearly is the similarity between the results for the two groups of teams, more than the differences.

The pattern exhibited in the coach data held true for the participant data as well, with large numbers of team members reporting gains on most measures of knowledge, skills and attitudes (Tables 3-5a, b, and c). On most measures, 80% or more of participants reported agreement (on questions with an "agree" or "strongly agree" response) or that skills and attitudes had increased at least "a little" (on questions with "a little" or "a lot" responses).

- In terms of knowledge-related outcomes, roughly 90% or more of participants agreed or strongly agreed that, as a result of FLL they had learned about science and technology; that they could use their skills to solve community problems; and that science and technology and the subjects they study in school have real-world applications (Table 3-5a). Participants also reported learning several key lessons about their peers: that both boys and girls can be good at computers and robotics, and that every team member has something to contribute – key lessons for working in team settings at school or at work.

Table 3-5a: Impact on Knowledge – Participant Perspectives

	2004 FLL Underserved				2003 FLL
As a result of FLL, I learned:	**N**	**Percent 'Agree'**	**Percent 'Strongly Agree'**	**Percent 'Strongly Agree' or 'Agree'**	**Percent 'Strongly Agree' or 'Agree'**
That both boys and girls can be good at computers or robotics	151	37.1%	60.3%	97.4%	95.6%
That science and technology (like computers and robots) can be used to solve problems in the real world	152	35.5%	61.2%	96.7%	97.1%
That I have skills that can help other people on a project	151	47.7%	49.0%	96.7%	94.6%
That helping other people solve problems can be fun	151	43.0%	52.3%	95.4%	92.6%
That science and technology are important in everyday life	151	43.0%	51.7%	94.7%	95.0%
That subjects I study at school (like math or science) can help me solve problems in the real world	152	33.6%	60.5%	94.1%	93.3%
That every team member has ideas that can help make a project better	152	37.5%	55.3%	92.8%	94.3%
About some of the kinds of jobs people do that use science and technology	152	51.3%	36.8%	88.2%	90.0%

- 80% or more of participants also reported gains on a wide array of teamwork, project-planning and problem-solving skills (Table 3-5b). 90% or more reported gains on teamwork skills, such as being able to work with others, offering and receiving suggestions, brainstorming ideas with others, deciding on who would perform what jobs on a project, and resolving disagreements among team members. 90% or more also reported gains in project planning and problem-solving skills, such as managing their time, using trial and error, and using math to solve real-world problems. The least common gains reported were on writing skills (64%), developing a research question (79%), and making presentations (80%), again possibly reflecting the lower proportion of participants who were involved in tournaments and research projects. It is worth noting, however, that while improved writing skills was one of the least frequently reported gains, significantly more participants reported those gains in 2004 than on the 2003 FLL teams.

Finally, team members were also asked to assess the impact of FLL on a variety of attitudes and values generally related to the goals of positive youth development (Table 3-5c). As with the other measures, the results for 2004 closely matched those of 2003, the large majority of participants (88 to 97%) agreeing that FLL had had an impact. Only a few significant differences emerged between the participant reports in 2004 and 2003. A higher proportion of participants in 2004 reported wanting to be able to solve problems for their community when they were older (83.7% in 2003 to 91.2% in 2004). Yet, a smaller proportion expressed interest in becoming a scientist or engineer when they were older (58.7% in 2003 to 45.2% in 2004). What stands out again, however, is the fact that the outcomes for the 2004 teams were generally comparable to those in 2003.

Table 3-5b: Impact on Skills – Participant Perspectives

As a result of FLL, I learned:	2004 FLL Underserved				2003 FLL
	N	Percent 'A Little'	Percent 'A Lot'	Percent 'A Little' or 'A Lot'	Percent 'A Little' or 'A Lot'
Offer suggestions to someone else working with me on a project	147	40.1%	56.5%	96.6%	95.7%
Work with other team members to solve a complicated problem	149	39.6%	56.4%	96.0%	95.9%
Identify ways in which science (like robotics or computers) can help solve a problem in the real world	147	38.8%	57.1%	95.9%	95.5%
Identify the steps I need to follow to complete a project	148	37.2%	58.8%	95.9%	95.6%
*Work well with both girls and boys**	148	31.8%	63.5%	95.3%	87.8%
Manage my time so that I can get all the steps in a project done	148	45.3%	50.0%	95.3%	93.6%
Brainstorm ideas with other team members	149	48.3%	47.0%	95.3%	94.0%
Decide who is going to do what job on a project	149	48.3%	45.6%	94.0%	92.8%
Accept other people's suggestions about my ideas	148	38.5%	55.4%	93.9%	95.2%
Use trial and error to figure out if something (like my robot) is going to work or not	148	31.8%	60.8%	92.6%	93.6%
Use math to help solve a problem in the real world (not just in class)	148	39.9%	52.7%	92.6%	88.7%
Solve disagreements between team members working together on a project	148	43.9%	48.0%	91.9%	89.0%
Find the information I need to answer a research question about a science or technology challenge	148	47.3%	41.9%	89.2%	88.6%
Explain the scientific ideas that my team used in building our robot	148	41.9%	44.6%	86.5%	89.1%
Talk to people I don't know about something I think is important	147	43.5%	38.8%	82.3%	76.7%
*Make a presentation using charts, graphs, pictures, computers, video, or other types of presentation materials**	148	41.2%	39.2%	80.4%	87.6%
Develop a research question	149	46.3%	32.9%	79.2%	84.1%
*Write a brochure or letter that explains my team's project to someone outside our team**	149	34.9%	28.9%	63.8%	50.6%

Note: Based on participant surveys. Blank cells indicate that the question was not asked in that year. Items with an asterisk (*) show a statistically significant difference between the 2003 and 2004 results at a .05 level or greater.

Table 3-5c: Impact on Attitudes – Participant Perspectives

	2004 FLL Underserved				2003 FLL
As a result of FLL:	**N**	**Percent 'Agree'**	**Percent 'Strongly Agree'**	**Percent 'Strongly Agree' or 'Agree'**	**Percent 'Strongly Agree' or 'Agree'**
I believe that I can succeed when I try hard	148	28.4%	67.6%	95.9%	94.7%
I feel the adults on my team care about me and how I am doing	147	43.5%	48.3%	91.8%	
*I want to be able to solve problems for my community when I am older**	148	56.8%	34.5%	91.2%	83.7%
I had something I enjoyed doing when I was not in school	149	39.6%	50.3%	89.9%	
I feel like I am better at math or science that I thought I was before FLL	149	35.6%	36.2%	71.8%	65.5%
*I want to be a scientist or engineer when I am older**	146	28.8%	16.4%	45.2%	58.7%

Note: Based on participant surveys. Blank cells indicate that the question was not asked in that year. Items with an asterisk (*) show a statistically significant difference between the 2003 and 2004 results at a .05 level or greater.

As has been the pattern with the 2003 data as well as with the outcomes related to participant interest, lower percentages of parents than coaches reported that their child had increased knowledge, skills and positive attitudes as a result of FLL (Table 3-6). Still, it is important to note that in 2004, each of these outcomes had at least half of parents reporting at least some increase on each of the measures. The 2004 data show two substantial differences from the 2003 data in the proportion of parents reporting increases. Parents in 2003 were less likely to report gains in their child's ability to work in a group with other students (79.6% in 2003 to 68.4% in 2004) and their child's confidence speaking in front of someone they do not know (71.1% in 2003 vs. 55.3% in 2004). However, a substantially larger proportion of parents saw an increase in their child's math skills in the 2003 Underserved Initiative programs (58.3% in 2004 vs. 42.5% in 2003).

Summary of Coach, Participant and Parent Assessments. Taken together, the coach, participant and parent survey responses present a relatively consistent and positive assessment of the impact of FLL on participants on the Underserved Initiative teams. Across the board, substantial majorities of all three groups report gains on measures of participant interest in science and technology, and on participant knowledge, skills and attitudes. While in many cases the gains are not considered large (i.e., participants gained "a little" rather than "a lot"), those results are appropriate for a program that involves participants over a relatively short period of time and for a relatively small number of hours per week.

More significant, perhaps, for this study is that despite the challenges faced by the 2004 Underserved Initiative teams in implementing the program, the outcomes reported by coaches, participants and parents are generally consistent with those of the broader group of FLL teams assessed in 2003. The lesson here (recognizing that it is based on a limited sample of teams) is that FLL can be established in underserved schools and communities and continue to have an impact on their participants.

Table 3-6: Impact on Knowledge, Skills and Attitudes – Parent Perspectives

Have you noticed changes in any of the following skills or attitudes in your child since he/she started FLL:	2004 FLL Underserved				2003 FLL
As a result of FLL:	N	Percent 'A Little'	Percent 'A Lot'	Percent 'A Lot' or 'A Little'	Percent 'A Lot' or 'A Little'
Knowledge					
You child's understanding in the science and technology involved with helping individuals with disabilities	96	51.0%	28.1%	79.1%	
Your child's understanding of the science involved in space exploration					84.2%
Skills					
Your child's ability to think through the steps involved in solving a problem	97	44.3%	32.0%	76.3%	80.8%
Your child's use of trial and error and other problem-solving strategies	97	46.4%	23.7%	70.1%	78.5%
*Your child's ability to work in a group with other students**	98	38.8%	29.6%	68.4%	79.6%
Your child's ability to take the lead on a group project	98	42.9%	25.5%	68.4%	68.4%
Your child's ability to compromise or settle disagreements peacefully	98	45.9%	18.4%	64.3%	68.6%
Your child's ability to use the library or Internet to find information for school projects	98	34.7%	26.5%	61.2%	65.1%
*Your child's math skills**	96	42.7%	15.6%	58.3%	42.5%
Attitudes					
Your child's sense that he or she can succeed if he or she tries hard	97	43.3%	30.9%	74.2%	77.4%
Your child's sense of belonging to a group	98	42.9%	24.5%	67.4%	75.6%
Your child's sense of self-confidence concerning school and schoolwork	98	36.7%	26.5%	63.2%	62.7%
Your child's sense of having adults on the team who know them and care about how they are doing	95	36.8%	26.3%	63.1%	
Your child's sense of having a safe and friendly place to go after school	97	27.8%	28.9%	56.7%	
*Your child's confidence speaking in front of group of people he/she doesn't know**	94	40.4%	14.9%	55.3%	71.1%

Note: Based on surveys of the parents of team members. Blank cells indicate that the question was not asked in that year. Items with an asterisk (*) show a statistically significant difference between the 2003 and 2004 results at a .05 level or greater.

