Robofest 2010 Official Report

Contents

Figure 1. World Robofest 2010 Student Participants (64 teams were advanced)

1. Analysis of Robofest Registration Data

The primary goal of Robofest is to spark young students' interest in STEM (Science, Engineering, Technology, and Math). A total of 1,443 students, 441 teams from four countries (Canada, Korea, China, and the USA) participated in the 11th Annual Robofest student robotics competition. Robofest 2010 featured a warm-up competition, 25 qualifying competitions, a video qualifier, a video regional, a regional championship, the World Championship, two afterglow events (IGVC and Maker Faire Detroit), and an associate event (RoboParade). Robofest 2010 would not be possible without the help of many dedicated people. The following Table 1 shows the total number of officially registered people including students, coaches, team sponsors, team volunteers, site sponsors, and site volunteers for the 2010 Season. Robofest 2010 has reached over 3,100 people all together. 56% of student participants were from outside of Michigan. Average team size was 3.3 students.

Location	Coaches	Students	Sponsors	Teams	Volunteers	Site Volunteers	Sub Total
Aiea_HI	15	192	27	36	71	35	376
VideoSubmission	13	59	23	22	23	(***)	140
AnnArbor_MI	22	133	38	41	58	41	333
Belleville_MI	15	105	26	29	37	5	217
LTU_MI (L2Bot only)	2	3	4	3	3	2	17
Battle_Creek_MI	2	17	2	6	6	6	39
Aurora_CAN	1(**)	156	0	32	33		222
CompLearningCtr_FL	12	69	13	19	21	23	157
Cardston_CAN	5	25	3	12	15	15	75
Redford_MI	4	43	13	13	14	19	106
Emerson_Detroit_MI	3	30	7	8	8	11	67
Fort_Wayne_IN	1(**)	4	0	2	2		9
AAT_Detroit_MI	10	39	7	10	10	25	101

Galveston_TX	5	62	11	17	23	37	155
Saginaw_MN	1(**)	28	18	9	9	11	76
San_Ramon_CA	2	50	15	16	16	29	128
ClintonTwp_MI	4	27	4	10	11	6	62
Canton_MI	12	72	13	20	28	15	160
Monroe_WA	3	24	6	8	8		49
Sichuan_China	1(**)	32	16	16	16		81
Austin_TX	10	46	16	12	18	18	120
Medina_OH	9	29	7	9	14	10	78
MACUL_MI	5	26	4	9	11	7	62
Southfield_MI	11	60	16	17	22	24	150
Northville_MI	7	28	2	7	12	14	70
AsiaPacific (*)		84		**58**			142
	175	**1443**	291	**441**	489	353	3192

(*) the numbers for the Asia-Pacific site are excluding students who participated in non-autonomous events.
(**) One coach registered all the teams in some sites
(***) Blank cell means the site did not use Robofest volunteer registration system

Table 1. Total Number of Registered Participants for Each Robofest 2010 Qualifying Competition Location (Numbers for Associate, Afterglow, Regional, World Robofest events are excluded.)

Figure 2 shows the number of student participants since 2000. The decrease in the 2010 season is mainly due to the following two reasons. (1) There was a considerable decrease in student participation in the AsiaPacific region because the government did not encourage students to participate in large events due to the H1N1 flu pandemic. (2) Robofest director was on medical leave.

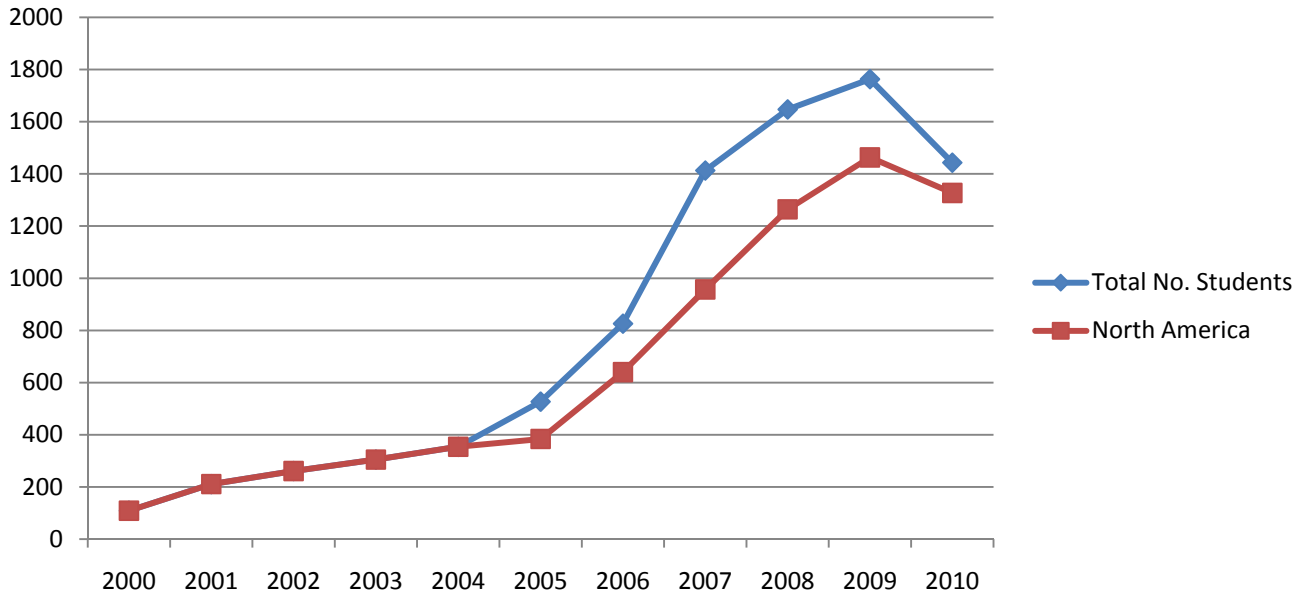


Figure 2. Number of Robofest Student Participants Since 2000 (numbers include only qualifying events)

Total number of sites decreased as well. That is due to our continued management decision that sites with fewer than 5 teams should be canceled or merged with other sites. As a result, average number of students per site increased compared to the years before 2009, as seen in figure 3. On average, 56 students and 17 teams participated per site.

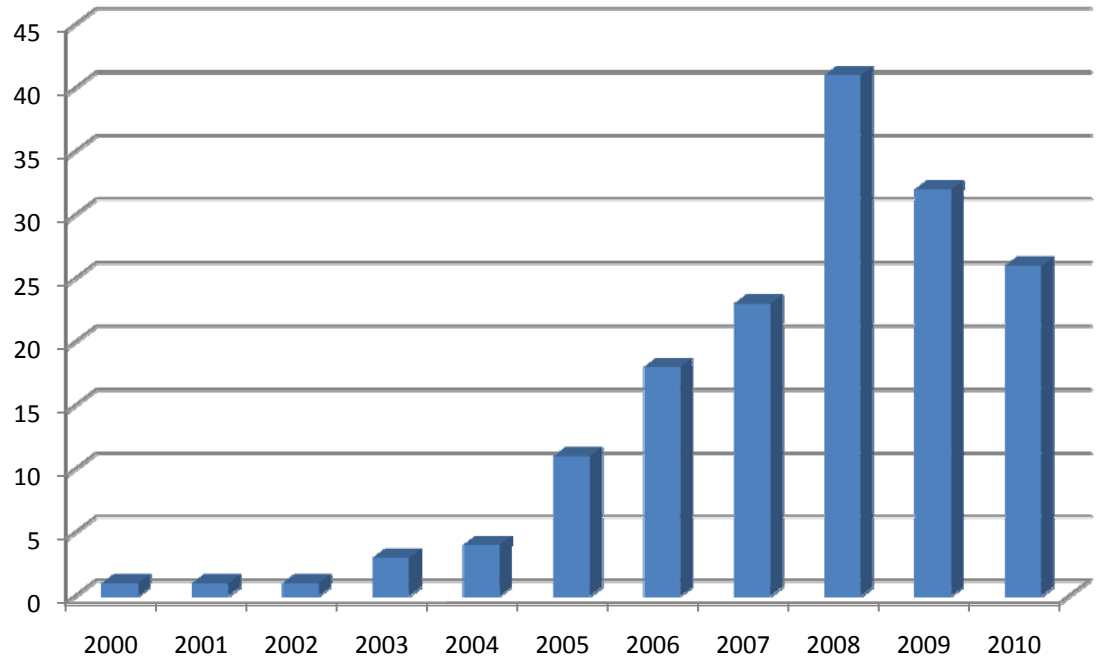


Figure 3. Number of qualifying sites (Average size of a qualifying site became larger in 2010)

69% of teams participated in the RoboPower Game, 18% in Exhibitions, 6% in Fashion Shows, and 7% Vision Centric L2Bot Challenges. See Figure 4 below by age division & competition category.

