

ROBOFEST 2019 ~ 2020 Annual Report

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(Figure 1) Robofest Online World Championship 2020 participants and major sponsors

1. Analysis of Robofest Team Participation Data

Robofest® is Lawrence Technological University's world-wide robotics program for students in 4th - 12th grade and college. Student teams design, construct, and program their autonomous robots to compete for trophies in a variety of competitions. Robofest's mission is to generate excitement & interest among young people for Science, Computer Science, Technology, Engineering, and Mathematics (STEM), develop soft skills such as teamwork, creative thinking, communication and problem solving, and prepare them to excel in higher education and technological careers.

In the 2019-2020 academic year, extended into October 2020 due to the COVID-19 pandemic, a total of **1,476** students in **549** teams participated from 13 countries: Canada, Egypt, Ghana, Hong Kong, India, Mexico, Nigeria, Saudi Arabia, South Africa, South Korea, Taiwan, United Arab Emirates, and USA. In the USA, Robofest had students from 5 States: Florida, Illinois, Kansas, Michigan, and Ohio. 546 site volunteers registered as judges, online local judges, proctors, check-in, setup/cleanup crew, etc.

Site ID in Robofest registration system	Coaches	Teams	Participants	Volunteers
Abuja_BaunSTEMRobotics_Nigeria	11	13	64	16
Alexandria_TechnoFuture_Egypt	5	8	35	Data n/a
Bengaluru_JainUniversity_India	5	21	55	0
Hyderabad_BrillianceInternationalSchool_India	9	57	203	15
Hyderabad_KeystoneSchool_India_Jan26	7	36	107	0
MockCompetition_Dec20	3	3	6	6
MockCompetition_Oct21	5	4	4	9
Oldsmar_Nielsen_FL	8	31	90	21
Saline_WCA_MI	2	11	23	15
TaoyuanCity_ICDA_Taiwan	28	51	130	55
Warmup_LTU_MI	5	6	16	17
Wolfville_Acadia_Canada	23	38	137	52
Regular in-person competition Total (A)	111	279	870	206

Mock_BottleSumo_June23	6	7	14	13
Mock_Exhibition_May19	5	5	13	5
Mock_Game_June2	4	5	13	16
ML camp with EV3 July 10	12	16	28	1
Camp_ML_for_EV3_with_Scratch_Aug14	11	21	32	1
Camp_ML_for_EV3_with_Scratch_Jul24	6	16	23	1
LATAM_Online	8	23	69	26
USA_Video_Qualifier	15	24	54	4
Other Online Competition Total (B)	67	117	246	67

ROWC_BottleSumoTT_Jr	14	17	34	35
ROWC_BottleSumoTT_Sr	19	31	64	61
ROWC_Exhibition_Jr	9	9	24	10
ROWC_Exhibition_Sr	7	7	20	12
ROWC_Game_Jr	15	23	47	43
ROWC_Game_Sr	19	22	62	43

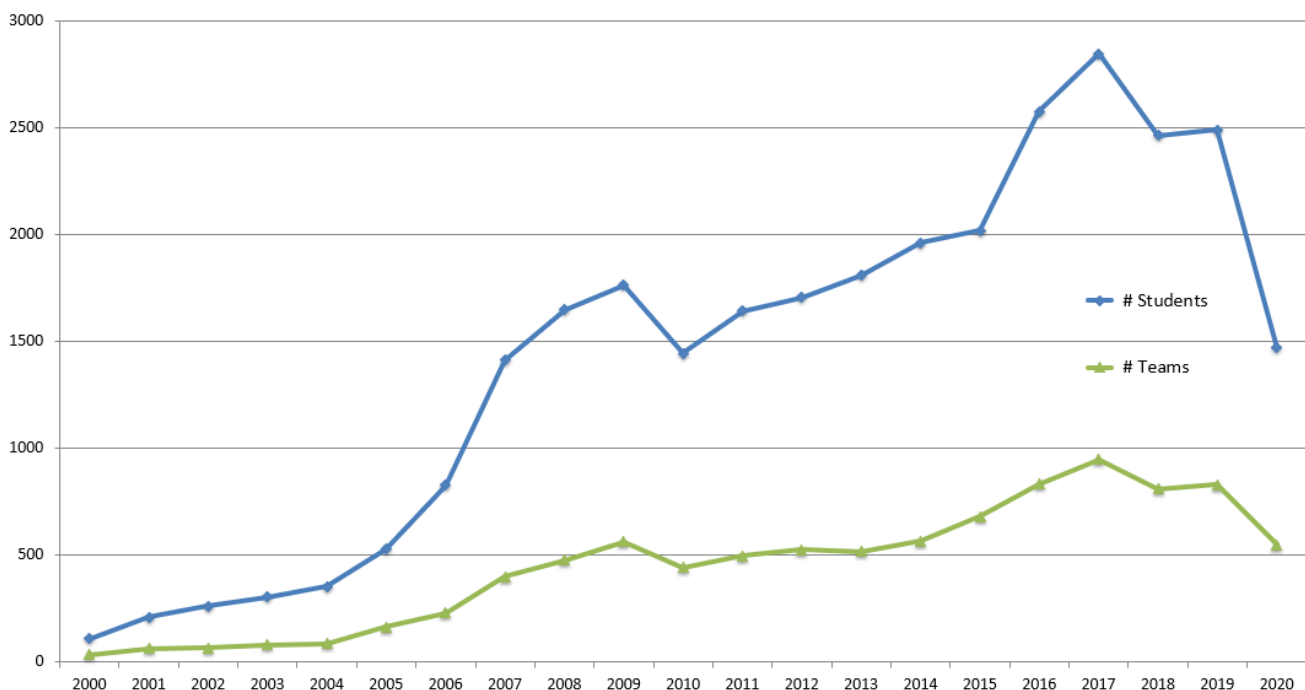
ROWC_RoboArts	11	11	37	8
ROWC_RoboMed	10	10	28	8
ROWC_UMC_Jr	8	12	23	26
ROWC_UMC_Sr	9	11	21	27
Online World Championship Total (C)	121	153	360	273

Grand total: (A)+(B)+(C)	299	549	1476	546
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(Table 1) Number of Registered Participants at Robofest 2019-2020 Official Competition Sites

Table 1 shows the total number of officially registered coaches, teams, and students for each site for the extended 2019-2020 year. This table shows only the data on Robofest web database system. Ghana, Hong Kong, Saudi Arabia and South Korea used their own registration systems.

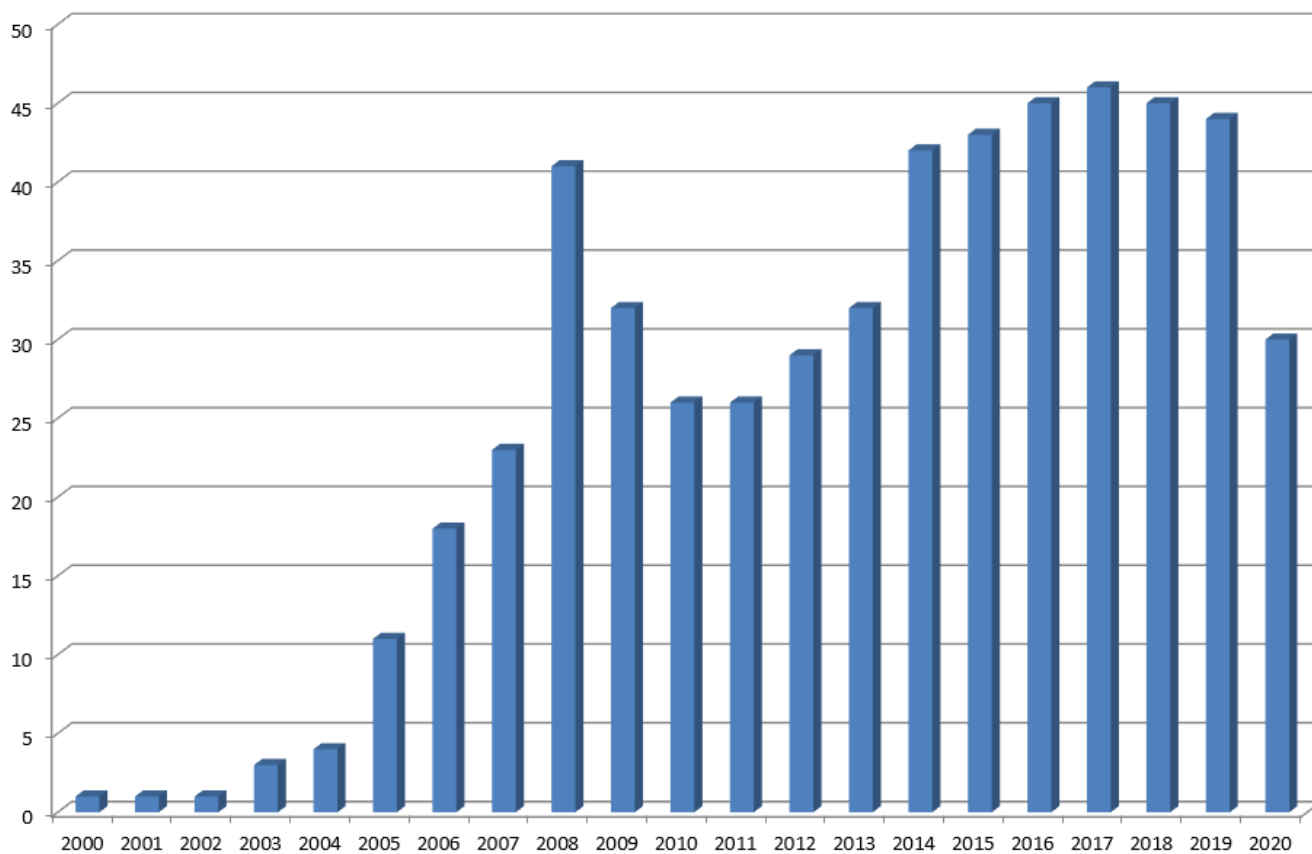
The average Robofest team size in 2020 was 2.7, down from 3.0 in 2019. The decrease of team size was expected due to the lockdown. We believe this small team size is good for effective learning, because each student has more opportunities to contribute to the team's objectives. Figure 2 shows the number of student participants since 2000. The cumulative number of registered students and teams in our web database since 2000 has reached 29,839.



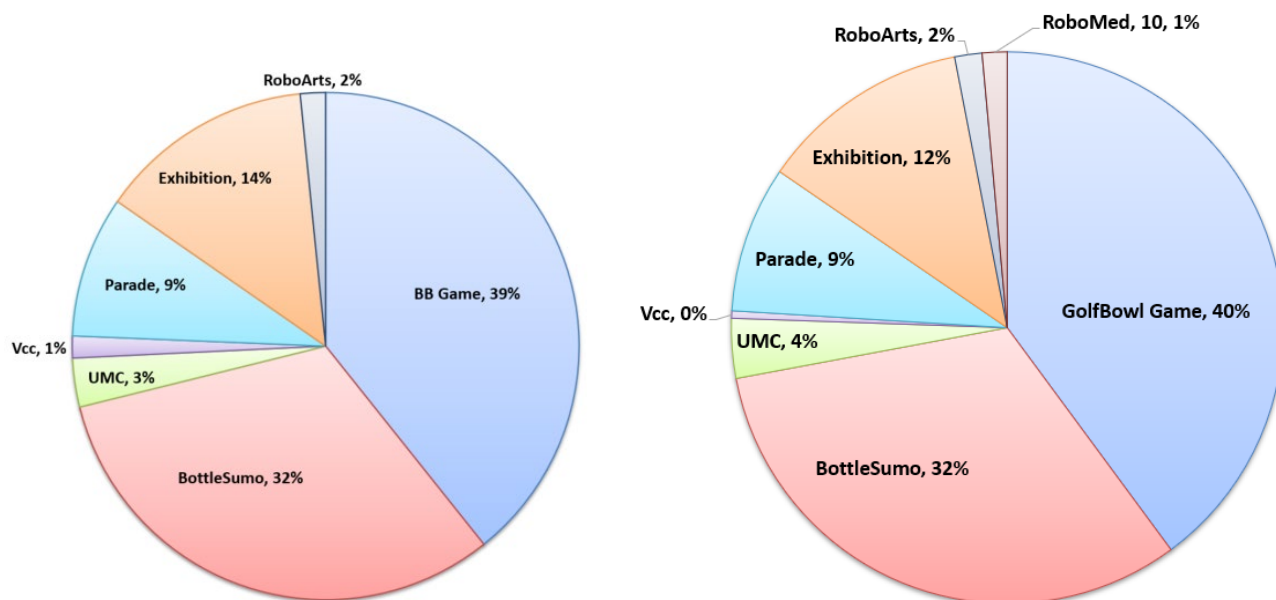
(Figure 2) Number of Robofest Student Participants and Teams Since 2000

The total number of Robofest competition site locations listed in Table 1, was 30 in the 2019-2020 year. On average, 49 students and 18 teams participated per competition site that Robofest managed. Figure 3 shows the history of number of official competition sites since the inception of Robofest.

Robofest offers a variety of categories in which to compete. 39% of teams participated in the GolfBowl Game. The second most popular category was BottleSumo with 32%, then Exhibition with 14% of teams. Pie charts in Figure 4 below show percentages of teams by competition category.

