

Robofest 2010~2011 Official Report

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(Figure 1) Some of World Robofest 2011 teams (67 teams were advanced)

1. Analysis of Robofest Student Registration Data

The primary goal of Robofest is to motivate young students' interest in STEM (Science, Technology, Engineering, and Math) and ICT (Information and Communication Technologies).

A total of 1,641 students, 496 teams from five countries (Canada, Korea, China, Singapore, and the USA) participated in the Robofest 2010~2011 season. The Robofest 2010-11 season featured a warm-up competition, 23 qualifying competitions, a video qualifier, a video regional, 2 regional championships, the World Championship, one afterglow event (IGVC), and two associate events - RoboParade and IEEE nVn RoboSumo.

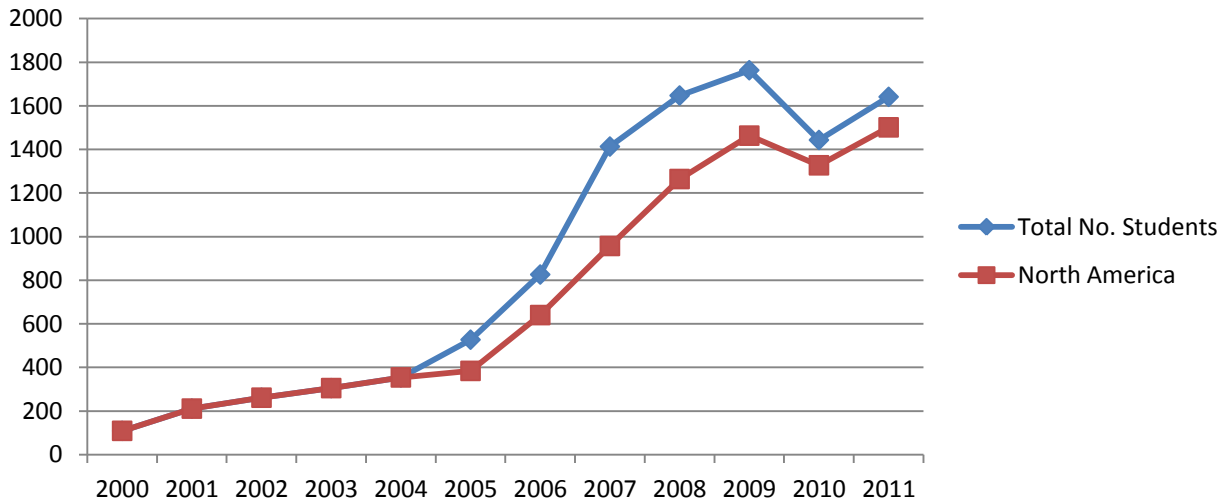
Robofest 2011 would not have been possible without the help of many dedicated people. The following Table 1 shows the total number of officially registered participants including students, coaches, team sponsors, team volunteers, site sponsors, and site volunteers for the 2010~11 season. Robofest 2011 has reached over 3,000 people all together. 53% of student participants were from outside of Michigan. The average team size was 3.3 students.

Site Location	# coach	# students	# team sponsors	# teams	# site volunteers
2010-IEEE_nVnSumo_MI	3	17	2	12	5
2010-RoboParade	16	92	27	34	41
2011-CIS_Detroit_MI	5	32	2	7	3
2011-Austin_TX	5	25	11	10	19
2011-Nashua_NH	1(**)	6	n/a	4	n/a(***)
2011-Medina_OH	24	115	11	34	20
2011-Redford_MI	9	65	16	20	40
2011-Galveston_TX	4	69	7	17	18
2011-Aurora_CAN	15	161	10	37	29
2011-VideoSubmission	8	44	17	18	18
2011-Battle_Creek_MI	2	25	4	8	n/a
2011-Canton_MI	19	107	37	26	35
2011-Fremont_CA	4	28	1	7	6
2011-ClintonTwp_MI	12	65	17	19	20
2011-Cobo_Detroit_MI	16	106	29	32	32
2011-MilkRiver_CAN	5	43	7	20	10
2011-Northville_MI	8	47	5	13	15
2011-Saginaw_MN	1(**)	22	7	7	7
2011-Sichuan_China	1(**)	30	n/a	16	n/a
2011-Emerson_Detroit_MI	4	27	8	8	7
2011-Asia-Pacific(*)	n/a	110	n/a	48	n/a
2011-Warren_MI	8	39	7	10	5
2011-CompLearningCtr_FL	9	41	12	14	5
2011-UD_Detroit_MI	10	78	11	18	12
2011-Pearl_City_HI	16	198	22	41	38
2011-IGVC_OU_MI(****)	17	49	17	16	29
Totals	222	1641	287	496	414

(*) the numbers for the Asia-Pacific site are estimates and excluding students who participated in non-autonomous events.
(**) One coach registered all the teams in some sites
(***) n/a means the site did not use Robofest volunteer registration system
(****) The data is only for new teams that did not participate in regular Robofest competitions in 2011

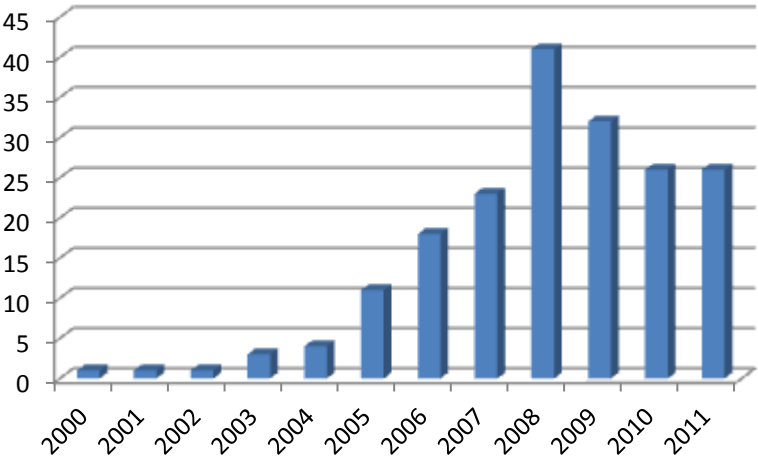
(Table 1) Total Number of Registered Participants for each Robofest 2010-11 Official Site Locations

Figure 2 shows the number of student participants since 2000. 92% of participants are from North America. The accumulated number of students since 2000 has reached over 10,000.



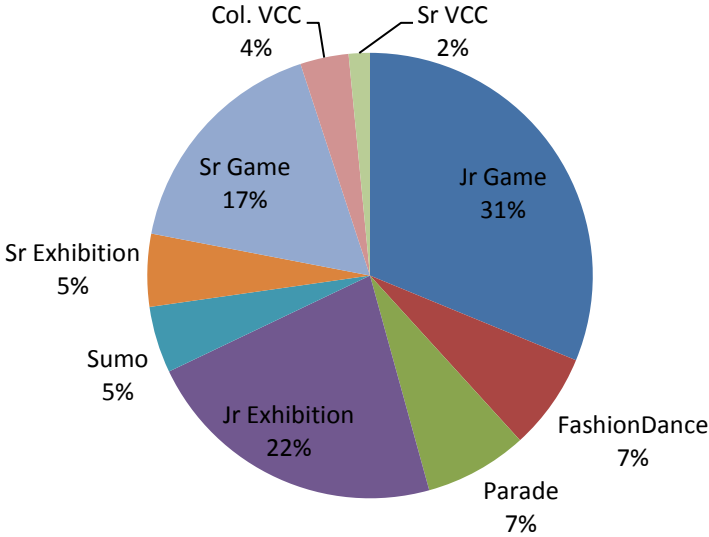
(Figure 2) Number of Robofest Student Participants Since 2000

The total number of site locations was 26 in 2010-11 season. Our continued management decision is that sites with fewer than 5 teams should be canceled or merged with other sites. On average, 63 students and 19 teams participated per site. Figure 3 shows the history of number of sites since the inception of Robofest.



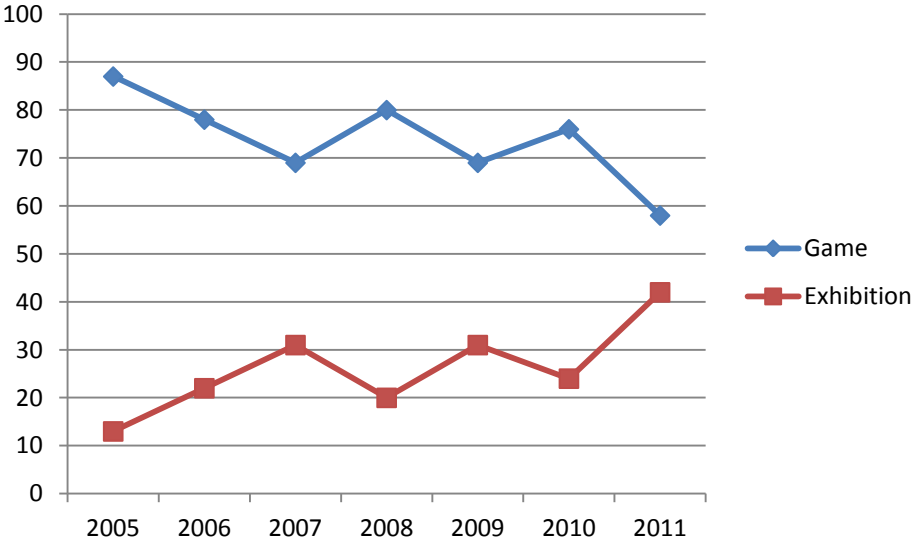
(Figure 3) Number of official site locations

Robofest offers a variety of categories in which to compete. 48% of teams participated in the BTOS(Block The Oil Spill) Game. We offered nVn sumo games in November during IEEE SEM conference. IGVC in June featured nVn and Jr. Sumo. The sumo competition attracted 5% of teams this season. See Figure 4 below by age division & competition category.



