Robofest 2015~2016 Annual Report

Contents

(Figure 1) Robofest 2016 major sponsors and World Robofest 2016 participants

1. Analysis of Robofest Team Participation Data

Robofest® is Lawrence Technological University's world-wide autonomous robotics program for students in 4th grade – 12th grade and college. Student teams design, construct, and program their robots to compete for trophies in a variety of competitions.

Robofest's mission is to generate excitement among young people for Science, Technology, Engineering, and Mathematics (STEM), develop creativity and problem solving skills, and prepare them to excel in higher education and technological careers.

In the 2015~2016 academic year, a total of 2,575 Robofest students in 834 teams participated from 8 countries (Canada, China, Colombia, Egypt, Ghana, Hong Kong, India, and South Korea) in addition to 13 States from the U. S. (California, Florida, Hawaii, Illinois, Massachusetts, Michigan, Minnesota, Missouri, New Jersey, North Carolina, Ohio, Texas, and Washington). Table 1 shows the total number of officially registered coaches, teams, and students for the 2015~16 year. Note that Warmup, Michigan Championship, Video Screening, and World Championship are not added to this table to avoid double counting of the same students who participated in qualifiers. 538 site volunteers registered as judges, score keepers, setup/cleanup crew, etc. As National organizer, we organized World Robot Olympiad in the USA in 2015. The numbers do not include WRO.

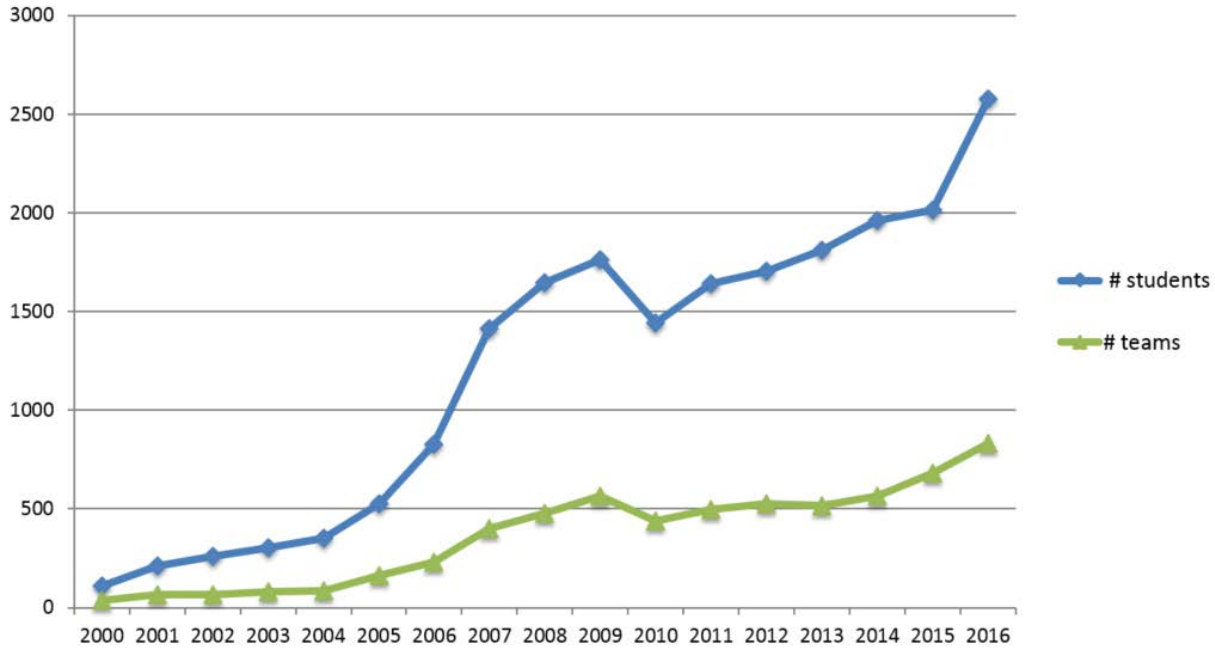
Official Site	# Coaches	# Teams	# Students
Alexandria_EGYPT	11	12	51
AnnArbor_UofM_MI	8	9	36
Bangalore_NovatechRobo_India	8	43	123
Belleville_WCCCD_MI	12	11	40
Brazoria_Tx	3	5	12
Canton_Achieve_MI	15	20	68
CANTON_CCA_MI	12	17	59
Canton_Gallimore_Elt_MI	13	13	48
Chicago_HolyTrinity_IL	8	23	58
Cloquet_MN	3	14	28
Coimbatore_Irobochakra_India	10	40	93
Detroit_Emerson_MI	1	4	11
Detroit_UDJH_MI	17	42	193
Houston_UrbanSTEM_TX	5	8	19
Hyderabad_Nvision_College_India	5	10	20
Hyderabad_Nvision_India	11	62	190
International_Video_Qualifier	5	6	26
Medina_AIRootMS_OH	8	22	86
Monroe_SVEC_WA	3	7	15
Newmarket_York_CAN	3	4	8
Ocala_Cornerstone_FL	6	12	47
Oldsmar_Nielsen_FL	7	14	45
ParkHills_StFC4H_MO	6	8	17
Patna_ZHI_India	1	15	40
PearlCity_HIFusionED_HI	18	56	210
Pensacola_PFHS_FL	5	8	28
RIHK_HONGKONG_Parade	1	20	58
SanCarlos_STEAMKids_CA	6	17	35
SterlinghHts_Parkway_MI	5	16	38
StPeteBeach_RcCtr_FL_Parade	5	9	30
Troy_Bethany_MI	14	17	55
USA_Video_Qualifier	18	19	57
Warren_Macomb_MI_GRAF	4	4	7
Warren_Macomb_MI_Parade	13	29	93
Waterford_Oak4HLegoLegion_MI	9	16	57
Westford_CreationStation_MA	2	3	6
Westland_FordCareerTechCtr_MI	12	12	49
Winners_China (*)	13	25	82
Winners_Ghana (*)	2	3	8
Winners_HongKong (*)	11	18	53
Winners_Korea (*)	9	23	67
Wolfville_Acadia_Canada	17	21	96
World_Bottle_Sumo	38	61	137
World_Championship_Vcc	12	20	37
World_UMC	12	16	39
Total	**407**	**834**	**2,575**

(*) Includes only teams that advanced to World Championship; More teams were involved locally.

(Table 1) Number of Registered Participants at Robofest 2015-16 Official Competition Sites

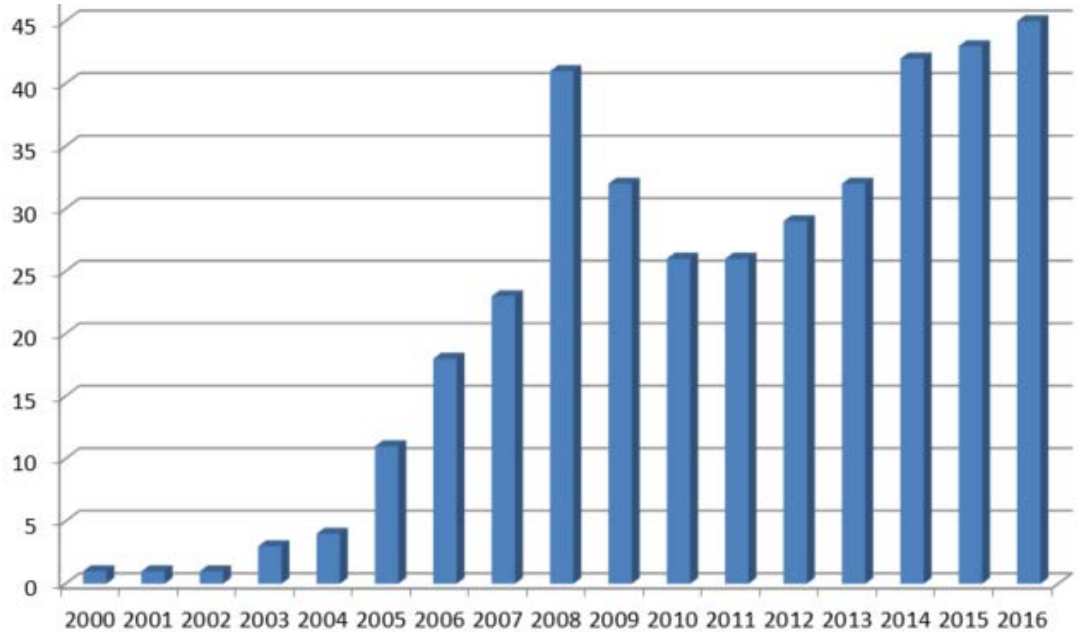
Table 1 above shows only data on Robofest web database system. South Africa, Lebanon, and Hungary participated in Robofest, but we do not have any data about their teams. They did not send teams to World Championship this year.

The average Robofest team size in 2016 was 3.0 which is same as that of last year. This small team size is good for effective learning, because each student has more opportunities to contribute to the team's objectives. Figure 2 shows the number of student participants since 2000. There was a surge in numbers this year due to the growth in the international sites especially in India. This year, the cumulative number of registered students and teams in our web database since 2000 has reached 20,569. Note that some of these students are duplicated from year to year.



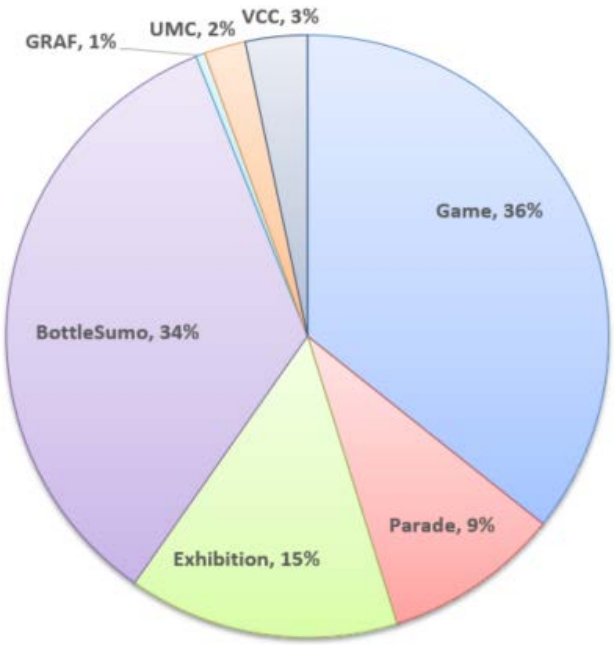
(Figure 2) Number of Robofest Student Participants and Teams Since 2000

The total number of Robofest competition site locations listed in Table 1 excluding WRO and championship events was 45 in the 2015-16 year. On average, 44 students and 15 teams participated per local competition site. Figure 3 shows the history of number of competition sites since the inception of Robofest.