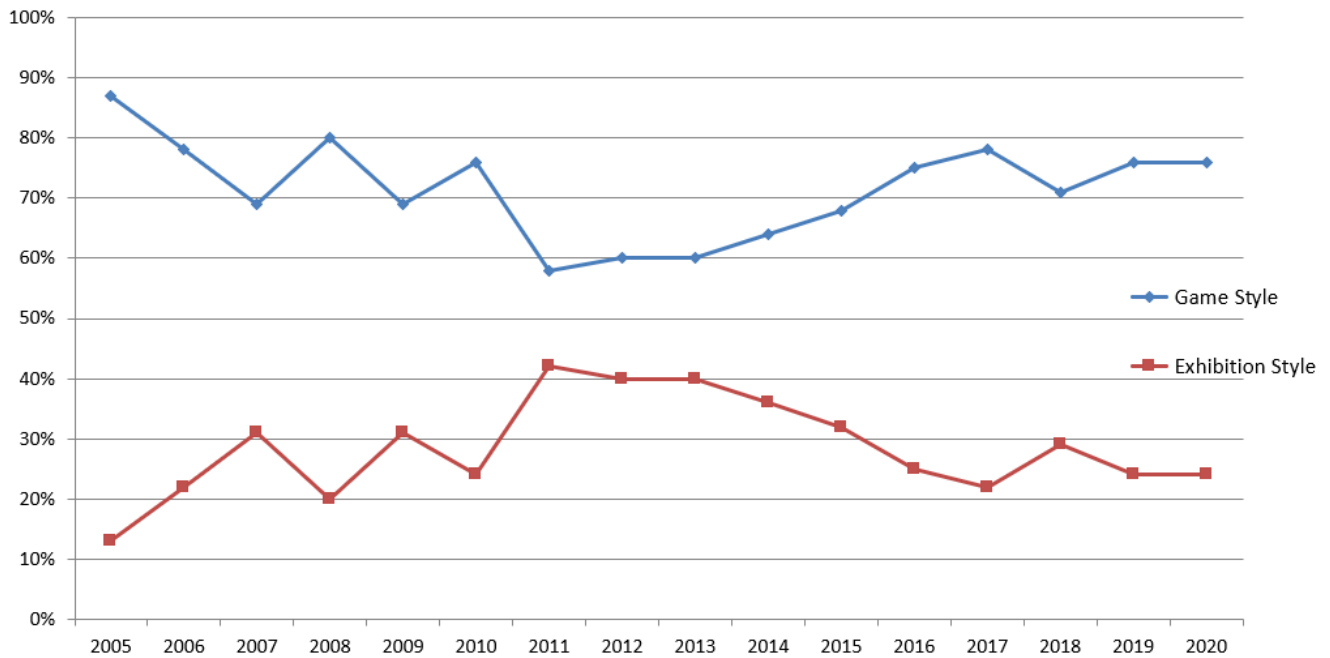


(Figure 3) Number of official competition site locations



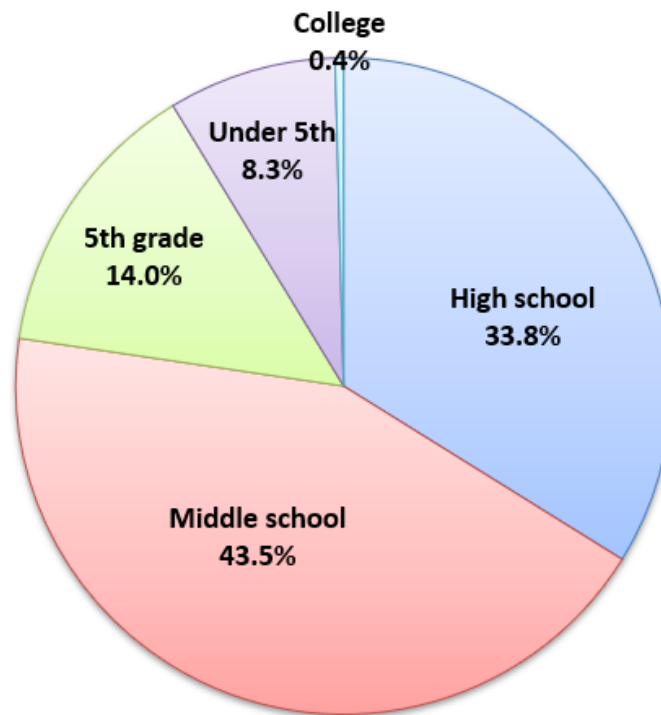
(Figure 4) Percentages of Teams per Competition Category in 2010 (left) and 2020 (right)

Robofest competitions can be generalized into two categories: (1) Game style that uses fixed rules including BottleSumo, Vision Centric Challenge, and Unknown Mission Challenge and (2) open-ended Exhibition style that has no or a few fixed rules including Exhibition, RoboParade, RoboArts, and RoboMed. Figure 5 shows the trend of number of teams between Games and Exhibition since 2005. The 2020 ratio remains the same as that of 2019.

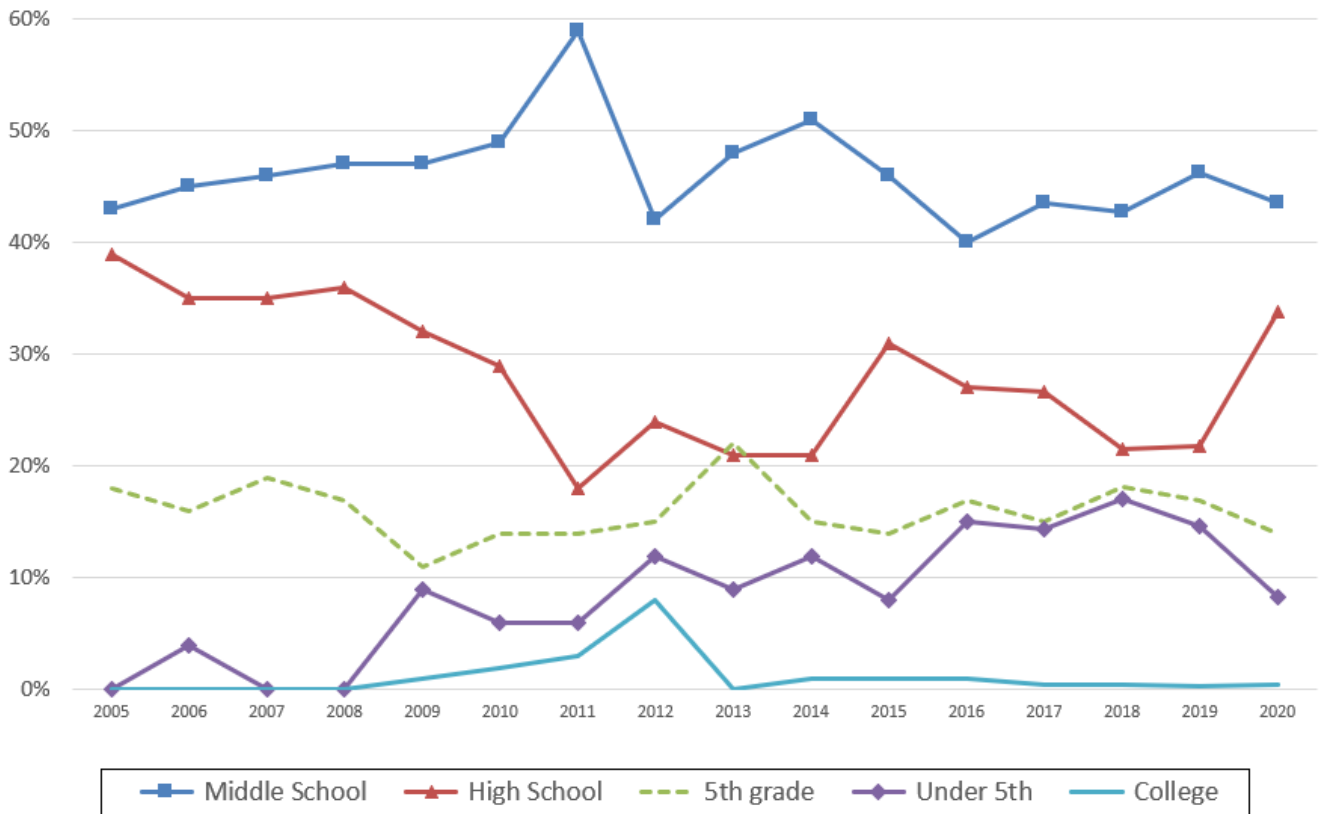


(Figure 5) Percentages of Game style teams and Exhibition style teams

Figure 6 shows student participation by academic level; 43.5% of the students were from middle school (6th through 8th grade). Figure 7 shows the trend of each age group since 2005. The participation rate of high school students has increased sharply during the pandemic.

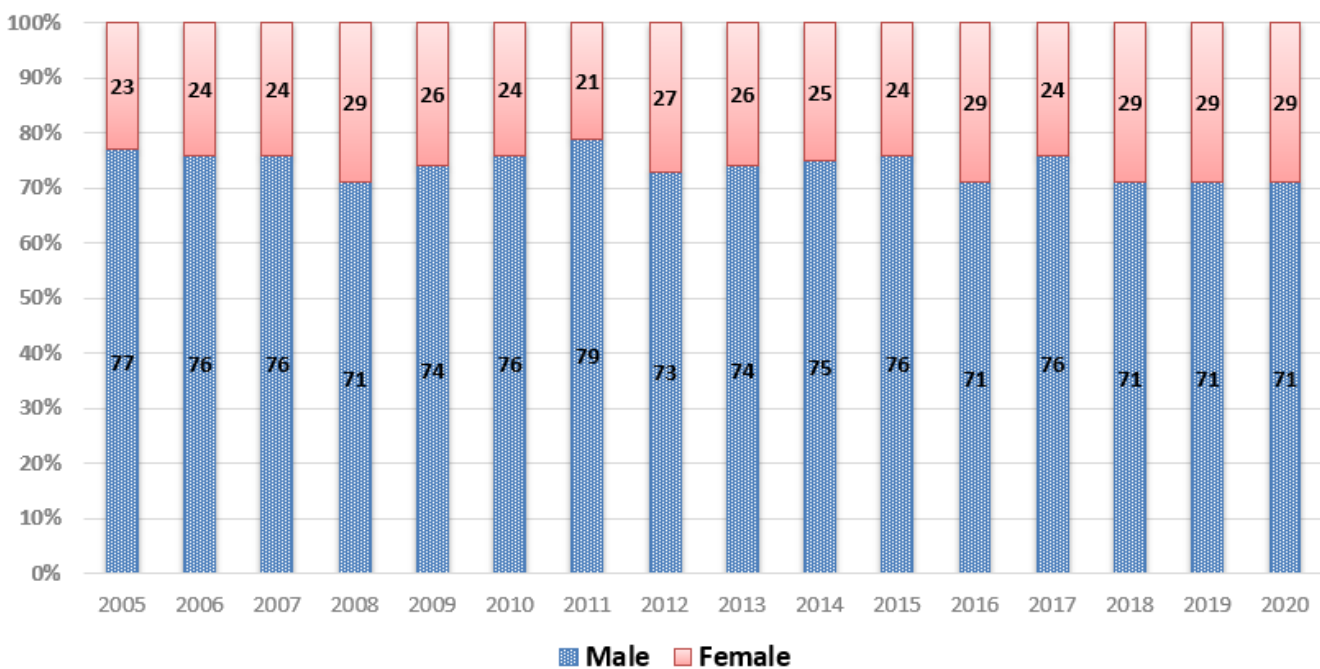


(Figure 6) Percentage of Student Participants per School Grade in 2020



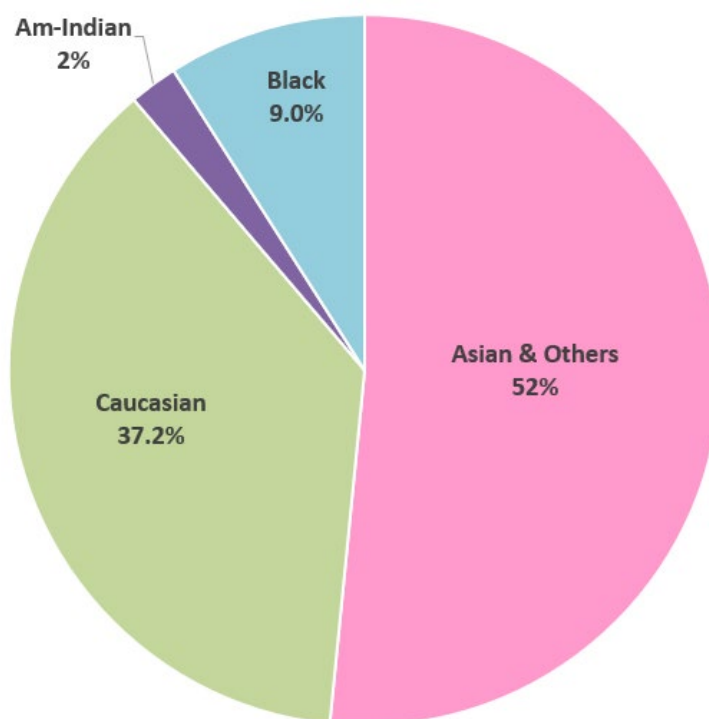
(Figure 7) Percent of age group since 2005

Gender ratios (71% male and 29% female) have been steady in recent years as shown in Figure 8. Note that the data is taken directly from our registration database. Some international students' data is excluded.



(Figure 8) Gender Ratios of Robofest Students

In 2018, we introduced a new optional field on the registration system to identify ethnicity when a coach registers team members online. Because the field on the online form was not required, a majority of coaches did not provide the students' ethnicity information. The following data is from 543 (31.9%) students. 9% of Robofest 2020 students were African/Black as shown in Figure 9. Figure 10 shows the changes since year 2005. Asian, Indian-Asian, Indian_AN (Alaskan Native), Pacific Islander, Pacific_Asian, and other ethnicity classes are grouped into "Other" to show the data in the same categorical format as previous years. Note that the ethnicity data is only from the students registered on our system. Data from some countries are not included.