Examining Differences in Impacts Among Groups within the Study

In addition to the overall assessments of the FLL impacts on participants and the comparison with teams in the 2003 study, the evaluation team also conducted several comparative analyses in response to questions or comments from FLL staff on the initial survey results. In each case, the comparisons were made using participant survey data, which was the only part of the data set large enough to permit these kinds of subgroup analyses.

Rookie Team Comparisons. As noted throughout this chapter, the results showed that large numbers of coaches, participants and parents reported that participant outcomes had occurred as

a result of FLL, and that the results were similar to those for the teams studied in 2003. Where there were differences, one of the questions was whether they reflected the fact that there were more "rookie" teams in the 2004 study than in 2003, or indicated real differences in the experiences of teams in underserved communities versus more typical FLL teams. In order to examine this, the evaluation team compared outcome data from each year for participants who were on teams run by first-year coaches. The full set of tables is presented in Appendix A.

Interestingly, while there were some significant differences between "rookie" teams in 2003 and 2004, in general the outcomes for both groups of rookie teams were comparable. Where differences between the rookie teams did appear, they were generally the same differences that were found when comparing all 2003 teams to all 2004 teams. In that regard, it seems clear that the differences in outcomes that were evident between the Underserved Initiative teams and the 2003 sample were not the result of more rookie teams in one sample, but reflected a real difference in the experience of the teams in the 2004 initiative. As such, where differences in outcomes were evident (for example in the tournament experience and tournament-related outcomes), they represent issues that FIRST and FLL need to examine, rather than artifacts of the sampling process.

Motorola and BGCA. An analysis was also done to compare whether participant outcomes for 2005 differed among those teams who had been recipients of direct FLL (Motorola) grants versus those teams who were part of the Boys and Girls Club of America effort. Those two groups represented the two largest groups of programs within the Initiative. Overall, very few significant differences emerged between these two types of teams. Team members from Motorola teams were more likely to report that they were involved in testing the robot and that they wanted to be able to solve problems for their community when they are older. Motorola participants were also more likely to report that they had learned to offer suggestions to someone else working with them on a project. BGCA participants were more likely to report engaging in raising money for their team. In general, however, very few differences were detected between the Motorola and BGCA groups of participants and the differences that were observed likely reflect random variations in outcomes rather than evidence of systemic differences in the impacts of the programs at the two types of sites.

Attendance at Tournament

An important question that emerged during the evaluation was the degree to which attendance at FLL events affected participant outcomes. In order to examine this, analyses were done to determine whether participant outcomes differed according to a participant's reported attendance at an FLL event (i.e., tournament, qualifier, local event, or other event). To accomplish this, the 2005 participant sample was split between those participants who reported attending at least one event, and those that did not report attending any. Tables showing the results are presented in the Appendix.

A number of significant differences emerged, and all favored the group that had attended at least one event. Several of these differences were not surprising, as they related to the tournament experience. For example, those attending events were more likely to report that they had participated in testing the robot, setting up or fixing the robot at a tournament, and explaining how it worked to judges. They were more likely to be involved in creating team materials and

presenting their team project at tournaments. But participants who attended events were also more likely to report that they were involved in programming the robot, deciding on the question for the *No Limits* project, and getting information from a scientist.

The quality of their team experience differed significantly on several items as well. Participants attending events were more likely to report that the kids made the important decisions as opposed to the adults, that they had a chance to do lots of different jobs, that they had real responsibilities on their team, that they got all the help they needed to do their jobs, and that the adults working with them paid attention to them. They were more likely to feel that they belonged to and were part of the team, and that their team really listened to their ideas. In terms of skill development, those attending events were more likely to report that they had learned to solve disagreements with team members while working on a project, and that they had learned how to work well with both boys and girls, use trial and error, develop a research question and explain the scientific ideas that their team used to build their robot.

These results could be interpreted in a number of different ways. They may reflect differences in the coaches for teams that attended tournaments: i.e., that coaches who are more committed and adept at leading a team are more likely to also attend the tournaments. These coaches may understand the importance of the team building process, and the need to expose participants to as many different aspects of FLL as possible (i.e., programming, research project, etc.).

Alternatively, it could be that preparing for and attending the tournament is in itself the major team-building catalyst, regardless of the coach or other adult volunteers, and that important gains come from participating in that process. Another important consideration to note is that a number of teams did not attend the tournament because they were late starting the program. Because these teams formed late, they may just not have had enough time and experience to develop as fully as teams who had spent the additional weeks working together.

Whatever the reason, this analysis does suggest that involvement in the tournament process is an important part of the FLL experience and likely contributes to the overall outcomes for the program. While participants who are not involved in tournament events may still benefit from participation in FLL, gaining new skills and having an exposure to science that they might otherwise not have had, they will likely reap fewer of the benefits associated with being part of a team. In that regard, this analysis puts increased emphasis on ensuring that teams in future Underserved Initiatives have the time and assistance they need to fully participate in the FLL tournaments as part of their involvement in the program.

Comparison to Other Extracurricular Activities

Lastly, as part of the assessments of FLL, participants and parents in both 2003 and 2004 were asked to compare the overall impacts of FLL to other after-school programs their children were involved in. Given the number of other programs and activities that are available to young people, it is important to have some measure of comparison with other extracurricular activities in which team members might be involved. Both participants and parents were asked to check whether they (or their child) were involved any of several types of activities, other than FLL. For those that were involved in another activity, they were asked to compare the program.

The results are presented in Tables 3-7 and 3-8. In general, a substantial proportion of participants in FLL were actively involved in other types of after-school activities, with approximately 75% of participants in 2004 (and 76% in 2003) involved in at least one other form of extracurricular activity. The large majority of those participants felt that FLL had at least a comparable impact to the other programs, with a substantial portion (35% to 48%) reporting a greater impact from FLL. The parent data showed similar results, with most parents feeling that FLL had had at least the same level of impact on their child as other programs, and with 30%-40% feeling that it had more of an impact. For both participants and parents, FLL was seen as most likely to have a greater impact in teaching cooperation and teamwork, with just under half of the participants also reporting an impact on their sense of self-confidence.

Table 3-7: Involvement in Other Extracurricular Activities

	2004 FLL Underserved		2003 FLL
Participant involvement	**N**	**Percent Involved**	**Percent Involved**
After-school arts, theatre or music groups	156	19.2%	19.5%
After-school clubs (science, debating, etc.)	156	16.0%	15.9%
Intramural or school sports	156	34.0%	33.2%
Boy or Girl Scouts	156	17.3%	18.7%
Volunteer or community service activities	156	9.0%	8.4%
Other	156	24.4%	29.8%
Involved in at least one after-school activity	156	75.0%	76.1%

Note: Based on participant surveys. Blank cells indicate that the question was not asked in that year. Items with an asterisk (*) show a statistically significant difference between the 2003 and 2004 results at a .05 level or greater.

Table 3-8: Comparison to Other Extracurricular Activities

	2004 FLL Underserved				2003 FLL
How do you think FLL compared to your other after-school programs?	**N**	**Percent 'Same Impact'**	**Percent 'More Impact'**	**Percent 'More' or 'Same'**	**Percent 'More' or 'Same'**
Participant Assessment					
Motivating me to do my best all the time	113	60.2%	36.3%	96.5%	92.8%
Teaching me about cooperation and teamwork	112	48.2%	48.2%	96.4%	93.4%
Helping me feel more self-confident	112	46.4%	45.5%	92.0%	89.6%
Parent Assessment					
Teaching your child about cooperation and teamwork	71	52.7%	43.2%	95.9%	96.6%
Helping your child gain a sense of self-confidence	70	61.3%	32.0%	93.3%	95.9%
Motivating your child to excel	68	50.7%	40.0%	90.7%	96.1%

Summary

Taken together, the data from the teams involved in the 2004 Underserved Initiative indicate that despite the challenges they faced, the FLL teams in those communities were able to have a positive impact on their participants, and in most cases, the reported impacts were similar or comparable to those reported by the more "typical" FLL teams in the 2003 Brandeis study. Overall, a large majority of the coaches, participants and parents involved in the 2004 teams

reported gains in participant interest in science and technology and on a wide array of program-related knowledge, skills and attitudes. While the increases were generally characterized as "a little" rather than "a lot", the fact that gains took place given the short season for FLL and the delays in start-up for many teams represents an important accomplishment. Equally significant is the fact that the outcomes for the 2004 Underserved Initiative teams were generally similar to those for the teams in the 2003 study. This suggests that movement into more underserved communities does not necessarily mean a decrease in impact for FLL and, as the new FLL teams gain experience, may actually lead to greater relative gains.

Several cautions are in order in reviewing the data on impacts, however. The first is the reminder that the teams in the 2004 study represent a relatively small portion of the full set of Underserved Initiative teams. To the extent that the non-reporting teams were less organized, less likely to have participated in tournaments, or never formed at all, the results for the initiative as a whole may have been less positive. In that regard, these results should be viewed as those of the more successful teams, representing the potential of the Underserved Initiative more than a definitive assessment of its impact on all the young people involved.

Similarly, some caution needs to be used in comparing the 2004 and 2003 results. On the one hand, the nature of the Challenge differs from year to year, and while impacts on basic skills and attitudes should not vary, it is possible that different challenges may affect interests differently or involve participants in using different skills. Perhaps more important, the 2003 and 2004 assessments are being made by different coaches, participants and parents, who may apply different sets of standards in assessing the program. As such, while large proportions of respondents in both years reported gains, those are perceived gains and may be influenced by different expectations and experiences.