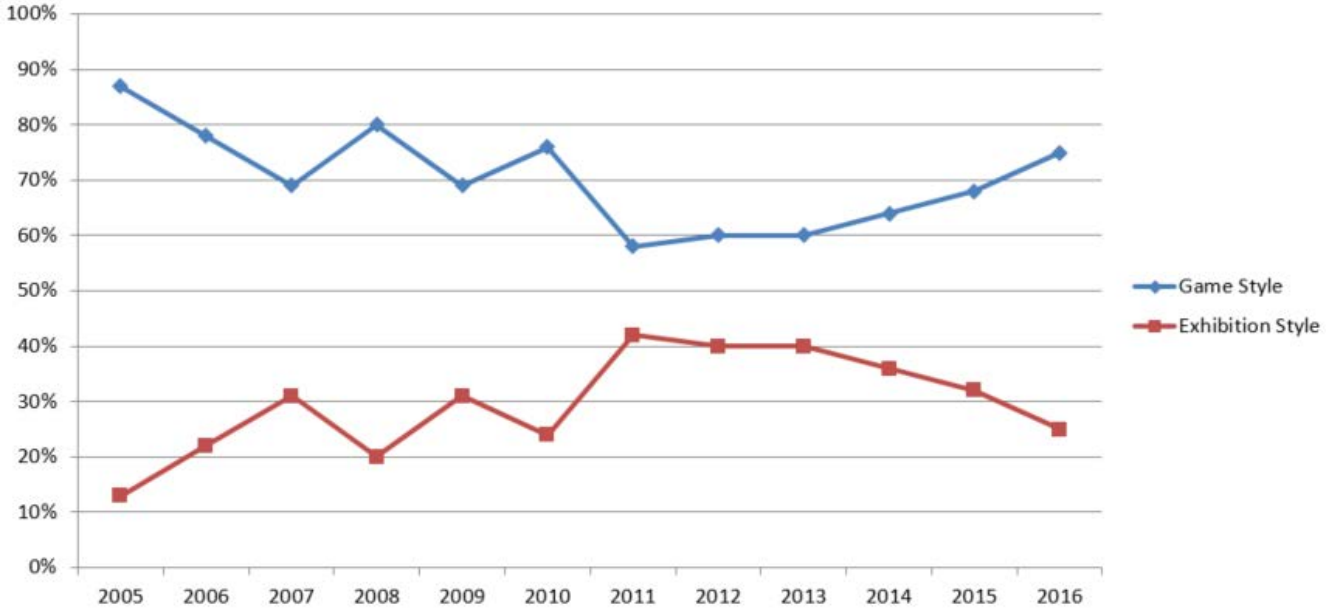
(Figure 3) Number of official competition site locations

Robofest offers a variety of categories in which to compete. 36% of teams participated in the RoboGolf Game. The second most popular category was BottleSumo with 34%, then Exhibition with 15% of teams. Figure 4 below shows percentages of teams by competition category. This does not include Camp (workshop plus mini competition) data.



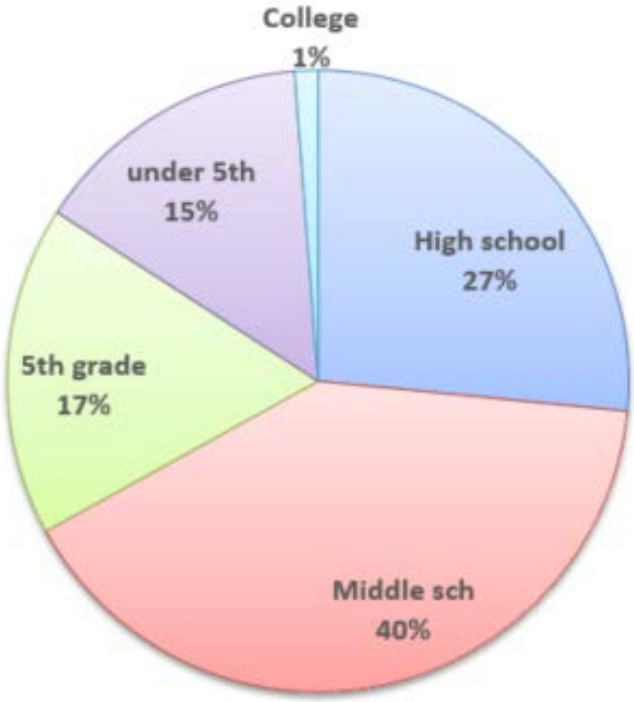
(Figure 4) Percentages of Teams per Competition Category in 2016

Robofest competitions can be generalized into two categories: Games that use fixed rules including BottleSumo, VCC (Vision Centric Challenge), and UMC (Unknown Mission Challenge) and open-ended style which has no fixed rules including Exhibition, RoboParade and GRAF (Global Robotics Art Festival). Figure 5 shows the trend of number of teams between Games and Exhibition since 2005. We can see that the participation in the open-ended exhibition categories has been decreasing since 2013.

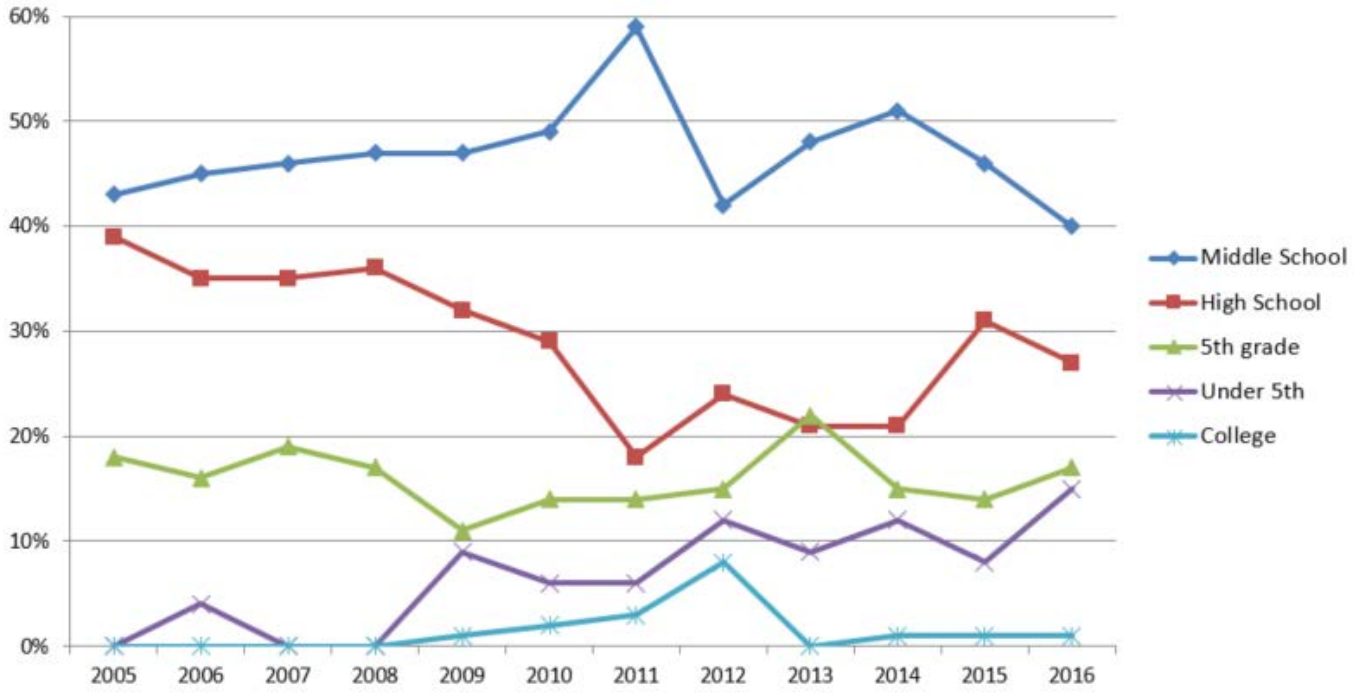


(Figure 5) Percentages of Game and Exhibition teams

Figure 6 shows student participation by school grades. 40% of the students were from middle school, 6th through 8th grade. Figure 7 shows the trend of each age group since 2005. From 2015 to 2016, the percentage of 5th grade or younger increased from 22% to 32%.