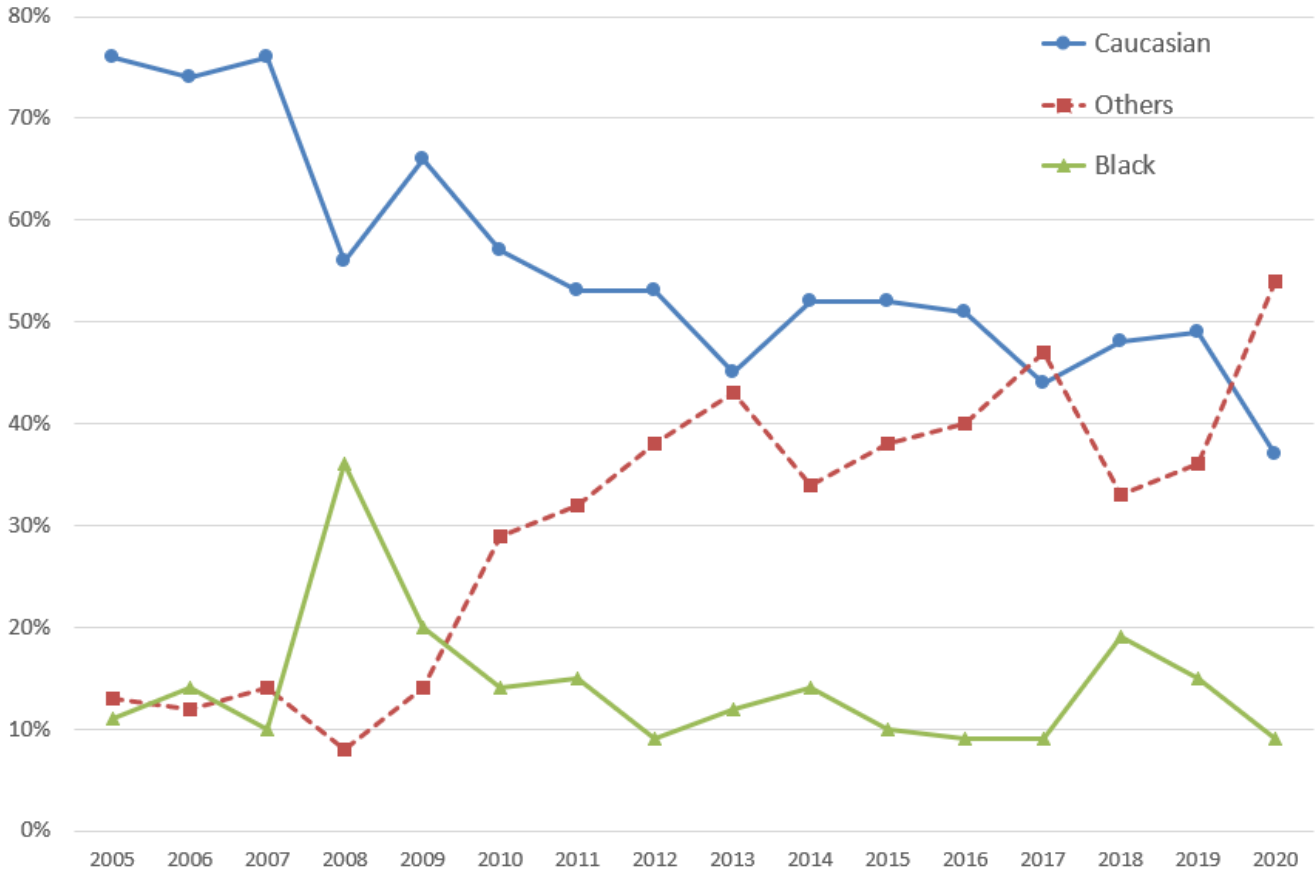


(Figure 9) Percentage of Student Participant by Ethnicity Data in 2020

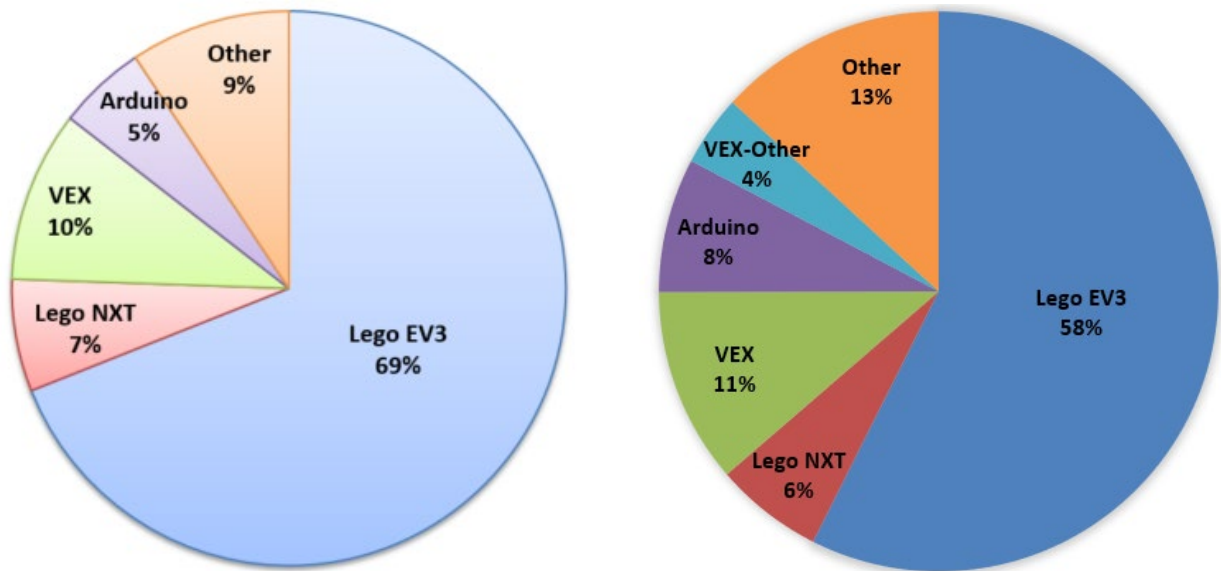
Robofest is completely open and allows the use of *any* robotics platform, which is one of its unique features. Figure 11 shows the data on robotics kits used by the teams. Still the majority of the teams (58+6=64%) were using LEGO products. 2nd generation Lego NXT kits are still being used (6%). The use of VEX platforms increased from 10% to 15% in 2020. The use of Arduino doubled from 4% to 8%. Other kits also increased from 9% to 13%.

Robofest remains focused on getting student participants to learn STEM through computer programming/coding and testing. The languages used in Robofest 2020 are shown on the graph to the right 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 Arduino C (Sketch). RobotC became popular for high school teams when Carnegie Mellon Robotics Academy provided free licenses for Robofest teams beginning in 2009. All C-style languages together totaled 14%. Scratch-like Robot Mesh for VEX IQs was used by 7% of teams. "Other" includes Java, C#, and other languages. Robofest provides opportunities to learn professional programming languages and helps prepare our students for future professional career paths. Robofest students continue to show advanced technical skills and

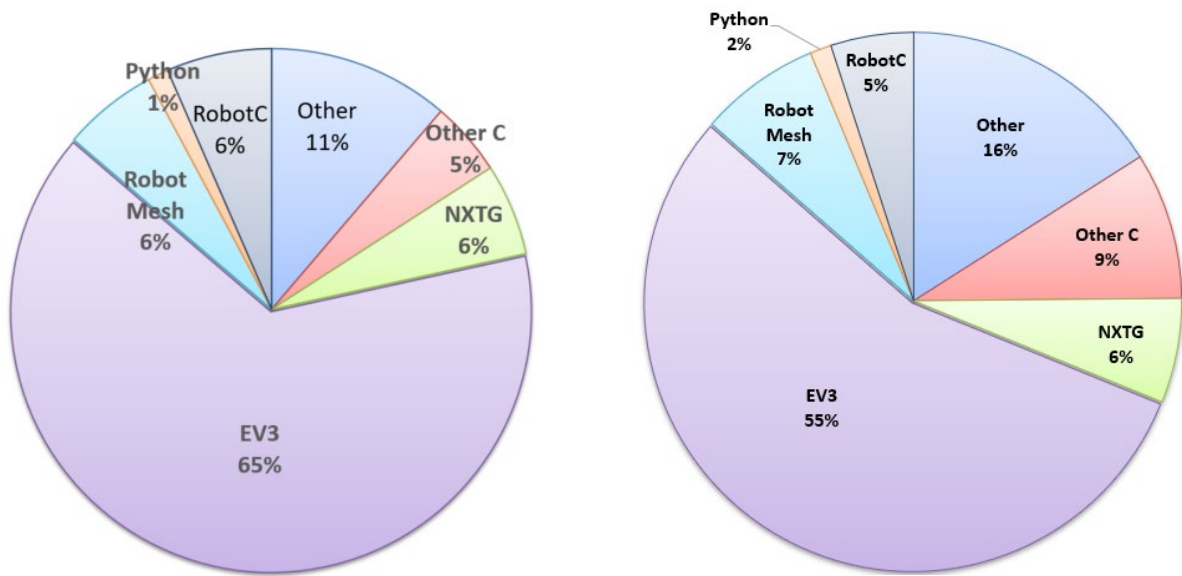
improvements in their STEM and Computer Science abilities. This is possible because of the many dedicated coaches and technical mentors associated with Robofest.



(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 2019 (left) and 2020 (right)



(Figure 12) Percentage of Programming languages used in 2019 (left) and 2020 (right)

2. Robofest 2020 Coach & Volunteer Survey Results

This section shows the results of the following anonymous surveys on the web after ROWC competitions.

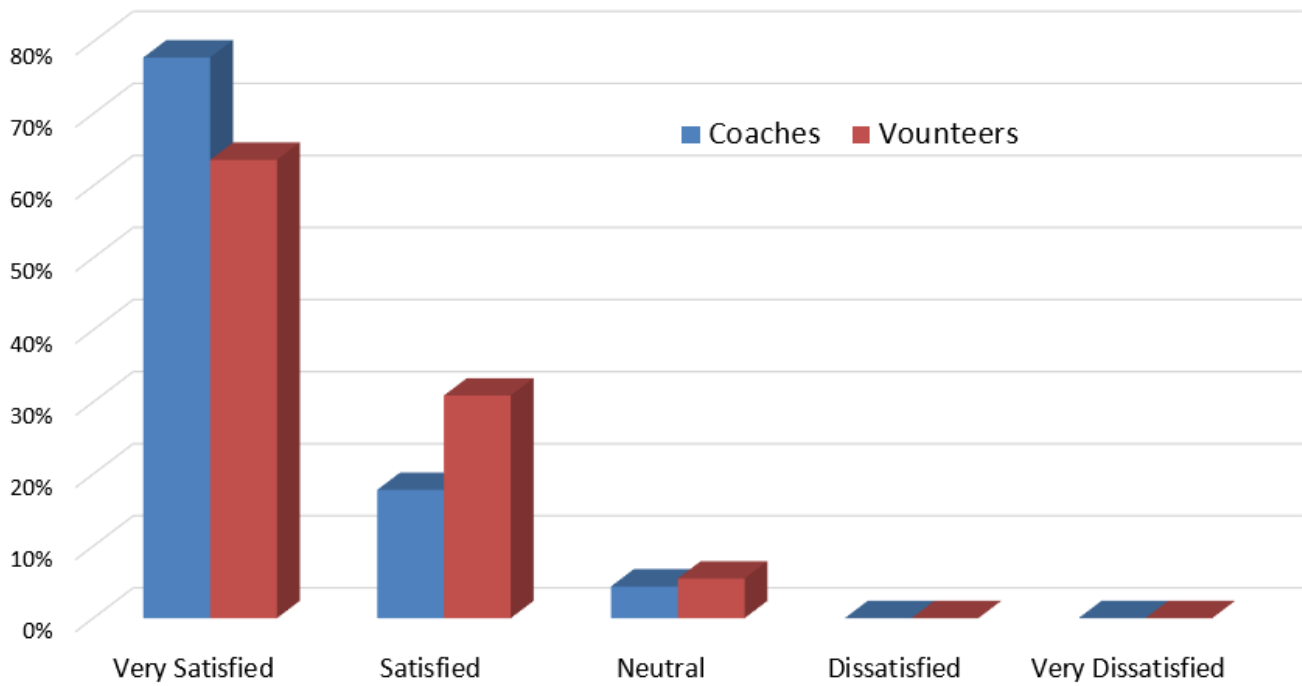
- Coach survey (45 coaches participated)
- Local Volunteer survey (55 volunteers participated)

Table 2 shows the satisfaction rate from each survey and Figure 13 displays the table data in a 3D bar graph. There were no “dissatisfied” responses this year.