That said, however, the overall results in terms of participant impacts have to be seen as encouraging, with FLL teams moving into new settings and reaching out to new coaches and participants still able to generate a positive set of outcomes for program participants.

Chapter Four

Coach and Parent Involvement and Satisfaction

Traditionally, the success of FLL has hinged on the involvement and satisfaction of coaches and the parents of participating participants. As such, one of the major goals of the evaluation was to determine to what extent FLL was able to successfully engage adults in support of the FLL teams in underserved communities. To what extent was FLL successful in engaging and satisfying the coaches working with the teams in the Underserved Initiative? Did participation in the program have an impact on coaches in terms of their own interest in or knowledge of science and technology or on the way in which they work with young people? Were parents of team members actively involved with the FLL teams, and how did their level of involvement compare with that for the general population of FLL teams, based on the data from the 2003 study?

The data for the pilot year indicate that the coaches working with the teams in the Underserved Initiative were engaged and satisfied with their experience, and largely expect to continue their participation in future years. While the coaches in the Underserved Initiative were somewhat less satisfied with their experience than their counterparts in 2003, they expressed an interest in returning at almost the same rate as the coaches from more "typical" FLL teams.

The coaches who were teachers or staff at a community agency also reported a variety of positive impacts on their teaching and program practices as result of their participation. While few felt that FLL had changed their practices "a lot," a large proportion indicated that some change in thinking or classroom practice was taking place.

The FLL teams in the Underserved Initiative were less successful in involving parents in the team. As noted in Chapter 2, teams were much less likely to have parents involved, and those that were involved participated at much lower levels than parents of team members in the 2003 study. As is discussed in the next chapter, the experience of the pilot teams suggests that improving parent involvement is one of the major challenges facing FLL as it moves into more underserved communities.

Coach Involvement and Satisfaction

In many ways, the coaches involved in the Underserved Initiative represent a major change from the typical FLL coach observed in the 2003 study. As discussed earlier in the report, and as shown in Table 4-1, the 2004 coaches were much less likely to come from the ranks of team parents and substantially more likely to be coaching the team as part of the job, either as a teacher or a community agency staff person. Nearly half of the coaches in the 2004 sample (48%) reported that they were coaching the team as part of their job, and more than a third (36%) reported that coaching was an assigned task – not something they had volunteered to do.

Table 4-1: Coach Involvement and Satisfaction

	2004 FLL Underserved		2003 FLL
Overall satisfaction with coaching experience:	**N**	**Percent**	**Percent**
Very satisfied	13	39.4%	56.3%
Satisfied	13	39.4%	31.0%
Somewhat satisfied	6	18.2%	12.0%
Not satisfied	1	3.0%	0.6%
Did you volunteer or were you assigned to become an FLL coach?			
Volunteer (i.e., had a choice)	21	63.6%	
Assigned coaching role	12	36.4%	
Initial Level of Interest in taking on role as an FLL coach:			
Very interested	17	51.5%	
Somewhat Interested	16	48.5%	
Not Very Interested	0	0.0%	
Not Interested at All	0	0.0%	
Primary reason coaching team this year:			
Part of my job as a teacher or community agency staff person	15	48.4%	4.9%
Way to get children interested in science and technology	8	25.8%	54.3%
Like to learn new skills or take on challenges	3	9.7%	11.1%
Way to spend time with my child/children	2	6.5%	27.2%
Way to support the school or community agency	1	3.2%	14.2%
Want to contribute to my community	1	3.2%	16.0%
Part of my home-school program	1	3.2%	2.5%
Part of my company's community involvement program	0	0.0%	1.2%
Socialization/meet new people	0	0.0%	4.3%
Other	0	0.0%	14.8%
Total Respondents	31		
Plan to Return Next Year	31	83.9%	88.2%

Note: Blank cells indicate the question was not asked in that year. Total coach survey respondents was 33 in 2004 and 162 in 2003.

Despite this difference in how coaches became involved in FLL, all of the 2004 coaches reported being initially interested in taking on the role. About half of coaches (51.5%) reported being 'very interested' and about half (48.5%) reported being 'somewhat interested.' None, despite the "non-voluntary" nature of the assignment indicated that they were "not interested" or "not interested at all".

Within this context, coaches were also generally satisfied with their experience with FLL, with 79% of coaches being 'satisfied' (39.4%) or 'very satisfied' (39.4%) with their coaching experience. Only one coach reported being 'not satisfied.' However, coaches were somewhat less satisfied in 2004 than their counterparts in the 2003 study, 87% of whom were reported being 'satisfied' or 'very satisfied'. It may be that the differences reflect the start-up problems experienced by the 2003 teams, or a higher level of frustration among coaches because of some of the challenges working in underserved communities. What is striking, however, is that despite a lower level of reported satisfaction, the 2004 coaches indicated that they planned to continue in FLL at a rate nearly that reported by the coaches in 2003. The five coaches (out of 33) who did not intend to return cited lack of time/other obligations (2); changing schools or jobs (2); lack of funds to support the team (2); and lack of volunteer support (1).

When asked on the surveys to describe the primary benefit of being an FLL coach, coaches discussed enjoying working with young people, gaining new skills, and being able to give back to the community. As one coach noted:

> *"[The primary benefit of FLL was] working with youth throughout the challenging process, growing in my own technical knowledge, while helping my team gain knowledge and confidence in robotics."*

Impacts on Coach Attitudes and Practices

Coaches who were teachers or staff at a community agency were also asked to report on FLL's impact on their own knowledge, attitudes, and teaching or group leadership practices (Table 4-2), Twenty-four of the FLL coaches responded.

In general, most of the coaches (roughly 80% or more) reported a positive impact from their involvement in FIRST on their own knowledge, interests, and approach to their job, including their use of youth-led projects in their classes, their emphasis on the application of technology to real-world problems, their own knowledge and interest in science and technology, and their own enjoyment and satisfaction in teaching. Coaches also noted an increased use of computers and robotics in their classes, an increased respect for the capacity of their participants, and an increased sense of connection with their students. Only one coach reported any negative impacts due to his or her FLL involvement. In that case the coach reported that his respect for young people's capacity to work as a team had decreased as a result of his experience with FLL.

In most cases though (on 6 out of 9 measures), coaches were more likely to report that their involvement in FLL increased their knowledge, skills, and attitudes 'a little' rather than 'a lot." Given their first-time involvement and the relatively short season, this is not a surprising result. At the same time, on most measures (5 of 8), the proportion of coaches reporting an impact was similar to those reporting impacts in 2003. The one major difference was that the coaches in the 2004 Underserved Initiative were substantially more likely to report an impact on their use of youth-led projects (91% in 2004 vs. 67% in 2003).

Finally, it is worth noting that far fewer coaches reported that FLL had an impact on their schools or community organizations through the creation of new partnerships. However, this is one of the areas where the impacts were apparently much larger for the 2004 Underserved Initiative teams than the "typical" FLL program in 2003. While 58% of the coaches reported new partnerships in 2004, only 33% of the coaches reported new partnerships in a somewhat differently worded question in 2003. In this instance, participation in the FLL Underserved Initiative may have helped introduce a number of schools to new resources or partners in the community.

Table 4-2: Impacts on Teacher/Staff Attitudes and Practices

	2004 FLL Underserved				2003 FLL
How has your involvement in FLL affected:	**N**	**Percent Increased 'A Little'**	**Percent Increased 'A Lot'**	**Percent Increased 'A Lot' or 'A Little'**	**Percent Increased 'A Lot' or 'A Little'**
My use of youth-led projects in my classroom or programs	23	69.6%	21.7%	91.3%	66.7%
My emphasis on the application of science and technology in real-world settings	24	66.7%	20.8%	87.5%	86.5%
My own knowledge of current science and technology	24	62.5%	25.0%	87.5%	88.2%
My own enjoyment or satisfaction in teaching (or working with young people)	23	43.5%	43.5%	87.0%	83.0%
My respect for young peoples' capacity to work as a team independent of an adult	24	41.7%	41.7%	83.4%	81.3%
My use of computers and robotics in my classroom or programs	24	41.7%	41.7%	83.4%	75.9%
My sense of connection to the young people in my classes or programs	24	50.0%	29.2%	79.2%	86.4%
My understanding of what young people can accomplish when given the chance	24	45.8%	33.3%	79.1%	89.8%
My school or organization's partnerships with or support from area businesses	24	45.8%	12.5%	58.3%	
My school's partnerships with area businesses					33.4%
Business support for other programs in my school					28.6%
Total respondents	24				

Note: Respondents in 2004 were teachers or community agency staff. Respondents in 2003 were teachers only. A blank cell indicates the question was not asked in that year. Total coach survey respondents was 33 in 2004 and 162 in 2003, of whom 67 responded to this set of questions..

Parent Involvement and Satisfaction

While FLL teams were largely successful in engaging and having an impact on the team coaches, the teams in the Underserved Initiative were much less successful at gaining the involvement of parents. As noted at the beginning of this chapter, parent involvement with FLL was low, with half of the parents surveyed indicating no involvement beyond their child's participation on the team (Table 4-3). Only 5.1% reported being 'very involved,' and an additional 18% reported being 'moderately involved.' These figures contrast sharply with the data from the 2003 study, which found that nearly a quarter of the parents from those FLL teams were 'very involved' and another 23% were 'moderately involved.' Overall, parents of the 2004 participants reported spending an average of 1.9 hours per week (including driving their child to events) on FLL-related activities during the season. This figure is approximately half the 3.7 hours reported by parents associated with the teams in 2003. Given the low levels of parent involvement as reported by parents, it is no surprise that one of the biggest challenges for coaches was obtaining support from parents (as discussed in Chapter Five).