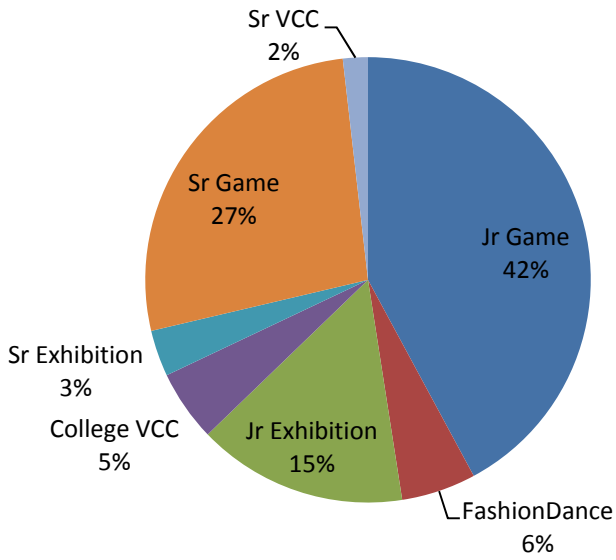


Figure 4. Percentages of Teams by Age Division & Competition Category

Robofest was still popular for Middle school, 6th through 8th grade students. 49% of the student participants were from the group as seen in figure 5. 14% of students were 5th grade level (Up from 11% in 2009) while 6% of participants were below 5th grade who requested an age waiver or participated in RoboFashion & Dance category. The percentage of high school students decreased by 3% this year. Please note that the data does not include students from the Asia Pacific region.

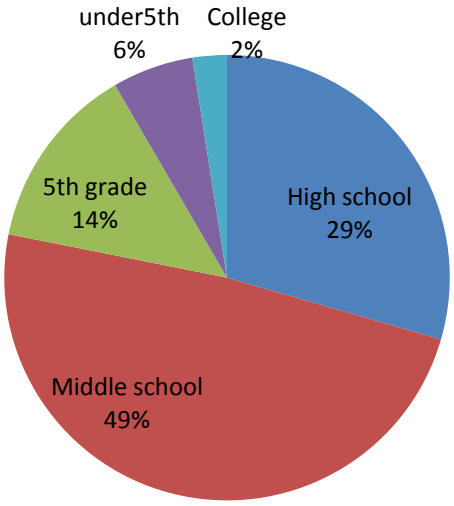


Figure 5. Student Participant School Grade

Figure 6 shows gender ratios of Robofest 2010 students. Robofest has been continuously successful in motivating young female students to participate in Robofest robotics which requires them to learn STEM subjects. The data does not include the students participating at the Asia Pacific competition as they were using their own registration system and we were not able to obtain the data.

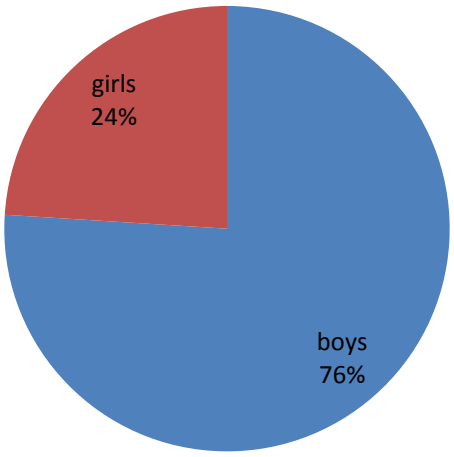


Figure 6. Gender Ratios of Robofest 2010 Students

Ethnic diversity is represented with over one third (43%) of Robofest 2010 participants having minority backgrounds. 14% of Robofest 2010 students were African American, 29% were others as shown in figure 7.
The percentage of African Americans decreased from 20% to 14%. This decrease was due to the discontinuation of the funding specifically dedicated to the support of inner city schools. Figure 8 shows the changes from 2005. Robofest continues to work hard to encourage students from underserved communities to participate in STEM education through robotics. Figures 7 and 8 data excludes students from the Asia Pacific region.

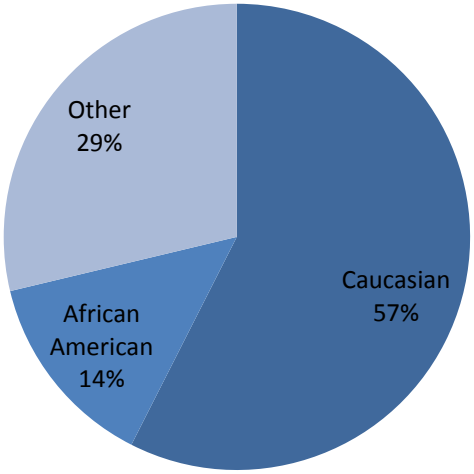


Figure 7. Robofest 2010 Student Participant Ethnicity Data

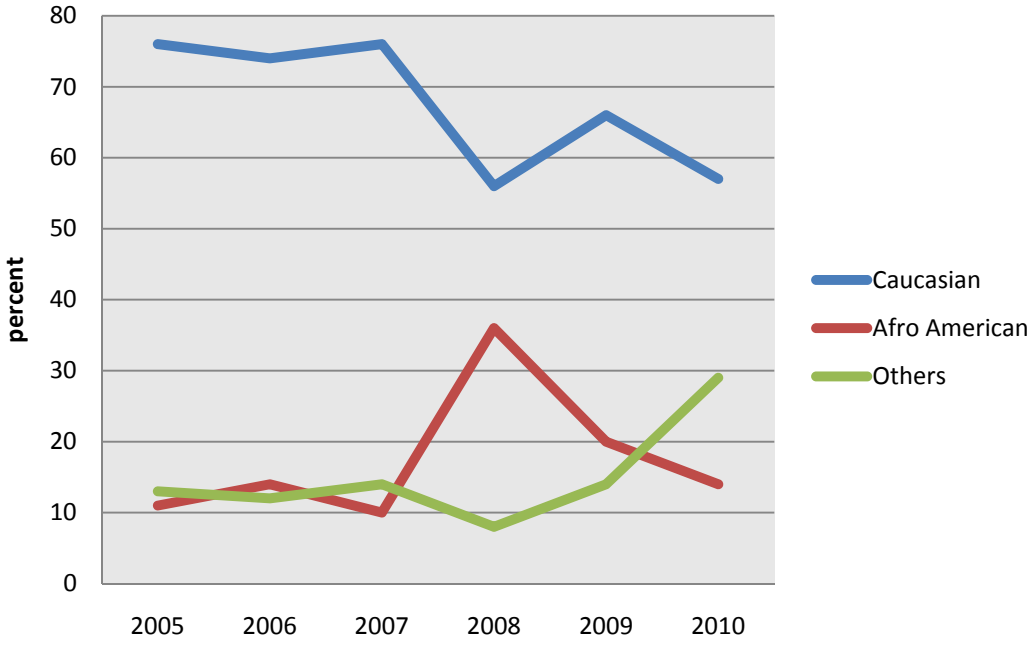


Figure 8. Robofest Ethnicity Data since 2005

Robofest allows the use of any robotics platform, which is a very unique feature of Robofest. Figure 9 shows the data on robotics kits used by the teams. RCX is still popular. The use of VEX has increased from 2% to 5%. Sr. exhibition World Champion winning team was using VEX kits. Due to the L2Bot competition in China, the percentage for L2Bot also increased from 4% to 7%. We do not have detailed data from the teams in the Asia Pacific region. The majority of the teams (76%) were using LEGO NXTs.

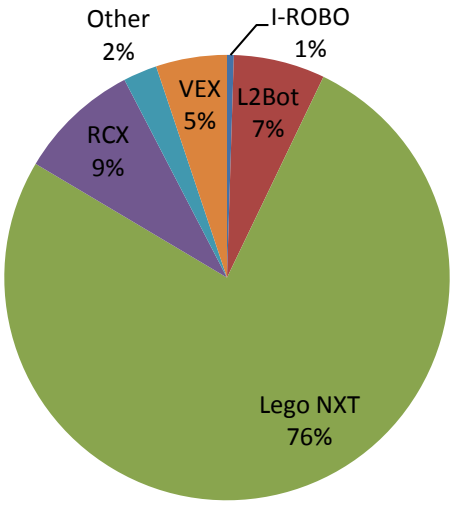


Figure 9. Robotics Kits Used by teams

Robofest remains focused on student participants learning STEM through computer programming. The programming languages used in Robofest 2010 are graphed in Figure 10. Student teams continue to use advanced and varied forms of programming languages. Allowing students to use whatever programming language they prefer is one of many unique features of Robofest. “Other C” in the figure includes C, Easy C, NQC, NXC, C++, and C#. RobotC became popular since Carnegie Mellon Robotics Academy provided free licenses for Robofest teams in 2009. All C-style languages together totaled 23%. Robofest provides opportunities to learn professional programming languages such as C and Java, and helps to prepare our students for future professional career paths. Robofest students continue to show advanced technical skills and improvements in their abilities. This is possible because of the many dedicated coaches and technical mentors.