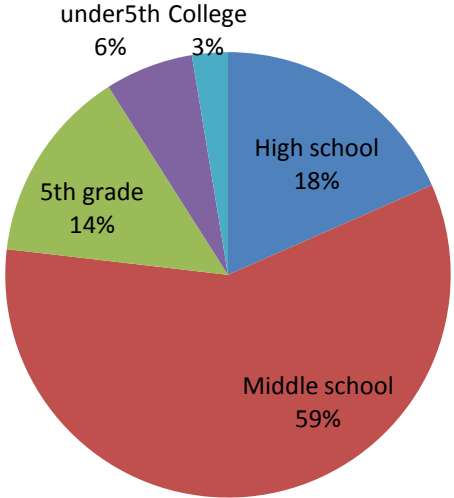
(Figure 4) Percentages of Teams by Age Division & Competition Category

Robofest can be generalized into two categories: Games that use fixed rules and open-ended Exhibition that includes Fashion & Dance and Parade. Figure 5 shows the trend of number of teams between Games and Exhibition.



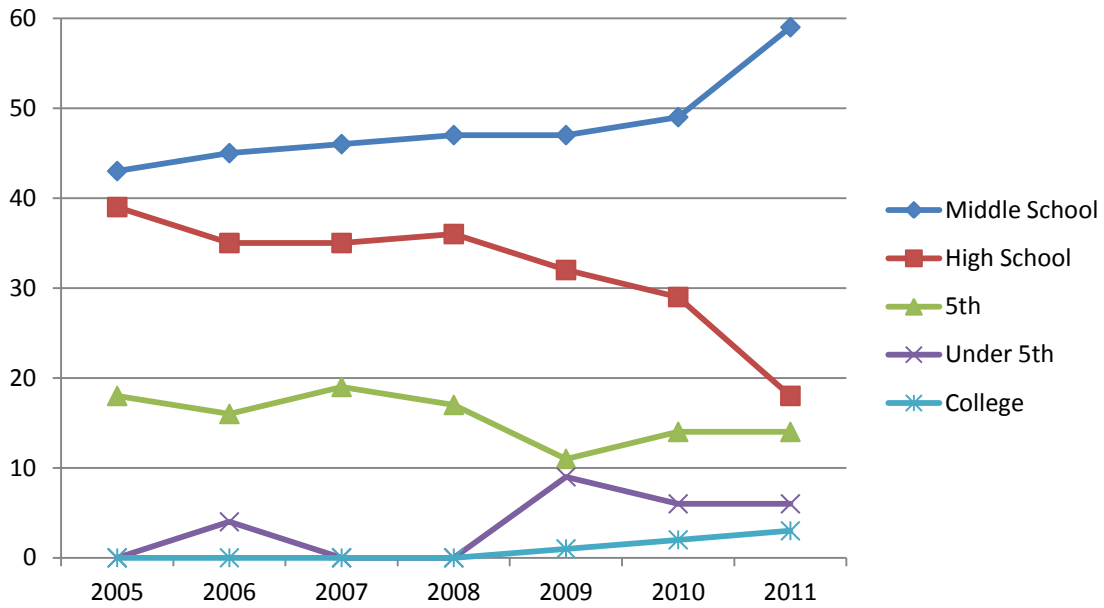
(Figure 5) Percentages of Game and Exhibition teams (Parade data is included in 2011 only)

59% of the student participants were from middle school; 6th through 8th grade students as seen in figure 6. The percentage of high school students decreased again this year.



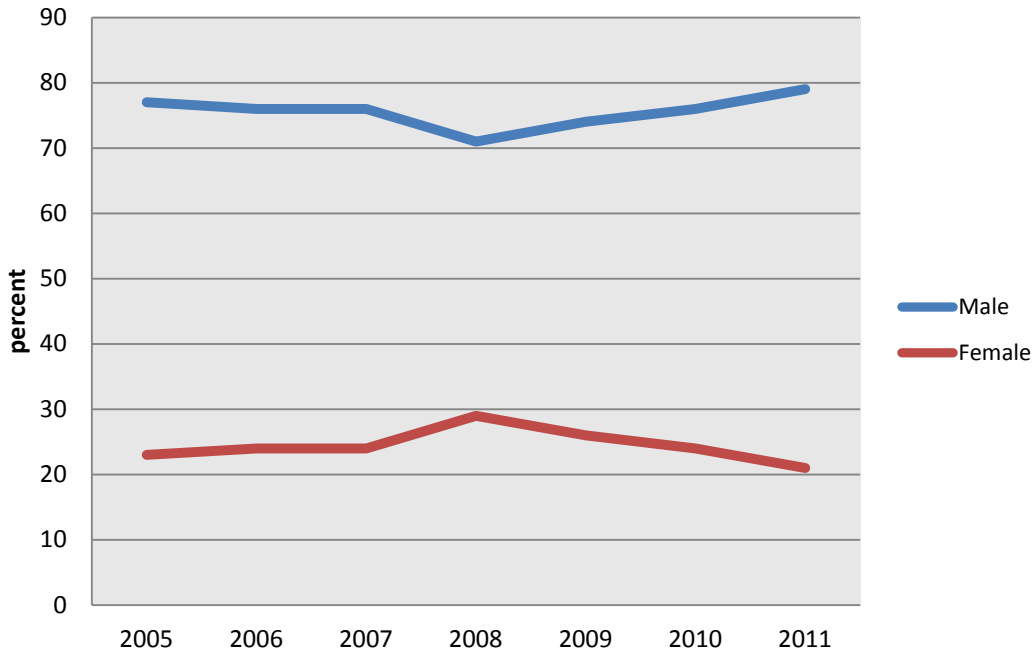
(Figure 6) Student Participant School Grade

Figure 7 shows the trend of each age group since 2005. Note that the data does not include students from the Asia Pacific regional hosted at Hanyang University who did not provide the age data to us.



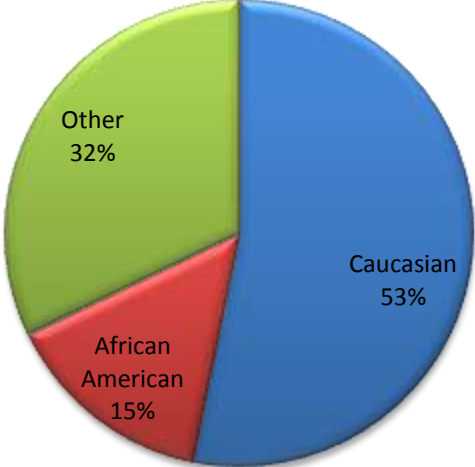
(Figure 7) Percent of age group since 2005

In 2011, 79% were male and 21% were female students. Figure 8 shows the gender ratios of Robofest students. 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.

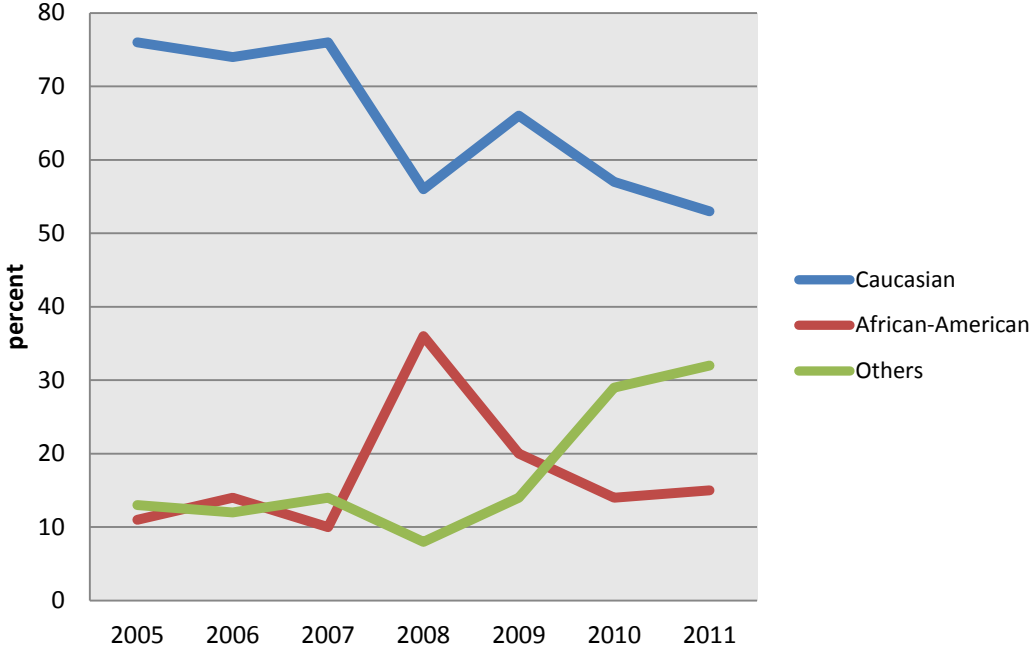


(Figure 8) Gender Ratios of Robofest Students

Ethnic diversity is represented, with almost half (47%) of Robofest 2011 participants having minority backgrounds. 15% of Robofest 2011 students were African American, 32% were other as shown in figure 9. The percentage of African Americans increased from 14% to 15%. Figure 10 shows the changes from 2005. Robofest continues to work hard to encourage students from underserved communities to participate in STEM education through robotics. Figures 9 and 10 data exclude students from the Asia Pacific region, nVnSumo, IGVC, and RoboParade.