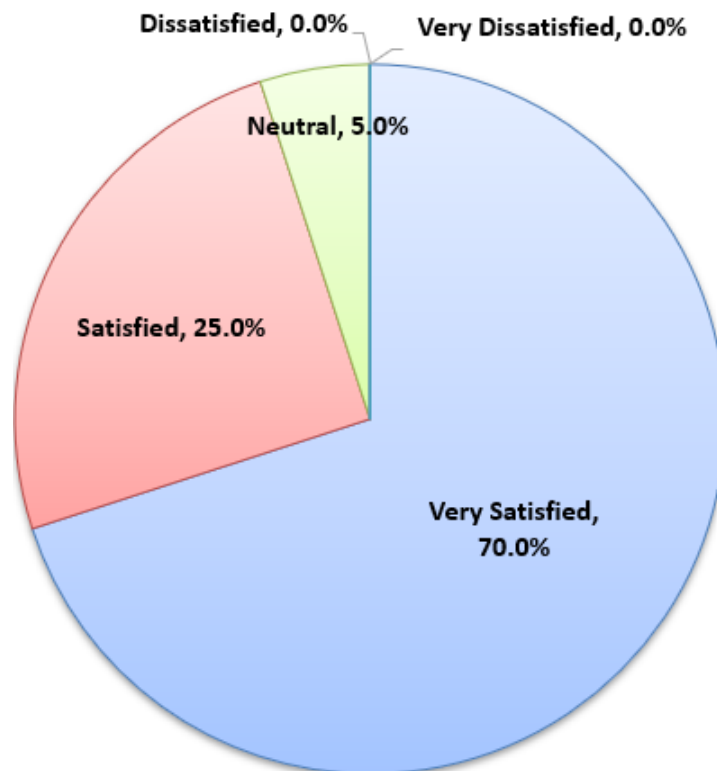
	Coaches	Site Volunteers (Local Judges)	Weighted Average
Very Satisfied	77.8%	63.6%	70.0%
Satisfied	17.8%	30.9%	25.0%
Neutral	4.4%	5.5%	5.0%
Dissatisfied	0.0%	0.0%	0.0%
Very Dissatisfied	0.0%	0.0%	0.0%

(Table 2) 2020 Satisfaction rate from each of 2 surveys

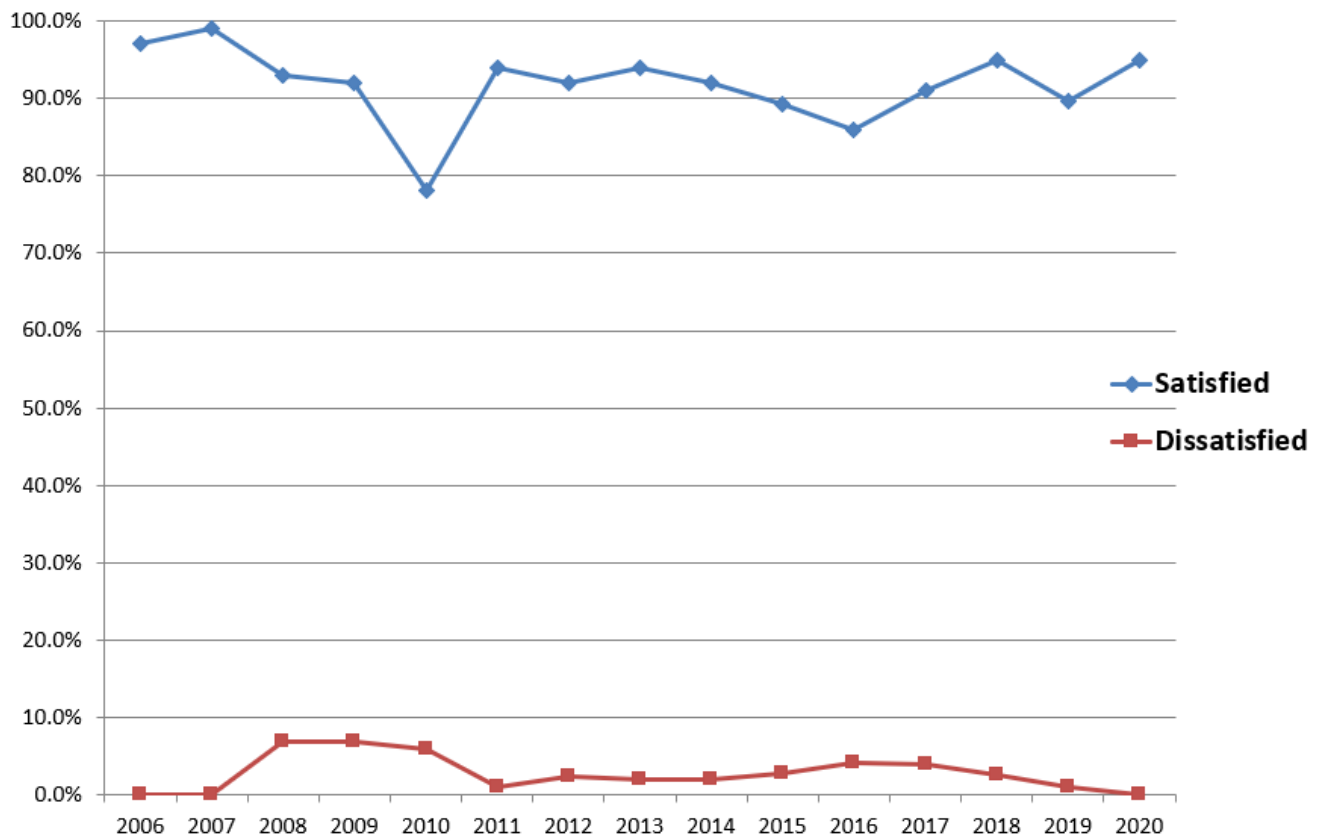
Figure 14 shows average satisfaction rate from the 2 surveys. Considering the satisfaction rate (70+25=95% were satisfied or very satisfied), Robofest 2020 was yet another successful year. Figure 15 shows Overall coach/volunteer satisfaction level changes since 2006. It does not show neutral cases.



(Figure 13) Satisfaction rate from each of 2 surveys in 2020



(Figure 14) 2020 Coach/Volunteer Satisfaction rates



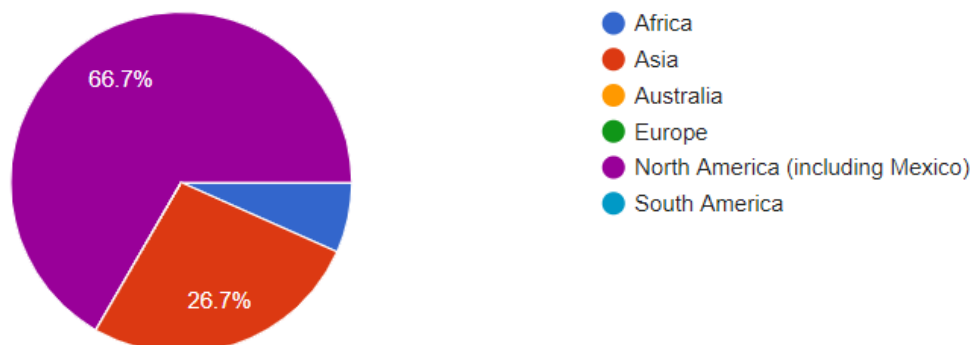
(Figure 15) Overall coach/volunteer satisfaction level changes since 2006 (2006~2009 & 2014 contain only coach data)

2.1 Coach Survey Results

The following (Figure 16a) with 8 questions shows the results of 2020 coach surveys.

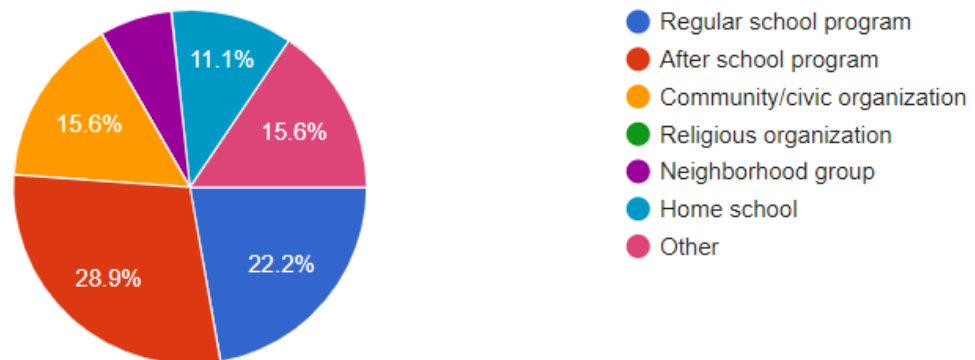
Q1. Where are your teams from?

45 responses



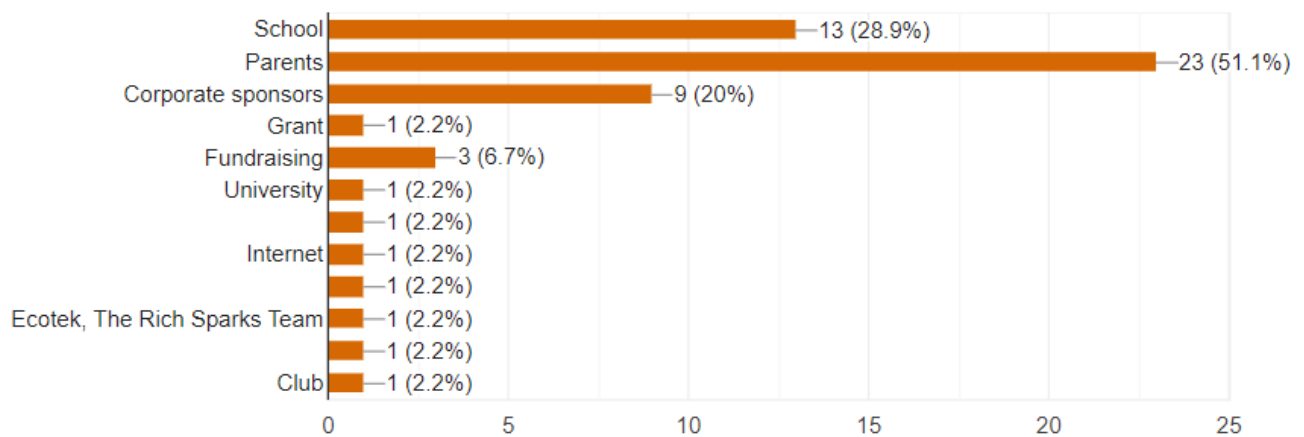
Q2. Your team participated in Robofest 2020 through:

45 responses



Q3. From whom did your team receive funding?

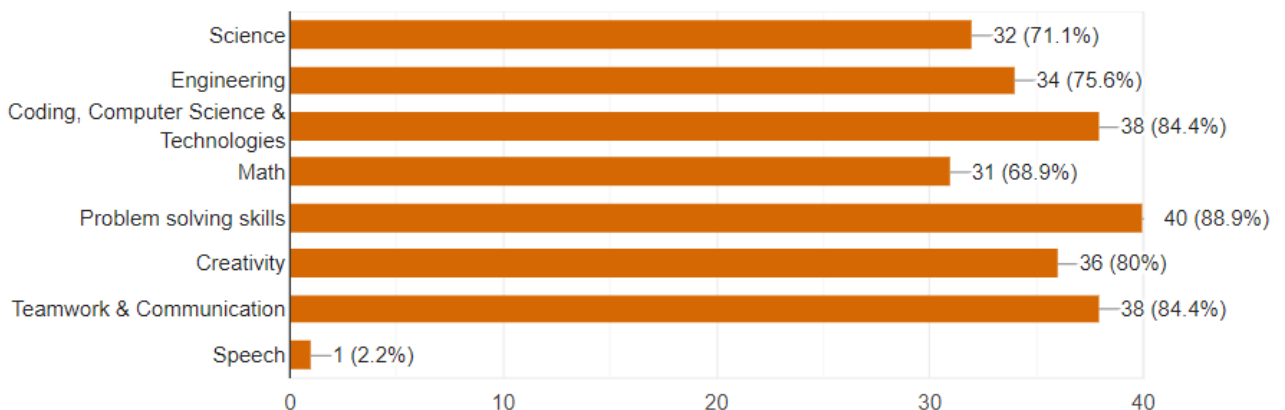
45 responses



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

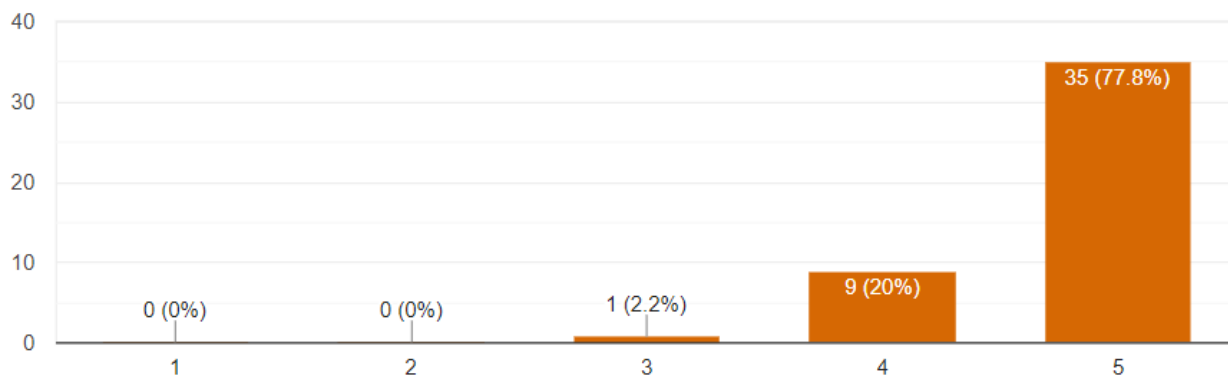


45 responses



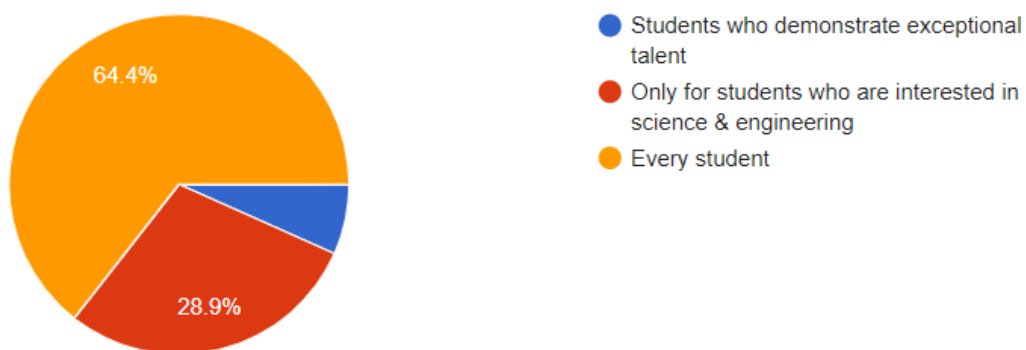
Q5. Do you think your team members learned and improved science, technology, engineering, math, and/or coding knowledge through the Online Robofest 2020?

45 responses



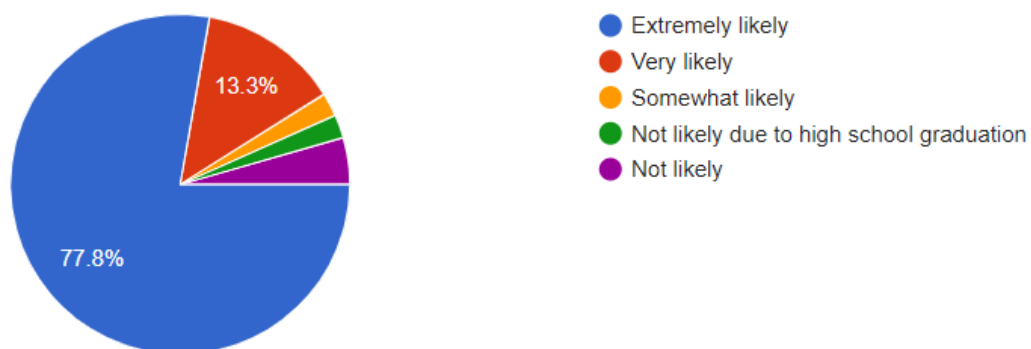
Q6. For whom do you think the Robofest programs should be designed?