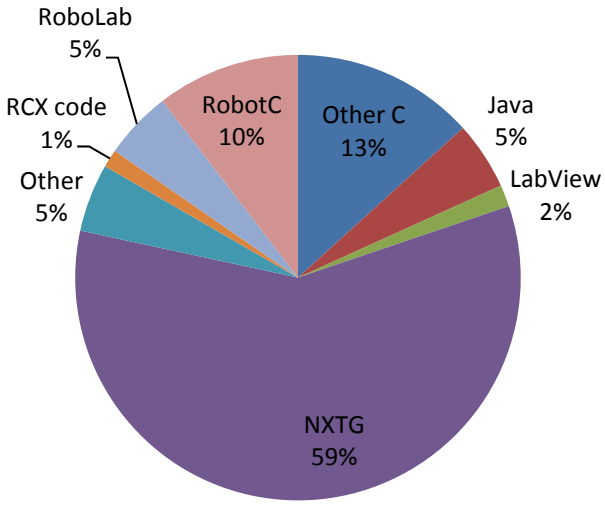


Figure 10. Programming languages used

2. Robofest 2010 Survey Results

This section shows the results of the anonymous web survey conducted in May right after the World Robofest. This year we had two survey groups: One for coaches and the other for site volunteers/judges. 50 coaches (out of 175, 29%) and 71 site volunteers/judges (out of 353, 20%) participated in the anonymous online survey.

Q. How are Robofest teams formed? Figure 11 shows that most Robofest teams (45%) were learning and preparing for competition through after school programs. We found that a large portion of teams (25%) were from home schools and that percentage was increased from 15%. 10% came from family groups or school friends.

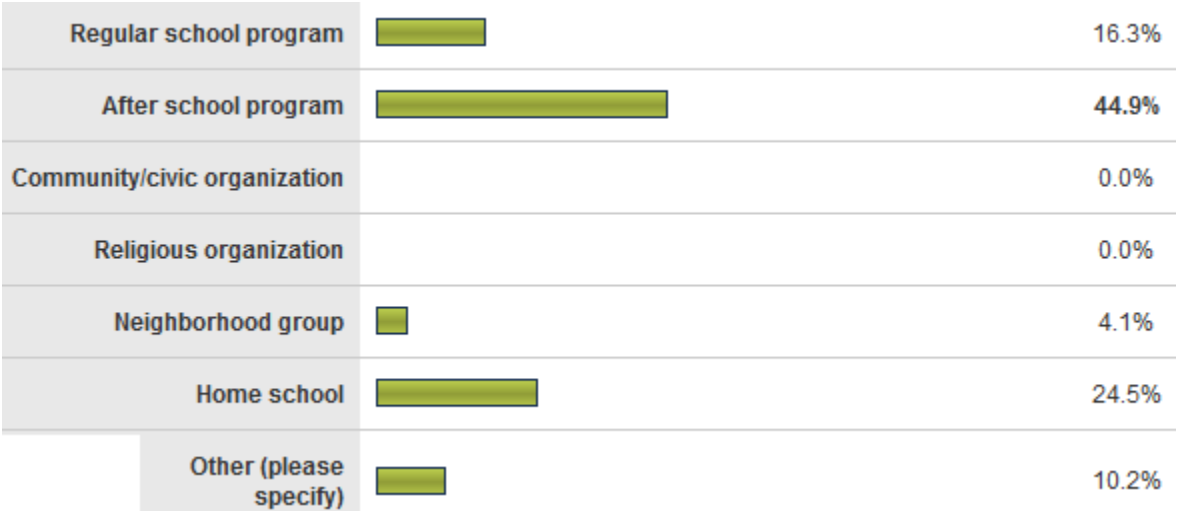


Figure 11. Team organization

Q. What area do you think is enhanced (or will be enhanced) through Robofest robotics for students? (Select all that apply) Figure 12(a) and (b) shows that both coaches and volunteers/judges share similar views. Other areas enhanced included leadership, problem solving, critical thinking, communication skills, and time management.

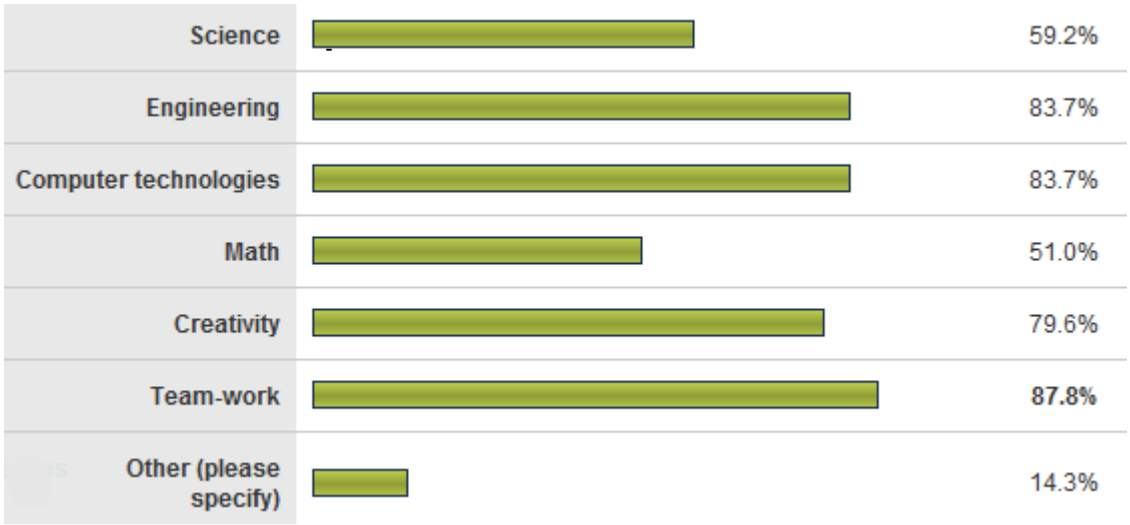


Figure 12 (a). Enhanced areas through Robofest (survey by Coaches)

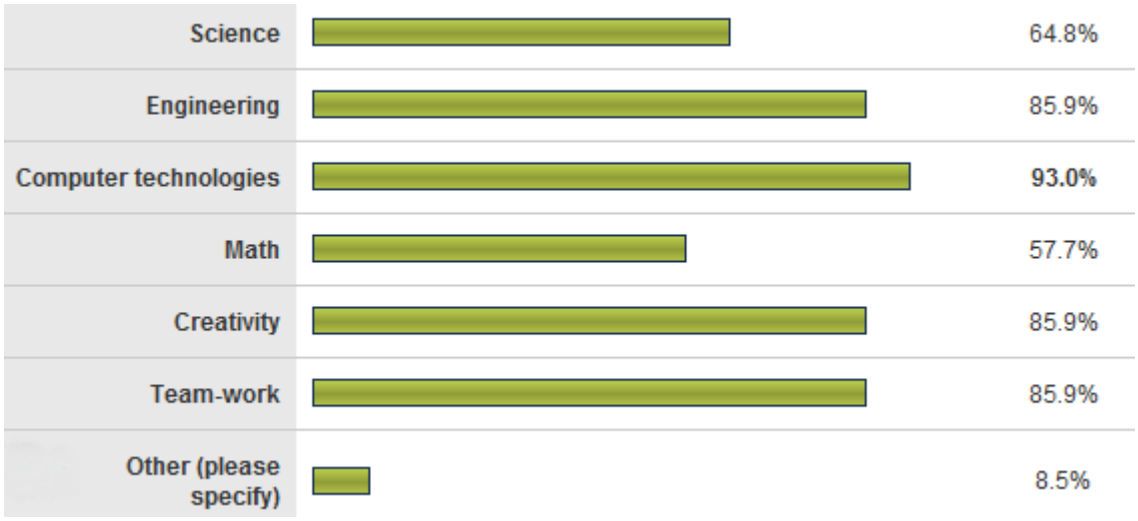
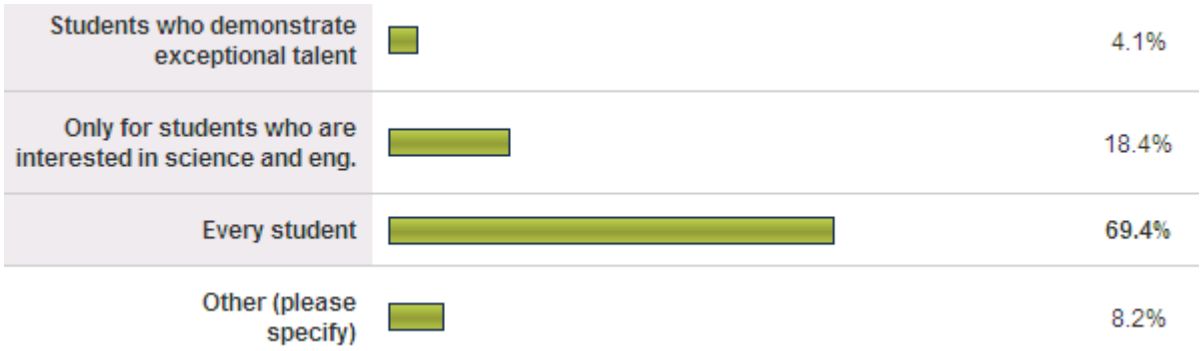