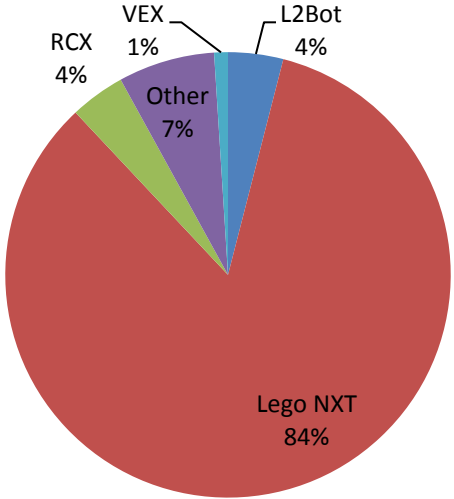


(Figure 9) Robofest 2011 Student Participant Ethnicity Data



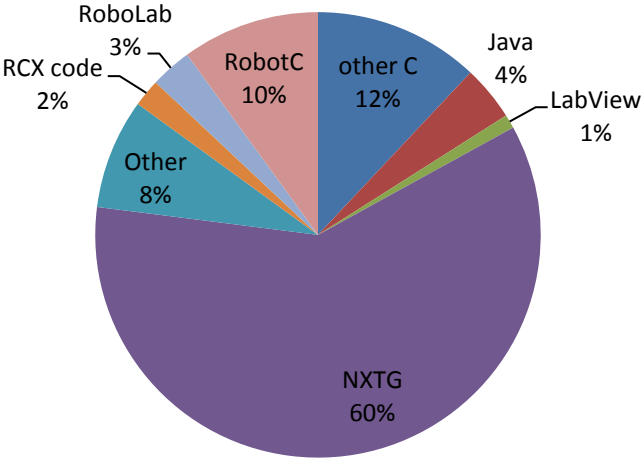
(Figure 10) Robofest Ethnicity Data since 2005 (The surge of African American in 2008 was due to a targeted grant)

Robofest allows the use of any robotics platform, which is a unique feature of Robofest. Figure 11 shows the data on robotics kits used by the teams. RCX is still in use. The use of VEX has decreased from 5% to 1% this year. We do not have detailed data from the teams in the Asia Pacific region. RoboParade data was not included either. The majority of the teams (84%) were using LEGO NXTs.



(Figure 11) Robotics Kits Used by teams

Robofest remains focused on student participants learning STEM through computer programming. The programming languages used in Robofest 2011 are graphed in Figure 12. 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 beginning in 2009. All C-style languages together totaled 22%. 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. RoboParade and Asia Pacific region data were not included in the graphing.



(Figure 12) Programming languages used

2. Robofest 2011 Survey Results

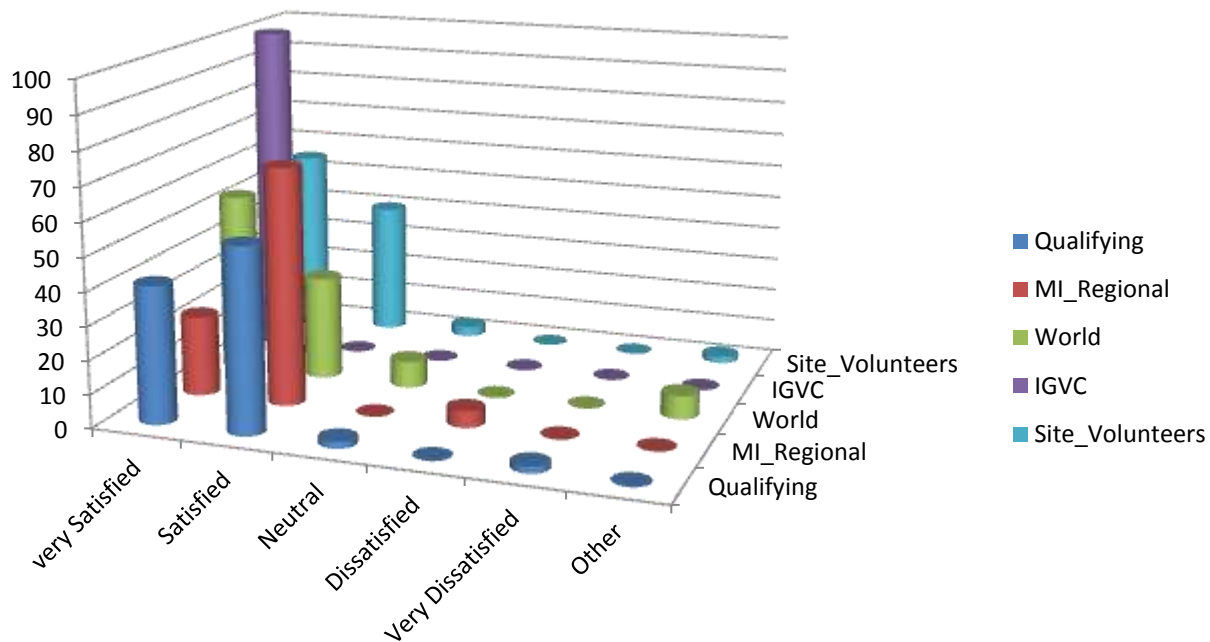
This section shows the results of the following anonymous web surveys

- Right after each qualifier (41 coaches participated, 18% of all the coaches)
- Michigan Regional (21 coaches, participation rate: 43%)
- World Championship (13, participation rate: 26%)
- IGVC (6, participation rate: 38%)
- Site Host volunteers after World Championship (58, participation rate: 14%)

The following Table 2 shows the satisfaction rate from each survey and Figure 13 visualizes the table in 3D.

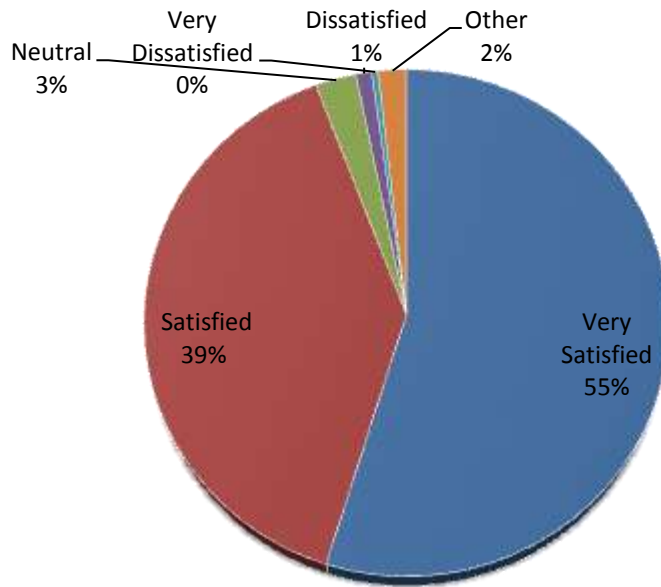
	Qualifying	MI Regional	World	IGVC	Site Volunteers
Very Satisfied	41%	24%	54%	100%	55%
Satisfied	55%	71%	31%	0%	40%
Neutral	2%	0%	8%	0%	3%
Dissatisfied	0%	5%	0%	0%	0%
Very Dissatisfied	2%	0%	0%	0%	0%
Other	0%	0%	7%	0%	2%

(Table 2) Satisfaction rate from each of 4 surveys



(Figure 13) Satisfaction rate from each of 4 surveys

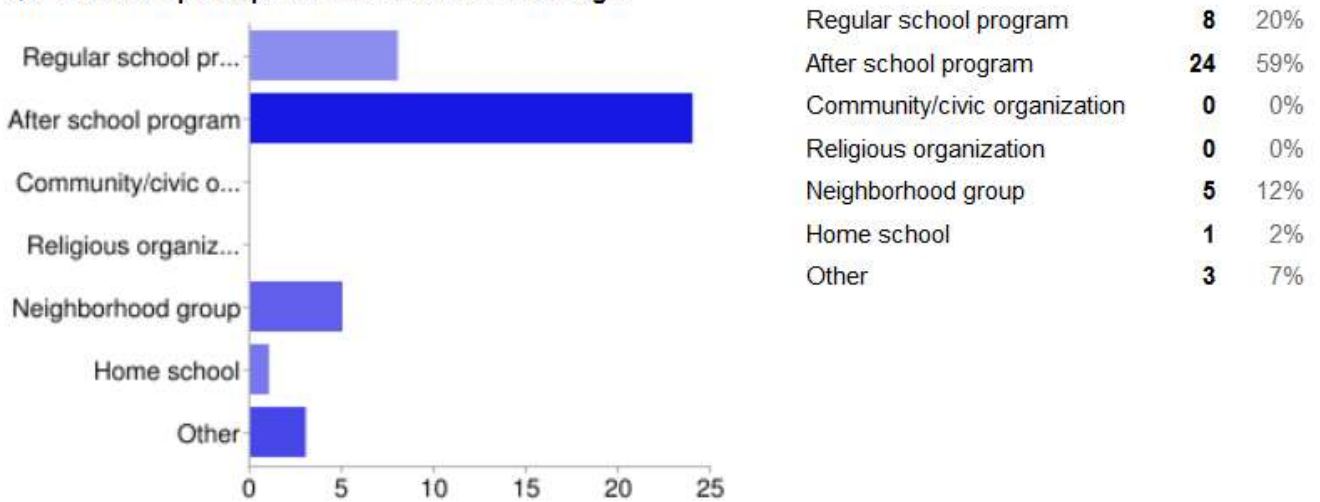
Figure 14 shows average satisfaction rate from all the surveys. Considering the satisfaction rate (94% were satisfied or very satisfied), Robofest 2011 was a very successful year.



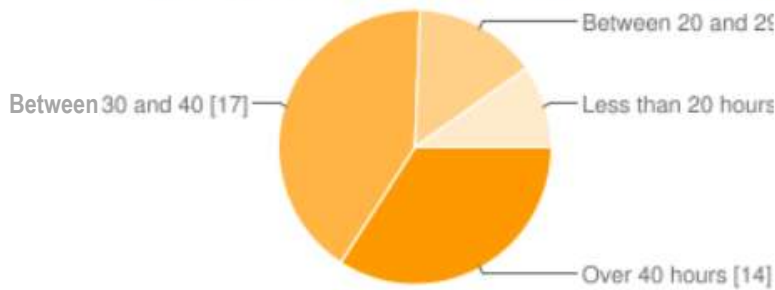
(Figure 14) Averaged Satisfaction rates

The following shows the results of coach surveys from qualifiers.