Table 4-3: Parent Involvement

	2004 FLL Underserved		2003 FLL
Extent of Involvement	**N**	**Percent**	**Percent**
Very involved	5	5.1%	24.2%
Moderately involved	18	18.2%	22.7%
Slightly involved	23	23.2%	35.1%
Not involved beyond child's participation in FLL	50	50.5%	18.3%
Time Spent on FLL-Related Activities	**N**	**Mean**	**Mean**
Avg. hours spent by parent during FLL season (including driving child)	82	1.9	3.7
Avg. hours spent by child during FLL season (excluding travel time)	87	4.1	5.4
Primary Reason Actively Involved[13]	**N**	**Percent**	**Percent**
Way to support the school/community organization	19	50.0%	7.0%
Way to spend time with my child/children	17	44.7%	44.3%
Want to get children interested in science and technology	14	36.8%	35.9%
Want to contribute to my community	7	18.4%	1.1%
Like to learn new skills or take on challenges	5	13.2%	3.3%
Wanted to meet new people/get involved with people	4	10.5%	1.1%
Part of my company's community involvement program	1	2.6%	0.0%
Other	3	7.9%	7.3%
Total respondents	38		
Primary Reason NOT Actively Involved[14]			
Lack of time	45	67.2%	71.3%
Do not feel that I have much to contribute	7	10.4%	20.6%
Lack of interest in robotics/mechanical things	4	6.0%	5.4%
Don't want to make too big a commitment/plan too far in advance	3	4.5%	2.7%
Too many administrative tasks in the program	1	1.5%	0.4%
Uncomfortable with other adults on team	0	0.0%	1.3%
Uncomfortable with students on team	0	0.0%	0.0%
Dislike the way team is run	0	0.0%	0.4%
Program did not meet my expectations	0	0.0%	0.4%
Other	16	23.9%	4.0%
Total respondents	67		
Type of Current Involvement			
Provided transportation (for children other than their own)	22	22.2%	45.5%
Supplied food for meetings or events	18	18.2%	
Donated money or materials	17	17.2%	50.6%
Assisted the team with their Research Project	9	9.1%	30.2%
Provided mechanical or engineering assistance to team	8	8.1%	18.9%
Held meetings at their home	5	5.1%	
Researched or contacted possible funding sources	5	5.1%	11.7%
Provided mechanical or engineering assistance to coach	1	1.0%	7.7%
Other	10	10.1%	24.6%
Parents Attending			
Team meetings	27	27.3%	63.7%
Tournaments	26	54.2%	80.3%

Note: A blank cell indicates the question was not asked in that year. Total parent survey respondents was 99 in 2004 and 699 in 2003.

[13] The format of the question differed from 2003 (check one) to 2004 (check all). As such, responses are not directly comparable from year to year.
[14] See footnote above.

Parents with children on the 2004 Underserved Initiative teams chose to be involved with FLL for a variety of reasons. Half of the parents were involved as a way to support the school or community organization, a reason cited by only 7% of the parents in 2003. Parents also saw FLL as a way to spend time with their child/children (45%) and got involved because they wanted to get children interested in science and technology (37%). Smaller proportions of parents were involved with FLL as a way to contribute to their community (18%); because they liked to learn new skills or take on challenges (13%); as a way to meet new people or get involved with people (11%); and (rarely) as a part of their company's community involvement program (2.6%).

Parents were involved with their teams in several ways. The most common type of involvement (22% of parents) was providing transportation for children other than their own, followed by supplying food for meetings or events (18%) and donating money or materials (17%). Relatively few parents in 2004 helped their team with a research project (9%); provided mechanical or engineering assistance to the team (8%); held meetings at their home (5.1%); and/or researched or contacted possible funding sources (5.1%). Overall, the participation levels in 2004 in all of these specific areas were substantially lower than in 2003: half of the parents in 2003 reported donating funds to the team, 46% provided transportation, 30% assisted with the research project, and nearly 20% provided engineering assistance to the team. Parent in 2003 were also substantially more likely to report attending team meetings (64% in 2003 vs. 27% in 2004) and the FLL tournaments (80% in 2003 vs. 54% in 2004).

Parents cited a few key barriers to being actively involved. The most common reason reported (by two thirds of the parents) was lack of time, and another 4.5% did not want to make too big of a commitment or plan too far in advance. Nearly one-quarter (23.9%) of parents selected 'other' as the reason they were not involved with FLL. In most cases these parents noted they were never asked to volunteer, did not know they could volunteer, or were unaware of what FLL was about. Smaller proportions of parents did not get involved because they did not feel they had much to contribute (10.4%); lacked an interest in robotics or mechanical things (6.0%); or thought there were too many administrative tasks in the program (1.5%).

Two points stand out from the data on parent involvement. The first is the degree to which this is a pervasive issue for the 2004 Underserved Initiative teams. The relatively low levels of involvement clearly suggest that this is likely to be an issue for teams working in underserved communities, even after the initial start-up issues are solved. At the same time, it is also clear that FLL teams in these communities can and need to do a better job in communicating volunteer needs and opportunities, making sure that parents are aware of the program and encouraging coaches to let parents know how they can be involved.

Summary

The data on coach and parent involvement present a somewhat contrasting sets of findings. In general, coaches working with teams in the FLL Underserved Initiative were satisfied with their experience and felt that it had enhanced their thinking and teaching in a number of ways. A high proportion of the 2004 coaches reported that they planned to stay involved, a positive finding both as a measure of basic satisfaction with the program and as an indicator that teams initiated under the grant have a good chance to persist.

At the same time, the issue of parent involvement is clearly a challenge, and one that appears substantially greater for the new teams in the Underserved Initiative than for the more "typical" teams in the 2003 study. The data here, as well as the feedback discussed in Chapter Five suggest that some form of additional information and outreach to parents will be required to bring them more actively into the FIRST "family" of programs.

Chapter Five
Challenges and "Lessons Learned"

One of the major goals of the evaluation was to identify implementation issues and "lessons learned" or "best practices" information regarding the establishment and sustainability of FLL teams in underserved communities. What kinds of barriers did teams in the Underserved Initiative have to confront in establishing or operating their teams? What kinds of issues do teams need to address in terms of sustaining their operations over time? At the same time, were teams in the Underserved Initiative able to identify effective strategies for engaging youth, running the team, securing resources, or promoting the team's sustainability over time? What suggestions or recommendations did they have to offer other FLL teams or FIRST?

To begin to answer these questions, the evaluation drew on several major sources of information. Coach and parent surveys solicited responses to open-ended questions asking about barriers and potential solutions. During telephone interviews with a sample of FLL coaches, FIRST, and intermediary organizations, staff painted a richer picture of the challenges and strategies used in forming and operating the teams.

What emerged is a valuable body of data on the barriers faced by teams in the Underserved Initiative and a host of suggestions for ways in which individual teams and FIRST can start to address them. Key barriers included those of finding adult mentors and volunteers and securing parent support, as well as the challenges of gaining and holding the attention of team members amidst a variety of competing interests and attractions. Some of the key needs identified and solutions offered included development and distribution of additional technical assistance and support materials for coaches (particularly video-based materials that can help rookie teams better understand the competition process) and more effective promotion and dissemination of information on FLL, both in terms of general program information (what it is, how to set up a team) and local information on team operations (schedules, potential parent roles, etc.).[15] Although the teams in the 2004 study were largely from underserved areas and/or were rookie teams, many of their comments (especially those related to the need for more publicity for FLL, more coach support and training, and the need for videos or other visual materials) echo those from the 2003 study of the FLL program as a whole.

Beyond this, coaches, parents and others have a variety of practical suggestions to offer. In presenting the information gained from the interviews, this chapter first provides background on the sources of information (interviews, surveys, etc.), then highlights the survey data on barriers, and then organizes the coach, parent and participant feedback in terms of further explanation of the barriers and potential solutions.

[15] In some cases, this information may already be available from FIRST, but coaches are not aware that it exists.

Sources of Data on Barriers and Lessons Learned
As noted, the evaluation drew on two major sources of data in collecting information on the barriers and "lessons learned" associated with the FLL Underserved Initiatives: responses to open-ended questions on the coach and parent surveys and telephone interviews with a sample of coaches and FIRST and intermediary staff.

Feedback from Surveys. The surveys used in the 2004 study included a series of questions designed to get feedback on how to best operate teams in underserved areas. Coaches were asked to comment on challenges or barriers; materials or resources from FLL they found especially helpful; materials/information, training, and other types of assistance FLL could provide to help teams like theirs compete successfully; strategies or resources they found particularly useful or successful as they organized and ran their team (e.g., recruiting and fundraising strategies, ways to help team members prepare for the Challenge, websites or organizations that had helpful materials); and other advice and feedback for FLL. Parents were asked to describe what FLL could do to make it easier for children like theirs to be involved in the program; make the FLL experience better for children in the program; and make it easier for parents to get involved in their child's FLL team. The open-ended responses were compiled and sorted by topics for analysis. Copies of all the open-ended responses are included in the Appendix.[16]

Telephone Interviews. Telephone interviews were conducted with a sample of coaches and FIRST and intermediary staff. At the "national" level, the interviews with FIRST and intermediary staff were aimed at gathering background information on the major components of the FLL Underserved Initiative, with a focus on how teams were identified, recruited and/or selected to receive grants; the kinds of technical support provided by the partners to teams; and the challenges and benefits of this type of targeted demonstration. Interviews were conducted with key national program staff from FIRST, Boys and Girls Clubs, and one of the FLL Partners.

At the team level, telephone interviews were conducted with a sample of coaches aimed at identifying and highlighting challenges, lessons learned, and effective practices, with a focus on such issues as the process of recruiting coaches and team members; finding mentors with appropriate expertise; logistical issues (transportation, meeting locations), financial issues, and the role of the national 'partners' (FIRST, BGCA, and the YMCA) in organizing and supporting the teams. Coaches were asked to identify and discuss any issues that were particularly associated with operating teams in underserved communities and for suggestions to FIRST on how to expand FLL into additional underserved areas. The interviews also explored the related issues of the impact of the FLL grant, sustainability, and what kinds of assistance teams in underserved communities are likely to need in order to continue over the longer term. Finally, coaches were also asked to identify any "smart strategies" they had discovered – ideas that had worked (or not worked) that could serve as the basis for advice to other teams.