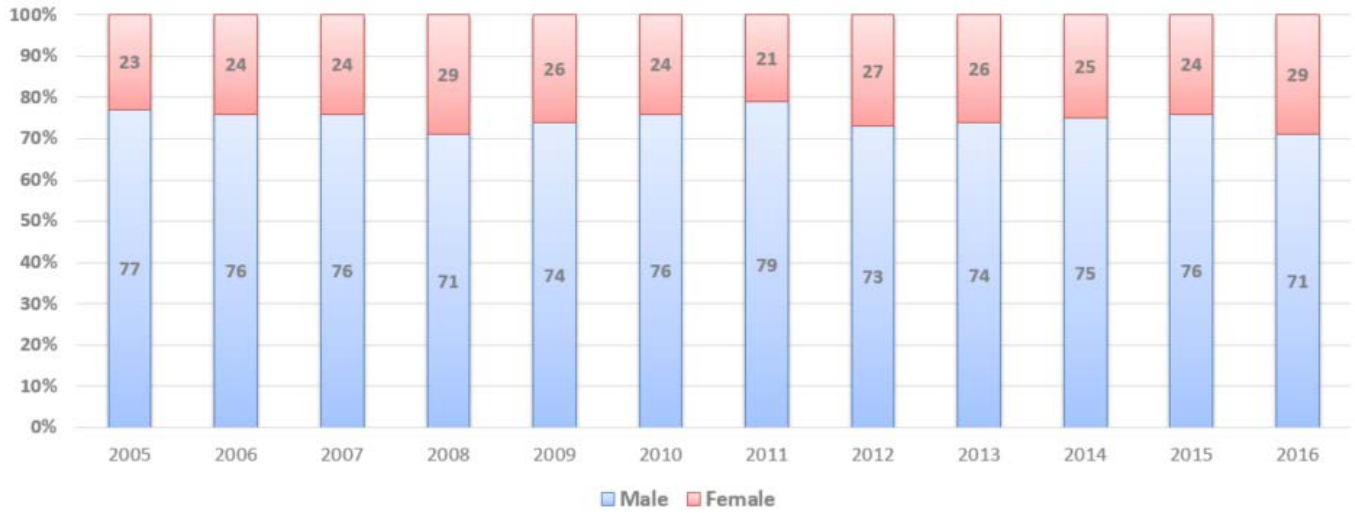


(Figure 6) Percentage of Student Participant per School Grade in 2016



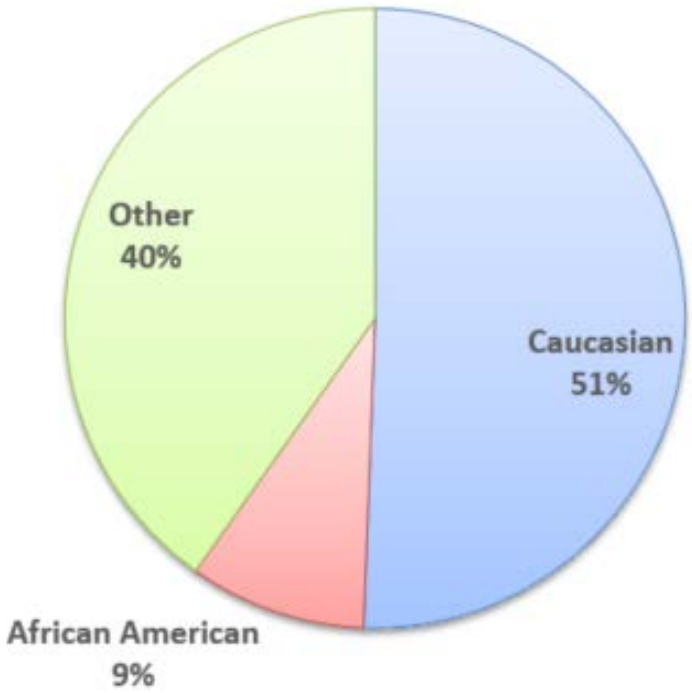
(Figure 7) Percent of age group since 2005

Regarding gender, we experienced an increase of female student population in 2016; 71% were male and 29% were female students. Figure 8 shows the gender ratios of Robofest students. The average since 2005 had been 75% male and 25% female. Note that the data is taken directly from our registration database which means it does not include the students participating in Korea, Ghana, China, or Hong Kong as they were using their own registration system and did not provide us with their data.



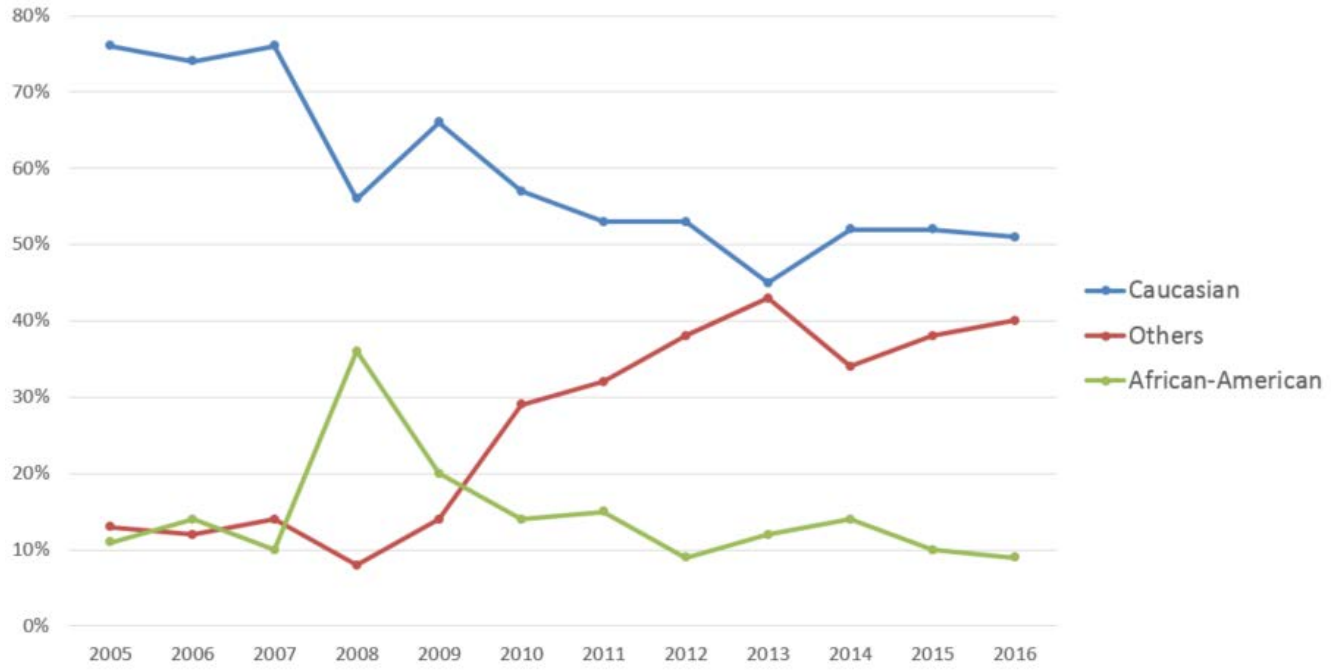
(Figure 8) Gender Ratios of Robofest Students

9% of Robofest 2016 students were African American, decreased from 10% in 2015. Figure 10 shows the changes since year 2005. We need to work harder to encourage students from under-served communities to participate in STEM education through robotics. Note that the ethnicity data is only from the USA.

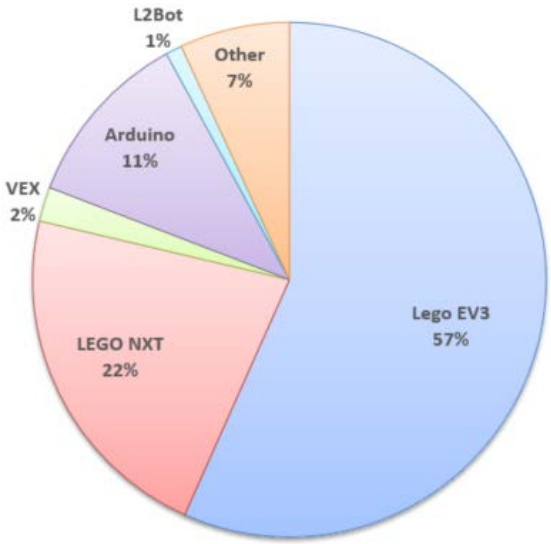


(Figure 9) Percentage of Student Participant by Ethnicity Data (Other includes Hispanic and Asian)

Robofest is completely open and allows the use of *any* robotics platform, which is one of its unique features. Figure 11 shows the data on robotics kits used by the teams. The majority of the teams (79%) were using LEGO products. The use of Arduino increased notably from 3% to 11% in 2016.

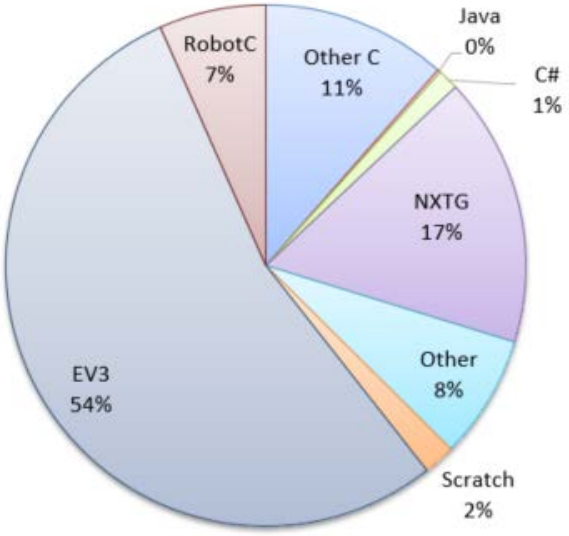


(Figure 10) Robofest Ethnicity Data since 2005 (The surge of African American in 2008 was due to a targeted grant)



(Figure 11) Percentage of Robotics Kits Used by teams in 2016

Robofest remains focused on the student participants learning STEM through computer programming and testing. The programming languages used in Robofest 2016 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 the unique features of Robofest. “Other C” in the figure includes Easy C, NXC, and Arduino C (Sketch). RobotC became popular when Carnegie Mellon Robotics Academy provided free licenses for Robofest teams beginning in 2009. All C-style languages together totaled 18%. Robofest provides opportunities to learn professional programming languages and helps to prepare our students for future professional career paths. Robofest students continue to show advanced technical skills and improvements in their STEM abilities. This is possible because of the many dedicated coaches and technical mentors associated with Robofest.



(Figure 12) Percentage of Programming languages used in 2016

2. Robofest 2016 Coach & Volunteer Survey Results

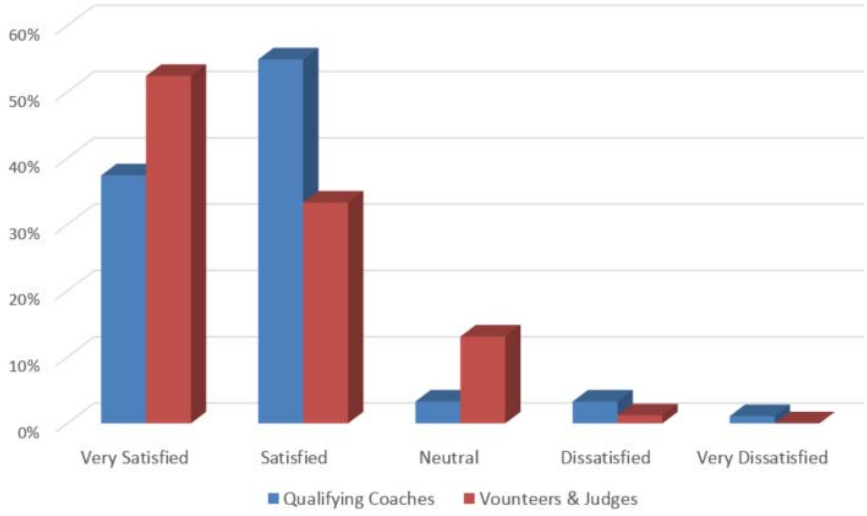
This section shows the results of the following anonymous web surveys.

- Coach survey (83 out of 407 coaches emailed, participation rate: 20%)
- Site Volunteer (Judge) survey (88 out of 538 emailed, participation rate: 16%)

The following Table 2 shows the satisfaction rate from each survey and Figure 13 displays the data in a 3D bar graph.