Q1. Your team participated in Robofest 2011 through:

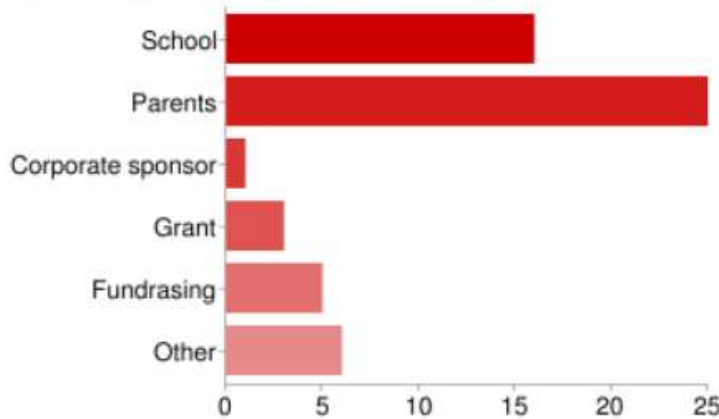


Q2. How many total number of hours has your team met to work in this 2011 season so far?



Over 40 hours	14	34%
Between 30 and 40	17	41%
Between 20 and 29	6	15%
Less than 20 hours	4	10%

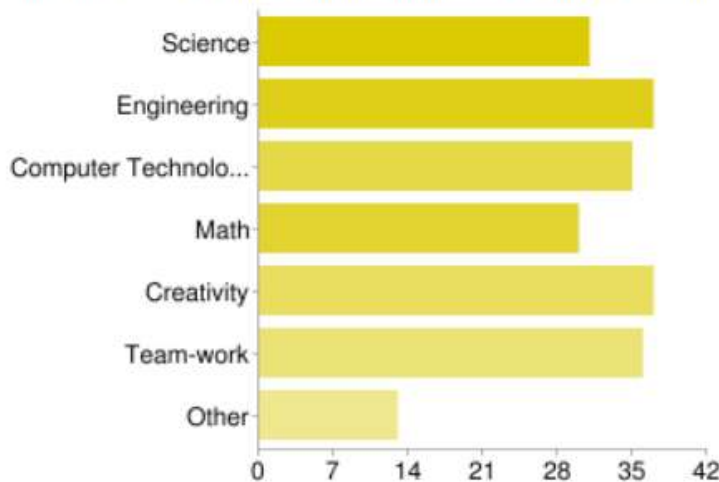
Q3. From whom did your team receive funding?



School	16	39%
Parents	25	61%
Corporate sponsor	1	2%
Grant	3	7%
Fundraising	5	12%
Other	6	15%

People may select more than one checkbox, so percentages may add up to more than 100%.

Q4. What areas do you think are enhanced (or will be enhanced) through Robofest for students?

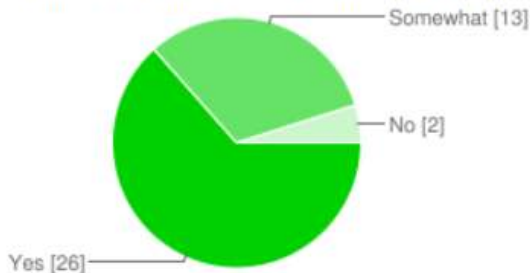


Science	31	76%
Engineering	37	90%
Computer Technologies	35	85%
Math	30	73%
Creativity	37	90%
Team-work	36	88%
Other	13	32%

People may select more than one checkbox, so percentages may add up to more than 100%.

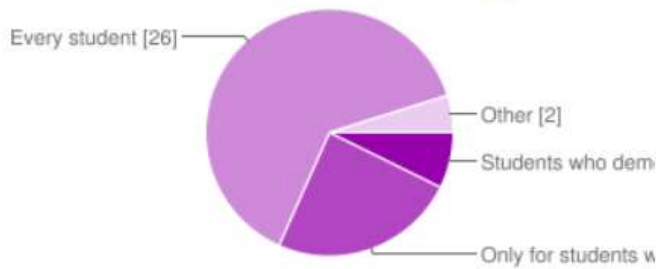
Other areas enhanced included project management, general problem-solving skills, self-confidence, time management, public speaking, willingness to take risks, focus, persistence, and grace under pressure.

Q5. Do you think your team members learned and improved math and science knowledge through Robofest 2011?



Yes	26	63%
Somewhat	13	32%
No	2	5%

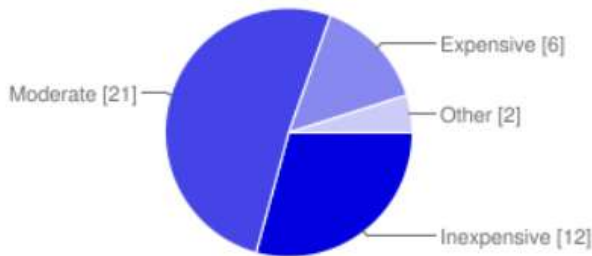
Q6. For whom do you think the Robofest programs should be designed ?



Students who demonstrate exceptional talent	3	7%
Only for students who are interested in science and eng.	10	24%
Every student	26	63%
Other	2	5%

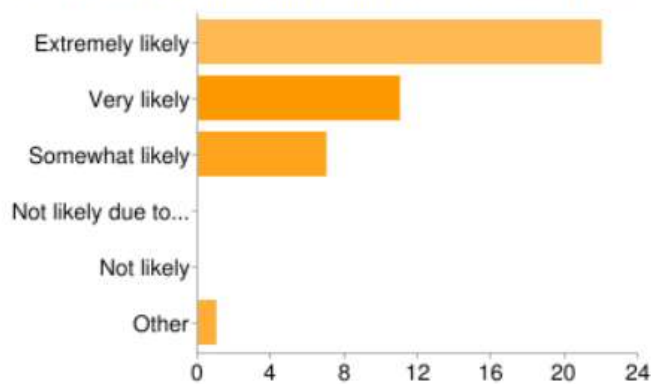
Other comments were: (1) Students who learn best by doing -- and typically are intrigued with manipulating objects, materials, and technology. This could be the majority of students. (2) It should be designed to GET students interested in science and engineering. This is a good point that Robofest has been trying to. We will change the survey question next year.

Q7. 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:



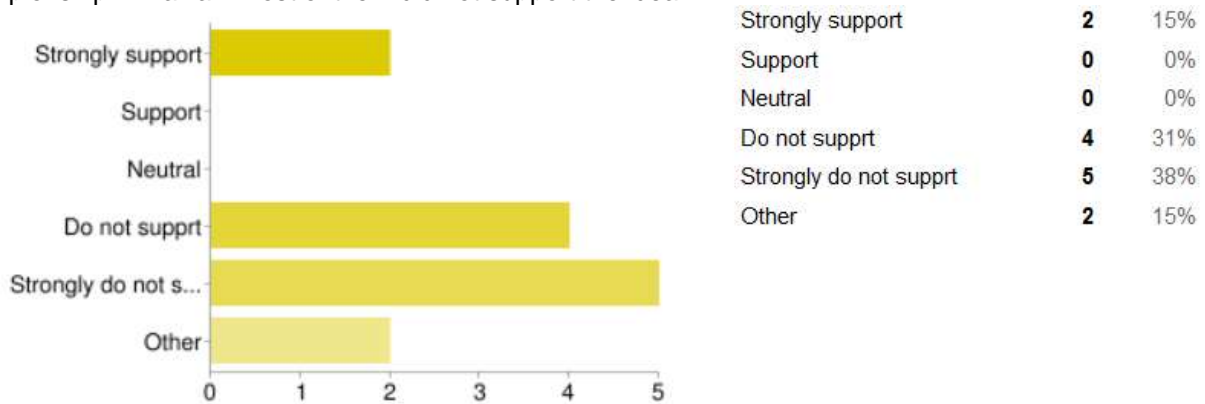
Inexpensive	12	29%
Moderate	21	51%
Expensive	6	15%
Other	2	5%

Q8. How likely are you to participate in Robofest next year?



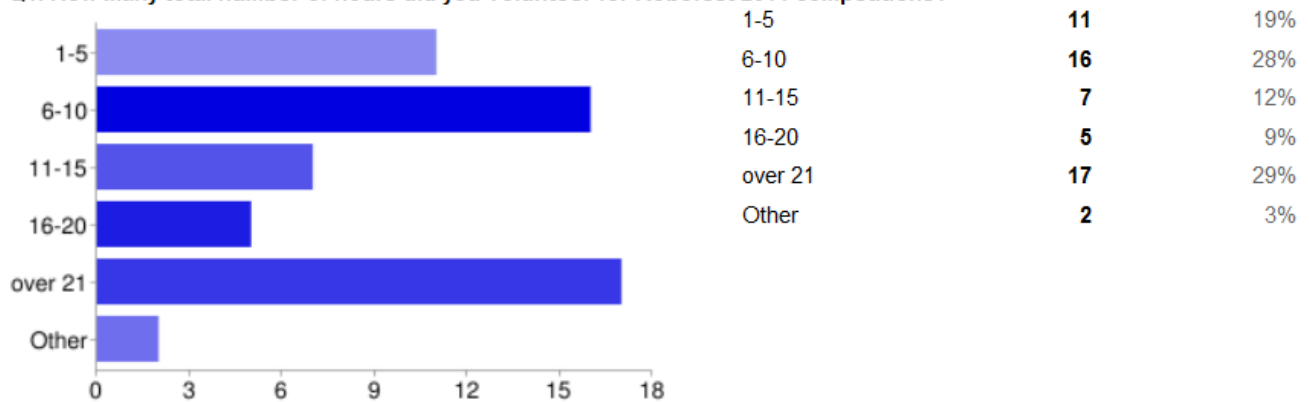
Extremely likely	22	54%
Very likely	11	27%
Somewhat likely	7	17%
Not likely due to high school graduation	0	0%
Not likely	0	0%
Other	1	2%

Robofest has a strong partnership with isisHawaii.org, a not-for-profit organization dedicated to exciting students about STEM. We asked World Championship coaches only whether they support the idea of holding the World Championship in Hawaii. Most of them did not support the idea.