A deliberate effort was made in selecting a sample of teams for the telephone interviews to capture a variety of experiences and points of view. The initial sample of 30 coaches selected for interviews was constructed through a stratified random sampling process designed to ensure the

[16] Participant surveys also included comments on what participants like and did not like about their FIRST experience. Those comments are also included in the Appendix.

inclusion of coaches from each of the major components of the grant Initiatives ((Direct grants (Motorola), BGCA, and the Houston YMCA teams)), as well as teams that did not receive any grants. In addition, in an effort to capture the experiences of some of the teams that had not responded to the survey, coaches were also selected from both the survey respondent and non-respondent groups. Of the original 30 coaches selected, telephone interviews were completed with 16: half were survey respondents and half were not. Nearly all (14) of the coaches interviewed had successfully run teams; two of the coaches had not been able to get a team organized, and one had to stop the team midway through the season due to an illness in the family. Three-quarters of the coaches interviewed (12 teams) had received grants from FIRST; four had not. Table 5-1 provides a summary of the background of the coaches/teams included in the interview process.

Table 5-1: FLL Coach Interviews

	Direct (Motorola)	NIST BCGA	No grant	Total
Ran team	7	4	3	14
Did not run team	1	0	1	2
Total	8	4	4	16

The coaches interviewed ran teams in a mix of urban, suburban, and rural settings. With some exceptions, coaches described their communities as being ones where racial minorities or participants from low-income families are in the majority, having many single-parent homes, and having high levels of unemployment. Several teams operated through technology clubs and programs at schools or community-based organizations. One team was comprised of all girls and operated out of a YWCA and another operated out of a BGCA which served Native American youth. One coach had run a team in the past, but this was the first year his team was able to attend a competition. In almost every case, the interviewees were willing to take considerable time for the interviews. As such, they provided a rich and valuable source of information for FLL and the study.

Identifying the Barriers to Implementing and Sustaining an FLL Team

The starting point for the discussion of barriers and solutions is a set of questions on the FLL Coach Survey that asked coaches to rate a series of potential challenges to forming or operating a team. The list of barriers had been drawn from the 2003 study of FLL, as well as discussions with FIRST staff. Coaches were asked to rate each item on a scale of whether it was a "major barrier/challenge" to "not a barrier/challenge". The results are presented in Table 5-2 below.

The results help to highlight the mix of challenges faced by the teams in the Underserved Initiative. Three of the barriers were cited by over half of coaches as 'major' or 'moderate' challenges: finding volunteers/adult mentors with technical expertise; gaining sufficient parent support; and turnover/lack of attendance among team members. Most other issues (getting help or advice on how to prepare for the FLL Challenge, raising sufficient-funding, recruiting enough team members, having sufficient access to computers and the Internet; and obtaining an appropriate location where the team could meet) were seen as 'major' or 'moderate' challenges by at least one-fourth of coaches.

What is surprising to a degree is that a majority of coaches responded that three of the issues were *not* seen as a barrier or challenge: having sufficient access to computers; finding an

appropriate location; and gaining administrative support. Given the focus on schools and organizations serving low income communities, the fact that access to computers and space is not an issue for many coaches provides a degree of reassurance about FLL's ability to expand into these areas. Similarly, the fact that over 40% of the coaches indicated that funding was not a barrier also suggests that FLL is seen as relatively affordable by a substantial portion of the target audience, though this response may have been influenced by the availability of the various FLL grants.

In the end, what is clear is that the list of barriers represents a useful list to consider in exploring the challenges to the implementation and expansion of FLL in underserved communities. As such, the following section is organized by the list of barriers/challenges and includes comments and suggestions from the interviews and open-ended survey responses related to each. That section is followed by a discussion of additional challenges that coaches mentioned either during the phone interviews or in the open-ended survey responses.[17]

Table 5-2: Challenges and Barriers

	2004 FLL Underserved					
Challenges or barriers to forming or operating teams:	**N**	**Percent 'Not' a barrier/ challenge**	**Percent 'Minor'**	**Percent 'Moderate'**	**Percent 'Major'**	**Percent 'Major' or 'Moderate'**
Finding volunteers/adult mentors with technical expertise	33	21.2%	6.1%	27.3%	45.5%	72.8%
Gaining sufficient parent support	33	33.3%	12.1%	33.3%	21.2%	54.3%
Turnover/lack of attendance among team members	32	21.9%	25.0%	25.0%	28.1%	53.1%
Getting help or advice on how to prepare the team for the FLL Challenge	33	33.3%	24.2%	27.3%	15.2%	42.5%
Raising sufficient funding for the team activities	33	42.4%	21.2%	21.2%	15.2%	36.4%
Recruiting enough team members	33	39.4%	30.3%	18.2%	12.1%	30.3%
Having sufficient access to computers and the internet	33	60.6%	12.1%	21.2%	6.1%	27.3%
Obtaining an appropriate location where the team could meet	33	63.6%	12.1%	9.1%	15.2%	24.3%
Getting administrative support	33	66.7%	18.2%	9.1%	6.1%	15.2%

Note: Questions in this table were not asked in 2003. Total coach survey respondents was 33 in 2004.

Finding Volunteers or Adult Mentors with Technical Expertise

Finding adult volunteers or mentors was the most commonly noted barrier on the surveys, cited by 73% of the coaches as a major/moderate challenge, and as a major challenge by nearly half. Coaches struggled to find enough mentors, especially those with a technical background, "so that all students who desire to participate can participate." One coach commented that he needed "serious mentor assistance" and was unable to get contact information for a senior mentor. Some requested help with training their mentors; as one coach noted, it was difficult to "keep the volunteers motivated."

[17] For more specific examples, please see the Appendix for quotations from the open-ended survey responses.

Gaining Sufficient Parent Support
The second most frequently cited challenge (cited by 55% of coaches as a major/moderate barrier) was that of parent involvement and support. Some coaches observed that they found the cultural difference amongst parents to be challenging: some parents were hesitant to push their children in new directions; others, having never left the local area themselves, were reluctant to send their children on trips to tournaments; and some parents picked up their children too early from meetings. Coaches also described how it was often difficult to reach parents and hard to get permission slips signed.

Better scheduling and communication
Coaches noted that parents may want to help, but do not always have the time to be able to do so. Along those lines, parents suggested better fitting the FLL schedule with their work schedules, with suggestions that teams "have meeting sessions on Saturdays and Sundays" or "possibly at home exercises." Parents also suggested publicizing the team's activities more and in greater detail; e.g., "[Send] newsletters about what's going on, what they are doing and what's next to look forward to."[18]

In addition to written material, parents suggested having the team do robotics demonstrations or provide a video highlighting the program to spark interest. **Lack of information about the program in general may have inhibited parents from participating.** As one parent said, "It would have helped if FLL provided a pamphlet explaining robotics etc. and what is involved. While reading the survey I'm just finding out it had something to do with helping people with disabilities. If I had known this, I would have probably participated in the competition at least." Parents also requested that they receive information "on events and schedules earlier" and/or at the "beginning of the school year."

Still, **other parents requested that FIRST or coaches provide an "itemized list of things parents can do" to help with the team**. Parents did not specifically mention feeling intimidated by robotics, but some may want to know that they can help with the team in ways that do not require technical expertise, such as with "typing and administrative work" as one coach noted. Others had ideas about how coaches could directly involve more parents. One parent noted, "Our team was a 'co-op': each parent helped at certain meetings and that was good for the children and parents." Encouraging teams to do robotics demonstrations at PTA meetings was also suggested as a strategy FIRST should consider.

Turnover or Lack of Attendance among Team Members
Issues around gaining consistent attendance and participation were also mentioned by a majority of coaches (53% of the coaches in the survey). Coaches at BGCA, 4-H, and other settings talked about the difficulty in securing regular attendance, in part due to other activities (e.g., basketball) available at their club which they saw as "competing" with FLL for the children's time and interest. Some coaches instituted tough requirements to select only motivated and high-achieving students and required all team members to attend meetings on time. While restricting participation to the most motivated, this type of screening method was seen by these coaches

[18] When asked in the survey to discuss what FLL could do to make it easier for parents to get involved, roughly 42% of those responding discussed the need for increased program awareness and at least 25% suggested ways for directly involving parents with teams.

using it as an effective solution to attendance problems. One coach found attendance to be a problem because his team was run at a club as an open program with no requirements of the participants. In this instance, children came and went as they pleased, making it difficult to build any continuity. On the other hand, another coach suggested that FIRST either restructure the FLL program or create a new program for teams that have trouble finding a committed group of children. Under that model, FLL or a new program would operate more as an open club where different children could participate at different times to contribute to a variety of small challenge tasks that would be completed in a short timeframe or on a drop-in basis. Interestingly, when interviewed, the Director of Technology at BGCA talked about the organization's involvement with the FLL program as a way to get children to come more regularly to their clubs. Clearly opinions and ideas for solution in this area varied, though the issue is clearly a concern as FLL moves into more non-school club settings.

Getting Help or Advice on How to Prepare the Team for the FLL Challenge

Approximately 40% of the coaches cited getting help or advice as a major or moderate barrier or challenge in the survey. Coaches discussed needing more assistance with the technical aspects of FLL (e.g., programming, using sensors, and being informed that removing the battery would erase all that had been programmed); advice on how to structure their meeting time; a better explanation of the research project and how it should be presented; and a better idea of what to expect at the tournaments. As one coach commented, "[I needed] more info on how to prepare for the tournament -- I honestly felt blindsided." Also, coaches and parents suggested having access to past challenges and successful projects so that they would know what to expect at the tournament. Videos were suggested by nearly one-third of coaches as a great medium for providing this type of information.[19]

A Need for More Training and Workshop Opportunities

Coaches and parents called for more training and workshop opportunities ("need it desperately").[20] Some requested that training sessions be free of charge or available as a video for teams in more remote areas or for those that cannot afford to travel. Several requested a series of sessions just for first-time coaches. Others emphasized the value of seeking coaches' input into such workshops. Those without technical expertise themselves felt it was more difficult to coach the team, especially when they were unable to find mentors to fill in that knowledge gap.