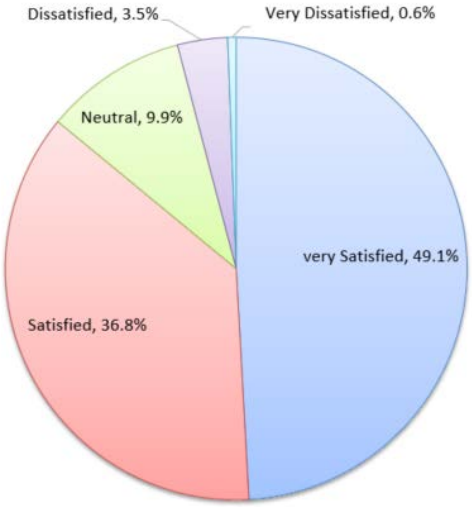
	Coaches	Site Volunteers (Judges)	Weighted Average
Very Satisfied	44.6%	53.4%	49.1%
Satisfied	41%	33.0%	36.8%
Neutral	9.6%	10.2%	9.9%
Dissatisfied	3.6%	3.4%	3.5%
Very Dissatisfied	1.2%	0%	0.6%

(Table 2) Satisfaction rate from each of 2 surveys

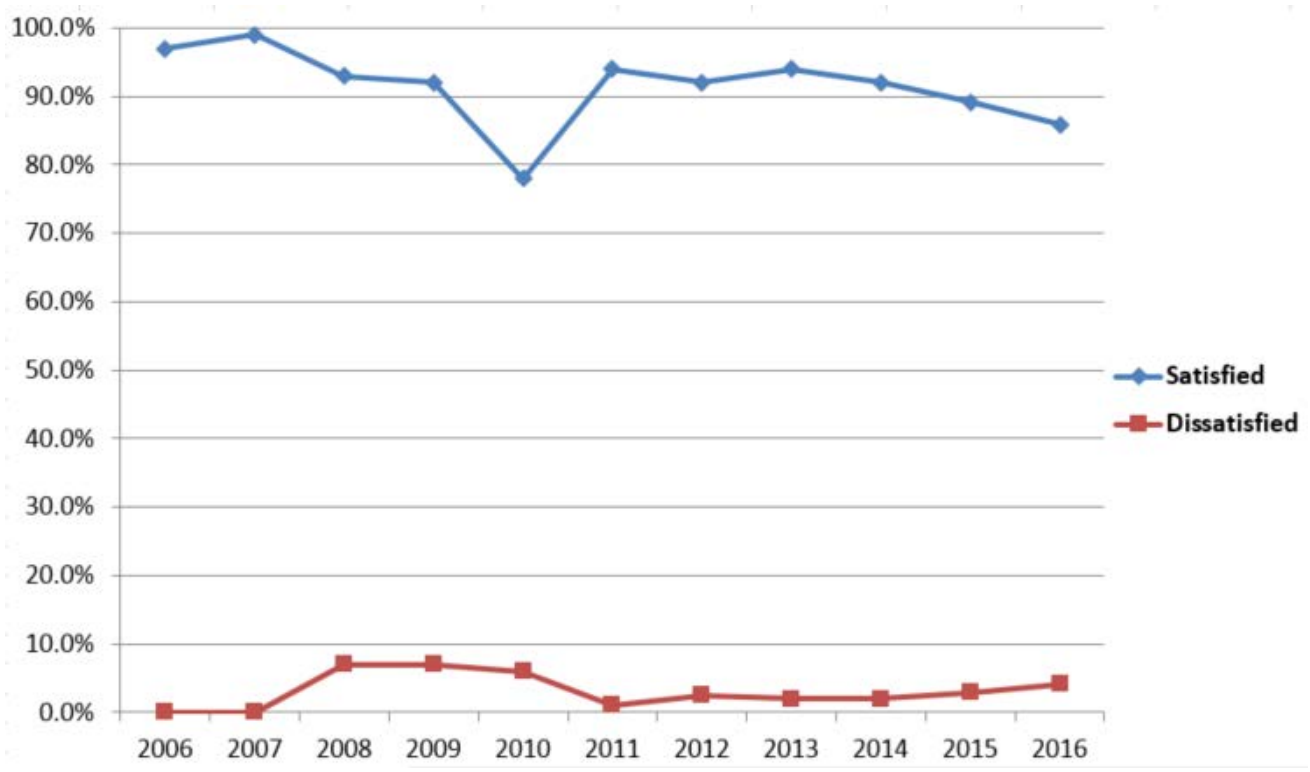


(Figure 13) Satisfaction rate from each of 2 surveys

Figure 14 shows average satisfaction rate from the 2 surveys. Considering the satisfaction rate (89.2% were satisfied or very satisfied), Robofest 2016 was yet another sucessful year, but as seen in Figure 15, the satisfaction rate has been declining. We believe this is due to the increasing number of international sites over which our office has little control. Figure 15 does not show neutral case.



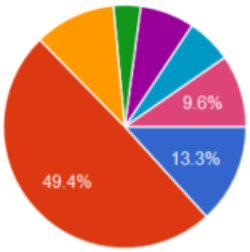
(Figure 14) Coach/Volunteer Satisfaction rates



(Figure 15) Overall coach/volunteer satisfaction level changes since 2006 (2006~2009, 2014 data contains only coach data)

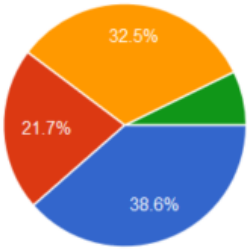
The following figure 16a with 9 questions show the results of coach surveys.

Q1. Your team participated in Robofest 2016 through:



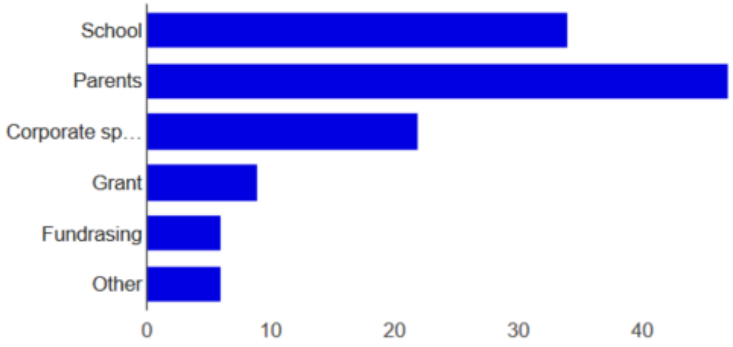
Regular school program	**11**	13.3%
After school program	**41**	49.4%
Community/civic organization	**9**	10.8%
Religious organization	**3**	3.6%
Neighborhood group	**6**	7.2%
Home school	**5**	6%
Other	**8**	9.6%

Q2. How many total number of hours has your team met to work in this 2016 season, so far?



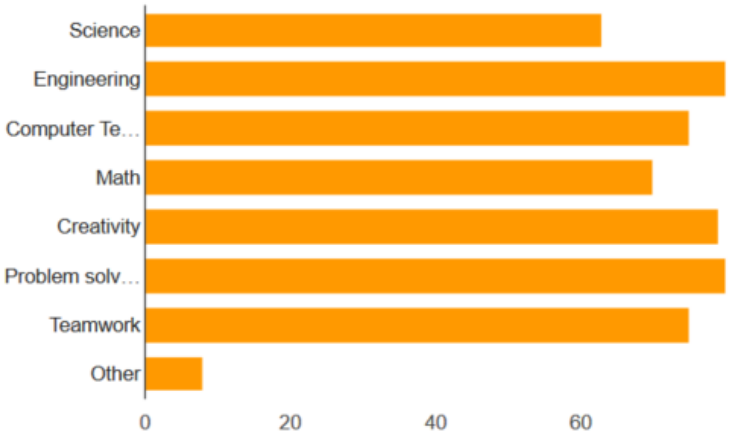
Over 60 hours	**32**	38.6%
Between 40 and 59	**18**	21.7%
Between 20 and 39	**27**	32.5%
Less than 20 hours	**6**	7.2%

Q3. From whom did your team receive funding?



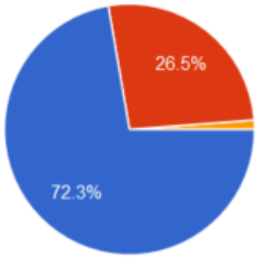
School	**34**	41%
Parents	**47**	56.6%
Corporate sponsors	**22**	26.5%
Grant	**9**	10.8%
Fundrasing	**6**	7.2%
Other	**6**	7.2%

Q4. What areas do you think are enhanced (or can be enhanced) through Robofest programs?



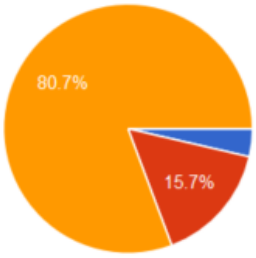
Science	**63**	75.9%
Engineering	**80**	96.4%
Computer Technologies	**75**	90.4%
Math	**70**	84.3%
Creativity	**79**	95.2%
Problem solving skills	**80**	96.4%
Teamwork	**75**	90.4%
Other	**8**	9.6%

Q5. Do you think your team members learned and improved math and science knowledge through Robofest 2016?



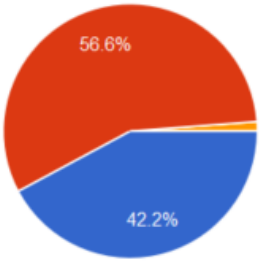
Yes	**60**	72.3%
Somewhat	**22**	26.5%
No	**1**	1.2%

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



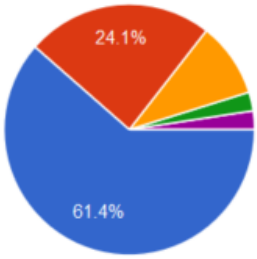
Students who demonstrate exceptional talent	**3**	3.6%
Only for students who are interested in science & engineering	**13**	15.7%
Every student	**67**	80.7%

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:



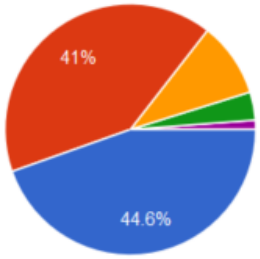
Inexpensive	**35**	42.2%
Moderate	**47**	56.6%
Expensive	**1**	1.2%

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



Extremely likely	**51**	61.4%
Very likely	**20**	24.1%
Somewhat likely	**8**	9.6%
Not likely due to high school graduation	**2**	2.4%
Not likely	**2**	2.4%

Q9. How would you rate your overall Robofest 2016 qualifying season experience?