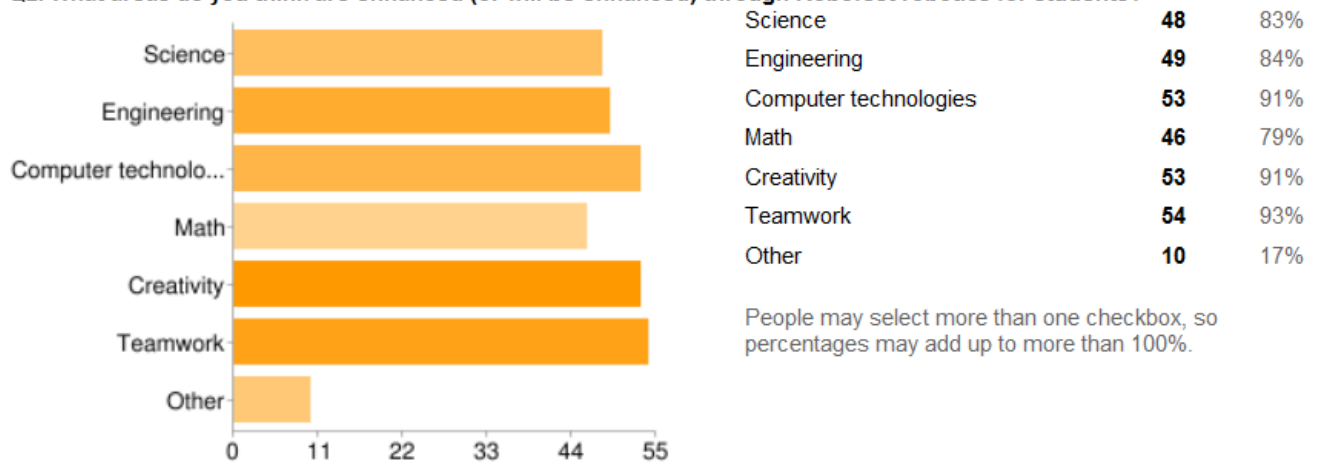


The following shows the results of site volunteer surveys conducted in May, 2011 after World Robofest.

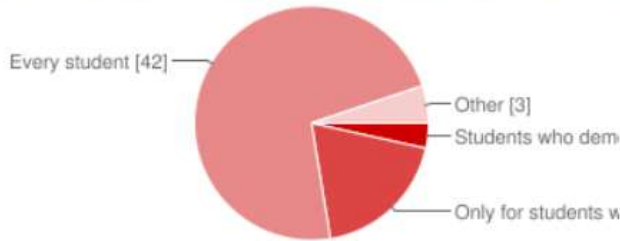
Q1. How many total number of hours did you volunteer for Robofest 2011 competitions?



Q2. What areas do you think are enhanced (or will be enhanced) through Robofest robotics for students?

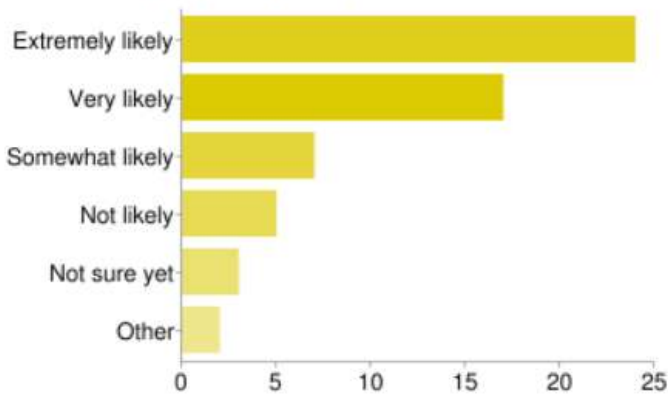


Q3. For whom do you think the Robofest program should be designed for?



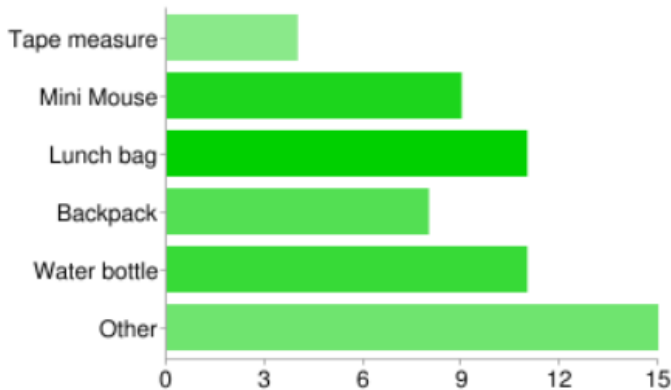
Students who demonstrate exceptional talent	2	3%
Only for students who are interested in science and eng.	11	19%
Every student	42	72%
Other	3	5%

Q4. How likely are you to participate in Robofest next year?



Extremely likely	24	41%
Very likely	17	29%
Somewhat likely	7	12%
Not likely	5	9%
Not sure yet	3	5%
Other	2	3%

Q5. As a small token of appreciation, Robofest provides a T-shirt and small gift. (If you did not receive the gift, please contact robofestoffice@gmail.com. We will mail it to you.) Could you let us know your preference for the future? Sorry we cannot provide heavy items considering shipping cost...



Tape measure	4	7%
Mini Mouse	9	16%
Lunch bag	11	19%
Backpack	8	14%
Water bottle	11	19%
Other	15	26%

Many of volunteers said T-shirt is enough or nothing.

The survey has two essay questions. The following summarized the comments. The number in the parenthesis shows the number of people who wrote the comment.

Essay Q1. The one aspect of Robofest that I like the best is:

- The unknown problem, with kids having to program on their own and coaches were not allowed to help (7)
- Variety of competition types (5)
- Excitement and pride about student accomplishments (4)
- Creativity of students as evidenced in the variety of robot designs and unique solutions to the challenge. I like that the kids are allowed to design/build according to their own interest. I think this encourages more participation and enthusiasm----although it is probably harder to judge. (4)

- A well managed program with excellent communication between LTU and participating programs and wonderful volunteers (3)
- Robofest is inclusive of students with varying interests and skill levels (3)
- Opportunity for students to work as a team, with teams even helping each other at competitions (3)
- The autonomous aspect of the robots and the feeling of success when you get a program to work (2)
- The openness and celebratory nature of the event, making the competition a real event with the “Star Spangled Banner”, announcements, awards, etc. (2)
- Student independence and problem solving encouraged (2)
- All the staff was VERY encouraging to the participating students, even in the face of failure (1)
- Four minutes to explain project to judges, keeping the competition moving (1)
- Building the robot (1)
- Making the challenges like real world challenges so the children can see a real need for robotics in the world---capping oil pipes, mine rescues, etc. (1)
- Inexpensive and very open to the use of different materials (1)
- It was an excellent program. It was difficult for the students at first, but once they started learning it got easier (1)
- RoboSumo during IGVC was the best for audience and students; it is a lot of fun and the desire to win was high (1)
- I love the level of math engagement required for this year’s challenge, especially for highly capable students. The less advanced students still engaged on authentic problem solving and creative solutions with their exhibition projects (1)
- Even though the problems are announced in December, our students don’t begin their Robofest projects until second semester----the beginning of February. It was excellent to have a video submission opportunity (1)
- I liked your pre-competition assessment quiz and hope you follow up with a post competition assessment (1)

Essay Q2. If there were one aspect of Robofest that I would change, it would be:

Game Competition

Summary of Comments and Complaints	Answers and Replies
Judges need to make sure the project and programming are done by the kids and not parents or coaches. Parent and teacher involvement sometimes makes the competition between the adults and not the students. (5)	We have tried various ways to monitor this in the past, but have not found an effective way to do so. Furthermore, it is difficult to find judges with a programming background who would be able to interview the students about their program in order to determine students’ knowledge and input, and there is not enough time to interview all of the game teams, so we only interview the exhibition and dance teams. We will keep trying to find an effective way to resolve this important issue.
More clarity of rules (3)	First of all, we admit that the BTOS rule was too complex. We are always striving to see that the rules are clear and easily understood. Our Kick-Off in December gives coaches an opportunity to see the new game and give us feedback so that we can clarify anything that requires more information.
More than 30 minutes of practice time---there are too many teams trying to use the practice tables. (3)	Thirty minutes should be sufficient time for a team to program their robots to perform the unknown challenge. We will try to have more practice fields available, as space allows, so that all teams will be able to try out their programs before the time runs out. It is necessary to limit the amount of practice time in order to keep the competition running at a timely pace.