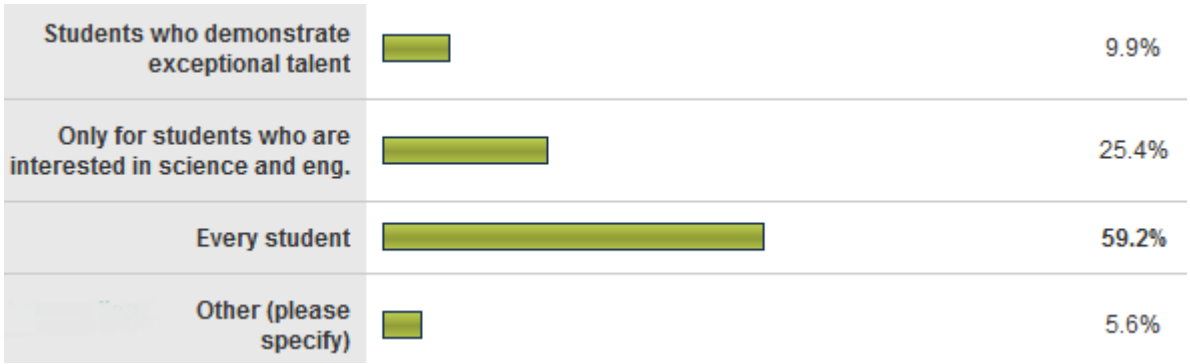
Figure 12 (b). Enhanced areas through Robofest (survey by site volunteers/judges)

Q. For whom do you think the Robofest program should be designed for? Coaches and site volunteers share similar views for Robofest target students as seen in figure 13(a) and 13(b)



Other comments were: Students who are motivated to make things; First and Second; Bright students (not necessarily straight A students); For every student who shows an interest

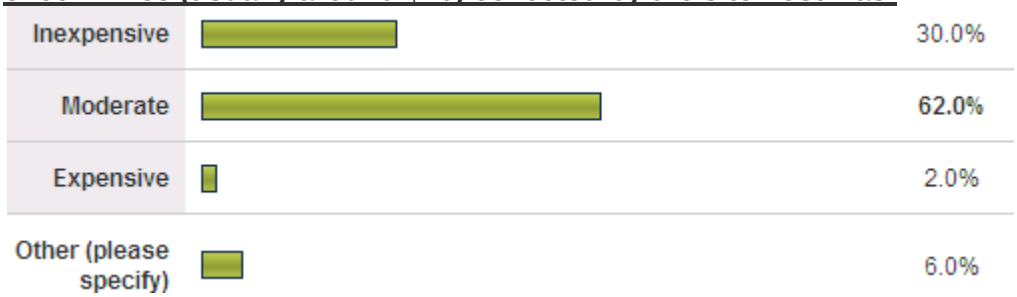
Figure 13 (a). Target students (by Coaches)



Other comment: It should be designed to GET students interested in science and engineering. This is a good point that Robofest has been trying to make. We will change the survey question next year.

Figure 13 (b). Target students (By site volunteers/judges)

Q. The initial registration fee of $50 collected by the LTU Robofest office, and the site check in fee (usually around $20) collected by the site host was:



Other comment: Perhaps charge more initially so that you don't charge at world's

Figure 14. Robofest fees (by Coaches)

Q. From whom did your team receive funding? Figure 15 shows funding sources for teams. Parent support was greater than that of schools again.

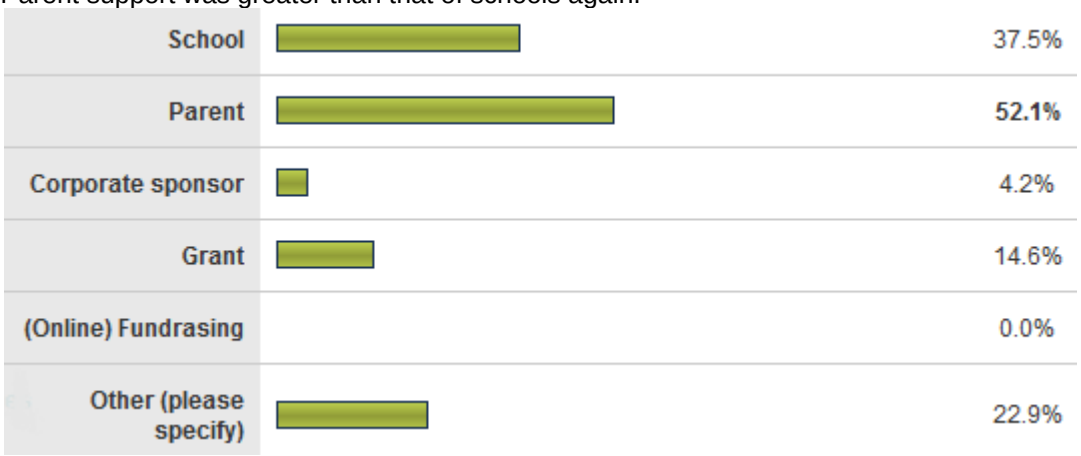


Figure 15. Team Funding Source

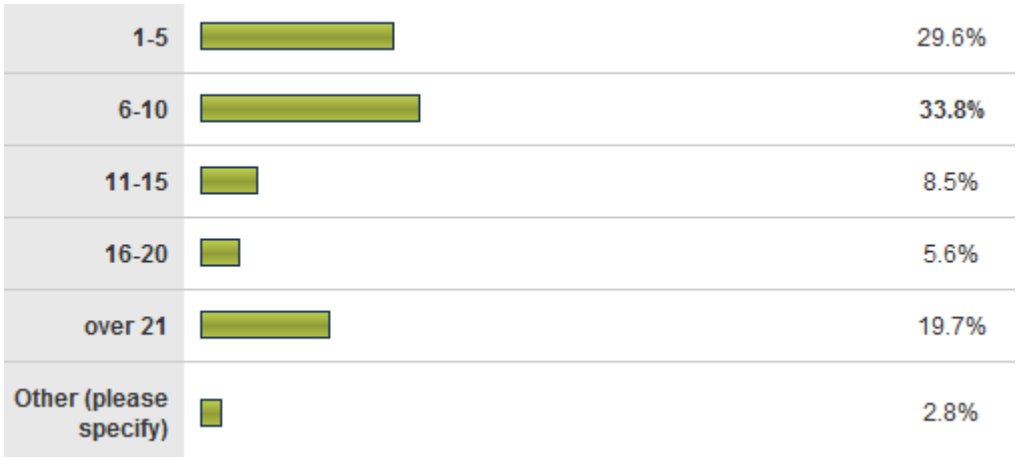
Other funding sources coaches commented on were:

- proceeds from summer robotics camp and students
- Coaches (teachers) – 3 coaches
- Fundraising (Raffle) – 2 coaches
- Another school's principal paid the team's entry fee
- Military Partnership
- PTC GROUP
- Many internal school groups, alums, parents, etc.

Another innovative idea in 2009 was by Team Justice from Canada who set up an online fundraising tool for their travel to World Robofest. See Figure 16 and check it out at http://pledgie.com/campaigns/3871

Figure 16. Online Fundraising Site for Team Justice (2009)

Q. How many total number of hours did you volunteer for Robofest 2010 competitions? (Please include hours for reading rules, attending meetings, communication, driving, etc.)



Other comments were: 40-50 and 100+ hours. We understand they must be site host organizers that required over 100 hours. We all appreciate their dedication.

Figure 17. Volunteer total number of hours

Q. How likely are you to participate in Robofest next year? We have learned that teams led by just parents do not return when their children go to college.