45 responses



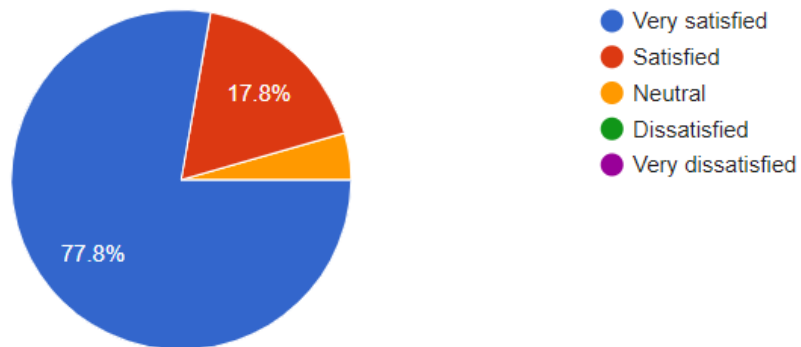
Q7. How likely are you to participate in Robofest next year?

45 responses



Q8. How would you rate your overall Robofest 2020 season experience?

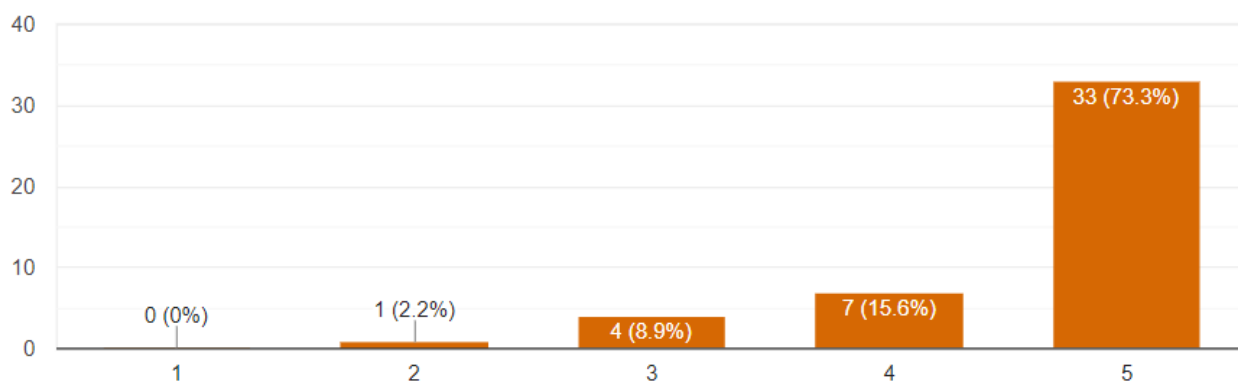
45 responses



Q9. Would you participate again if *online* competitions are offered in the future?



45 responses



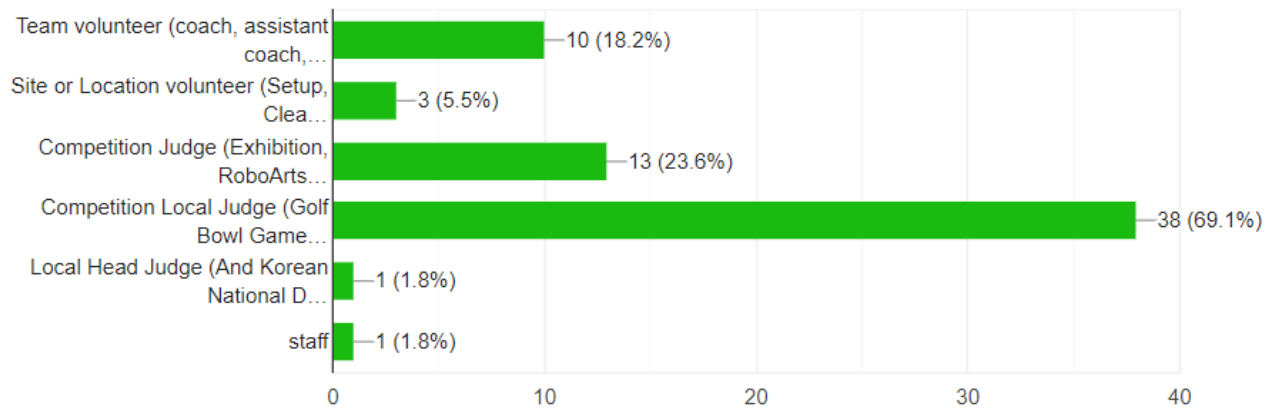
(Figure 16a) 2020 Coach survey results

2.2 Volunteer Survey Results

The following (Figure 16b) with 4 questions shows the results of 2020 Volunteer/Judge surveys.

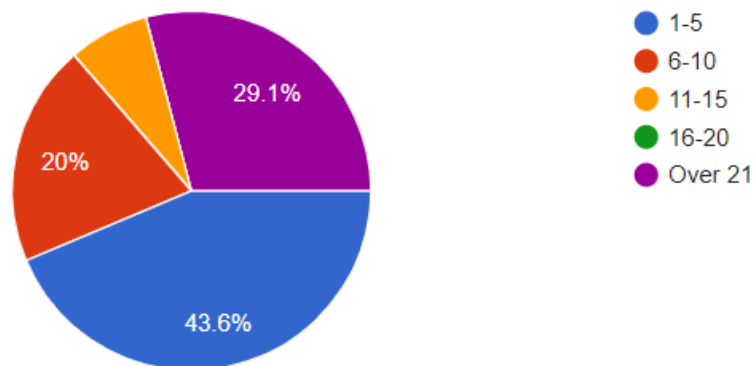
Q1. What was your role as a volunteer?

55 responses



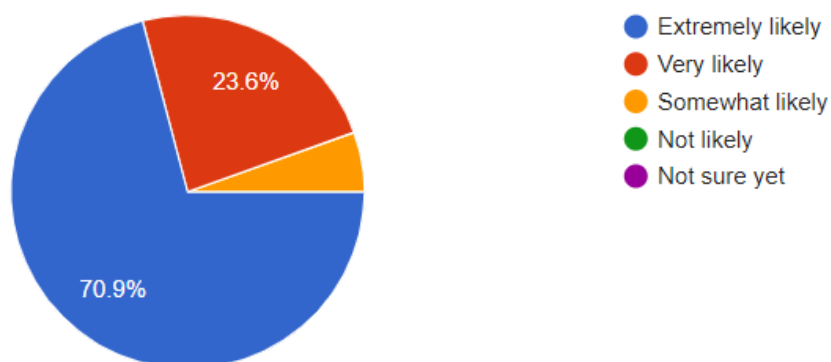
Q2. How many total number of hours did you volunteer for Robofest competitions this season?

55 responses



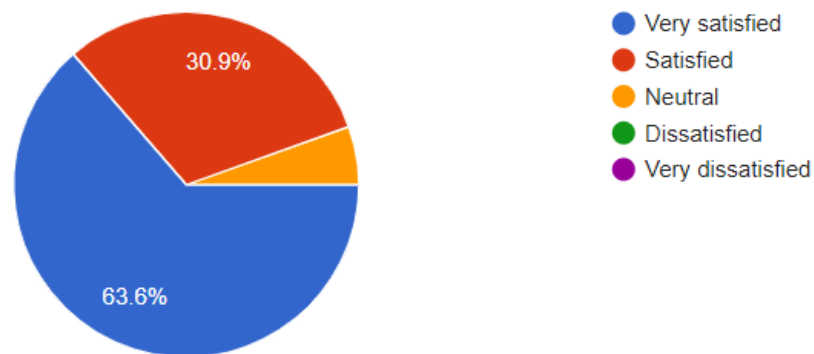
Q3. How likely are you to participate in Robofest next year?

55 responses



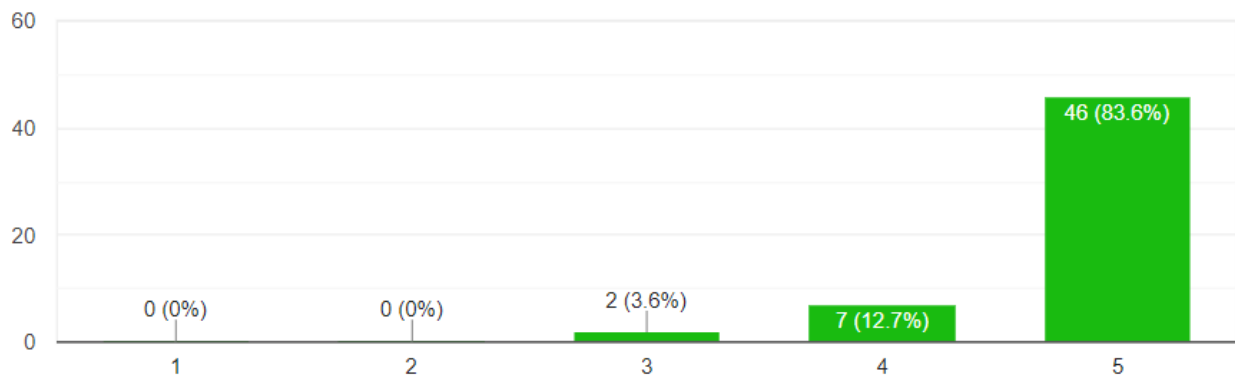
Q4. How would you rate your overall Online Robofest experience?

55 responses



Q5. Would you help us again if *online* competitions are offered in the future?

55 responses



(Figure 16b) 2020 Volunteer & Judge survey results

The coach survey included an essay (short answer) question: *Q9. Please write any suggestions, comments, criticism, and encouragement to improve the quality of Robofest.* Comments and corresponding Robofest office's responses/comments can be found on the web at:

<http://www.robofest.net/2020/CoachSurvey.pdf>

The surveys for Volunteers & Judges had an essay question: *Q5. Please provide any suggestions/comments which will help us enhance the quality of Robofest.* Volunteers' comments and corresponding Robofest office's comments can be found on the web at:

<http://www.robofest.net/2020/VolunteerSurvey.pdf>

We appreciate everyone who participated in the surveys. Please note that the survey was completely anonymous.

3. Workshops and online eAcademy

We held 14 technical hands-on workshops. Tables 3a and 3b show six instructors and their classes during the 2019-2020 academic year. Total number of workshop attendees was 297. In addition, we had 3 online camps (workshop + competition) to teach machine learning by Dr CJ Chung as listed in Table 1. We thank all the Robofest official sponsors especially DENSO and NDIA Michigan for sponsoring workshops. The Lawrence Tech helpdesk provided laptops for the workshops. Most of the workshop materials were posted on the web for on-site and online participants.

Date	Time	Workshop Topic	# Attendees	# LTU Stu assistants	Lead Instructor
11/9/19	8am ~ 12pm	EV3 Game	25	2	Joe DeRose
1/11/20	1pm ~ 4pm	EV3 Game with Python	11	3	Joe DeRose
1/25/20	9am ~ 12pm	EV3 Game	17	3	Chris Cartwright
2/8/20	9am~Noon	Robot Mesh for Game with VEX IQ	17	3	Elmer Santos
2/8/20	1pm ~ 4pm	EV3 Game	8	3	Chris Cartwright
2/17/20	3pm ~ 6pm	RobotC for Game with VEX IQ	2	0	Elmer Santos
2/22/20	9am ~ 3pm	EduBot for Vcc using Python	7	2	Eric Liu

(Table 3a) 2019-2020 Workshops at LTU

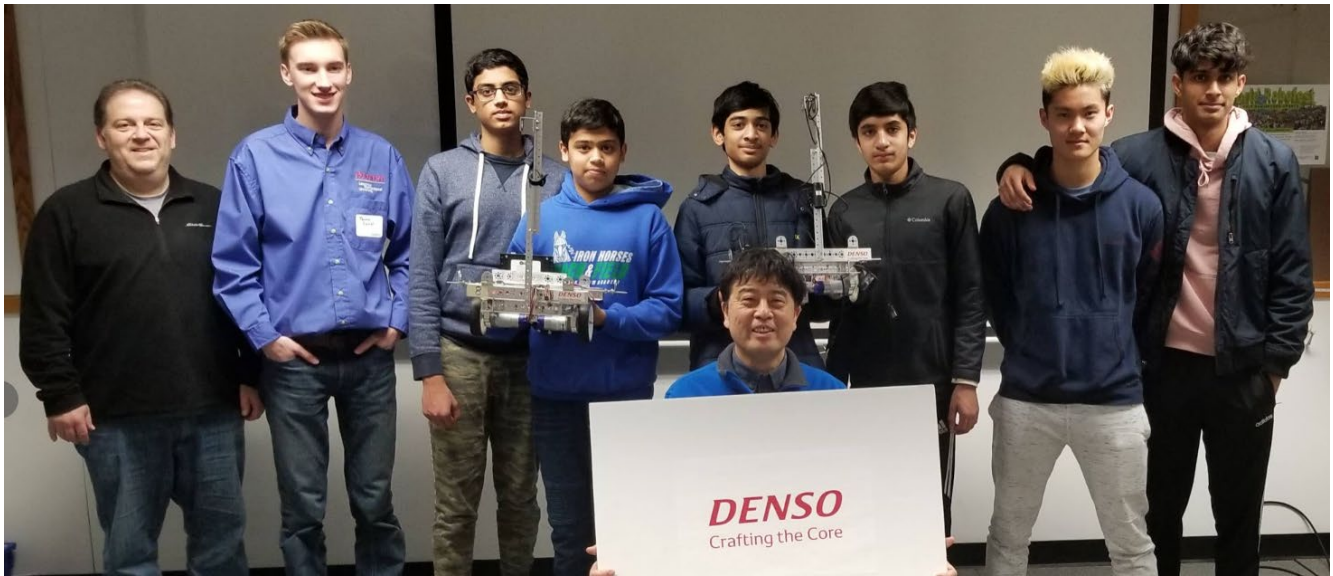
Date	Time	Workshop Topic	# Attendees	# LTU Stu assistants	Lead Instructor
1/23/20	2:30 ~ 3:30pm	Robot Mesh for Game with VEX IQ	21	1	Elmer Santos
1/30/20	2:30 ~ 3:30pm	Robot Mesh for Game with VEX IQ	21	1	Elmer Santos
2/6/20	2:30 ~ 3:30pm	Robot Mesh for Game with VEX IQ	21	1	Elmer Santos
2/13/20	2:30 ~ 3:30pm	Robot Mesh for Game with VEX IQ	21	1	Elmer Santos
3/3/20	1:30 ~ 3:30pm	Robot Mesh for Game with VEX IQ	21	0	Elmer Santos
3/5/20	2:30 ~ 3:30pm	Robot Mesh for Game with VEX IQ	21	1	Elmer Santos
3/12/20	2:30 ~ 3:30pm	Robot Mesh for Game with VEX IQ	21	1	Elmer Santos

(Table 3b) 2019-2020 Workshops at MacArthur K-8 School in Southfield

Robofest thanks the generous donation from our platinum sponsor DENSO for our workshops and camps. We added 3 new EduBots for Vision Centric Challenge (Vcc). The platform is designed using Tetrix and a PRIZM controller. Robofest now has 16 (13+3) EduBots and each of the robots has DENSO logo. The participants took EduBots home in order to work on the Vision Centric 2020 “CBC (Construction Barrel Course)” challenge after the Vcc workshop on Feb 22, 2020. Figure 17a shows EduBot workshop participants as well as some EduBots on the workshop day. Figures 17b, 17c, and 17d show some other DENSO sponsored workshop participants at LTU. Figure 17e shows an after-school workshop meeting at MacArthur K-8 University Academy in Southfield in February 2020.