Coaches wanted to be able to call on other coaches for help and suggested having a database with the contact information for local coaches or those in other underserved areas. Coaches also suggested being partnered in their first year with a veteran coach.

In addition to needing help with FLL program specifics, coaches frequently asked about getting help with how to best motivate and coach children. For instance, one coach found it difficult "working with the differing needs of girls." Another found team members were reluctant to

[19] Nearly one-third of all coaches discussed the need for videos when asked on the survey to note what FLL could do to help teams. A similar proportion of coaches noted that visual materials were among the most helpful resources they used. The need for videos was also noted by coaches in the 2003 study.

[20] When asked on the survey what FLL could do to help teams, roughly 36% of coaches mentioned providing training or workshops. Comments during phone interviews also reflected this as being a priority.

show their true intelligence. A coach at a Boys and Girls Club thought examples of how teams were run in other club settings would be helpful.

Keeping Young People focused

Similarly, focusing the children to stay on task was another challenge mentioned by coaches.[21] A few coaches decided to switch meeting times to Saturdays to remove distractions for their team members who had been having trouble staying focused. One coach noted that meeting on the weekend also worked better for his mentors. Some coaches had trouble getting their team members interested in FLL activities because the children did not want to do "school-like work" after school. Others found it difficult to "occup[y] all members at once during team practices and meetings." Still others talked about the challenges of dealing with their team members' short attention spans. To that end, one coach thought that having a smaller team (5-7 team members instead of 10) would have worked better.

Ensuring a child-directed program (one of FLL's goals) was difficult for a few of the coaches. For example, one coach described his greatest challenge as "maintaining a successful student directed program" and another as "being able to step back and let the girls run the show." To combat this challenge, one coach worked to instill confidence in his team members: "I coached the students that they could do it themselves and they did!" FIRST may want to circulate best practices on running child-directed teams.

Advice on Team-building

Finally, coaches needed advice on how to have all their members work together as a unified team. For instance, one coach running a team in a club setting noted, "The fact that we were working with girls, all from different schools, created the need for us to do more team-building activities." Coaches hoped FIRST could provide them with advice on team-building resources. To that end, one coach dedicated the first two weeks of the season to only doing team-building activities. Another coach, who viewed her team as being youth-led, saw her role as coach to be there just to "stop conflicts." One strategy she used was to have team members test everything out and vote on decisions. Another coach emphasized the importance of rewarding the team members for their cooperation and progress. Again, FIRST may want to hold workshops for or provide coaches with suggested team-building strategies.

Addressing Academic Needs

Finally, several teams reported that they had team members who were functioning below-grade level academically. As FIRST moves into more schools in underserved communities it may need to provide more resources for coaches on how to help address the academic needs of participants. Coaches suggested that FIRST consider providing them with curricula, lesson plans, or suggested resources for teaching relevant SMET principles and the skills needed for the Research Project in an engaging and fun fashion. Other teams might benefit from advice or examples of how teams deal with the academic needs of their team members. One coach, for example, spent an hour at each team meeting for the students to work on homework and prepare for tests; another had his students do math problems related to the project. What is clear,

[21] Reported by one-fifth of coaches responding to a survey question about their greatest challenge as a coach. This kind of challenge was also mentioned by coaches in the 2003 study.

however, is that as FIRST tries to broaden the involvement in FLL, it will likely also need to provide more of these kinds of supports to the coaches and teams who are participating.

Raising Sufficient Funding for the Team Activities
Funding issues were not presented as the most important challenge, but were noted as major or moderate challenges by roughly one third (36%) of the coaches in the surveys. In general, when coaches and parents cited the need for more funding, they did not specify a dollar amount. However, one BGCA coach noted that his club could not afford to spend more than $200 on any one program. Another coach advised FIRST to "continue to have scholarships [i.e., grants to underserved teams] available."

In addition to needing more money, some coaches and parents talked about needing more robots. For instance, one parent said: "I had children using one robot and conflicts arose often." Similarly, another parent thought a maximum of three participants per robot would be ideal. Indeed, some Motorola grantees were able to buy a second kit with their grant money, and were then able to involve more children on the team and have the participants compare the two robots side-by-side. In identifying other financial needs, another coach thought that it would be easier to start more teams in underserved areas if teachers were paid for their FLL coaching time.

As noted earlier, while the need for funds was identified by approximately one third of the teams as a major or moderate barrier, 60% indicated that raising sufficient funds for the team was "not a barrier" or only a "minor" barrier. This is not to understate the degree to which resources are an issue for these teams. But it is important to recognize that money is not the major issue for many teams, and substantial numbers are able to address it through their own fundraising or grant-writing efforts.

Recruiting Enough Team Members
Almost one-third of coaches (30%) found it difficult to recruit team members. In contrast, one coach mentioned too much participant interest - "having to turn students away" - as being a challenge.

Recruiting Girls.
Specifically recruiting girls was a challenge for some coaches. For instance, a coach in a 4-H club ran an all-boys team this year; he was unable to get girls involved because they saw FLL as a "boy thing." Another coach ran an all-boys team purposefully to avoid "gender issues" but hopes to involve girls next year. One coach had several girls on his team because he "inadvertently got them involved separately from the boys, and they felt more confident in their ability and importance in the process." He described that when the team worked together as a whole later, "the girls knew the importance of their voices and were less self-conscious about their input."

Some teams operated as all-girls teams. A coach of one such team offered some strategies for engaging girls during team meetings. For example, she used a storytelling game as a way for her team members to develop their presentation for the research project. Team members went around a circle, with each girl adding a part to the story and voting on what to keep.

The BGCA Director of Technology also suggested some strategies for involving more girls. He thought FIRST could improve marketing materials by creating posters, brochures, and other items in which girls are featured more prominently. He also suggested that in marketing FLL to girls, FIRST and coaches should place more of an emphasis on FLL's teamwork benefits. He had found that girls tend to be attracted to being part of a group. Another strategy he suggested was to create some girls-only options: for example, a girls-only tournament. Finally, he mentioned choosing challenge themes carefully to make sure they appeal to both boys and girls. He had found that girls tend to be more interested in using robots to solve social issues; they seemed to enjoy this year's "No Limits" theme on physical disabilities. However, he thought next year's "Ocean Odyssey" might be a less attractive topic to girls. A coach of an all-girls team also felt that FIRST should have more girl-friendly or gender-neutral topics.

Having Sufficient Access to Computers and the Internet
Though just over one-fourth of coaches (27%) found computer and Internet access difficult, few commented on this particular challenge in the interviews or open-ended responses. One coach noted that having computers was necessary in order to start an FLL team. He only had access to one computer and would like to find money to buy another. Another coach requested that materials be mailed to his team because of limited Internet access. On the other hand, it was clear in talking to the BGCA technology director that most club-based teams would have ready access to computers since most now had technology programs.

Obtaining an Appropriate Location where the Team could Meet
Finding space to meet and a safe space to store equipment were challenges for some coaches (approximately 24% of those responding to the survey). A parent noted that having to share a room with other student groups at the community agency or school "cause[d] some distraction" for the FLL team.

In addition to obtaining a meeting space, location also affected team operations in terms of access to transportation. For instance, coaches found that some students could not stay after school because they had no way to get home after the meeting was over. Teams located far from big cities faced their own challenges. Travel to competitions was more costly and parents were sometimes less willing to allow their children to travel far from home. Attending training sessions and workshops and getting mentors with technical expertise were more difficult in these cases. The location of the team also affected parents' ability to attend team meetings or tournaments. A coach from a rural area with no public transportation noted that parents don't always have the time or the means to drive their children places. One parent suggested that FIRST should "find transportation for people without ways to travel."

The BGCA Technology Director noted two strategies that his organization had pursued to address some of the issues of distance. The first was the use of telephone conference calls and web conferencing was ways of providing training. He also suggested recording small web-based video training sessions (5-10 minutes each) on specific topics that coaches could download and view when it was convenient. BGCA was beginning to use web-based conferencing on a number of its technology initiatives and was finding it an effective way of reaching a widely dispersed audience.

BGCA and FIRST had also sponsored a pilot "Virtual Tournament" in which widely dispersed teams competed using teleconferences and video conferencing to talk with FLL Judges, and then videotaped their actual robot runs and submitted the tapes to BGCA for review and judging. Three teams participated in the "Virtual Competition" in early 2005, but BGCA is hoping to expand that approach for the 2005-2006 Challenge season.

Gaining Administrative Support

In addition to gaining support from colleagues, securing support from administrators was another challenge that some coaches experienced, although coaches did not comment much on this issue. Clearly, FLL works best in an environment in which coaches are encouraged to devote their time to the program and have the administrative support at the school or community agency needed to secure resources. One coach suggested inviting administrators to competitions as well as promoting FLL to local politicians so as to obtain their help with fundraising. Commenting on the future of his team, one coach noted that because the principal is involved and sees the benefits of FLL, his team should be sustainable.

Additional Challenges

In the surveys and during the telephone interviews, coaches were also given the opportunity to comment on other challenges. In most cases, they expanded upon the challenges already listed, but there were a few other challenges they discussed, including time and scheduling issues and the problems of competing interests and demands on participants and coaches.

Time and Scheduling Difficulties

Coaches reported having difficulty finding a good time to meet ("students have so many commitments before and after school") and managing their own team's time.[22] For instance, one coach requested "a training on how to structure three months of practice." Some coaches suggested adjusting the season schedule. One coach advised, "Announce [the] challenge a month earlier. With the start of the school year and the announcement at the same time it is too hectic…." Another coach noted, "We had about one month to prepare. We flew by the seat of our pants most of the time." Another felt that the time crunch put his team at a disadvantage at the tournament and felt like they had "no chance to win." Some parents thought that lengthening the season would make for a better FLL experience. For instance, one parent suggested that teams "have more time at school [to meet] - not just once a week- and more competitions, not just one."