Provide two levels of game rules---entry level and advanced level for junior and senior games. At competitions it seems that some teams are struggling just to get their robot to move and some teams get perfect scores. (2)	To implement two levels of game rules would make the judging more complicated and require even more judges. We have enough trouble to trying to find judges for one level of junior and senior games. We encourage teams that are struggling to attend our training workshops and to participate in our warm-up competition before the qualifier.
The dynamics at the competition environment are often different than what the teams were expecting and with which they practiced--- lighting, electricity, independence, practice time, etc. Stability of the playing field was also a problem for bigger robots this year. (3)	We understand that many factors can vary from site to site. We try to give clear instructions to our site hosts and emphasize the importance of lighting, equality of playing fields, etc. We will try harder to convey the importance of these standards. We did not anticipate the robots to be as large or heavy as they were this year.
Crowd control---people gathered around playing field making it difficult for many to see (3)	We encourage our site hosts to rope off the playing area so that spectators are able to view the playing fields. This is at the site host's discretion. It is already difficult to find enough volunteers, so it may not be feasible for many sites to have a volunteer to manage crowd control.
Add some fun game/competition for those kids who like robots but are not too much interested in the science/math calculation. These fun games could be like racing, finding some objects, etc. (2)	The main focus of Robofest is to increase the skill level of students in the areas of STEM and ICT education. We are adding Sumo events to the competitions, which seem to create more interest and fun for students who do not get very excited about science and math.
The problem was very difficult this year (2)	We try to include some simple aspects to the game, so that more teams have a chance to earn points for accomplishing at least a part of the task. Students should be encouraged to solve as much as they can, not become overwhelmed if they cannot complete a program for the entire challenge.
More difference between junior and senior game (2)	This year the set up for the playing fields was very complicated, and it was difficult to have a lot of difference between the junior and senior game. Next year we can try to increase the challenge for the senior game.
Coaches should be sequestered away from team and practice areas. Some coaches try to offer advice after the unknown variables are announced. (2)	We have proctors at each event whose main job is to maintain the integrity of the work area, preventing coaches and/or parents from helping the students after the unknown factors are announced. It is sometimes difficult to get enough volunteers to patrol the area effectively. We will encourage each site to have an adequate number of proctors. In addition, we will remind coaches to observe rules.

Exhibition

Summary of Comments and Complaints	Answers and Replies
More feedback from judges--- Exhibition teams could benefit from some anonymous feedback from the judges regarding 2 things they think the team could improve on and 2 things they really liked about the project. (2)	Our judges are encouraged to provide feedback to the teams. The chief judge's comments are available online after the competition. We will consider having comments from all the judges available online for next year.
Consistency of judging (4)	We try our best to train judges prior to competitions. Please remember that our judges are volunteers and do their best to be fair and consistent.
Judges should not be a participant team's coach, parent, or volunteer. (4)	It always is best if the judges are not directly involved with any team. However, it is very difficult to find volunteers who are not involved with the teams in some way. Sometimes coaches or parents have contacts who are willing to become involved, but that is not the case at most competitions. Please let Dr. Chung, chung@LTU.edu , know about more

	specific information.
More support, training for coaches and teams wishing to do exhibitions (1)	Since each exhibition project is unique, we have not come up with a good way to offer training for exhibition teams. We are open to suggestions on how to provide training for exhibition teams.
Real world application should be considered (e.g. demented carnival ride vs. cancer fighter or nuclear reactor application) (1)	Real world application is a factor in the judging, but so are the technical aspects of programming and the creativity of the task and the display, as well as the team presentation. All factors are considered by the judges.

Awards

Summary of Comments and Complaints	Answers and Replies
Awards - trophies are cheap. Medals have no meaning since every participating student gets one (1)	The trophy is a symbol of the accomplishment achieved by the team. Its value should be judged by its purpose, not by its cost. Robofest could purchase more expensive trophies either by raising the cost of registration or eliminating other aspects of the program, but we have chosen to do neither. Medals are given to each participant to recognize the hard work and achievement of each team member regardless of their final score. Everyone accomplished <i>something</i> through their involvement in the project and that should be appreciated and recognized. From 2012, we are going to personalize medals with each student's name on the back of the medal. Thank you for your comments.

Local Competitions

Summary of Comments and Complaints	Answers and Replies
We would really love an organized first round with everything set up before arrival (1)	It is our intention that everything should be set up and ready to go before teams arrive. We apologize if this did not happen at some competitions and will try to communicate the importance of organization and timeliness to our various sites.
There was a problem for the Canadian teams with the required cup size in the game competition, since metrics are used in Canada. Teams practiced with cups of a different size (the closest they could find) than those used at the competition (1)	We apologize for the problem created by the cup size. We did not realize there would be so much difference in the measurement for our neighbors to the north.
The schedule needs to be timely so that everyone can attend the awards at the end (1)	We try to maintain a 3 hour schedule at each qualifying competition site.

Promotion

Summary of Comments and Complaints	Answers and Replies
More teams in California (1)	We rely on word-of-mouth communication by coaches, site hosts, team members, etc. to get more teams, and therefore more sites, involved. We would love to see an increase in participation in California.

Miscellaneous

Summary of Comments and Complaints	Answers and Replies
None---it was perfect! (2)	Thank you.
The Robofest.net web site could be organized to present information more clearly (1)	Currently it is maintained by a non professional volunteer. We are trying to hire a part-time web manager. Improving the organization of the website would be a top priority for a

	new hire, but it is not easy due to limited budget.
More emphasis on teamwork (1)	We encourage coaches to oversee the inner dynamics of their team(s) and see that teamwork is stressed and supported among their team members.
Bigger area for opening and closing (1)	Many of our sites have limited space available.
More availability of monetary support for groups with limited funds (1)	Teams should seek sponsorship from local businesses, parent support groups, community support groups, etc. Robofest provides support to competition sites, but does not have funds available to give monetary support to teams.
A regional tournament in our area (1)	It is not cost effective to have a regional tournament in an area with few competition sites. Exhibition and Fashion/Dance teams are encouraged to enter the Regional Video Submission. Game teams advance according to their scores in the Qualifying competition.

3. Self-evaluation 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 know that some items summarized below are existing problems from previous years. Please understand that some issues take time and resources to improve.

3.1 General Administration

3 level Competition Structure

We used a 2-level structure from 2005 to 2009: local level qualifiers and one World Championship. 3-level competition structure has been introduced since 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 15.



(Figure 15) Robofest Competition Structure

Even though there was still some confusion about the video regional screening after qualifiers, it seemed the 3 level structure was working better this year.

Site Host Administration

During the 2011 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.

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 Michigan plan for earlier dates, as time is needed to fund the expenses in traveling to the Regional or World Championship. In the future 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.

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. We are proud of our cost-effectiveness and efficient management to minimize the cost for teams to participate in Robofest robotics programs. We did not charge check-in fees for Michigan regional or 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 on Robofest coach login account. 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 (a group for coaches and another group for teams) for communicating and networking with other teams. Robofest also has a Facebook "Page", www.facebook.com/robofest
- 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 next year. Please send your teams' achievements to your local newspapers and TV stations! We will send articles to newspapers 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. We are still working on renovating the website with a content management system. The new system will hopefully be introduced, if we find qualified part-time staff. However, we are proud of keeping almost all data/information/pictures from the 12 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%, 2011: 41%) We need to develop an automatic reminder function or require a team photo to compete.
- There are inefficiencies caused by the team registration system, mailing list system, and volunteer system not being integrated. For example, some coaches received 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.
- For some coaches, emails from Robofest have been treated as spam.
- Currently we are facing a problem to find a qualified staff to maintain/improve the system. We are looking for a professional Java Servlets, JSP, Ajax, and MySQL programmer who is willing to work part-time.

Free Technical Support and Workshops (See also section 7)

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 only to 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.

3.2 Competition Rules

The finalization of all the official rules was on time this year. However, the BTOS game was too complex and FAQs were not effectively delivered to the coaches and volunteer judges. The game rule must be simple next year. In addition, we need clearer communication and better organization. The introduction of nVn sumo was quite interesting. Also, junior "Bottle Sumo" during IGVC seemed to work fine. We plan to introduce more advanced sumo competitions like hexapod sumo next year.

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 490 people registered on the web and we deeply thank all the site volunteers. For next year, we plan to recognize volunteers through PVSA (President's Volunteer Service Awards). Robofest became a Certifying Organization of PVSA in 2011.

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.

Playing Fields/Tables

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

World Venue and Setup

- 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.
- Alternating Game and Exhibition seemed fine.

Judging

Judging is always challenging. Some judges were not familiar with the Robofest 2011 rules. The Chief Judge's role is very important and they need to be trained properly early on.

Miscellaneous

- To encourage teams to participate in earlier dates, we will continue to 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.
- We plan to provide medals with student names on the back from 2011-12 year.
- Currently LTU's \$2,000 scholarship is only for students of winning teams in World Championships. We *plan* to expand this opportunity to all Robofest participants. Regardless of the competition results, Robofest participants may apply for renewable Robofest Scholarship by submitting GPA, ACT or SAT scores to Lawrence Tech scholarship office. This plan has not been approved by Lawrence Tech administration at this time.

4. Revenue/Expense Summary

Robofest budget results for the 2011 season (August 1, 2010 ~ July 31, 2011) were as follows: \$77,954.24 in cash revenue including the transferred balance from 2010, \$66,594.84 in expense which resulted in an overall gain of \$10,999.40, which is needed to prepare for next Robofest 2012 before registration begins.

Table 3 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. If your team has not paid registration fees, please send us a check. However, we realize a more controlled registration process/tool for 2012 is necessary.

Cash Revenue	
Transfer from 2009-2010	\$11,096.90

Individual donors	\$999.98
Corporate/Org. Cash Sponsorship	\$16,800.00
TARDEC fund (as of July 31, 2011)	\$27,907.88
Team registration fees & other income	\$21,149.48
Total revenue	\$77,954.24

Cash Expense	
Workshop and summer camp lead instructors' wage	\$19,264.00
Coordinators' wage (*)	\$20,545.13
Student assistants' wage (**)	\$480.00
Supplies (medals, trophies, T-shirts, playing fields, office supplies, etc)	\$18,669.83
Table & tent rental for MI regional and Worlds	\$2,325.60
Postage	\$597.91
Robot kits, sensors, and parts	\$1,694.24
MI Regional and World Robofest food(*3)	\$2,168.63
Advertising and posters	\$1,209.50
Total expense	\$66,954.84
Robofest account balance as of July 31, 2011	\$10,999.40

(*) some coordinators' wages were paid by MCS fund. See table below.

(**) most of student assistants were paid by MCS fund. See table below.