Robofest eAcademy provides a series of online classes developed by Robofest instructors. Courses are available for free to Robofest teams through the Schoology Learning Management system. New online courses (<https://www.robofest.net/index.php/eacademy>) developed this year include:

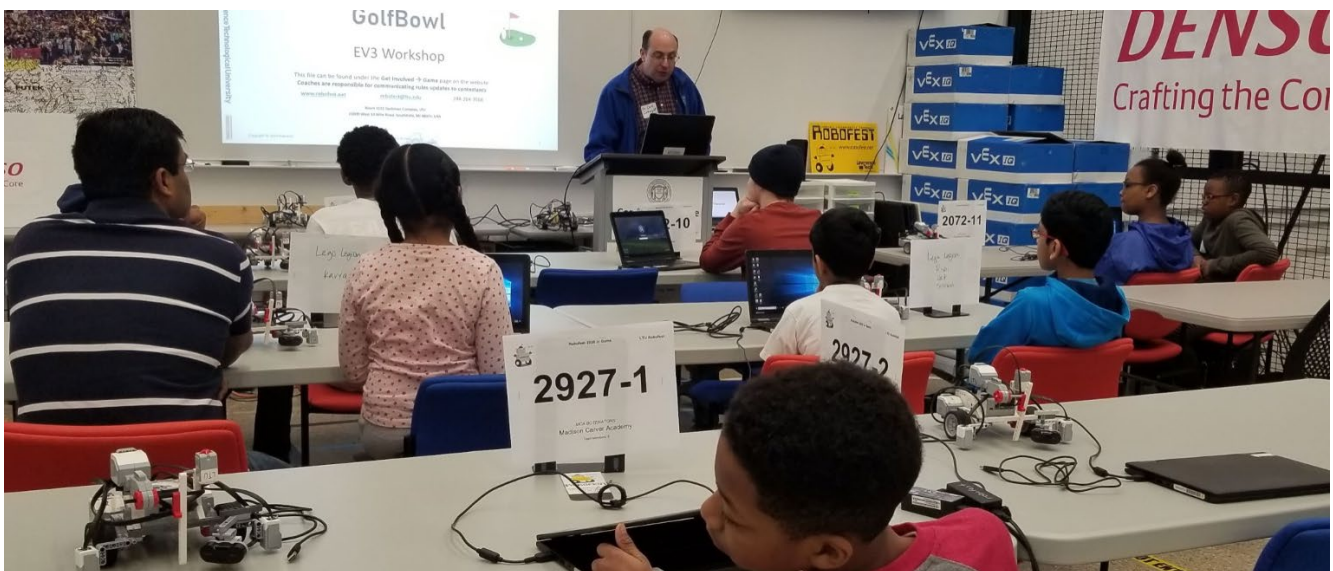
- 2020 Game using Vex IQ and RobotC language class code: TG7S-D3T4-SKX6H
- 2020 BottleSumo using Vex IQ and RobotC language class code: R7HN-5RKS-PBFGT
- 2020 Game using Lego EV3 and EV3 language class code: 6G38-T4FQ-KTXD4
- 2020 Game using Lego EV3 and Python language class code: R9ZX-D83G-77J8N



(Figure 17a) EduBot workshop participants at LTU, Feb 22, 2020



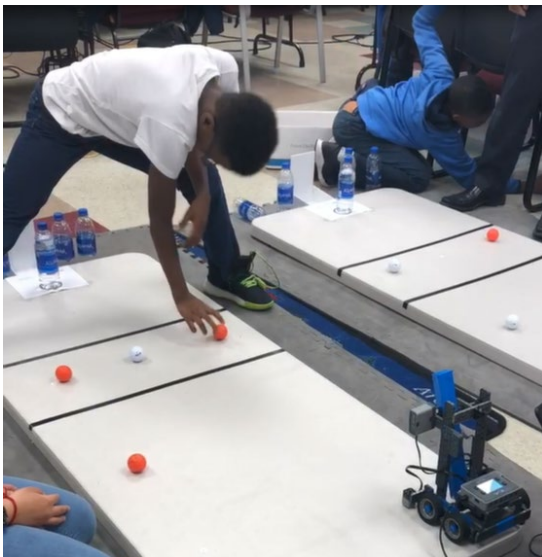
(Figure 17b) EV3 Python workshop participants at LTU on Jan 11, 2020



(Figure 17c) EV3 software workshop participants at LTU on Jan 25, 2020



(Figure 17d) Robot Mesh workshop at LTU on Feb 8, 2020



(Figure 17e) Workshop at MacArthur K-8 University Academy

The following eAcademy certification exams were also developed this year using Schoology Learning Management System:

- EV3 Software
- WeDo 2.0 with Scratch 3
- MIT Scratch 3 Basics
- Machine Learning with Scratch 3

4. Assessment

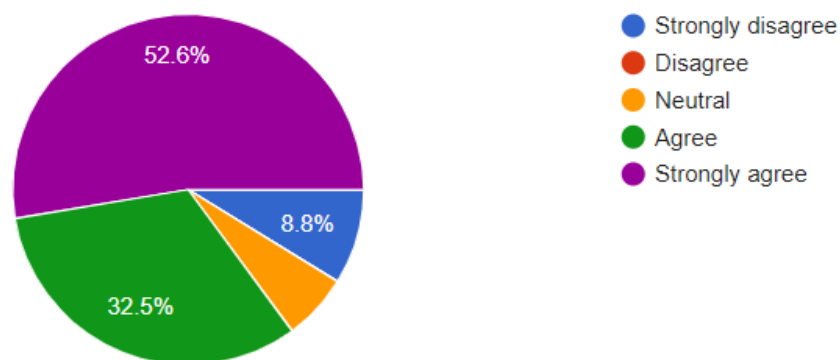
In order to assess the impact of autonomous robotics competitions in STEM education, Robofest students were asked indirectly through coaches to take online anonymous surveys before and after the competition.

4.1 2020 Pre-survey

114 students participated in the pre-assessment survey anonymously when teams were registered before starting Robofest work. 81.1% (50.9+30.2) of the students were very or somewhat interested in career in STEM fields in the beginning. Figure 18 summarizes the results of the student pre-assessment survey.

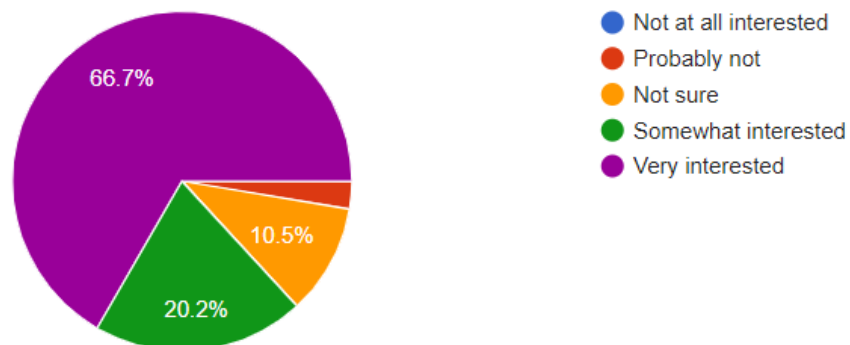
Q4. I like Coding, Science, Technology, Engineering, and Math related classes.

114 responses



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

114 responses



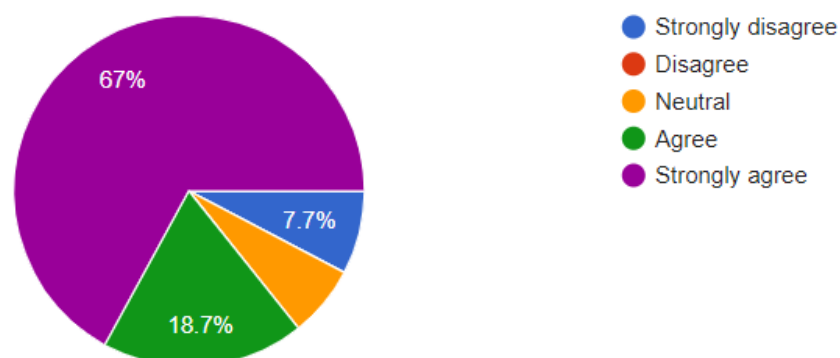
(Figure 18) Summary of 2020 pre-assessment student survey

4.2 2020 Post-survey

After the World Championship was completed, a post-assessment survey was conducted. 91 students participated in the survey anonymously and the summary is shown in Figure 19 below.

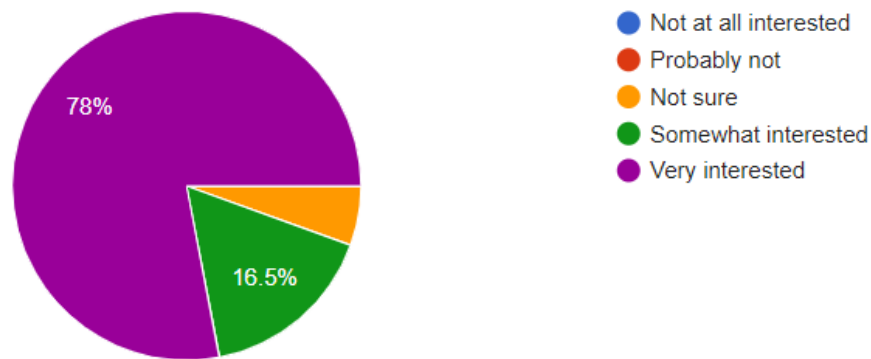
Q4. I like Science, Technology, Engineering, Math, and/or Coding related classes.

91 responses



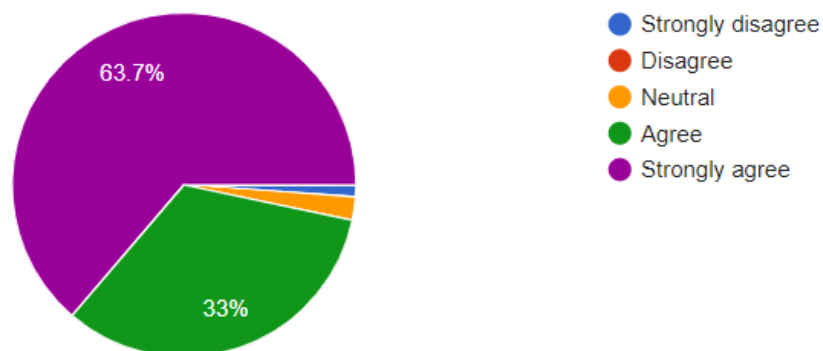
Q5. Are you interested in a career involving Science, Technology, Engineering, Math, and/or Coding?

91 responses



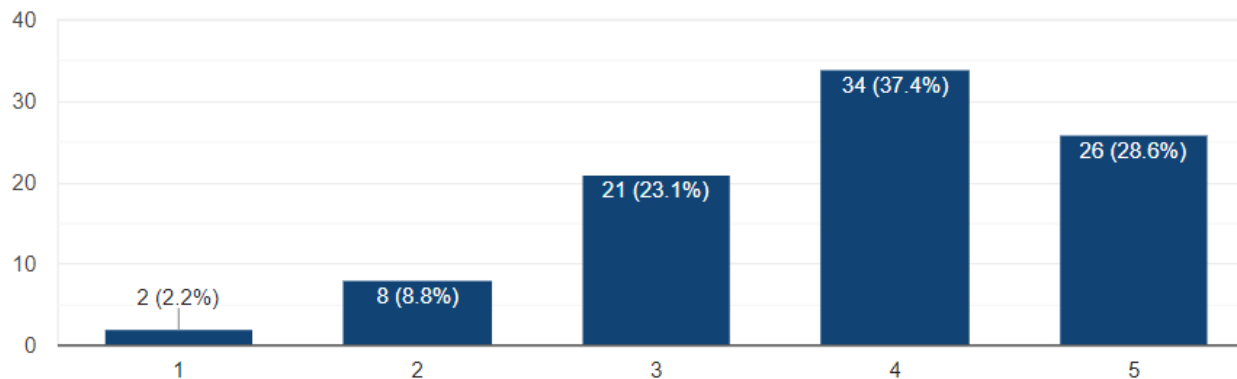
Q6. Robofest robotics experience helped me learn more about Science, Technology, Engineering, Math, and/or Coding.