Because many teams received their kits late in the competition season, some of these comments may stem from that situation. Furthermore, in the case of the BGCA teams, the FLL grants were not received until August, after BGCA budgets had been finalized and during a month of down-time for most clubs (many use this month to prepare programs for the school year, send staff to training conferences, etc.). As such, many of the BGCA teams did not receive their kits and/or register for tournaments until November 2004, well into that year's tournament season. Because of the late arrival of kits, some coaches ran FLL teams, but did not compete in any tournaments

[22] When asked in the survey to discuss their greatest challenge, about one-fifth of all coaches reported this difficulty. Similar comments were also made during phone interviews and by coaches in the 2003 study.

at all. Teams that did compete under these circumstances often felt rushed, overwhelmed, and at a disadvantage against other teams.

Finally, as discussed earlier, coaches mentioned the challenge of running FLL in the midst of competing commitments, such as other programs (e.g., sports programs at Boys and Girls Clubs) and other priorities in schools (e.g., "spending so much time preparing for Standard of Learning [state] tests"). Advice on how to organize their teams or manage their time differently might help these teams, as would making it easier for them to contact other, more experienced coaches for advice.

Expanding FLL into Underserved Areas

Given the challenges associated with operating in an underserved location, coaches were asked during the phone interview to identify how FLL can expand into these areas. Most were encouraging. Coaches thought that FLL provided youth from underserved areas with important skills and new opportunities ("much different than basketball") and was a valuable way to decrease "the technology gap between the haves and have-nots."

Coaches also saw a grant program like this year's Underserved Initiative as an important starting point for promoting FLL in underserved schools and communities. Most thought they would not have been able to run a team this year without a grant, and those who received FIRST grants thought "they made all the difference." It is important to note that all coaches interviewed funded their teams through grants, even if these grants were not given by FIRS*T*. Coaches saw the Underserved Initiative grants as a good strategy for starting teams in underserved areas. Rookie coaches saw the grants as removing the initial hurdle of having to raise money for a program with which most people were unfamiliar. Similarly, the BGCA Director of Technology felt the grants were helpful for start-up, particularly because their involvement began after the annual budgets had been set for most clubs. Even with the grants, however, some coaches had trouble raising sufficient monies in their first year and reported having to pay for some things out of their own pocket.

To get more teams from underserved areas involved in FLL, coaches noted again, that FIRST needs to do more to promote the program and raise awareness. FLL was described as being "almost secretive." Some felt that word-of-mouth was the most effective strategy. Other suggested strategies included encouraging community members to attend competitions, increasing the media coverage of competitions, and inviting teachers to come to workshops where there are robot demonstrations. In addition to better promoting FLL, some coaches felt that FIRST should do more to promote available grants. One coach advised FIRST to have an outreach team to better recruit and support teams from undeserved areas.

Coaches suggested a variety of people and groups to approach to start teams, but in general noted the importance of approaching someone who is motivated and who would be a good advocate for FLL. For schools, they talked about approaching technology teachers and teachers of gifted programs, after-school programs, principals, and PTA members. Others suggested approaching groups that already work with youth -- for example, BGCA, YWCA (most already have technology programs that work with robots), 4-H, Scouts, and staff from youth correctional facilities -- to start teams. Some suggested approaching groups such as the Society of Black

Engineers, engineers at military bases, and City Year to sponsor or mentor teams. The BGCA Director of Technology has already taken some steps to market FLL to clubs and felt like he would be able to recruit more teams next year because the interest is there.

Coaches were asked to comment on what structures or support a school or agency needs in place in order for FLL to be successful. In general, coaches noted that success is dependent upon: a dedicated staff and point-person; administrative and community support; space; time; a relationship with a company or other institution that can provide mentors with technical expertise; and sponsored training. In talking with the BGCA Director of Technology, he noted that the major barrier to forming his teams was not funding, but staffing – that dedicating a staff person to work with a group of 8-10 (instead of 25-30) young people required advance planning and support from the leadership of the clubs.

Finally, few coaches talked about challenges specifically associated with being in an underserved area when discussing how FIRST can expand (other than the challenges already mentioned). However, in a few cases coaches did reflect on the special challenges and needs of young people in poor communities, often with poignant comments that reinforced the fact that these challenges existed and were difficult to address. For instance, one coach mentioned that before he can have the children do a "fun project," he needs to first make sure that his students have basic necessities like soap and toothpaste as well as an understanding of basic health skills that they might not get at home. Others noted potential social or cultural barriers, such as children not wanting to show their true intelligence so as not to seem "uncool." It is important that FIRST keep these challenges in mind during their planning processes and, as they move into more underserved communities, look both at how to help coaches address some of these issues and at how FLL and its goals are presented.

The Role of FIRST and Other Partners in Supporting Teams

One of the topics in the surveys and interviews was the degree to which coaches were able to get the help they needed from FIRST and the other organizations involved in FLL. While most felt that the materials available from FIRST were helpful, it was also clear that coaches were often looking for additional help and support.

On-Line Resources

Most coaches (79%) reported using the coach resources (team activities, teaching materials, curriculum, etc.) available on the FLL website (Table 5-3). Most coaches also found these resources to be either 'helpful' (61.5%) or 'very helpful' (23.1%).

Table 5-3: Resources for Coaches

	2004 FLL Underserved	
Used coach resources available on the FLL website (team activities, teaching materials, curriculum, etc.)	**N**	**Percent**
Yes	26	78.8%
No	7	21.2%
If yes, how helpful were those materials?		
Very helpful	6	23.1%
Helpful	16	61.5%
A little helpful	4	15.4%
Not helpful at all	0	0.0%

At the same time, several coaches noted that the materials tended to focus more on technical issues and were more helpful for experienced teams. Commenting on this from the perspective of the BGCA teams, the BGCA Technology Director suggested creating short video-based start-up guides that newer coaches could download and view on individual topics.

Help from FIRST and Partners

Most teams found FIRST representatives and local coordinators very helpful when they contacted them or asked for assistance. Some coaches were aware of FLL training sessions and other support but were unable to utilize these opportunities due to time constraints or being too far away from where they were held. Only a few coaches reported taking advantage of training opportunities (one regional partner noted that most of his Underserved Initiative teams were registered too late to take part in the training workshops he ran). One coach found the training held at the local university to be very helpful, but would have preferred both being notified further in advance and being able to have more input into suggested times (e.g., holding one during the summer) for these types of events. Some were unaware of any training sessions offered. Many coaches:

- Requested more training sessions (for themselves, their team members and mentors);
- Identified resources they found particularly helpful (the LEGO Mindstorms book, materials that helped them better visualize the program such as the Robolab tutorial and a copy of the ZOOM episode on FLL); and
- Offered suggestions on ways FIRST could improve the program experience (provide videos/examples of past challenges, enhance support to coaches by making the website easier to navigate, and increase FLL publicity efforts).

Having the support of both national staff from BGCA and FIRST and coworkers at local clubs and organizations was seen by coaches as key to the team's success and sustainability. One coach noted that the Director of Technology at the BGCA national office was very helpful and provided good phone support. As noted earlier, when interviewed, the BGCA Director of Technology discussed the ways in which he supported the club teams. He ran several conference calls for teams throughout the season. During the calls, an experienced BGCA coach was on hand to answer 'how to' questions (registration, operation, tournament rules, etc.), and those calls had a high level of participation from teams. Using voice over Internet-protocol technology, he also ran a "virtual tournament" in May for teams to do on-line presentations and answer questions from judges. These sessions were recorded as videos and uploaded to a website run by BGCA so that others could view them. He found coaches and team members enjoyed participating in the virtual tournaments and being able to compete against teams from far away (e.g., Missouri vs. Japan). He expects to run these virtual tournaments again this year, but earlier in the season as a way of raising awareness and interest. Finally, working with FIRST, he ran a separate tournament event for eight teams in Orlando at the BGCA technology conference. He found this tournament to be a good way to market FLL because roughly 400 conference participants had a chance to see the competition and talk with the team members.

Coaches saw gaining interest and support from their coworkers as more of a challenge. For instance, some coaches found it hard to get other staff to build FLL into scheduling. For Boys and Girls Clubs that decided not to run FLL teams, the major barrier was inadequate staffing. Given limited staffing, clubs found it impractical to allocate an individual staff person to a small group of five to ten kids. In contrast, one coach at a YWCA felt like she had great support from the staff there; the team practiced their presentation in front of staff and the directors came to watch the team at a competition.

Coaches also discussed the importance of finding mentors to work with their teams. Teams that did not have mentors with a technical background often found FLL to be confusing and would have liked to get mentors to help with things like programming.

Smart Strategies and Other Advice

In addition to discussing challenges they encountered and strategies for dealing with them, coaches also provided advice to new coaches and general feedback to FIRST for program improvement. Some of this "coach to coach" advice is presented in the exhibit on the following page. Team members and their parents were also invited to give feedback. It is important to note that, even when asked to provide suggestions for improvement, many coaches, parents, and students talked about the positive experience they had with FLL, with comments ranging from: "It rocked. Thank you" from a team member; to "[My daughter] seems to love it. Whatever it is you're doing keep it up" from a parent; to "Overall, a tremendously positive experience" from a coach.

Coach to Coach Advice

Approach to FLL: Be flexible and have a positive attitude

- "Do what works for the day. Decide what your expectations are and then take pride in small achievements. Set simple goals, build on successes year to year. Do not compare yourself to other established teams."
- "Just jump in; learn from experience."
- "Keep things simple. Build simple robots that can do some things; it's not as overwhelming."
- "Recognize they are just kids. Go into the competition aware that things won't go perfectly."
- "Be patient."
- "Have fun. It takes time. Learn by trial and error."
- "Trust the kids. Work hard and don't give up. You will have a lot of challenges and you will make mistakes; do it for the experience."
- "It's time consuming, but the rewards are endless."