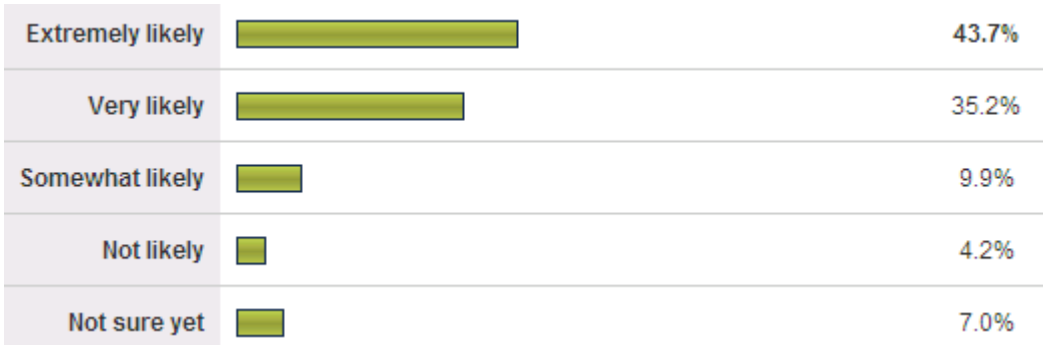


Figure 18 (a). Plan to return next year (by Coaches)

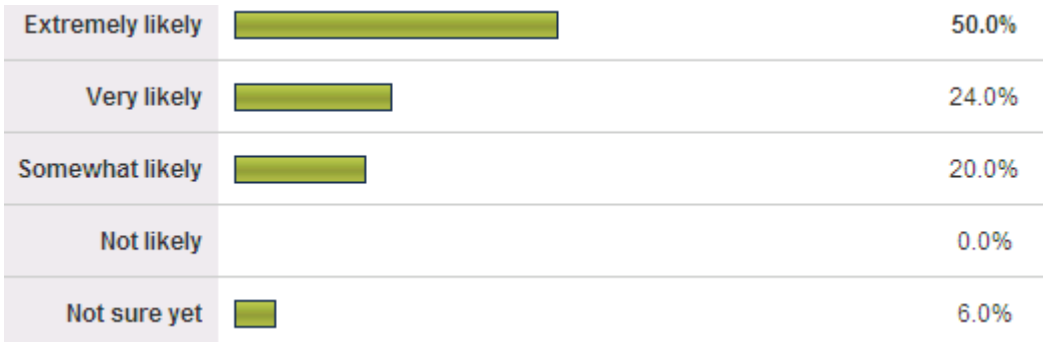
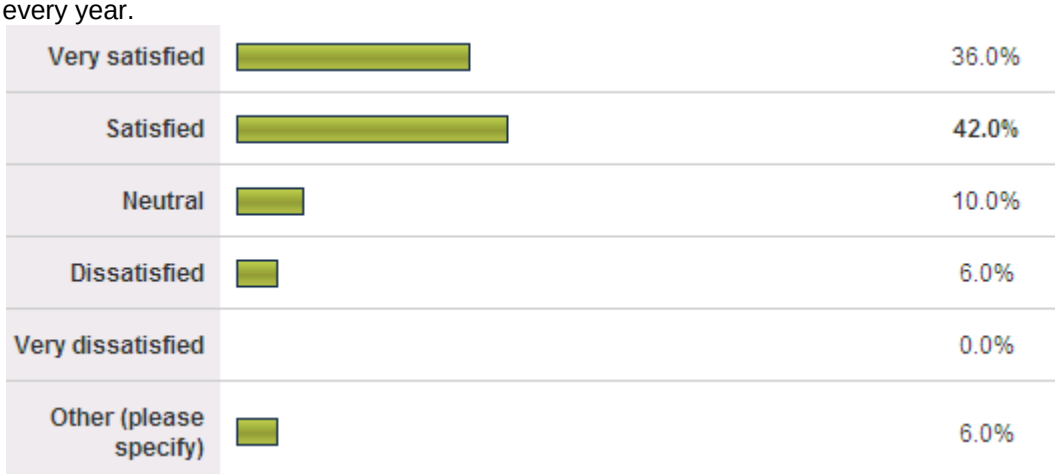


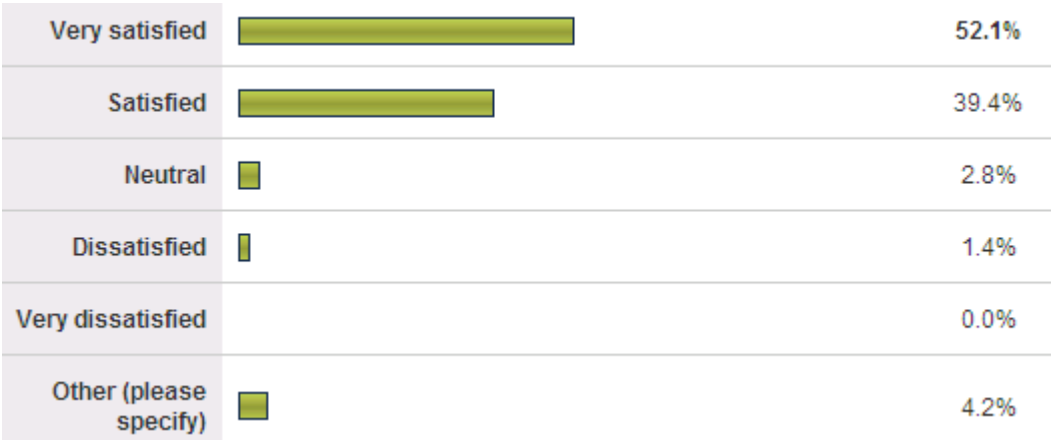
Figure 18 (b). Plan to return next year (by volunteers/judges)

Q. How do you rate the overall Robofest 2010 season experience? Figure 16 shows the overall satisfaction percentages this year. We realize again that it is not easy to satisfy everyone when organizing a competition. We will, however, try hard to maximize the satisfaction rate for every team every year.



Other comments: Do not allow flash photography DURING THE JUDGING PHASE; Decide regional and World championship dates not to overlap with other competitions.

Figure 19 (a). Overall Satisfaction rate (by Coaches)



Other comments: Judging is difficult without experience. LTU members should teach people how to do it properly; Extremely Satisfied - kids, parents, and volunteers gives Robofest an A++ for this program!; It wasn't clear how the teams were making it to Worlds.

Figure 19 (b). Overall Satisfaction rate (by Volunteers/Judges)

Q. The one aspect of Robofest that I like the best is:

(*) *The number in the parenthesis shows the number of people who wrote the comment.*

- It was accessible and appealing to any type of student, regardless of their academic ability and family income. All students received recognition for their efforts. (10)*
- Participating was inexpensive. (9)
- Robofest encourages creativity and teamwork. (8)
- Robofest generated interest from kids in science and engineering. (8)
- The learning style was fun for kids. (7)
- Kids could choose from a variety of different events; there was something for everyone. (6)
- Educational: math, computer programming, etc. (6)
- Competition gives feedback to students so they can evaluate how well they did. Robofest gave “Feeling of accomplishment” (6)
- Students were encouraged to think on their own without the involvement of parents. At the competition they had to work by themselves and were not allowed the assistance of coaches. (5)
- Exhibition competitions give students a chance to explain their projects and interact with the community. (5)
- Robofest challenged students to do their best. (3)
- Local competitions for qualifying rounds allow local flavor. (3)
- Robofest staff did a super job (2)
- Addition of the Regional round. (2)
- Robofest allows the use of any type of robot and programming language. (2)

Q. If there were one aspect of Robofest that I would change, it would be:

Game Competition

(*) *The number in the parenthesis shows the number of people who wrote the comment*

Summary of Comments and Complaints	Answers and Replies
Inconsistent judging – errors in judging, judges need more training prior to the competition day. (12)*	We will try our best to set clear rules and train judges based on the consistent rules. However, please understand that judges were volunteers.
The unknown problem did not involve math and science. (9)	We will make sure that the UP requires STEM for 2011.
Bring back competitions with multiple robots.	Team cost and complexity of judging are the issues.

(6)	However, we plan to add a multi-robot Sumo game category for Robofest 2011. We will also keep a separate single robot Game for 2011.
The Game challenge is too hard for some teams. (5)	We plan to include some simple tasks in the Game competition for 2011 so that more teams should have a chance to earn at least some points and get a sense of accomplishment. There were too many teams with zero or negative scores this year.
All teams should use the same materials and program, for example only Lego NXT for Junior division. (3)	A basic philosophy of Robofest is to encourage diversity of technologies. Based on 11 years of Robofest history and data, the type of robot kit used did not play a major role in winning. It is the programming the students did that mattered most.
The game competition should include more STEM (3)	The game competition is already too difficult for many teams. Including more STEM to the game would increase the difficulty. We plan to include more STEM in the unknown problem part of the game.
The game competition needs to be more fun (2)	We hope that the 2011 games will be more fun than the 2010 games.
Bring back Robo Sumo (2)	Traditional robot sumo cannot be repeated because the challenge is simple and teams can use the same code again every year. However, we plan a multi-robot sumo game category that will be really challenging for 2011.
Bring back the third round for the game (1)	We eliminated the third round because previous competitions took too much time. We do not want to increase the amount of time the competitions require.
Lock down the robots prior to start of each round so that each team gets the same amount of time to work on their robot (1)	This would decrease the amount of time teams would have to work on the robots. We want to maximize students' chances to improve their robots during the competition. However, we will consider this idea for future games.
Make sure playing fields are all the same and in good condition prior to the competition. (1)	We try to give clear instructions and emphasize the importance of setting up playing fields equally to all site hosts and we apologize for any incidents with poor or unequal playing fields.