(*3) some are not paid yet due to disputes with food services

(Table 3) Cash Revenue and Expense Summary

Table 3 above does not include Lawrence Tech's monetary support. Table 4 below summarizes cash contributions from Lawrence Tech. Other LTU contributions include: marketing, fundraising, and special events support by Univ Advancement; help desk laptop support; audio & visual equipments; teaching release time for Dr. Chung (Robofest director) and Dr. Carwright (Robofest program manager). 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, computer network services on campus, office space, etc.

Part-time web developer & coordinators' wage paid by MCS Dept	\$18,763.01
Student assistants' wage by MCS Dept.	\$21,627.29
Advertising paid by Marketing Dept.	\$911.50
Total LTU cash support	\$41,301.80

(Table 4) LTU support summary

5. Student Team Achievements

This year's game, Block the Oil Spill was extremely competitive. Teams had to average over 70 points to advance to the World Championship. The following teams had two perfect runs at World Championships.

Division	Team ID	Team Name	Coach Name	Score	Time	Award
Senior Game	72-1	Robohawks	Steve Dail	105	0:05	1 st place
	826-1	SuchBros	Mark Suchezky	105	0:12	2 nd place
	1421-1	ESS 1	Cathy Webb	105	0:43	3 rd place
	833-1	Geek Squad	Steve Tao	105	0:57	4 th place
	1080-1	Bethany Bruins	Brian Kincheloe	105	1:35	5 th place
Junior Game	645-1	2D TetraBots	Scott Peacor	105	0:13	1 st place
	1250-1	Wired up	Satesh Potluri	105	0:15	2 nd place
	1244-1	Wasps	Satheesh Makkapati	105	0:25	3 rd place
	1283-1	ALL 2 JESUS	Cheri Pelic	105	0:39	4 th place

	22-4	The Cappers	Betsy Lamb	105	1:30	5 th place
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(Table 5) Teams that had two perfect game runs at World Championships



Especially, Harrison's Robohawks won the 1st place with astonishing speed, just 5 seconds! Their achievements were reported in local newspapers in Michigan. They constructed 3 different robots to optimize the design.

They calculated the length the robot traveled while the light sensor activated. However, because the pipe length they had to measure was divided into two parts, labeled A and B, and the team knew the ratio of the two parts in regards to the total length, they figured they only had to measure the first part of the pipe.

"The kids figured that they didn't have to go all the way down to the end. All they had to do was measure A and use some algebra to calculate how long the whole thing was," Brouillette said. "So that saved several seconds."

(Excepted from Farmington Press, 6A, May 25, 2011)

This year's VCC (Vision Centric Challenge) using L2Bot was very challenging. The game was similar to the IGVC Autonomous Challenge (www.igvc.org). The following High School teams did an amazing job completing the missions. Roboteers wrote an article on their VCC experience for Robot Magazine, Nov-Dec 2011 issue.

Team Name	ID	Coach Name	Award
Roboteers	348-1	Jonathan Crocker	1st Place
G squad	1023-2	Leann Bigos	2 nd Place

(Table 6) Vision Centric Challenge winners

Many superb exhibition projects were entered this year. Team 1284-2, PACE Invaders from Detroit, MI invented a quadcopter that used PID control for its four propellers. This team won the 1st place Senior award from World Championship.

Another notable project was done by a team 1397-1, Remotics from Canton, MI. They created a toxic waste disposal system that was inspired by the damage the nuclear power plant suffered in Japan due to the tsunami. This team won the 1st place Junior award from World Championship.

The following table shows all the Exhibition World Championship winners.

Division / Category	Winner Team ID	Winner Team Name	Coach Name	City	State	Award
Junior Exhibition	1397-1	Remotics	Bharat Ajmera	Canton	MI	1 st
	1420-2	RoboNerds	Robb Colbrunn	Hinckley	OH	2 nd
	1408-1	Ignatius B	Kim Anthony	Scarborough	Canada	3 rd
Senior Exhibition	1284-2	PACE Invaders	Lynda Yearwood	Richmond Hill	Ontario	1 st
	1230-3	Robo Cubs 3	Jenny Friday	Detroit	MI	2 nd
	1113-1	Future Civil Engineers of Texas	Elaine Stephens	Houston	TX	3 rd
	72-2	Robohawks	Steve Dail	Farmington Hills	MI	4 th
	515-1	Intelligent Design	Wendy MacLennan	Northville	MI	5 th

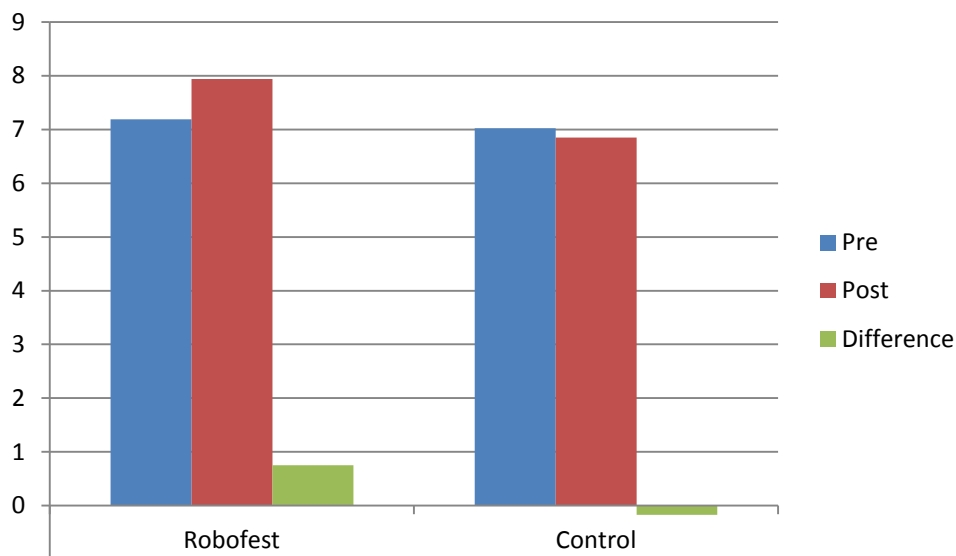
(Table 7) Winners of the 2011 World Championship Exhibition competition

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, Robofest students were asked to take online assessments before and after the competition. In addition, the same assessment was taken with another group of students who did not participate in the competition as a control group. Each assessment consisted of 15 multiple-choice mathematics questions. Additionally, we collected information on the students' grade, gender, and whether or not they participated in Robofest, but no other identifying information. The pre- and post- assessments were implemented as a Google document.

Data from Robofest 2011 involves a comparison of math scores among 4th to 12th grade students who did and did not participate in either Robofest or other robotics competitions. The pre-assessment comparison comprised 164 students who participated in Robofest and 47 students who did not participate (the control group). The post-assessment comparison involved a subset of the students who took the pre-assessment: 51 Robofest students and 40 Control students. The pre- and post-assessments were multiple-choice tests of 15 similar math questions. As shown in Figure 16, Robofest students' mean scores improved from 7.19 to 7.94 ($p < .10$), while the control group's scores actually decreased slightly. This data suggests that participation in robotics competitions can help improve STEM scores.



(Figure 16) Robofest 2011 math assessment results

We believe the following factors in Robofest competition helped improve the scores.

- Explicit math components in the game
- Unknown factors in the game
- No adult help allowed
- Judging criteria requiring the use of Math and Science components in Exhibition and RoboFashion and Dance

7. Workshops and Summer Camps

The following table 7 lists all the workshops and summer camps.

Date	Time	Topics	Location	# Participants
Fri. Oct 1	3 ~ 4pm	NXT-G for RoboParade	Winas Middle School	20* (Fig. 19)
Sat. Oct 9	9am ~ Noon	NXT-G for RoboParade	Lawrence Tech, M218	18*
Sat. Oct 16	1pm ~ 4pm	NXT-G II for RoboParade	Macomb Community College, Lorenzo Cultural Center	10*
Thu. Nov. 4	5 ~ 5:30pm	VCC and nVn RoboSumo Challenges	U of M Dearborn	25*
Sat. Nov. 6	Noon ~ 3pm	NXT-G for RoboParade	Lawrence Tech, Atrium	3
Sat, Nov 13	1pm ~ 2pm	Introduction to Robofest and RoboMath	Lamphere High School, during DACTM/MDSTA conference	4
	2:30 ~ 3:30pm			1
Sat. Dec 4	2:30pm ~ 4pm	Robofest 2011 Kick-off info meeting	Lawrence Tech and Webinar	29 (Fig. 17)
Tue. Dec 7	5:30pm ~ 7pm	Robofest 2011 Kick-off info meeting	Lawrence Tech and Webinar	13
Sat, Jan, 8, 2011	1pm ~ 4pm	NXT-G for Robofest Game	Lawrence Tech, M218	17
	4pm ~ 5:30pm	Robofest 2011 Kick off presentation	Lawrence Tech, M218 and Wimba	15*
Sat, Jan, 15, 2011	9am ~ noon	NXT-G for Robofest Game	Lawrence Tech, M218 and Wimba	15
	1pm ~ 4pm	RobotC for Robofest Game	Lawrence Tech, M218 and Wimba	2
Sat, Jan, 22, 2011	1pm ~ 4pm	LeJos Java	Lawrence Tech, M218	5*
Jan 24, Feb 14, 28, Mar 7, 8, 14, 21, Apr 13	3pm ~ 5pm	NXT-G for Robofest Game	Emerson School, Detroit	16 (Fig. 18)
Sat, Jan, 29, 2011	2pm ~ 3:30pm	L2Bot with Java	Lawrence Tech, M218	5 (Fig. 21)
Sat Feb 5	9am-noon	NXT-G Workshop for Game	Lawrence Tech University	10*
	1pm ~ 4pm	NXT-G Workshop for RoboFashion & Exhibition		10*
Sat Feb 19	9am-10:30am	Judge Training and webinar	Lawrence Tech University	15*
	1pm ~ 4pm	L2Bot Workshop		3 (Fig 21)
April 20, 27, May 4, 11, 18	3-5pm	NXT-G Workshop for Jr. Robofest Sumo	Emerson School	16 (Fig. 18)
May 6, 20, 27	3:45~5:45pm	NXT-G Workshop for Jr. Robofest Sumo	Cornerstone	11 (Fig 20)
June 24	4~8pm	RoboMath camp for teachers	Lawrence Tech University	17 (Fig 22)
June 28 ~ 29,	9am ~4pm	L2Bot programming with Java	Lawrence Tech University	5 (Fig 24)
July 7	10am ~ 3pm	RoboMath for students	Lawrence Tech University	8 (Figure 23)
July 12	9am ~4pm	Kalman filter algorithms	Lawrence Tech University	8 (Fig 26)
July 18~19	9am ~4pm	Android Mobile App Programming plus Lego NXT with LeJos	Lawrence Tech University	4 (Fig 25)
July 22	10am ~ 3pm	RoboMath for students	Lawrence Tech University	15 (Fig 27)
July 28	10am ~ 3pm	L2Bot with Java	Lawrence Tech University	4 (Fig 21)
Aug 23	10am ~ 3pm	Hexapod Sumo	Lawrence Tech University	11 (Fig 28)
			Total # of participants	335
			Total # of workshops	43