91 responses



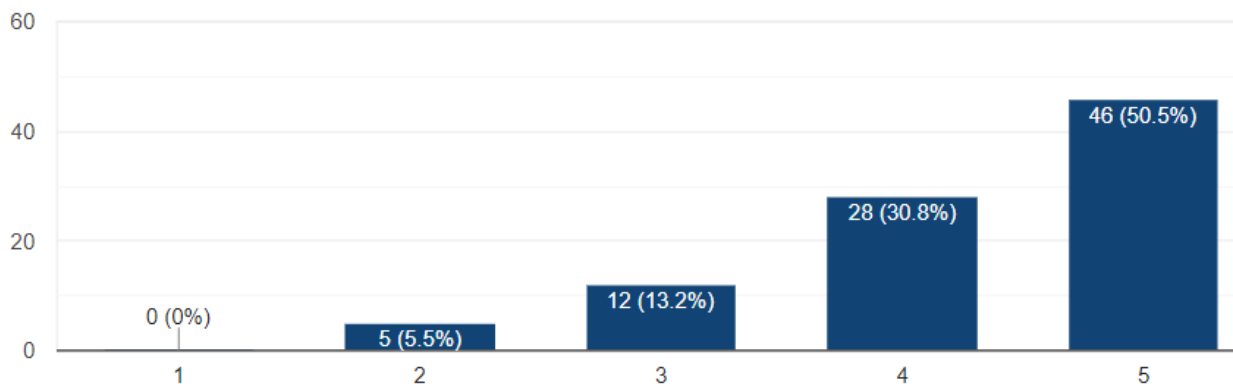
Q7. Did you like the **online** format of the robotics competitions?

91 responses



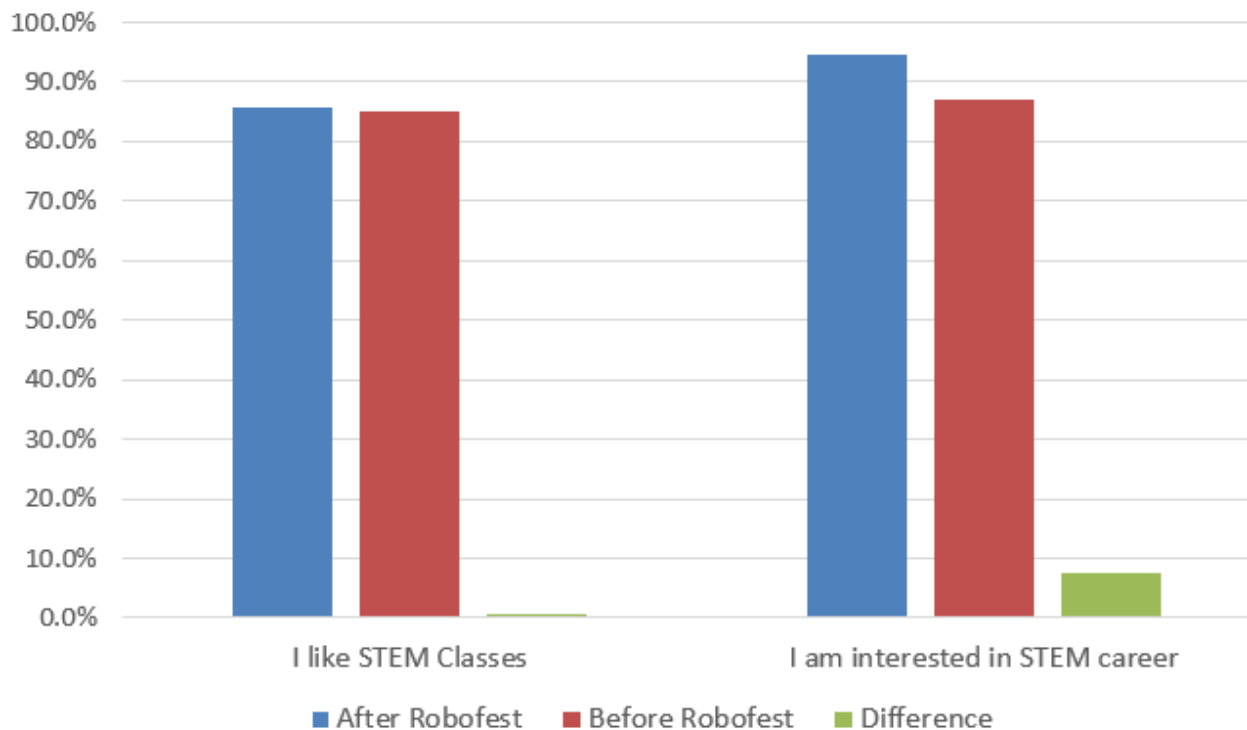
Q8. Will you participate again in the **online** format of the robotics competitions in the future?

91 responses



(Figure 19) Summary of 2020 post-assessment student survey

The result of Q6 in Figure 19 shows that a majority (63.7+33=96.7%) of students indicated the Robofest robotics experience helped them learn more about Science, Technology, Engineering, or Math (STEM). 85.7% of students liked STEM classes and 94.5% of students also expressed that they would now consider a career involving STEM after their Robofest exposure. After Robofest experience, both ratios were increased as shown in Figure 20.



(Figure 20) 2020 Assessment Summary

4.3 Overall Program Self-Evaluation

Robofest's mission statement has 3 main goals:

- A) Generate excitement & interest among young people for STEM
- B) Develop soft core skills such as problem solving, creative thinking, and teamwork (leadership & communication)
- C) Prepare them to excel in higher education and technological careers

We defined and collected the following metrics to measure the success of a Robofest academic year.

- 1) Total number of registered teams during an academic year
- 2) Dropout rate (% of registered teams that did not compete)
- 3) Percentage of teams that received over 60% scores for Games
- 4) Percentage of teams that received over 3.0 out of 5 for Exhibition
- 5) Percentage of teams that solved the unknown problems without the help from adults. (Robofest has unknown problems like exams unveiled at the beginning of competition.)
- 6) Overall coach & volunteer (Judge) satisfaction rate
- 7) Percentage of teams that participated in the 2nd chance Game competition
- 8) Percentage of teams that improved scores on average in the 2nd chance competition.
- 9) Percentage of students who indicate that Robofest robotics experience helped them learn more about STEM
- 10) Increased percentage of students who like STEM classes after having Robofest experience
- 11) Increased percentage of students who consider a career involving STEM after their Robofest exposure
- 12) Percentage of coaches who indicate that Robofest experience helped students in learning soft core skills such as teamwork, leadership, creativity, communication and problem solving

Evaluation of the 2020 year for each metric is summarized in Table 4. The overall evaluation of the Robofest 2019-2020 year related to Robofest's goals is analyzed in Table 5.

Metric #	Criteria to claim the metric is successful	2020 Metric Outcome	Evaluation
1)	Total number of registered teams > 500	549	Successful
2)	Dropout rate < 5%	12.45%	Unsuccessful
3)	% of Game teams with over 60% scores > 30	25.6%	Unsuccessful
4)	% of Exhibition teams with over 3.0 > 50	93%	Successful
5)	% of Game teams that solved unknown problems > 40	69.4%	Successful
6)	Overall satisfaction rate > 80%	95%	Successful
7)	% of teams that tried 2 nd Chance > 30	33%	Successful
8)	% of teams that improved scores on average in the 2nd chance competition > 60	50%	Unsuccessful
9)	% of students who indicate that Robofest experience helped them learn more about STEM > 80	96.7%	Successful
10)	Increased % of students who like STEM classes after having Robofest experience > 5	0.6%	Unsuccessful (Usually students who like STEM classes participate in Robofest. Unsuccessful in recruiting standard population)

11)	Increased % of students who consider a career involving STEM after their Robofest exposure > 5	7.6%	Successful
12)	% of coaches who indicate that Robofest experience helped students in learning soft core skills such as teamwork, leadership, creativity, communication & problem solving > 60	97.8%	Successful

(Table 4) Evaluation of 2020 year for each metric number

Goal ID	Metrics used to measure the success of the goal	Successfully or almost successfully achieved metrics in 2020	Evaluation
A)	1), 2), 6), 7), 10), and 11)	1), 6), 7), 10), and 11)	83% (5/6)
B)	4) and 12)	4) and 12)	100% (2/2)
C)	3), 4), 5), 8), 9), 10), and 11)	4), 5), 9), and 11)	57% (4/7)

(Table 5) Overall evaluation based on Analysis of Goals and metrics

5. Plans for 2021

Due to the global pandemic, it is hard to predict the best format for 2021 at this time. Therefore, partial plans including online qualifiers for 2021 will be announced on December 3 at 8:30am EST via Zoom.

6. Revenue/Expense Summary

Financial results for the extended 2019-2020 academic year (Aug. 12, 2019 ~ Oct. 23, 2020) due to COVID-19 pandemic situation are as follows: **\$48,547.27** in cash revenue including the transferred balance from 2018-2019 year. Net expense was **\$45,644.67** and \$2,902.60 will be transferred to the next year. LTU College of Arts and Sciences supported **\$69,532.35** to pay part-time staff and student assistant hourly wages. Therefore, the total program cost was **\$115,177.02**. Tables 6~8 show the summary of cash revenue and expenditure.

Transfer from 2018-2019	\$18,001.76
Individual donors	\$1,772.26
Corporate/Org. Cash Sponsorship (*)	\$20,500.00
Team registration fees & other income	\$8,273.25
Total net cash income without transfer from last year	\$30,545.51
Total revenue including transfer from last year	\$48,547.27

(*) In-kind donations not included.

(Table 6) 2019-2020 Cash Revenue

Workshop lead instructor wage, part time faculty hours, and faculty summer hours	\$20,879.98
Student assistants' wage	\$0.00
Buying out faculty release time	\$3,361.00
Trophies, individual trophies, and plaques	\$1,654.25
Qualifier and Championship Medals	\$1,971.57

Supplies (Amazon web services, Cloudflare, IBM Watson, playing fields, office supp, signs, flags, banners, workshop food, USPS postage, UPS, etc.)	\$6,267.19
Give away & merchandise items (sanitizer spray)	\$878.36
Table & chair rental for World Championship	\$0.00
Poster & Banner printing	\$15.00
T-shirts for Judges, volunteers, and teams	\$0.00
Robofest staff travel; Team & Judge travel support	\$126.48
Out of State workshop support; Sponsored site support	\$992.50
Robot kits & parts (VEX IQ, Tetrix, PRIZM, Arduino)	\$8,943.70
Zoom webinar account fee	\$554.64
World Championship food	\$0.00
Net direct expenses	\$45,644.67

(Table 7) 2019-2020 Robofest Account Expense Summary

Part time staff wage support from College of Arts & Sciences	\$53,283.66
Student assistant wage support from College of Arts & Sciences	\$16,248.69
Total LTU Cash Support	\$69,532.35

(Table 8) LTU Direct Support Expense Summary in 2019-2020

Note that Table 8 does not include LTU's indirect cost. Table 9 shows cost per student data history since 2014.

	2014	2015	2016	2017	2018	2019	2020
Direct expense	\$158,356	\$155,303	\$168,784	\$146,085	\$141,908	\$155,482	\$115,177
# Stu. Served	1,962	2,017	2,575	2,846	2464	2489	1471
Cost / Student	\$80.71	\$77.00	\$65.55	\$51.33	\$57.59	\$62.47	\$78.30

(Table 9) Cost per student data since 2014

7. Recognition & Acknowledgement



(Figure 21) IEEE Sponsored Medals

Each student who participated in qualifying competitions before the lockdown in the USA received a medal sponsored by IEEE SEM (Southeastern Michigan Section) See Figure 21. Due to the shipping cost, team members of winning teams of ROWC can order the medals.

List of Winning Teams with participant names can be accessed at: https://www.robofest.net/images/1920/2020_Winners_List.pdf

Table 10 summarizes Robofest Online World Championship (ROWC) with web links for award winners, score sheet, highlight video, judge bios, and program of each competition category.

We would like to thank all the ROWC Exhibition, RoboArts, RoboMed, BottleSumo Time Trial, and Game Judges. Their short bios can be found in the Table 10 "Judge Bios" column.

Category	Award Winners	Score Sheet	Highlight Video	Judge Bios	Program
Jr. UMC	UMC Awards	Scores	Jr_UMC	Jr_UMC	Jr_UMC
Sr. UMC	UMC Awards	Scores	Sr_UMC	Sr_UMC	Sr_UMC
Jr. & Sr. RoboArts	RoboArts Awards	Jr Sr	RoboArts	RoboArts	RoboArts
Sr. & College RoboMed	RoboMed Awards	Sr College	RoboMed	RoboMed	RoboMed
Jr. Exhibition	Exhibition Awards	Scores	Jr Exh	Jr Exhibition	Jr Exhibition
Sr. Exhibition	Exhibition Awards	Scores	Sr Exh	Sr Exhibition	Sr Exhibition
Jr. BottleSumo Time Trial	BSTT Awards	Scores	Jr BSTT	Jr BSTT	Jr BSTT
Sr. BottleSumo Time Trial, CL & UL	BSTT Awards	Classic UL	Sr BSTT	Sr BSTT	Sr BSTT
Jr. Game - GolfBowl	GolfBowl Awards	Scores	Jr GolfBowl	Jr GolfBowl	Jr GolfBowl
Sr. Game - GolfBowl	GolfBowl Awards	Scores	Sr GolfBowl	Sr GolfBowl	Sr GolfBowl

(Table 10) Robofest Online World Championship (ROWC) 2020 Summary Table with Links

Robofest was again very fortunate this year to have 9 corporate/foundation Bronze or higher sponsors and 8 Friends level sponsors as shown in Figure 22. Without their support, Robofest & ROWC 2020 would not have been possible. Sponsor logos were shown on programs for warmup and qualifying competitions as well as all the highlight videos. A list of all the 2020 sponsors can be found at www.robofest.net/2020/sponsors.htm.