Exhibition

Summary of Comments and Complaints	**Answers and Replies**
Make teams aware of the rubric judges will be using. Provide judges' results to teams. (2)	Rubrics were on the web for the public, although maybe not easy to find. We will work on improving the website. We posted judges' rank for each team. We will try to post judges' comments too.
Not one team out of the 11 Junior Exhibition teams knew what to do for their opening. (1)	There are guidelines about the opening to help teams in the official rules. Please read the rules.
Have one person talk while the other team-mates perform the demonstration (1)	We want all members of the team to talk during the demonstration because we want to make sure that all team members played a role in creating the robot and can explain their role. After that it is up to the team.
Don't allow coaches to stay with their exhibition team during the competition. (1)	We did not have enough proctors to check both the game and exhibition areas. We will try to have more proctors available to enforce the rules in 2011. We will make the rule clear.
Reward teams that try complex, risky tasks rather than choosing to perfect simple tasks. (1)	We want to encourage teams to take on ambitious projects. We will consider weighting the complexity of the projects higher in determining the Exhibition score. However, we value reliability first.

Exhibition teams should have displays and should work on their public presentation more. (1)	Excellent point! We encourage coaches to guide their teams in using displays and working on presentation skills.

Awards

Summary of Comments and Complaints	Answers and Replies
Awards ceremony is too long at World Robofest. (5)	Robofest tries to recognize students' achievement as much as possible.
We get less for the money. No more T-shirts, and trophies only if there are at least 5 teams at qualifiers. (1)	T-shirts are only for site volunteers. Revenue has been down and we have chosen not to raise the registration fees in order to keep the cost of the competition to teams down. We will try to combine very small qualifying sites together into larger sites so that all sites may award trophies.

World Robofest General Issues

Summary of Comments and Complaints	Answers and Replies
Better organization. (4)	We will try to be better organized.
The time for the competition is too long- too many days and/or too many hours. (3)	The time was slightly reduced this year. We will try to be even more efficient next year. The facilities at LTU were not large enough to host a World Championship that would incorporate enough Michigan teams. The addition of the Michigan Regional has allowed more Michigan teams to compete at an advanced level.
Too much time to wait for the award ceremony to begin (1)	We cannot begin the awards ceremony until we have the results for all competitions. The Exhibition judging requires more time. We will consider beginning the exhibition judging earlier so that the wait may be minimized.

World Robofest Equipment/Facility Issues

Summary of Comments and Complaints	Answers and Replies
A venue with more space and less noise would be helpful. (7)	We may plan no concurrent events. We plan to fix the sound system in the gym. We are also considering other venues, if LTU allows.

Local Competitions

Summary of Comments and Complaints	Answers and Replies
Light conditions were very poor at one qualifier. The competition tables were placed under a sky light. (1)	We try to emphasize to site hosts that competitions should be held where outside light is minimized, but we must emphasize this even more.
Organizers at one site allowed flash photography. (1)	We need to make sure the site hosts understand the reason for the no flash photography and emphasize more that it is followed.
It was unclear how many teams will advance to regionals at our qualifying site. More senior teams should advance to regionals. (1)	We will communicate with teams more effectively. We agree on the idea of advancing more senior teams.

Promotion

Summary of Comments and Complaints	Answers and Replies
Better promotion to attract more Senior division teams (4)	We have been trying and will try harder.

Miscellaneous

Summary of Comments and Complaints	Answers and Replies
The website and online registration needs to be improved. (5)	It is hard to find qualified web developers who are willing to work part-time. We have new website administrators and this will be one of the priority tasks. However, it will take time.
Teams should explain their code to judges. Teams should provide more documentation of their use of STEM. (3)	We have tried various ways to do this in the past (interviews with judges, code and robot inspections, etc.) but have not found a time efficient way to accomplish this yet. Also, recruiting volunteer judges who know programs is hard.
Rules should be made available earlier to give teams more time to work. (3)	We plan to announce the rules earlier for the 2011 season.
Other possibilities for competitions: second practice in March, internal school, online competitions. (3)	Unofficial internal school competitions are encouraged. For online competitions, we have the video submission division.
More workshops (3)	Robofest resources are limited. With increased revenue and staff we could offer more workshops.
More support for non-Michigan teams. (3)	Unfortunately Robofest's resources are limited, especially physical resources. We will try to provide more support for out of state teams online.
Rules need to be clarified, especially for Robofashion. For example, what is/ is not autonomous? (2)	We strive to make the rules as clear as possible, and will work to achieve even greater clarity for the 2011 rules. In Robofashion and Exhibition, we define autonomous robots as computer programmed robots that are interacting with its environment. A human player or other computer systems (robots) can be considered as components in the environment. Hardwired interaction is not allowed, though.
Provide more online training (2)	We will move in this direction for 2011. Our resources will limit how much online training we are able to offer.
Add a People's Choice Award for Robofashion. (1)	Very nice idea. We have a People's Choice Award for Exhibition and not Robofashion because there are many more Exhibition teams than Robofashion teams. If the number of Robofashion teams increases, we could add a People's Choice Award.
Provide a "winners list" with sample codes from winning robots. (1)	Some coaches do not want this. But we will consider as a rule.
The billing process needs to be more formal (use invoices, etc.) (1)	We agree that the billing process needs to be improved, and will work on this issue for 2011. If you request an invoice from the Robofest office we will send an invoice.

3. Evaluation of Changes and Plans for Improvement

We have identified various facets of Robofest needing refinement, enhancement and improvement in the coming years based on outcomes, anonymous on-line surveys, private conversations, and emails with coaches, parents, volunteers, and site hosts. We realize that some items summarized below are existing problems from previous years. We understand that some issues take time and resources to improve.

3.1 General Administration

Introduction of New Competition Structure

We used a 2-level structure from 2005 to 2009: local level qualifiers and one World Championship. For the first time, we introduced a 3-level competition structure in 2010 season. In order to compete at the World Championship, a team had to pass both a local qualifier and a regional competition as depicted in the following Figure 20.

Figure 20. Robofest Competition Structure since 2010 season

Introduction of the Michigan regional championship made a majority of Michigan teams happy since more teams were able to compete at the higher levels. A reduced number of teams invited to the World Championship enabled the Robofest office to better manage the event. The introduction of regional competitions before the World Championship seemed right and timely. However, the following problems were identified:

- Some teams did not know about the change
- Non-Michigan teams went through "Video Regional" that required them to submit videos by April 17. But the rules were not clear and the announcement was too late. When we announced teams that advanced to the Worlds, many teams could not come to Michigan because they needed more time to raise funds for the team members to travel. In short, Video Regional Championships were not well organized.
- Less than expected non-Michigan and international teams came to World Championship

Currently, we are planning the following regional championships for 2011: Midwest, West, South, Asia-Pacific, and Online-Video. Due to the introduction of the regional championships, our timeline will change too. We will start the season slightly earlier. We plan to invite only 60~70 teams to the World Championship considering our capacity as we did in 2010.

The World Championship venue may also be flexible starting in the 2012 or 2013 season to share access and further promote Robofest for future growth.

Site Host Administration

Even though the number of qualifying sites were decreased (see Figure 3), the cost and complexity of supporting site hosts both inside and outside of Michigan remained high in 2010. For example, on Saturday, March 27, there were 7 events concurrently. Amazingly, we were able to ship and email supporting items out of state and support local sites with limited staff and volunteers. Efforts will be made to proactively schedule dates next year so that there are not as many events on one day. It is strongly suggested that sites outside of Michgan plan for earlier dates, as time is needed to fund the expenses in traveling to the Regional or World Championship. Some sites were too close to each other. Developing committees for each state to coordinate events is being considered, especially for the regional championships. The hope is to alleviate scheduling conflicts outside of Michigan and to provide geographic distribution as well.

Categories/Age Divisions

During the 2010 season when there were fewer than five (5) teams registered for a specific category/age division of competition, the division or site was cancelled. The decision was made three weeks before the actual qualifying date. We suggested displaced teams move to another site or use video submissions.

Registration Fees and Check-In Fees

According to the anonymous survey, few people said the registration fee ($50) or check-in fee (up to $20) were expensive (See figure 14). We are proud of our cost-effectiveness and efficient management to minimize the cost for teams to participate in Robofest programs. We will not charge check-in fees for the World Championship in 2011.