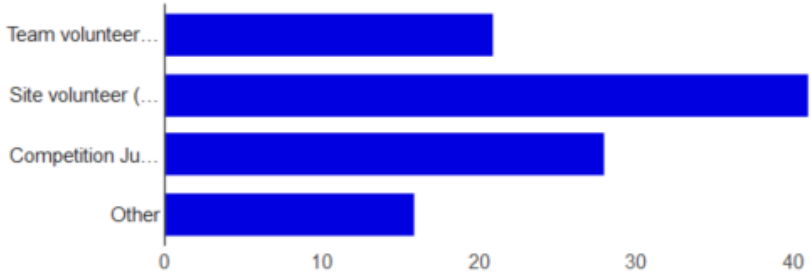


Very satisfied	**37**	44.6%
Satisfied	**34**	41%
Neutral	**8**	9.6%
Dissatisfied	**3**	3.6%
Very dissatisfied	**1**	1.2%

(Figure 16a) Coach survey results

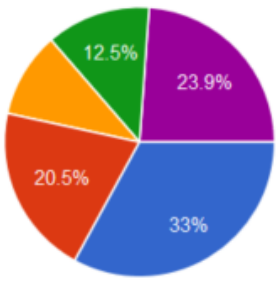
The following figure 16b with 4 questions shows the results of volunteer/Judge surveys.

Q1. What was your role as a volunteer?



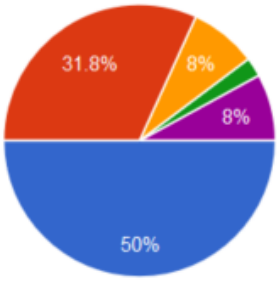
Team volunteer (coach, assistant coach, mentor, helper, etc)	**21**	23.9%
Site volunteer (setup, cleanup, check-in, etc)	**41**	46.6%
Competition Judge	**28**	31.8%
Other	**16**	18.2%

Q2. How many total number of hours did you volunteer for Robofest competitions this season?



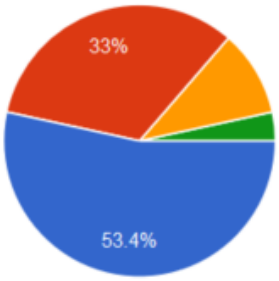
1-5	**29**	33%
6-10	**18**	20.5%
11-15	**9**	10.2%
16-20	**11**	12.5%
Over 21	**21**	23.9%

Q3. How likely are you to participate in Robofest next year?



Extremely likely	**44**	50%
Very likely	**28**	31.8%
Somewhat likely	**7**	8%
Not likely	**2**	2.3%
Not sure yet	**7**	8%

Q4. How would you rate your overall Robofest experience this season?



Very satisfied	**47**	53.4%
Satisfied	**29**	33%
Neutral	**9**	10.2%
Dissatisfied	**3**	3.4%
Very dissatisfied	**0**	0%

(Figure 16b) Volunteer & Judge survey results

The surveys for coaches included the following three essay questions.

(Q1) The one aspect of Robofest that I like the best is:
(Q2) If there were one aspect of Robofest that I would change, it would be:
(Q3) Please write any suggestions/comments to improve the quality of Robofest for STEM education.

We appreciate all the comments that can be found in PDF format on the web at:
http://www.robofest.net/2016/Survey.pdf

The comments about (Q2) above are summarized on this document at:
http://www.robofest.net/2016/CoachSurveySummary.pdf

The surveys for Volunteers & Judges had an essay question: “Please write any suggestions / comments to improve the quality of Robofest for STEM education”. Their comments can be found on the web at: http://www.robofest.net/2016/VolunteerSurvey.pdf

Please note that the survey was completely anonymous and comments are from 13 US states and 8 other countries.

3. Plans for 2017

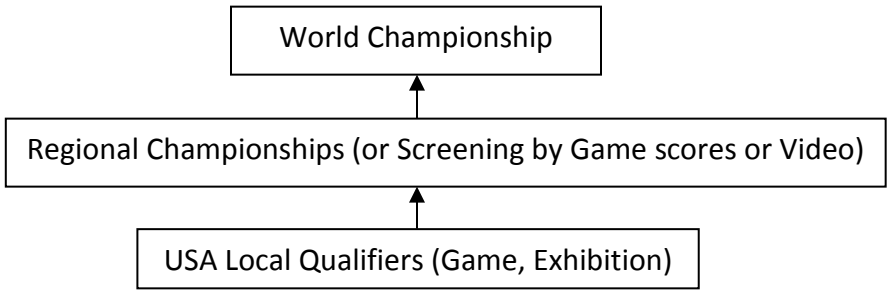
We have identified various facets of Robofest needing refinement, enhancement and improvement in the coming years based on outcomes, anonymous on-line surveys, private conversations, self-evaluation, and inputs from coaches, parents, students, volunteers, and site hosts. We know that

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 Only for Game and Exhibition

The 3-level competition structure was introduced in 2010. In order to compete at the World Championship, a Game or Exhibition team in the USA had to pass both a local qualifier and a regional competition as depicted in the following Figure 17. However, to promote more international teams, we offered 2 level structure for International qualifiers again this year.



(Figure 17) Robofest Competition Structure for Game and Exhibition Categories in the USA

The 3-level structure worked well. Non-Michigan Game teams were screened by using scores from qualifying competitions. According to World Championship Game category results, it seems that Michigan teams performed better, since they had another chance to compete through the Michigan Championship. It is our hope that we can introduce more State or Regional competitions in the near future.

World Championship

For the 2016-17 academic year, the World Championship will be held in St. Pete Beach in Florida. BottleSumo, and UMC competitions will be held on June 2, 2017. Game, Exhibition, and VCC will be held on June 3. We also plan Robot Drawing Contest, RoboParade, GRAF (Global Robotics Art Festival), and WISER (World conference on Integrated STEaM Education through Robotics) to provide an opportunity for coaches and students to learn more by authoring and presenting papers. Robofest World Championship hosting opportunity will be granted to other countries or states every 4 years.

Site Host Administration

During the 2016 season, in most cases 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 usually 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 World Championship. The development of committees for each state to coordinate events is needed, especially when there are multiple site hosts from a region. The hope is to alleviate scheduling conflicts outside of Michigan and to provide geographic distribution as well. We will be using improved Site Host application and letter of agreement forms to make responsibilities of both parties clear.

Registration Fees and Check-In Fees

According to the anonymous coach survey (see Figure 16a Q7), only 1.2% said the registration fee ($50) or check-in fee (up to $20) was expensive. We are proud of our cost-effectiveness and efficient

management to minimize the cost for teams to participate in inexpensive Robofest robotics programs for everyone. We did not charge check-in fees for Michigan Regional or the World Championship in 2016.

Communications

- There is a way for coaches to get information on other teams including the email addresses of other team coaches at their qualifying site on Robofest coach login account. However, we found that few coaches were using this function. If you are a coach, please log on to your account to find email addresses of peer coaches.
- We encourage teams to use Facebook for communicating and networking with other teams. The Robofest Facebook page is at www.facebook.com/robofest . Please post rule related questions there. We will also consider the use of Facebook group again to serve as a Blog site.
- We will actively use more Webinars. Recorded Webinars will be available later on the web.
- 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 newpapers and magazines too.

Robofest Website

We are proud of keeping almost all data/information/pictures from the 17 years of our history. However, it is true that it is not easy for (new) teams to find all the needed information on the web. We are fully aware that the current website is not well structured to navigate. Web pages are not consistent with design styles and color themes. There are some broken links. We are working on improving/renovating the website.

Online Registration Systems

- We are working on improving team registration processes.
- Currently we are facing a problem to find a qualified staff member 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.
- Less than half of teams uploaded team pictures this year (2006 – 68%, 2007 – 53%, 2008 – 55%, 2009 – 50%, 2010 – 50%, 2011 – 41%, 2012 – 34%, 2013 – 44%, 2014 – 36%, 2015 – 23%, and 2016 – 19%).

Free Technical Support and Workshops (See also section 7)

Some of the workshops were available on the web through real-time or recorded webinars. Most of the workshop files were posted on the web "Tech Resources" page 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 utilize our webinars or organize their own workshops using our materials.

3.2 Competition Rules

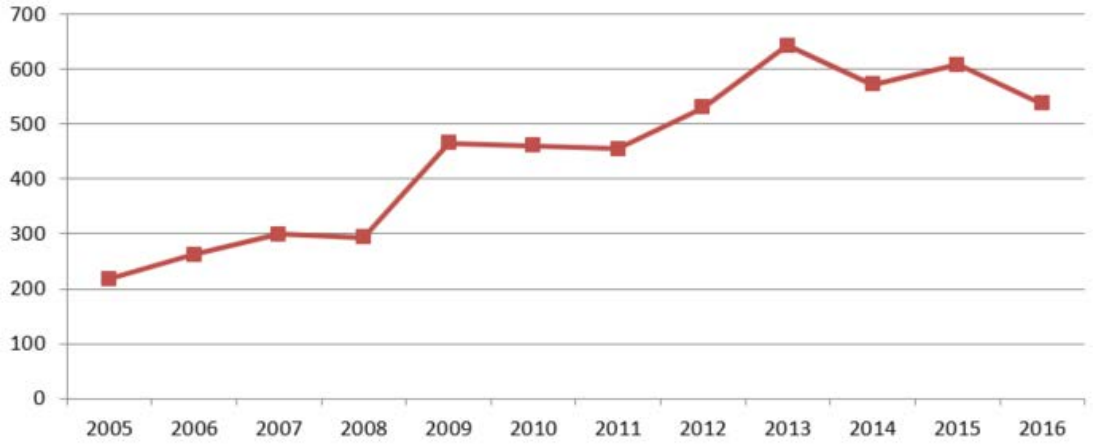
Draft rules for 2016-17 season will be available online in November. We will continue to max. team size at 5 students. We will again introduce "surprise" unknown tasks for World Championship game competitions. We will make it clear that the official language of the Exhibition competition is English. We will slightly revise Exhibition scoring system and rubrics. Categories for beginners like BottleSumo and RoboParade are recommended for sites to host throughout the year across the nation.

Regarding the Game category, it is highly recommended to ask everyone to leave the competition area during the 30 min work-time. We will provide a proctor report form. It is a must to protect the impounding table, since there were incidents of touching/damaging other team's robots.