Partners



Friends of Robofest

Best Western Premier Detroit Southfield Hotel
 Dein-Maehroboter.de (Leading Lawn Robot Mower Site)
 Buckfire Law Firm
 Valpak (Direct Mail in Detroit)
 ART/DESIGN Group, Clawson, MI
 Robin G. Leclerc CJ & Min Chung

(Figure 22) Official Sponsors of Robofest 2019-2020

Gavin Coleman, Ed. D. (Coach ID 2782) was recognized as a 5 year anniversary coach during the ROWC award ceremony. We deeply thank them for his dedication and hard work for STEM education through robotics in Florida.



World Robofest 2020 QUALIFYING EVENTS

register now www.robofest.net

COMPETITION CATEGORIES
 Game: GolfBot!
 Exhibition
 Vision Centric Challenge (VCC)
 BottleSumo
 Unknown Mission Challenge (UMC)
 RoboParade
 RoboArts
 RoboMed

VIDEO QUALIFIERS
 Video Submissions deadline: 11:59 p.m., EDT, April 20, 2020
MICHIGAN INVITATIONAL EVENTS
 April 24–25, 2020 Lawrence Technological University
WORLD ROBOFEST CHAMPIONSHIP
 May 14–16, 2020 Lawrence Technological University

OFFICIAL QUALIFYING LOCATIONS
 (as of January 27, 2020)

INTERNATIONAL
 Addis Ababa University, Addis Ababa, Ethiopia
 Alexandria University, Wadi Hilla, Nova Scotia, Canada
 Alexandria Center for the Arts, Alexandria, Egypt
 Bannu Talib Consultants Ltd/Sheikh STEM Robotics, Abuja, Nigeria
 Brilliance International School, Hyderabad, India
 (Organized by Novatech Robot)
 Hellenic Gymnasium of Modern Heraklion, Crete, Greece
 (Organized by Robotics & Science Academy, Crete)
 Ethiopian Academy of Science, Addis Ababa, Ethiopia
 (Organized by Abadiya Robotics Computer & STEM Center)
 Ghana Robotics Academy Foundation, Accra Central, Ghana
 Jain University, Bengaluru, India, (Organized by Novatech Robot)
 Keystone School, Hyderabad, India (Organized by Novatech Robot)
 King Abdulaziz University, Jeddah, Saudi Arabia
 Phoenix STEM & Robotics Learning Center, Cebu, Philippines
 Robert Institute of Hong Kong, Kowloon, Hong Kong
 BECA & Hanyang University, Seoul, South Korea
 Robofest Latin America, Pachuca, Mexico
 (Organized by CEMEX)
 Shree Gauri Laxmi Sanskrit School, Nanoli, Kenya
 Science Museum of Moscow, St. Moscow (Organized by RHR)
 Department of Youth Affairs, Taoyuan, Taiwan
 (Organized by International Creativity Development Association)
 Robotics Foundation Limited, Blantyre, Malawi
 Watkinson High School, Portlouis, South Africa

Detailed information on registration, competition categories, rules, and prizes can be found at www.robofest.net. For more information, contact 248.204.3568 or robofest@ltu.edu.

Lawrence Technological University
 College of Arts and Sciences, Department of Mathematics and Computer Science, 21000 West Ten Mile Road, Southfield, MI 48075-1050, www.ltu.edu

ROBOFEST Little Robots, Big Missions
 A Competition Worthwhile Young Minds to Make the Machine

(Figure 23) Robofest 2020 poster

Robofest cannot reach our students without site hosts. We would like to applaud all the work done by our great site host organizers in Table 11. Without their leadership, dedication and sacrifice, the Robofest 2019-2020 season would not have been possible. All the sites are listed on 2020 poster shown in Figure 23. Table 12 lists National Directors who organized competitions in their countries not using Robofest registration system and/or sent teams to ROWC.

Site Name in RMS**	Site Host Organizer Name(s)
AbugidaRobotics_Ethiopia*	Dr. Tariku Fedaku / Eng. Mehret Walga
Abuja_BaunSTEMRobotics_Nigeria	Femi Fadairo
Alexandria_TechnoFuture_Egypt	Farid Hussien / Ayman El Kabbany
Beaverton_Mathletics_OR*	Shirley Ma
Bellevue_Cornerstone_FL*	Joe Moseley
Bengaluru_JainUniversity_India	I. A. Khan
Blantyre_Malawi*	Janet Kapito
BloomfieldHills_Cranbrook_MI*	Katie Bis
BloomfieldHills_Cranbrook_MI_BottleSumo*	Katie Bis
Canton_Achieve_MI*	Elizabeth Gaecke
Canton_CCA_MI*	Lalita Mishra
Canton_Gallimore_MI*	Cara Wegrzyn
Cloquet_MN*	Cameron Lindner
Crete_RSA_Greece_SAT*	Chara Kamnaki
Crete_RSA_Greece_SUN*	Chara Kamnaki
Detroit_UofD_MI*	Lawrence Schulte
Franklinville_Wellsville_NY*	Caitlin Bowen / David Taylor
Hyderabad_BrillianceInternationalSchool_India	I. A. Khan
Hyderabad_KeystoneSchool_India_Jan25	I. A. Khan
Hyderabad_KeystoneSchool_India_Jan26	I. A. Khan
Jasper_VincennesUniv_IN*	Marti Mauntel
Naic_Philippines*	Jennylou Pangilinan-Riel
Nairobi_Kenya*	Ronald Mokoro
Napoleon_NCS_MI*	Adam Draa
Napoleon_NCS_MI_BottleSumo*	Adam Draa
Oldsmar_Nielsen_FL	Emma Alaba
PlantCity_AdvantageAcademy_FL*	Keith Miller / Gavin Coleman
Saline_WCA_MI	Betty Recker
Sonoma_StFrancisSolano_CA*	Carlo Ligotti
TaoyuanCity_ICDA_Taiwan	Richard ChienChih Lo / Jason ChienTai Lo
Troy_Bethany_MI*	Brian Kincheloe
USA_Video_Qualifier	Robofest Staff
Warren_WWCS_MI*	Anna Raese / Becky Branch
WestBloomfield_WBHS_MI*	Andrea Foglietta
Wolfville_Acadia_Canada	Jenna Watson-Findley / Heather Travers

(*) The competitions were canceled due to COVID-19 pandemic

(**) RMS: Robofest Management System

(Table 11) Site Host Organizers using Robofest Management System

Country	National Director
Ghana	Dr. Yaw Okraku-Yirenkyi, GRAF
Hong Kong	Yau Ka Chun, RIHK
Korea	Stephen Seungdong Baek, RECA
Mexico	Dr. Ramiro Marrero, CENIPAD
Saudi Arabia	Eng. Mohammed Elhassan, BenaaEDU
South Africa	Pieter Pretorius/Mr. Jaco van Wyk
UAE	I. A. Khan, Novatech Robo

(Table 12) National Directors who organized competitions not using RMS and/or sent teams to ROWC

Math & Computer Science Department's Administrative Assistant, Marilyn Wiseman, provided dedicated services for handling purchasing & reimbursement requests, employment related paperwork, food coordination, among others. Tracy Kash, CoAS Dean's Office Administrative

Assistant, assisted Marilyn during her medical leave and managed the College of Arts & Sciences budget account for Robofest.

LTU administrators who *directly* supported Robofest this year include: President & CEO Dr. Virinder Moudgil (video remarks for ROWC), Vice President & Provost Dr. Tarek Sobh (ROWC award ceremonies), Dr. Srinu Kambhampati, Dean of College of Arts and Sciences (Kick-off remarks & Budget support), Matt Roush (Press releases), Mariana Hernandez Johannesen (Sponsorship), Renee Tambeau & Sofia Lulgjuraj (Poster), Charlene Ramos (Helpdesk director – laptop services), Brian Breen (Digital Media Specialist at Marketing + Public Affairs), Norman Plant & Thomas “Sam” Vukonich (Audio/Visual), and MCS Department Chair Dr. Patrick Nelson (FT position & transition).

Scott Lehman (Media Production Coordinator at eLearning Services) provided training and technical support for Zoom Webinars as well as the video production of opening & closing remarks.

Dr. Yawen Li, Department Chair of Biomedical Engineering helped us to launch a new competition category, RoboMed. She also served as a Judge and helped recruit Judges.

Dr. Chris Cartwright continued to be the Chief Game Judge, the most difficult & challenging position in Robofest.

Prof. Gordon Stein who is studying PhD at Vanderbilt University continued the maintenance of our Tomcat & Joomla webserver systems.

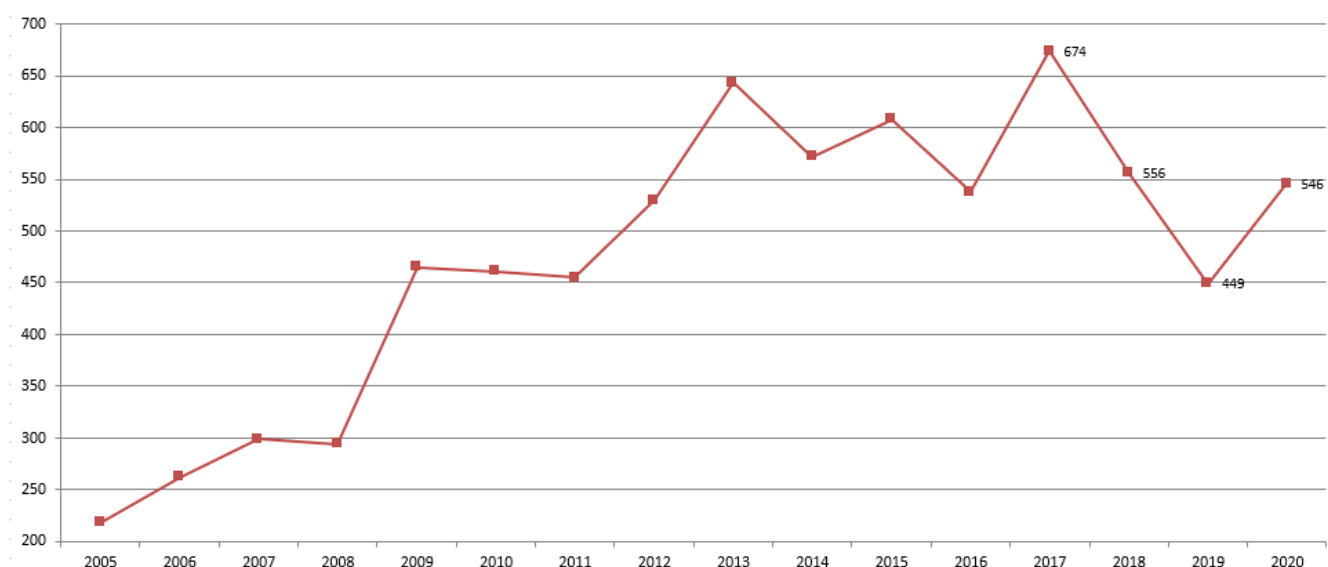
Prof. Joe DeRose who works for Ford Motor Company and Adjunct Professor in the Department of Mechanical Engineering at LTU was the chairperson of UMC. He played a great part in many aspect of Robofest rules.

Former student assistant Candace Byrnes who is now a Sports Reporter & Esports Show Host at Yellow Flag Productions, emceed ROWC closing & award ceremonies.

David Reeves developed online match timer, <https://robofestoss.azurewebsites.net/team/timerdemo>

We are so happy to announce that Robofest 2019-2020 season was completed without any full-time staff again. Part-time staff members were Elmer Santos (Assistant Director), Shannan Palonis (Coordinator), Pam Sparks (Coordinator), Teresa Dubois, and David Carbery.

Student assistants include Daniel R. Oliver, Mark Kocherovsky, Yancong Nie, Nikitha Subramanian, Parameshwari Tirupari. Thomas Brefeld, and Joseph Schulte.



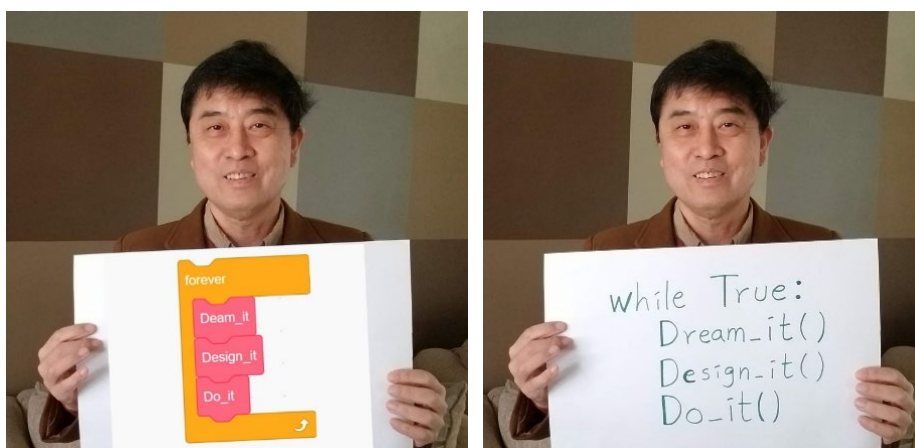
(Figure 21) Number of yearly registered site volunteers since 2005

We had 546 site & location volunteers registered on our system this year and we deeply thank all of them. See Figure 21 for the number of registered site volunteers since 2005. Short bios of all the ROWC Judges can be accessed in the Table 10 “Judge Bios” column.

In summary, as shown in section 4, we believe 2019-2020 Robofest has achieved its primary missions: inspiring students into STEM fields and supporting them even in this unprecedented Coronavirus year. We are proud that Robofest has been continuously inexpensive since its inception in 2000, while providing proven quality STEM education environments for students. Once again, we deeply thank everyone who has hosted, sponsored, supported, volunteered, worked, participated and learned in the 21st Robofest for the 2019-2020 year. 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 22nd annual Robofest 2021 season.

I have decided to step down from the Director of Robofest position. Prof. Chris Cartwright who has been with Robofest since 2005 will be the next Director. I wish Chris godspeed. An advisory board will be formed and I will assist Chris as a volunteer board member.

I would like to thank all the people who have been with Robofest since 1999. We have dreamed, designed, and done an exceptional educational program called Robofest.



Respectfully,
November 24, 2020

Chan Jin Chung

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