Communications

- There is a way for coaches to get information including email addresses of the other team coaches in their qualifying site. However, we found few coaches were using this function.

- We decided not to develop our own blogging site or bulletin board website. Instead, we will encourage teams to use Facebook for communicating and networking with other teams.
- We will actively use more Webinars.
- Although there were Robofest articles in several publications, Robofest was not well publicized in major media outlets. This is a shame, as students were doing advanced competitions and their achievements should be well publicized. We hope to improve media coverage for 2011. Please send your teams' achievements to your local newspapers and TV stations! We will send articles to newpapers and magazines too.

Robofest Website

The Robofest website is information rich. You can find all the information dating back to the beginning in 2000. However, it is still not easy for (new) teams to find all the needed information on the web. We are fully aware that the current website is neither well structured nor well-organized. Web pages are not consistent with design styles and color themes. There are some broken links. Some information is confusing, inconsistent, and cluttered. We are still working on renovating the website with a content management system. The new system will hopefully be introduced in late 2010. We are proud of keeping almost all data/information/pictures from the 10 years of our history. No other competition site provides that kind of information in detail over the years.

Online Registration Systems

- There are still problems operating the online registration system. For example, fewer teams uploaded team pictures this year compared to previous years. (2006: 68%, 2007: 53%, 2008: 55%, 2010: 50%) We need to develop an automatic reminder function or require a team photo to compete.
- There are inefficiences caused by the team registration system, mailing list system, and volunteer system not being integrated. For example, some coaches receive too many of the same emails generated from the systems if the coach registered for multiple roles. System integration is not a simple job. We have started the integration of the five independent database web application systems, but the job is not completed yet.
- The connection between our registration system and PayPal was significantly improved this year.
- Some coaches did not like the mandatory volunteer field when a team was registered. Unfortunately, each site host did not use the info effectively either. We need to improve this process.
- For some coaches, emails from Robofest have been treated as spam.

Free Technical Support and Workshops

In addition to the 2 on-site workshops in Detroit funded by TARDEC and The Herbert and Elsa Ponting Foundation, we provided 3 L2Bot workshops funded by DENSO as well as 1 NXT workshop for a Detroit High School on LTU's campus. Two free workshops were held for registered teams in January 2010 at LTU. Some of the workshops were available on the web through real-time webinars. Most of the workshop files were posted on the web for free. The URL was sent to only registered coaches. However, there were concerns from non-Michigan teams who could not attend workshops in Michigan. We encourage each site host to organize their own workshops using our materials if needed. We learned that teachers need to learn robotics, too. We are still developing multimedia online class materials. We have already introduced ways to borrow robots from LTU Robofest for a minor fee. If you are interested in this program, please email us at robofest@LTU.edu .

3.2 Competition Rules

Rule Documentation and Finalization

The finalization of all the official rules was on time this year. However, both the clarification of the rules and the FAQs were not effectively delivered to the coaches and volunteer judges. We still need clearer communication and better organization.

Game: RoboPower

Judging was much improved this year. However, the challenge itself was too difficult for some teams. Many got negative scores. Few teams were able to achieve a perfect score. No explicit, math-related, unknown problems were given for Games. We will plan games that require more math and science in future Robofest games.

Exhibition
There were many interesting and advanced exhibition projects. The TARDEC CI grant generated more interest. However, judging was not easy. See the survey comments and our responses above in Section 2. Definition of Autonomous robots for Exhibition was not clear.

RoboFashion & Dance Show
This category still did not gain as much popularity as expected. Integration between robots and human players using sensors were not exhibited as much as we had hoped. Definition of Autonomous robots for this category was not clear either.

Vision Centric Challenge (Associate Event)
No other robot competitions in the world are offering challenges like this for high school students. We plan to promote more participation in this category. Schools of workshop participants got free L2Bots sponsored by DENSO. Two high school teams accomplished this year's challenge, which is quite difficult even for college students. We plan to expand this category by allowing other auxiliary sensors in 2011.

3.3 Competition Event Organization

Volunteer Organization
Some qualifying sites did not fully use our online volunteer system. Volunteer recruitment must be started earlier. We found out that some site volunteers did not get T-shirts. If you were a site volunteer (not a volunteer for your competition team) and you did not get a T-shirt and a small gift, please let us know (robofest@LTU.edu). We had over 350 people registered on the web and we deeply thank all the site volunteers.

Hours of competitions
- The duration of the larger qualifying sites has always been an issue. We must work harder to fine tune the schedule to ensure finishing on time. We need to simplify competition procedures.
- Due to the large number of prizes, the World Championship award ceremony took too long. The introduction of seats for plaque award winners reduced the duration a little bit.

Playing Fields/Tables
The use of 6ft plastic folding tables will continue next year for Games and FashionShows.

World Venue and Setup
- The introduction of 3 row bleacher was successful in providing space for spectators.
- Although Robofest Game does not allow adults in the pit area, there were still complaints that some adults were helping the students. We need more volunteers for proctoring both for games and exhibitions.
- Exhibition area for the Michigan regional and Worlds was too noisy, especially when Game announcements were broadcasted. We are considering alternating games and official exhibition presentations.

Judging
Judging is always challenging. Some judges were not familiar with the Robofest 2010 rules. Head Judges need to be trained properly early on.

Miscellaneous
- Some certificates were not professionally printed, due to the color toner problems of our printers.
- To encourage teams to participate in earlier dates, we will advance more teams to the Regional at earlier qualifiers.
- Teams are allowed to compete at more than one site, if they are registered with different coach IDs.
- There was some confusion about World Check-in fees that were required for every team.

4. Budget Summary

Robofest budget results for the 2010 season (July 1, 2009 ~ July 31, 2010) were as follows: $64,602.32 in cash revenue, $53,505.42 in expense which resulted in an overall gain of $11,096.90, which is needed to prepare for next Robofest 2011 before registration begins.

Table 2 shows the summary of cash revenue and expenditure. Note that In-kind donations were not included in this table. Some Robofest teams still have not paid registration fees. We decided not to pursue this, since the hourly salary for Robofest staff members is greater than the money we could collect. However, we realize a more controlled registration process/tool for 2011 is necessary.

Cash Revenue	
Transfer from 2008-2009	$10,161.42
Individual donors	$1,946.00
Corporate/Org. Cash Sponsorship	$16,500.00
TARDEC-SAIC fund (after July 2009)	$15,333.51
Team registration & check in fees	$18,401.39
Other (merchant sale, rental, etc)	$2,260.00
Total	**$64,602.32**

Cash Expense	
Workshop instructors (faculty) salary	$3,622.00
Coordinators salary (*)	$10,663.23
Student assistants salary (**)	$914.15
CI Development grants to teams	$6,168.00
Supplies (medals, trophies, T-shirts, playing fields, L2Bot parts, sensors, etc)	$21,631.42
Table & tent rental	$2,561.40
Postage(***)	$986.33
Equipments (projectors, NXTs, VEX, Tetrix, etc)	$3,842.73
MI regional and World Robofest food	$2,225.16
Advertising and posters	$891.00
Total	**$53,505.42**
Robofest account balance as of July 31, 2010	**$11,096.90**

(*) some other coordinators were paid by MCS fund
(**) most of student assistants were paid by MCS fund
(***) some other mailings were paid by MCS fund

Table 2. Cash Revenue and Expense Summary

Table 2 above does not include Lawrence Tech's monetary support. Table 3 below summarizes cash contributions from Lawrence Tech. Other LTU contributions include: marketing, fundrasing, and special events support by Univ Advancement; help desk laptop support; audio & visual equipments; Dr. Chung's release time; MCS Department administrative support; general office supplies (papers); printing; copying, phone and fax; office space; utilities; mailing and postage by Admissions & MCS department; campus facilities; video taping and editing - eLearning Services; use of office computers, office space, etc.

Part-time web developer & coordinators salary by MCS Dept	$24,818.29
Student Assistants salary by MCS	$16,851.95
Official poster, site host version, paid by Admission's office	$397.56
Total	**$42,067.80**

Table 3. LTU support summary

5. Student Team Achievements

This year's game, RoboPower was an extremely difficult challenge. Many teams (around 20%) got negative scores. However, the following teams had perfect runs at least once.

Division	Competition	Team ID	Team Name	Coach Name	Score	Time	Award
Sr. Game	Canada Aurora Qualifier	725-17	ESS-2	Michael Roy-diclemente	135	N/A	1st place
Sr. Game	World Championship	1190-1	Hightech	Sangyong Bae	135	0:56	1st place
Sr. Game	World Championship	536-1	Rocky Robot	Jason Liu	135	1:39	2nd place
Jr. Game	IGVC	833-3	Geek Squad - 3	Steve Tao	105	1:49	1st place

Table 4. Teams that had perfect game runs at least once

This year's VCC (Vision Centric Challenge) using L2Bot was also very challenging.The game was similar to the one at IEEE Robotics and Automation chapter competition for professional engineers in Italy in 2006. Even our VCC added the recognition of 2D barcode. The following High School teams did an amazing job completing the missions. They were actually better than college teams.