3.3 Competition Event Organization

Volunteer Organization

Some qualifying sites still did not fully use our online volunteer system. Volunteer recruitment must be started earlier. We had 538 people registered on the web database and we deeply thank all the site volunteers. See figure 18 for the number of registered site volunteers since 2005. We need more careful planning since some sites had more volunteers than needed. We also need partnerships with volunteer groups.



(Figure 18) Number of yearly registered site volunteers since 2005

Hours of competitions

The duration of the larger qualifying sites / championships 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 and be well prepared.

Playing Fields/Tables

The use of 6ft plastic folding tables for Games may not continue next year.

World Venue and Setup at LTU

- No adult was allowed in the gym during the 30 minute period for the game.
- Violation Forms were introduced and announced teams that had violoations reported by proctors.
- We will keep finding ways to attract more people to visit Exhibition tables. Raffle prizes for People's Choice Award seemed effective.

Judging

Judge training must be conducted professionally, since some judges were not familiar with the Robofest 2016 rules. The Chief Judge's role is critical and they need to be trained properly early on. We need to find more qualified Exhibition Judges. Publishing Judges Bio at World Championship worked well. We need to find a way to shorten the time in recording and calculating winners. Judging errors happened in Michigan Championship and World UMC because of human errors by scorekeepers. Impounding tables must not be accessed by students as mentioned in the previous section. We must find a way not to allow the use of 2nd backup robot for Games.

Miscellaneous

- To encourage teams to participate in earlier dates, we will continue to advance more teams to the Regional at earlier qualifiers.

- Teams were NOT allowed to compete at more than one site this year, even though some coaches demanded.
- LTU's $2,000 scholarship is now for students of winning teams in both Michigan and World Championships.
- We are *considering* the following new technical components in Robofest:
    - the use of 3D printing for teams to design and produce parts for their robots
    - The use and promotion of Arduino and Raspberry PI.
- A new program called "Canival" will be introduced.

4. Revenue/Expense Summary

Robofest financial results for the 2015-16 academic year (August 19, 2015 ~ August 6, 2016) were as follows: **$137,148.73** in cash revenue including the transferred balance from 2014-2015 year, **$98,000.09** in expense of Robofest account, and **$70,784.27** LTU cash support, which resulted in an overall loss of **$31,635.63**. Tables 3 ~ 5 show the summary of cash revenue and expenditure. $39,148.64 will be transferred to Robofest account for 2016-17 year from Robofest 2015-16 account. Please note that WRO 2015 revenue and expenses are included.

Transfer from 2014-15	$25,131.51
Individual donors (Robofest & WRO)	$1,534.98
Corporate/Org. *Cash* Sponsorship - Robofest(*)	$32,800.00
Corporate/Org. *Cash* Sponsorship - WRO	$24,520.00
Team registration fees & other income – Robofest & WRO	$53,162.24
Total cash income without transfer	$112,017.22
Total revenue including transfer from last year	**$137,148.73**

(*) In-kind donations not included

(Table 3) 2015-2016 Cash Revenue

Workshop lead instructors' wage	$1,197.50
Part-time staff wage (*)	$10,462.00
Student assistants' wage (*)	$0.00
Trophies and plaques	$6,522.75
Medals	$4,163.40
Supplies (playing fields, office supplies, signs, flags, banners, give away items, gift cards, food, etc)	$17,709.75
3D printer	$1,199.00
Table & chair rental for MI regional and Worlds	$4,069.50
Robot magazine advertisement	$600.00
T-shirts (Robofest & WRO)	$4,327.16
WRO 2015 Team Travel Support and Robofest Travel	$21,899.65
WRO banners and VCC vinyl mats; table cloth	$940.00
Robofest poster frames since 2000	$2,685.06
Robot kits (EV3, L2Bot parts, Arduino kits, etc)	$18,506.80
RoboParade, MI Regional and World Robofest food	$3,717.52
Total	**$98,000.09**

(*) Additional staff wages were supported by Math and Computer Science budget

(Table 4) 2015-2016 Robofest Account Expense Summary

Staff wage support (Full-time, part-time, and student assistants)	$64,066.67
UPS mailing for Robofest and WRO	$5,791.60
Printing poster	$326.00
Other support (magazine & online ad etc.)	$600.00
Total LTU Cash Support	**$70,784.27**

(Table 5) LTU Direct Support Expense Summary in 2015-2016

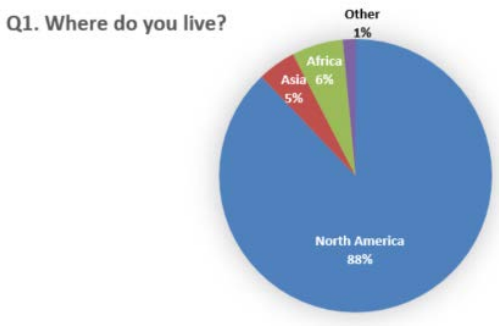
Note that Table 5 above does not include Lawrence Tech's indirect monetary support (overhead expenses) that includes: marketing, fundraising, and special events support by Univ Advancement; help desk laptop support; audio & visual equipment; teaching release time for Dr. Chung (Robofest Director) and Dr. Christopher Cartwright; MCS Department administrative support; general office supplies (papers); printing; copying, phone and fax; office space; utilities; mailing and USPS postage by Math & Computer Science department; campus facilities; video taping and editing – eLearning Services; use of office computers, laptops, computer network services on campus, Internet, etc. We greatly appreciate LTU's support. Table 6 shows cost per student data history since 2008.

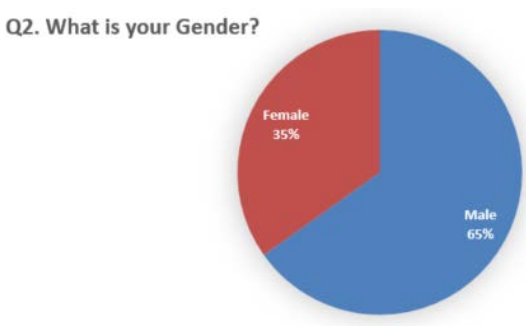
	2008	2009	2010	2011	2012	2013	2014	2015	2016
Direct expense	$84,509.58	$76,940.45	$95,573.22	$108,256.64	$85,520.10	$108,095.32	$158,356.19	$155,302.73	$168,784.36
# of Stu. Served	1,647	1,763	1,443	1,641	1,706	1,809	1,962	2,017	2,575
Cost / Student	$51.31	$43.64	$66.23	$65.97	$50.13	$59.75	$80.71	$77.00	$65.55

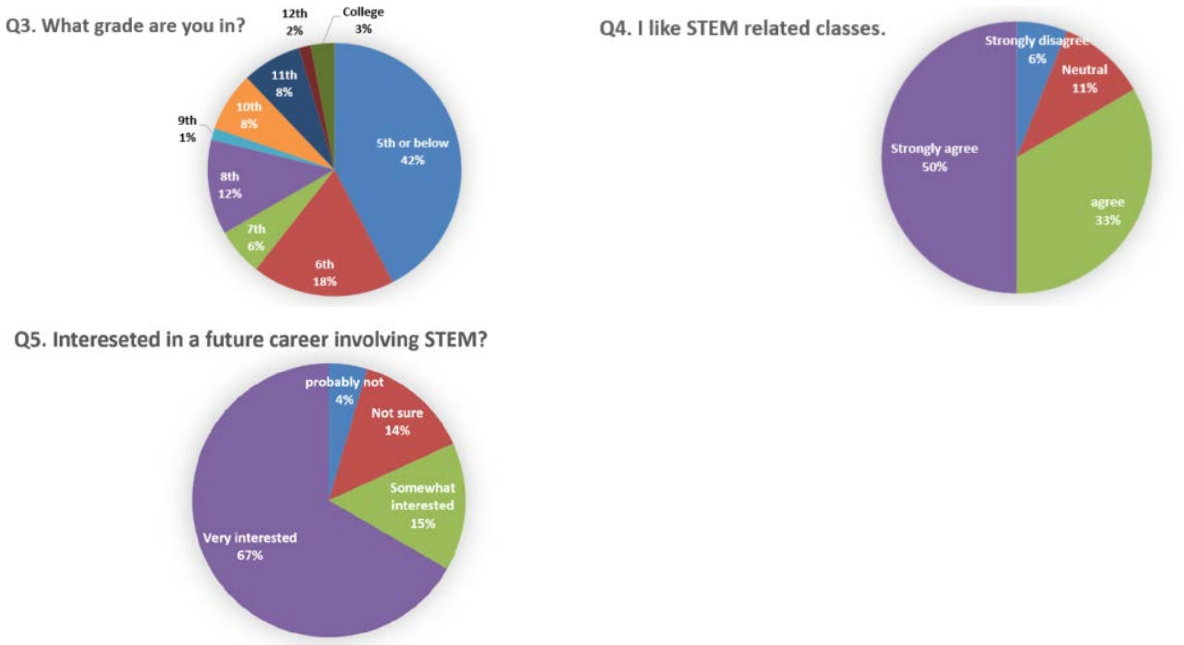
(Table 6) Cost per student data since 2008

5. Assessment

In order to assess the impact of autonomous robotics competitions in STEM education, Robofest students were asked to take online surveys before and after the competition. 65 students participated in the pre-assessment survey when teams were registered before starting Robofest work. 81.8% students were very or somewhat interested in career in STEM fields. Figure 19 summarizes the results of the student pre-assessment survey.



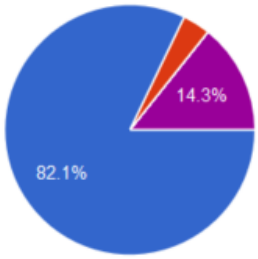




(Figure 19) Summary of pre-assessment student survey

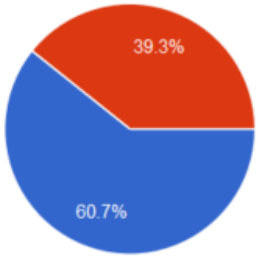
After World Championship was completed, a post-assessment survey was conducted. 84 students participated in the survey and the summary is shown in Figure 20 below.

Q1. Where do you live?



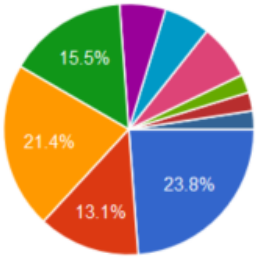
North America	**69**	82.1%
Asia	**3**	3.6%
Africa	**0**	0%
Europe	**0**	0%
Hawaii	**12**	14.3%

Q2. What is your gender?