(*) estimates

(Table 7) List of workshops and camps provided by Robofest during 2010-2011 academic year

The table does not include week long workshops and camps offered 3 times in Canton taught by Dr. DeRose (ME adjunct professor). We supported them by providing our curriculum, robots, and Laptops. CantonFun.org did registration and other administration work.

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 Detroit schools shown in Figures 18, 19, and 20 below. Total number of schools in Detroit that had on-site classes was 3 and total number of students served was 331.



(Figure 17) Robofest 2011 Kick-off workshop on Dec. 4, 2010



(Figure 18) A workshop by Prof. Bozin at Emerson School in Detroit



(Figure 19) A workshop at Winas School in Detroit



(Figure 20) A workshop at Cornerstone School in Detroit

We had a good year in advanced robotics with L2Bots thanks to the generous donation from DENSO. Figure 21 below shows the L2Bot workshops. The participants took the L2Bot built with the support from DENSO after the workshop to prepare for Vision Centric Challenge 2011. Each L2Bot has DENSO logo as seen on the last figure 21.



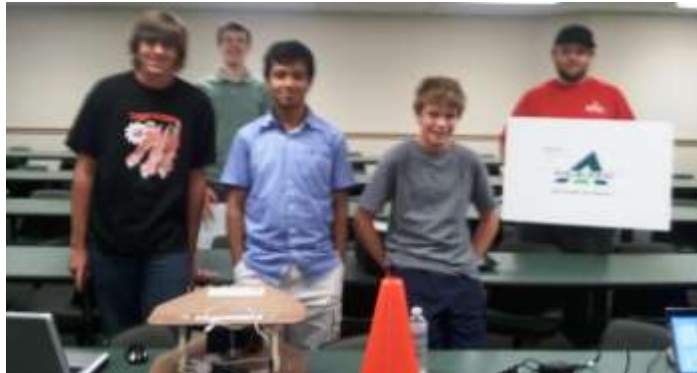
(Figure 21) L2Bot workshops, L2Bots were constructed sponsored by DENSO



(Figure 22) RoboMath camp for teachers



(Figure 23) RoboMath camp for students



(Figure 24) L2Bot programming with Java



(Figure 25) Android Phone + Lego NXT with Java



(Figure 26) Kalman filter algorithms



(Figure 27) RoboMath camp for students



(Figure 28) Hexapod robot camp

The following Table 8 shows all the instructors and their classes this 2010-2011 academic year. We thank the Lawrence Tech help desk for providing laptops for the workshops. Most of the workshop materials were posted on the web for on-ground and online participants.

Instructor	Workshops or camps taught
Prof. Keith Bozin	Emerson School in Detroit, NXT-G
Dr. Chris Cartwright	DACTM/MDSTA, Kick-off, NXT-G, RobotC, and RoboMath
Dr. CJ Chung	RoboParade, nVn Sumo, Kick-off, NXT-G, Winas Middle School Academy in Detroit, RoboMath, L2Bot, Android and NXT, and Hexapod Sumo robot
Dr. Kurt Meister	Cornerstone School in Detroit
Mr. James A. Ureel	NXT-G workshop for teams
Dr. Guang-Chong Zhu	Kalman Filter Algorithms
Mr. Joseph E Long	RoboParade at Macomb Community College
Mr. Ryan Steven Matthews	LeJos Java and L2Bot
Mr. Gordon Stein	Hexapod Robot Sumo
Dr. Joe DeRose	Canton

(Table 8) Workshop and summer camp instructors

8. Recognition & Acknowledgement



(Figure 29) Some Participants of World Robofest 2011 Championship - May 8, 2011

Figure 29 shows the 67 proud teams that advanced to World Robofest Championship this season. Each received a large championship gold medal shown in figure 30.



Figure 30. World Championship Gold Medal sponsored by TARDEC

Robofest was again blessed this year to have 16 corporate/foundation and 7 individual sponsors (Anonymous, CJ Chung, Howard Davis, Terrence Kalley, Anne and Stewart Harman, Dennis J. Howie, and Joel Stein). Without their support, Robofest 2011 would not have been possible. Figure 31 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 qualifying programs as well as the Championship programs (see Figure 32). Bronze level or higher sponsor logos were printed on our official

posters (see Figure 33). More than 1,000 spectators and 500 students came to the championship event held at Lawrence Tech in Michigan on May 9, 2011. A list of all the sponsors can be found at www.robofest.net.



(Figure 31) Robofest sponsor logos displayed and printed during the Championships at Lawrence Tech.



(Figure 32) Some of official Robofest programs with official sponsor logos



(Figure 33) Robofest 2011 Official Poster



(Figure 34) IEEE medal of achievement for Robofest 2011 qualifying competitions

Especially, we thank IEEE Region 4 PACE and SEM (Southeastern Michigan Section) for their sponsorship for IEEE medals of achievement (see Figure 34) that were awarded to the registered participants of Robofest 2011 during the qualifying competitions.

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

- John Maten: 2004, 2005, 2006, 2009, 2011
- Dana Johnson: 2006, 2007, 2008, 2009, 2011 (Battle Creek)
- Mike Waltz 2007-2011 (Fremont CA)
- Kamilla Sculte 2007-2011
- Theodore Armes 2007-2011 (Gal TX)
- Terrence Southern: 2007-2011
- Branti Holland: 2007-2011
- Kevin Furgal: 2007-2011

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 2010-2011 year were Jereme J Ureel (Robofest Coordinator), Teresa K Dubois (Associate Coordinator), Wendy MacLennan, Susan Latos, Sara R Moss (Web application consultant), Yevgeniya Tarakhovsky, and Maurice Tedder. Part-time student assistants were Tiffany Rochelle Platt, Ann Elise Maten, Ryan Steven Matthews, Jamie MacLennan, Taiga Sato, Jonathan David Nabozny, Daniel C Anderegg, Noah E Crocker, Matthew D Lanting, Joseph E Long, Christopher William Anders, Gordon Stein, and Daniel Rosendale.

The Institute of Electrical and Electronics Engineers USA (IEEE) honored Lawrence Tech Professor CJ Chung with its citation of honor award for his leadership in founding the Robofest competition to inspire interest in engineering among pre-college students. See figure 35.



(Figure 35) Associate Professor CJ Chung (R) receives a citation of honor from Ronald Gensen, president-elect of the Institute of Electrical and Electronics Engineers, USA, during the organization’s annual meeting held in Austin, Texas, on March 5.

We would like to praise all the works done by our heroes, site host organizers in the table 9 below. Without their dedication and sacrifice, we know Robofest 2010-2011 season would not have been possible.

Site Host Name	Host Organizer Name(s)
2011-CIS_Detroit_MI	Eric Dedmon
2011-Austin_TX	Diana Heinig
2011-Nashua_NH	Naveena Swamy
2011-Medina_OH	Brenda Magier
2011-Redford_MI	Ronald Fadoir
2011-Galveston_TX	Glenn Winstryg and Elaine Stephens
2011-Aurora_CAN	Chris Bortolin
2011-Battle_Creek_MI	Mark Gothberg
2011-Canton_MI	Jon Finch
2011-Fremont_CA	Robert Benn
2011-ClintonTwp_MI	Michael Klein
2011-Cobo_Detroit_MI	Cliff DuPuy
2011-MilkRiver_CAN	Monti Toly
2011-Northville_MI	James Cracraft
2011-Saginaw_MN	Cameron Lindner
2011-Sichuan_China	Lu Ming and Wei Xiong
2011-Emerson_Detroit_MI	Kunjan Vyas
2011-Asia-Pacific	Hyo-Jin Jeon
2011-Warren_MI	Kevin Furgal and Jordan Polak
2011-CompLearningCtr_FL	Emma Alaba
2011-UD_Detroit_MI	Peter Guenther
2011-Pearl_City_HI	Lynn Fujioka and Dwayne Abuel

(Table 9) Site Host Organizers (Sites organized by Lawrence Tech are excluded)

9. Conclusion

Robofest is a 100% autonomous robotic competition for every student. Data presented in previous sections show that the Robofest 2011 season accomplished our intended objectives:

- To spark many 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 12th Robofest for the 2011 season.

If you find any errors or have comments on this report, please let us know (robofest@LTU.edu). We are looking forward to meeting you during the 13th annual Robofest 2011-2012 season.

Respectfully,
August 31, 2011



CJ Chung, Ph.D.

Associate Professor of Computer Science
Founder & Director of Robofest
chung@LTU.edu

Lawrence Technological University
Math and Computer Science Department
21000 West 10 Mile Rd.
Southfield, MI 48075
www.LTU.edu



Chris Cartwright, Ph.D.

Associate Professor of Mathematics
Robofest Program Manager
ccartwig@LTU.edu