Team Name	ID	Coach Name	Award
Roboteers	348-1	Jonathan Crocker	1st Place
Rocky L2bot	1161-1	Cathy Wu	2nd Place
G squad	1023-2	Leann Bigos	3rd Place

Table 5. Vision Centric Challenge winners

Many superb exhibition projects were entered this year. Team Elmhurst trojan bots, 981-3, from Elmhurst High school, invented a robotic recycling system that sorts plastic bottles, cans, and aluminum cans. Their achievement was introduced in newspapers in Indiana. This team won the 1st place award from World Championship.

Another notable project was done by a team 725-15 from Aurora High School, Canada. They created a sophisticated computer vision system called Artemis Targeting System that will detect movement and orient toward that movement and fire projectiles. A video of Project Artemis can be found at: http://artemis.cheshire.ca

The following table shows all the CI grant winners.

Division / Category	Winner Team ID	Winner Team Name	School/Org. Name	Coach Name	City	State
Junior Exhibition	833-2	Geek Squad – 2	Geek Squad	Steve Tao	Canton	MI
	1049-1	K.C.'s Technobotz	Highland Middle School	Annette Wissel	Medina	OH
	1059-1	Geekabytes	Plymouth Christian Academy	David Cusumano	Plymouth	MI
	1094-1	Dawg Botz	Dawg Botz	Michael Bonello	Canton	MI
Senior Exhibition	336-1	The Galactic Hamsters	Newark Area Youth Robotics	Karen Lepper	Newark	OH
	725-15	Aurora High Exhibition	Aurora High School	Michael Roydiclemente	Aurora	Ontario, Canada
	981-3	Elmhurst trojan bots	Elmhurst High School Robotic Club	Phillip Springer	Yoder	IN

Table 6. Winners of the 2010 TARDEC CI (Creativity and Innovation) grant

All the winners of Robofest competitions can be found at www.robofest.net.

6. Assessment

In order to assess the impact of autonomous robotics competitions in STEM education, we planned to ask Robofest students to take online assessments before and after the competition. In addition, we plan the same assessment with another group of students who did not participate in the competition as a control group. However, the assessments were not done as planned in the rule mainly due to the director's medical leave. We really apologize for that. We will introduce a simpler approach in the coming years. Maintaining our own web-based system was also difficult, since the student who developed the system graduated.

7. Workshops

We especially thank TARDEC (Tank Automotive Research, Development and Engineering Center) - our Presenting Sponsor and The Herbert and Elsa Ponting Foundation our Gold Sponsor. Their funding enabled us to deliver on-site LEGO NXT robotics programming classes to 3 schools shown on Figures below. Here is the summary of the onsite hands-on classes:

- Total number of schools in Detroit that had on-site classes: **3**
- Total number of students served: **41**
- Total number of Robofest teams participating: **10** (5+2+3)
- Total number of teachers or administrators directly involved as coaches: **3**

Figure 21. Workshop for Digital Arts and Sciences Academy - Nov 7, 2009

Figure 22. Workshop for Cornerstone Schools (Apr. 2-3 and June 4), 2 teams

Figure 23. Two Detroit Merit Academy Teams participated in Redford Site (Workshop on April 1) 5 Teams registered

Dr. Kurt Meister and Mr. AJ Ureel delivered the classes for Detroit schools. We thank the Lawrence Tech help desk for providing laptops for the workshops. Unfortunately, no team was able to advance to the Michigan Regional Championship this season.

We had a fantastic year in advanced robotics with L2Bots thanks to the generous donation from DENSO. Figure 24 shows the first workshop in Nov. 2009. The participants took the L2Bot built with the monetary support from DENSO after the workshop to prepare for Vision Centric Challenge 2010. Later we offered additional workshops on Jan 16 and Feb 6. The instructor was Mr. Ryan Matthews.

Figure 24. L2Bot workshop, Nov. 7, 2009

Lego NXT workshops for Robofest teams were held on Jan 23 and Jan 30. The workshop materials were posted on the web for teams outside Michigan. Mr. Joe Long was the instructor. In addition we provided RobotC workshops for RET (Robotics Engineering and Technology) days on May 4 – 5 at Macomb Community College and IGVC(Intelligent Ground Vehicle Competition) at Oakland University on June 5. Prof. Kurt Meister was the instructor for the RobotC workshops.

Figure 25. RET Week at MCC

Figure 26. RobotC workshop at IGVC (June 5)

8. Recognition & Acknowledgement

Figure 27. Participants of World Robofest 2010 Championship - May 8, 2010

Figure 27 shows the 65 proud teams that advanced to World Robofest Championship out of 441 teams this season. Each received a large chamionship gold medal shown in figure 28 together with a framed certificate.

Figure 28. World Championship Gold Medal sponsored by TARDEC

Robofest was again blessed this year to have 14 corporate/foundation and 8 individual sponsors (David E. Bindschadler, CJ Chung, Howard Davis, Dennis J. Howie, Strarlett Sinclair, Joel Stein, Emily Trudell, and Operation Chocolate Team 304-2). Without their support, Robofest 2010 would not have been possible. Figure 29 shows all the logos of the corporate/foundation sponsors which were displayed on a large screen during the Michigan Regional and World Championship. The logos or names of the sponsor were also printed on all qualifying programs as well as the Championship programs (see Figure 30). Bronze level or higher sponsor logos were printed on our official posters (see Figure 31). More than 1,000 spectactors and 500 students came to the championship event held at Lawrence Tech in Michigan on May 9, 2010. A list of all the sponsors can be found at www.robofest.net.

Figure 29. Robofest sponsor logos displayed and printed during the Championships at Lawrence Tech.

Figure 30. Official Robofest programs with all sponsor logos

Figure 31. Robofest 2010 Official Poster

Figure 32. IEEE medal of achievement for Robofest 2010

We thank IEEE Region 4 PACE and SEM (Southeastern Michigan Section) for their sponsorship for IEEE medals of achievement (see Figure 32) that were awarded to the registered participants of Robofest 2010 during the qualifying competitions.

Dr. Maria Vaz, Provost of Lawrence Technological University awarded plaques of appreciation to the dedicated five or ten-year coaches during the World Robofest. See Figure 33.

Figure 33. A ten-year coach, Ms. Betsy Lamb, Cranbrook Schools

We were also pleased to recognize the following 5 or 10 year coaches during the Michigan Regional and World Robofest.

10 year coach	Betsy Lamb, 2001-2010
5 year coach	Kyungseol Lee 2006-
5 year coach	John Kim 2006-
5 year coach	Nona Goodwin , 2006-
5 year coach	Jonathan Crocker, 2006-
5 year coach	Julie Patterson, 2006-
5 year coach	Karen Lepper, 2006-
5 year coach	Bridget Stolz, 2006-
5 year coach	Steve Heleski, 2006-
5 year coach	Brian Smith (teams 506 and 507), 2006-
5 year coach	Stewart Harman, 2006-

Table 7. 10 and 5 year coaches

We thank Dr. Bindschadler, Chair of Math and Computer Science Department, for his support for Robofest since the inception in 2000. Department secretary Marilyn Wiseman provided dedicated services for the processing of purchasing requests, H.R. related paper work, and many others. Robofest part-time staff members in the 2009-2010 year were Wendy MacLennan, Jerri Ureel, Sara Moss, Susan Latos, Yevgeniya Tarakhovsky, Teri Dubois, and Shari Stout. Dr. Chris Cartwright joined as Program Manager in January. Part-time student assistants were Tiffany Platt, Joe Long, Ryan Matthews, Taojie Hua, Taiga Sato, and Jamie MacLennan.

9. Conclusion

Robofest is not about making noise and rewarding large groups. Data presented in previous sections show that the Robofest 2010 season accomplished our intended objectives:

- To spark young students' interest in STEM (science, technology, engineering, and math)
- To let each student truly understand the concepts of math and science while solving real-world problems with hands-on autonomous robots
- To promote imaginative, creative and innovative thinking and ideas for an entrepreneur mindset
- To build a globally competitive engineering work force for the future

We are proud that Robofest is continuously inexpensive since its inception in 2000, while providing a high quality STEM education environment for *all* students. We deeply thank everyone who has hosted, sponsored, supported, volunteered for, and participated in the 11th Robofest for the 2010 season.

If you find any errors or have comments on this report, please let me know (chung@LTU.edu). We are looking forward to meeting you during the 12th annual Robofest 2011 season.

Respectfully,
August 31, 2010

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