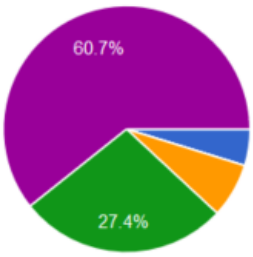
Male	**51**	60.7%
Female	**33**	39.3%

Q3. What grade are you in?



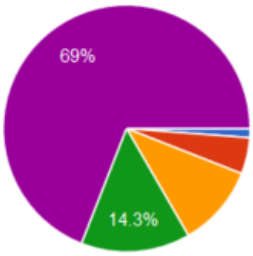
5th Grade or Below	**20**	23.8%
6th Grade	**11**	13.1%
7th Grade	**18**	21.4%
8th Grade	**13**	15.5%
9th Grade	**5**	6%
10th Grade	**5**	6%
11th Grade	**6**	7.1%
12th Grade	**2**	2.4%
College	**2**	2.4%
Other	**2**	2.4%

Q4. I like Science, Technology, Engineering, and Math related classes.



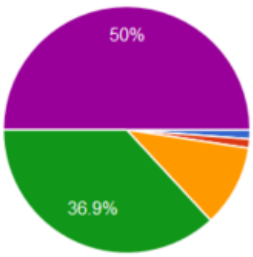
Strongly disagree	**4**	4.8%
Disagree	**0**	0%
Neutral	**6**	7.1%
Agree	**23**	27.4%
Strongly agree	**51**	60.7%

Q5. Are you interested in a career involving Science, Technology, Engineering, or Math?

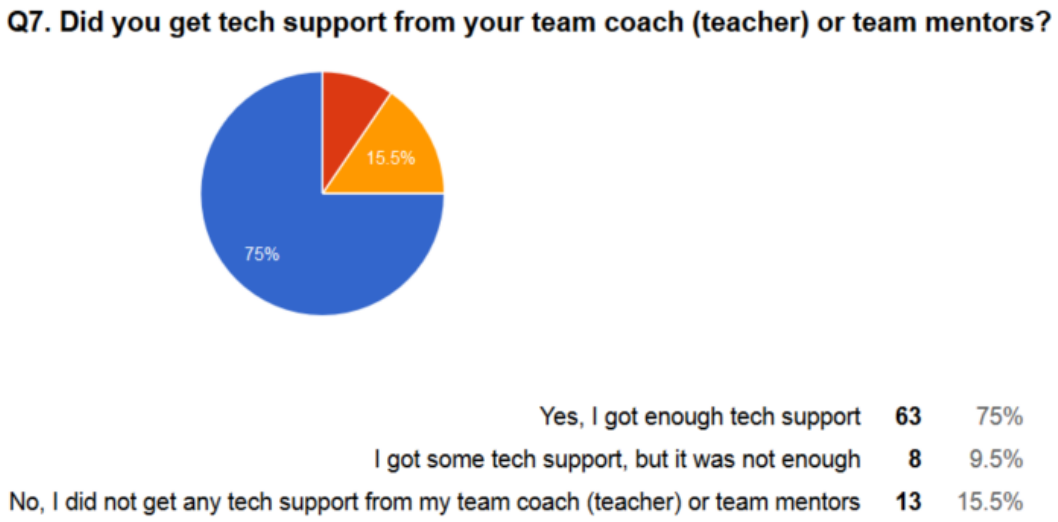


Not at all interested	**1**	1.2%
Probably not	**4**	4.8%
Not sure	**9**	10.7%
Somewhat interested	**12**	14.3%
Very interested	**58**	69%

Q6. Robofest robotics experience helped me learn more about Science, Technology, Engineeering, or Math.

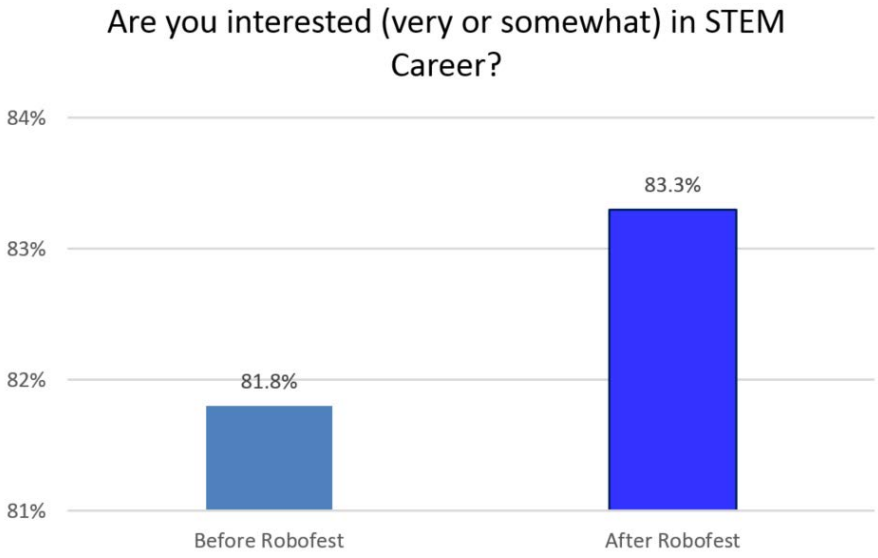


Strongly disagree	**1**	1.2%
Disagree	**1**	1.2%
Neutral	**9**	10.7%
Agree	**31**	36.9%
Strongly agree	**42**	50%



(Figure 20) Summary of post-assessment student survey

A majority (86.9%) of students indicated that the Robofest robotics experience helped them learn more about Science, Technology, Engineering, or Math. Students (from 81.8% to 83.3%) also expressed that they would now consider a career involving Science, Technology, Engineering, or Math after their Robofest exposure as shown in figure 21.



(Figure 21) STEM career interest (2016 Survey)

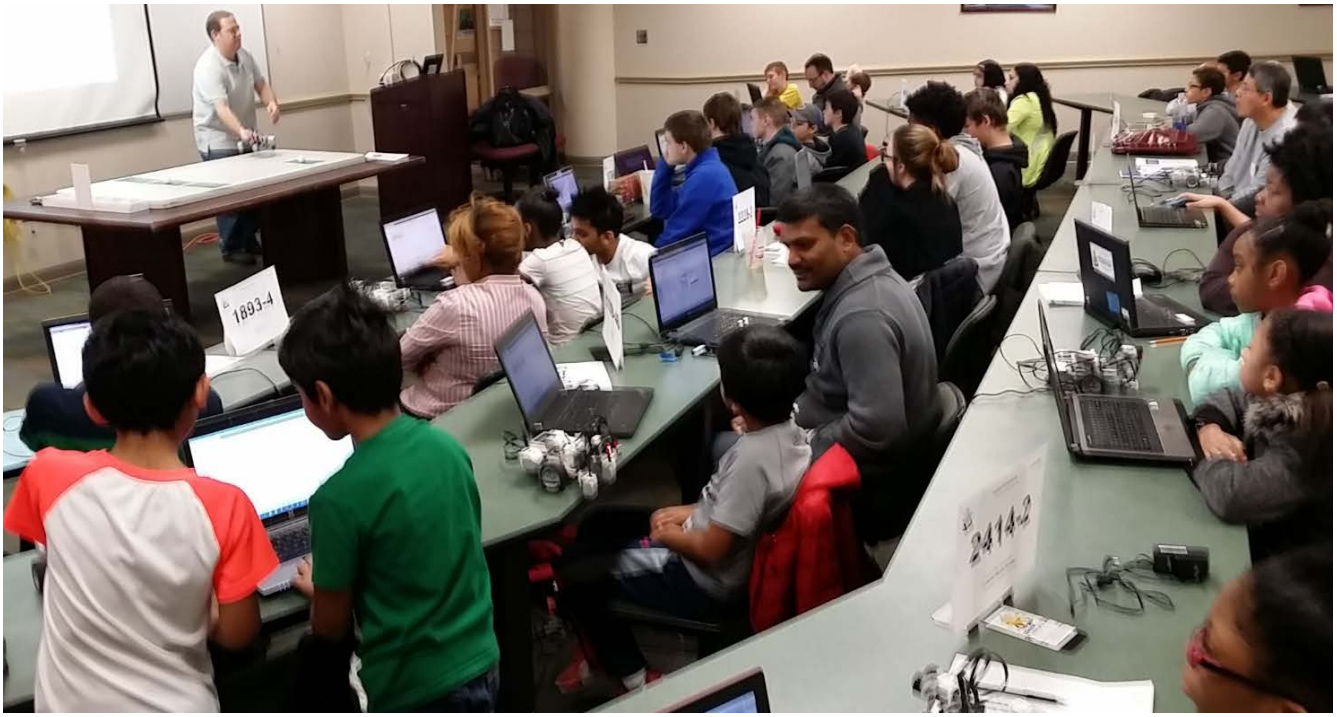
6. Workshops, Events, and Research

We held 13 technical hands-on workshops of which two were webinars. The following Table 7 shows six instructors and their classes during the 2015~2016 academic year. Total number of workshop attendees were 247. We thank all the Robofest official sponsors and the Lawrence Tech help desk for providing laptops for the workshops and camps. Most of the workshop materials were posted on the web for on-site and online participants.

date	Time	Workshop Topic	# attendees	Lead Instructor
10/3/2015	1:30pm~4:30pm	RoboParade Workshop	18	Chris Cartwright
1/16/2016	9am ~ Noon	EV3 workshop for RoboGolf Game (see figure 22-a)	30	Joe DeRose
1/23/2016	9am ~ Noon	EV3 workshop for RoboGolf Game	17	Chris Cartwright
1/23/2016	1pm ~ 4pm	EV3 workshop for RoboGolf Game	27	Fred Brauchler
1/26/2016	7pm ~ 9pm	EV3 ONLINE workshop for RoboGolf Game	20*	Keith Bozin
1/30/2016	9am ~ Noon	EV3 workshop for RoboGolf Game	25	Joe DeRose
1/30/2016	1pm ~ 4pm	RobotC workshop for RoboGolf Game	12	Joe DeRose
2/6/2016	2pm ~ 3:30pm	EV3 ONLINE workshop for RoboGolf Game	20*	Keith Bozin
2/6/2016	9am ~ Noon	EV3 workshop for RoboGolf Game	19	Chris Cartwright
2/13/2016	9am ~ noon	RobotC workshop for RoboGolf Game	16	Bryan Brauchler
2/27/2016	9am ~ 4:30pm	RobotC for EV3 workshop for teachers. Sponsored by Lego Education	15	Joe DeRose
3/26/2016	9am ~ 4pm	L2Bot workshop	15	Jon Ruszala
4/23/2016	9am ~ Noon	BottleSumo Workshop, EV3	13	Fred Brauchler

(*) Estimated number

(Table 7) 2015-2016 Workshops



(Figure 22-a) RoboGolf workshop, January 16, 2016

Especially, Robofest thanks the generous donation from DENSO, our platinum sponsor. We maintained over 20 L2Bots with the DENSO logo this year. The participants took the Denso sponsored L2Bot after the workshop to prepare for Vision Centric Robot Challenge 2016. Figure 22-b shows a picture of L2Bot workshop participants on March 26, 2016. Special L2Bots with Atmel controller boards were used for LTU's BS Robotics Engineering classes. Arduino with EVShield has

been also tested. We still plan to introduce Pixy cam for the system. Other robotics STEM outreach events in which we participated included “Bring Your Child to Work Day” at DENSO, April 28, 2016.