Team operations

- "Start early."
- "Learn the programming before teaching it to the kids."
- "We came up with a team name. Then the kids felt like they were part of a cool club. Provided snacks."
- "Let kids learn by trial and error."

- "Divide kids into small groups and let them alternate roles."
- "Choose the right kids. They need to be motivated and want to be there."
- "During practices, let the kids do three practice runs, then go out and play for a few minutes. Or use play as a reward for performance."
- "Go to as many practice competitions as possible. Talk to other coaches. Ask questions."
- "Getting mentors to help with technology was a great strategy—forged great relationships."

Feedback to FIRST. The final round of feedback to FIRST echoed many of the comments and ideas in the earlier sections. As previously mentioned in this report, coaches generally requested that FIRST increase its marketing efforts of FLL, send Kits and other materials earlier, provide more support to coaches (training, workshops, networking opportunities), and help them find mentors. Some coaches commented more specifically about robotics parts and aspects of the tournament process. For instance, one coach thought the time spent at tournaments waiting for the judging to occur was "tough" but did acknowledge that FLL has improved in recent years (e.g., the roll out mats were simplified). Another coach mentioned that she and others had problems with a gate piece.

Nearly half of parents also emphasized the need for increasing awareness around the FLL program.[23] As one parent suggested, "FLL should advertise the competition: not much is known about the program. In addition, parents requested both having more teams ("more leaders, so more teams for children to be a part of"; "start in earlier grades to spark interest") and more competitions. Also on the topic of tournaments, parents suggested they be better organized and some suggested having different levels of competitions (by age and experience level).

Team members' feedback was overwhelmingly positive, and most of the negative comments were made by members of just two teams. In those cases, team members were frustrated at the high level of adult involvement they saw on other teams. For instance, one team member described, "One thing I did not like about FLL was that other teams had parents or teachers do the work for them..."

Sustainability

The ultimate goal of the FLL Underserved Initiative was to create teams or involve organizations that would sustain their involvement in FLL. For the teams that responded to the surveys, that goal seems to have been accomplished. As noted earlier, most coaches plan to run a team again next year (83%) and those interviewed had generally given some thought about how to sustain their team for the long-term. Most coaches interviewed would also like to expand, either to grow their own team or start new teams at their school/organization or in surrounding communities. However, coaches noted that expanding would require more financial resources.

Sustainability does not just require obtaining adequate funding, but also having sufficient staff and staff support. In that regard, most, but not all, thought their team would survive if they stepped down from the coaching position. Coaches who had other staff or coaches involved in

[23] When asked in the survey to discuss what FLL could do to make it easier for parents to get involved, roughly 42% of those responding discussed the need for increased program awareness

the team or whose teams were part of an established club were more likely to feel this way. But, as discussed earlier in the report, some teams never formed due to staffing issues.

As discussed earlier, many thought the FIRST grants were helpful in addressing start-up costs. But, as with any grantmaking organization, an important consideration for FIRST is grant recipients' ability to sustain the program on their own after the grant period has ended. The BGCA Director of Technology expects that FLL costs can be built into his clubs' budgets. He told clubs to estimate needing $300-$400 in addition to the registration fee (the fee was covered by the grants) for purchasing the Mindstorms/Challenge Kit and paying tournament fees, with the total cost of running FLL for the first time in the $500-$600 range. Once teams have purchased the Mindstorms Kit, he estimates the annual cost of running a team in subsequent years to be only $175-$200. Budgeting for FLL will be easier once clubs are registered or aware of the program earlier on in the process, prior to the start of the season.

In addition to discussing the challenges they faced in running a team, coaches noted the challenges to ensuring sustainability of their FLL team: obtaining adequate funds; having dedicated staff/school leadership to support the team and run the team if the current coach were to leave; lack of awareness in the community; lack of time; lack of parent support; recruiting team members; finding mentors; and finding it hard to keep morale up during the rookie year (and, as one coach noted, everything listed as a potential challenge on the survey). One coach said he would probably not run the team next year due to scheduling problems and lack of interest in the adults. Another coach, who had run a school-based team in the past, was not able to run the team this year. The school decided to cut funding for the program because of insurance and liability issues; the school was unsure of who was liable if something happened to one of the students and was unsure if they needed to screen parent volunteers. She also found it hard to justify FLL to the school because the program is not tied directly to measures on state tests. Though the team lost its backing from the school, it is now run as a community club by parents. However, participation has decreased substantially. In a different case, though, one coach reported that his school system has been very supportive of FLL and would like to have one team in every middle school, so that their schools can collaborate and compete with each other. FIRST might consider asking superintendents in underserved areas who are supportive of FLL to help them approach other school systems with students from similar socioeconomic backgrounds.

Summary

What comes through in the interviews as well as the survey responses is that the challenges involved in creating and sustaining FLL teams in underserved communities are real and often difficult to overcome, but not insurmountable. The large majority of FLL coaches responding to surveys planned to return to FLL next year, and most had practical ideas and suggestions on how to make the process easier on the coaches that followed. Among the various comments and suggestions, perhaps three broad points stand out:

1. That the availability of grants does make a difference, particularly in bringing new teams into FLL, but that most teams did expect to be able to generate their own support and sustain their involvement over time.

2. That FIRST needs to continue to develop materials, workshops and video resources to support FLL teams. These types of "start-up" materials or guides (especially video resources) were particularly important for rookie teams, and have been identified as a need not only by the Underserved Initiative teams, but teams in the broader 2003 FLL study as well.

3. FIRST needs to look at new and more active ways to promote awareness of FLL. This was seen as important not only in terms of expanding FLL into new, underserved communities, but also as an essential element in building better parent and community involvement. Increased awareness and better communications about FLL activities and opportunities were both seen as important steps in building support and sustainability for new teams.

Finally, what also is clear from the interviews and survey responses, is the degree to which experienced FLL coaches represent a critical resource for new and struggling teams. The coaches interviewed for the study all had ideas and suggestions, based on their own experience, and those that had been connected to more experienced coaches all noted the benefits of the "mentoring" by those veteran teams. In that regard, it seems that one of the more critical ways in which FLL can support and promote expansion of the program is by finding ways of making those "coach to coach" connections easier to accomplish.

Chapter Six
Conclusion

In a continuing desire to inspire interest in and increase understanding of science and technology among young people through hands-on, project-based experiences, the FIRST FLL program undertook several efforts to expand the program into underserved communities and to capture the interests of a more diverse group of young people. This collection of efforts, known as the Underserved Initiative, included partnerships with the Boys and Girls Clubs of America and the YMCA, and through grants made possible through support from Motorola. The FLL Underserved Initiative evaluation was designed to assess the implementation and effectiveness of the Underserved Initiative and to begin to identify best practices and "lessons learned" that FIRST could use in strengthening future efforts.

The evaluation sought answers to several questions. FLL needed to know to what extent the Initiative was successful in its mission to create and sustain teams in urban and low income communities through the various grant programs and its work with community-based intermediaries such as the Boys and Girls Clubs of America and the YMCA. In addition, it was important to understand the impact of the program on participating team members, how successfully engaged adults (coaches, parents, volunteers) had been throughout the season, and about the challenges and barriers that existed for teams operating in underserved areas.

While recognizing the limitations of the data (low response rate, self-report), the findings from the surveys and interviews generally indicate that the FLL Underserved Initiative was successful in expanding access to the FLL program to a more diverse group of young people in low income and minority communities; that the teams were able to provide participating youth with a high quality experience; and that the programs in the FLL Underserved Initiative were able to produce participant impacts that were comparable to those of the broader population of FLL teams, based on the data from the 2003 FLL study.

At the same time, it is important to recognize that the teams in the Underserved Initiative in 2004 did differ from the average 2003 FLL team in some important ways. In general, the 2004 teams were less likely to participate in tournaments, less likely to have coaches with technical expertise, and less likely to have a high degree of parental involvement and support. These differences were also reflected in the outcomes, where, for example, teams in the 2004 Initiative were likely to score lower in areas related to tournament participation than their 2003 counterparts. To some degree, these kinds of differences may reflect the late start-up experienced by many of the teams in the Underserved Initiative. However, they also point to areas where new Underserved teams are likely to need additional support and assistance from FIRST.

While recognizing that the outcomes were generally positive, the 2004 pilot also served to highlight some of the barriers faced by teams in the Underserved Initiative and several areas in which program improvements that could be made. For example, clear definitions of eligibility, and stronger expectations for and tracking of organizations and teams receiving grants would aid in better managing the Initiative and would help in efforts to provide better support to the teams involved.

Though teams reported facing a variety of barriers in their efforts to establish themselves and successfully implement the full range of FLL activities, the difficulty in finding adult mentors and securing parent support was noted as a key challenge. Another key challenge was gaining and holding the attention of team members amidst a variety of competing interests and attractions. For example, participant turnover and attendance issues were cited as a problem for some teams operating in clubs that offer activities.

Survey respondents and interviewees offered suggestions on how to improve the FLL experience. Much of their advice pertained to FLL developing and distributing additional technical assistance and support materials for coaches. Video-based materials were frequently mentioned. These materials would assist them in setting up and operating their teams, and could also be used in promoting FLL locally (to parents, sponsors, schools). Similarly, having the support of both national staff from organizations such as BGCA and FIRST, as well as coworkers at their local clubs and organizations was an asset to teams. Individual support, such as coach mentoring, was also cited as a way to help teams, especially those headed by new coaches, establish and sustain themselves.

In conclusion, the recent efforts that FIRST has made to promote FLL in underserved communities were largely a success. The Underserved Initiative did meet its goal of recruiting teams from minority and low income backgrounds. While some teams did appear to experience the program differently, having less exposure to the various components of the program (tournaments, research project), less parental assistance, and less technically skilled coaches, the participant outcomes were quite similar to those from the broader 2003 study. Though many of these teams faced challenges, the results from this small sample of teams reveal that FLL can successfully establish teams in underserved communities, provide a positive experience for team members, and thus inspire interest in and understanding of science and technology throughout a wider group of young people than it has reached in past years.