(Figure 22-b) L2Bot workshop participants, March 26, 2016

7. Recognition & Acknowledgement

Figure 1 on the first page of this report shows over 250 students who participated in the World Robofest Championship this year. Each student received a small trophy with a personalized plate sponsored by our Platinum sponsor DENSO, shown LEFT in figure 23. Again this year, as shown right in figure 23, each medal awarded to students in qualifying competitions was personalized with the student name. Especially, we thank IEEE Region 4 PACE and SEM (Southeastern Michigan Section) for their sponsorship for IEEE medals (see the medal on the right side of Figure 23) that were awarded to the registered participants of Robofest 2016 during the qualifying competitions. IEEE SEM EMC Chapter sponsored medals for MI Championship as shown in Figure 23, leftside.

All the winners of Robofest competitions can be found on the web at
www.robofest.net/rms/uploads/scoresheets/World_Championship2016/world16winners.pdf
www.robofest.net/rms/uploads/scoresheets/World_Championship2016/world16winners_UMC_Sumo.pdf

Score sheets of each competition category can be found on the web at
http://www.robofest.net/rms/SharedPagesServlet?cmd=getGenericSiteWebPage&year=2016&location=World_Championship (See under Files section)

Especially we would like to thank all the Champihonship Exhibition Judges. Their short bios can be found at:
http://www.robofest.net/2016/BioJudges_WC.pdf
http://www.robofest.net/2016/MI_champ_Judge_Bios.pdf

Robofest was again fortunate this year to have 12 corporate/foundation Bronze or higher sponsors and 6 Friends level sponsors. Without their support, Robofest 2016 would not have been possible. Figure 24 shows all the logos of the corporate/foundation sponsors which were displayed on a large screen during the Michigan and World Championships. The logos or names of the sponsors were also printed on qualifying programs as well as the Championship programs (see Figure 25). Bronze level or higher sponsor logos were printed on our official posters (see Figure 27). A list of all the sponsors can be found at www.robofest.net.

(Figure 23) World Championship Individual Trophy sponsored by DENSO and participation medals for qualifiers sponsored by IEEE SEM and Region 4 PACE.

www.aramark.com
CJ Chung

young+
Howard Davis

Dennis J. Howie
Joel Stein, ART/DESIGN Group

(Figure 24) Sponsor logos or names displayed and printed during the Championships at Lawrence Tech.

(Figure 25) Some of official Robofest programs with official sponsor logos

We were also pleased to recognize the following, 15, 10 and 5 year anniversary coaches during the Michigan Regional and World Robofest. If we missed any coach reaching anniversary years, please contact Dr. Chung at cchung@LTU.edu.

- 10 year Coach: Kevin Furgal, Macomb Christian School
- 5 year coaches:
  - Douglas Chubb, Plymouth Christian Academy
  - Jessica Wash, Plymouth Christian Academy
  - Joe DeRose, Hoben Robotics Club
  - Robert Jones, SMCSI Mechatronics - Tecumseh Campus
  - David Carbery, CyberTrax
  - Pepper Bates, Wadsworth Middle School

Math and Computer Science Department administrative assistant Marilyn Wiseman provided dedicated services for the processing of purchasing & reimbursement requests, H.R. related paper work, and among others. Other people we would like to recognize include: Tracy Kash, CAS Dean's Office and Joyce McKissen, Dept of Humanities, Social Sciences, and Communication.
LTU administrators who supported Robofest include: President Virinder Moudgil, Provost Maria Vaz, College of Arts and Sciences Dean Hsiao-Ping Moore, Associate Dean Glen Bauer, Math & Computer Science Department Chair Tom Goulding. Matt Roush served as Emcee for Michigan and World Championships. Howard Davis assisted getting and processing sponsorships. Mark Brucki assisted to get Visas for International teams.

Robofest cannot reach out without site hosts. We would like to applaud all the work done by our great site host organizers in table 8 below. Without their leadership, dedication and sacrifice, the Robofest 2015-16 season would not have been possible.

Site Name	Site Host Organizer Name(s)
Alexandria_EGYPT	Farid Husein; Ayman ElKabbany
AnnArbor_UofM_MI	Phil Callihan
Bangalore_NovatechRobo_India	Imtaiz Kham; Basava Bhavan Bangalore
Beirut_LEBANON_Vcc	Ghazi Mtaweh
Belleville_WCCCD_MI	Gwen Shannon; Michael P. Dotson

Brazoria_Tx	Margaret Baugh
Canton_Achieve_MI	Elizabeth Gaecke; Jennifer Conley
CANTON_CCA_MI	Bharat Ajmera; Kelie Fuller
Canton_Gallimore_Elt_MI	Cara Wegrzyn; Aimee Bell
Chicago_HolyTrinity_IL	Patrick Kelly; Tim Bopp
Cloquet_MN	Cameron Lindner
Coimbatore_Irobochakra_India	Imtaiz Khan; Chinmaya Vidya Niketan School
Detroit_Emerson_MI	Kunjan Vyas; Brenda Carethers
Detroit_UDJH_MI	Peter F. Guenther
Houston_UrbanSTEM_TX	Dr. Monique Micheaux
Hyderabad_Nvision_College_India	Imtaiz Khan; IIT Hyderabad
Hyderabad_Nvision_India	Imtaiz Khan; IIT Hyderabad
Medina_AIRootMS_OH	Shayna Samosky
Monroe_SVEC_WA	Nona Goodwin; Karen Rosencrans
Newmarket_York_CAN	Michael Roy-Diclemente
Ocala_Cornerstone_FL	Joe Moseley
Oldsmar_Nielsen_FL	Emma Alaba
ParkHills_StFC4H_MO	Ann Boes
Patna_ZHI_India	Imtaiz Khan; Dr. U.K. Singh
PearlCity_HIFusionED_HI	Lynn Fujioka; Sandy Ahu
Pensacola_PFHS_FL	Dana Lupton
RIDGE ACCRA, Ghana	Dr. Yaw Okraku-Yirenky; Dr. Ashitey Trebi-Ollennu
RIHK_HONGKONG	Yau Ka Chun
RIHK_HONGKONG_Parade	Yau Ka Chun
SanCarlos_STEAMKids_CA	Alvin Wang
SterlinghHts_Parkway_MI	Tim Grau
StPeteBeach_RcCtr_FL_Parade	Emma Alaba
Troy_Bethany_MI	Dr. Mark Brudnak
Vanderbijlpark, South Africa	Pieter Pretorius
Warren_Macomb_MI_GRAF & Parade	Joe Petrosky and Valerie Corbett
Waterford_Oak4HLegoLegion_MI	Srinivas Bommidi
Westford_CreationStation_MA	Nandu Vellal
Westland_FordCareerTechCtr_MI	Zachery MacLean, Steven Kay
Winners_China	Zhao Yang; Dr. Xie Zeng
Winners_Ghana	Dr. Yaw Okraku-Yirenkyi
Winners_HongKong	Yau Ka Chun
Winners_India	Imtaiz Khan
Winners_Korea	Stephen Seungdong Baek
Wolfville_Acadia_Canada	Gary Walsh; Jenna Watson-Findlay
World_Bottle_Sumo	David Carbery; Keith Bozin
World_Championship_Vcc	Nathaniel Johnson, Emily Trudell, Tom Newman, Gary Givental
World_UMC	Dr. Joe DeRose

(Table 8) Site Host Organizers (Sites organized by Lawrence Tech are excluded)

We are so happy to announce that Robofest 2015-16 season was completed without any full-time staff. Part-time staff members in the 2015-16 year were Shannan Palonis (Coordinator), Katherine S Bis,

Lauren Jordan, Lynn C Garrison, Teresa K Dubois, Chris Deloren Parker, Michael Kenneth Dobbyn, Judith Williams, Alicia Lane, and David Carbery.

Especially Robofest is blessed to have Shannan Palonis as the new Robofest coodinator since July 2015. She learned all the details involved in Robofest admininistration quickly and worked with dedication. Associate Professor Dr.Chris Cartwright assisted Robofest as Head Game Judge and many other functions. Without them, the quality of this year's Robofest would have been very poor.

Part-time student assistants include Gordon Stein, Prathik Mouli Akunuri, Colin Patrick Ross, Nirmit Changani, Devson Butani, Candace Byrnes, Chanmee Chung, Joshua Brudnak, Nick Paul, and Levi Judah White. Figure 26 shows some core staff members and volunteers at a staff meeting on July 28, 2016.

(Figure 26) Robofest core staff & volunteers taken during a staff meeting on July 28, 2016

(Figure 27) Robofest 2016 official poster

2015-16 data shows that Robofest has achieved its primary missions: inspring students into STEM and supporting them. We are proud that Robofest has been continuously inexpensive since its inception in 2000, while providing a quality STEaM education environment for students. We deeply thank everyone who has hosted, sponsored, supported, volunteered, worked, and participated in the 17th Robofest for the 2015-2016 year.

Please note that this report does not include details of WRO (World Robot Olympiad). I decided to step down from WRO National Organizer duties since I have additional responsibilities in the Department as an Associate Chair. To access WRO-USA 2015 results, please go to the following link: http://wroboto.us/index.php/results15

If you find any errors or have comments on this report, please let me know (cchung@LTU.edu). We are looking forward to seeing you during the 18th annual Robofest 2016-17 season.

Respectfully,
August 10, 2016

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