Learning about Manufacturing and STEM through Robotics

Adult and Youth Perceptions of the VEX Robotics Program

MAY 2016

Prepared by: Matthew Steele and Stephanie Nelson-Dusek

451 Lexington Parkway North | Saint Paul, Minnesota 55104
651-280-2700 | www.wilderresearch.org

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Summary

This report outlines the findings from two surveys. The first is a survey of youth who participated in the 2015-16 VEX Robotics program sponsored by the 360 Manufacturing Center of Excellence (360), and the second is a survey of adults (including parents, teachers, and coaches) who either participated in or had a student who participated in the VEX Robotics program. Key findings from these surveys are highlighted below.

- Survey participants were very satisfied with the VEX Robotics program (youth: 70%, adults: 76%) and the majority would definitely recommend the program to their peers (youth: 75%, adults: 88%).
- Generally, two-thirds of youth said that they had learned a lot from the program (66%). When asked about specific skills gained by working with a team, both youth and adults were most likely to say that youth had learned "working by trial and error" very well (youth: 73%, adults: 72%), followed by problem solving and creativity.
- Time management appears to be an issue for youth at the tournaments. In a list of skills learned by working with a team, less than a majority of youth and adult respondents felt that youth had learned time management very well (youth: 41%, adults: 37%).
- Among adults, the most common suggestions for improving the program were to be more proactive in communications about tournaments (12%) and provide more help to teams so they can participate (12%). Youth suggested improvements to both the equipment used at the tournaments (19%) and the scheduling (15%).
- After participating in the program, youth reported greater interest and confidence in science, technology, engineering, and math (STEM), as well as greater interest and awareness in manufacturing careers.
- While awareness and positive perceptions of manufacturing careers increased after the VEX Robotics program, only 29 percent of youth said they were very likely to consider a career in manufacturing.
- When asked how VEX could better incorporate information about manufacturing and STEM careers into its program, adults most often suggested having presentations about career opportunities at the tournaments, and youth most often suggested having new challenges at the tournaments and disseminating information about careers to participants.

Introduction

The VEX Robotics program engages teams of youth in building robots from kits and competing with other teams at scrimmages and tournaments. The program is intended to develop and improve technical and teamwork skills, along with awareness and interest in science, technology, engineering, and math (STEM) and manufacturing careers. The 360 Manufacturing Center of Excellence (360) uses the VEX Robotics program as part of its overall mission to build the pipeline of manufacturing students and workers in Minnesota.

Survey methodology

In order to help gauge the success of the VEX Robotics program at reaching its goals, as well as the satisfaction of participating youth and adults, 360 contracted with Wilder Research to conduct an evaluation after the final VEX Robotics tournament. This is the fourth year that Wilder has conducted this evaluation.

In February 2016, Wilder sent a web-based survey to 442 adults involved with the VEX Robotics program, including parents, coaches, and teachers. Adults who received an email also had the opportunity to forward a survey link to other adults and youth who may have participated in the VEX Robotics program; this methodology was used to help capture additional participants for whom no email addresses were available.

To reach youth, evaluators emailed a survey link to 257 email addresses that were provided through consent forms. Wilder and 360 worked together to develop a consent form that adults could distribute prior to each tournament. Parents could either write their own email address or provide the email address of their child. 360 staff collected all completed consent forms and sent them to Wilder staff. Parents and coaches were also sent the youth survey link (when they received their own survey) to share with their students or children; this methodology, of using consent forms and sending the youth survey link to adults, has worked well in past years. A copy of the consent form is attached to this report.

Survey results

This section highlights results from the youth and adult surveys related to respondents' characteristics, satisfaction with the VEX program, the knowledge and skills youth developed through their participation, and how the program changed youth and adult perceptions regarding STEM and manufacturing. Additional data tables can be found in the appendix of this report.

Respondent characteristics

In total, 161 adults and 112 youth completed a survey. Because we do not know the total, unduplicated number of children and parents who were involved in the VEX Robotics program in 2015, we cannot calculate a response rate.

The average age of youth who participated in the survey was 15 years old. The majority of respondents identified as white (81%) and male (72%). Six in ten (63%) had competed at the Saint Cloud VEX Robotics tournament, and a majority (67%) were competing with their high school team.

Adult respondents were split into two categories depending on how they responded to an initial question about their primary role in the VEX Robotics program; 72 percent identified as parents and 28 percent indicated they were a teacher or coach. The majority of adult survey respondents were white (91%), although gender varied according to the respondent's primary role. The majority of parent respondents were female (69%), while only 26 percent of teachers/coaches were female. Over half (52%) of survey respondents were employed in a career related to STEM or manufacturing.

Satisfaction with the program

Overall, both youth and adult respondents were satisfied with the VEX Robotics program and corresponding tournaments.

- Nearly all youth and adults were satisfied with the VEX Robotics program, and the majority were very satisfied (youth: 70%, adults: 76%). Parents were particularly pleased with the program: 80 percent were very satisfied, compared to 64 percent of teachers or coaches.
- Most respondents said they would definitely recommend the program to their peers (youth: 75%, adults: 88%).

- In terms of the specific tournaments, the majority of both youth and adult respondents reported feeling satisfied, although fewer youth were very satisfied with their tournament experience (youth: 57%, adults: 71%).
- In a series of statements about the program, the majority of youth strongly agreed that participating in a tournament made them want to be in the VEX Robotics program again next year (69%) (Figure 1).

1. Level of agreement with statements about the program, youth (N=107-108)

	Strongly agree		Somewhat agree		Somewhat disagree		Strongly disagree	
	N	%	N	%	N	%	N	%
The tournament made me want to be in the program next year.	75	69%	27	25%	2	2%	4	4%
I got some good ideas from studying other robots.	68	64%	33	31%	4	4%	2	2%
I got some good ideas from talking to other competitors.	53	50%	44	41%	7	7%	3	3%
Our team worked to manage our time at the tournament.	53	50%	37	35%	12	11%	5	5%
There was enough time between matches to make repairs, charge batteries, etc.	35	33%	52	49%	16	15%	4	4%

Note: Percentages may not equal 100, due to rounding.

- Both youth and adults were asked about ways the VEX Robotics program could be improved. In both surveys, at least three in ten respondents had no suggestions (youth: 39%, adults: 32%). For adults, the most common improvements suggested were better communications to parents and teachers about the logistics of the tournaments (12%), as well as help to teams in participating at the tournaments (12%). Suggestions from adults included the following responses:

> *As a new instructor, I need help. Maybe a class for instructors would be helpful. – Adult respondent*
>
> *Let us know earlier than a few days before a competition exactly WHAT papers the parents need to sign (waivers, etc.). Some competitions want specific things only a few days before! – Adult respondent*
>
> *More opportunities within the state. Maybe allowing those who have not participated elsewhere to bump a team who has, when the event is full. – Adult respondent*
>
> *[Our team] got a late start and we were locked out of most local competitions. It is sad that those competitions fill up with some schools having 3-4 teams and newer teams not being allowed to enter because they finished their robots late. – Adult respondent*

> *VEX in MN is growing fast with lots of teams and it is tough to get into tournaments. Regional events should let local teams sign up first then allow other teams to sign up to fill openings. – Adult respondent*

- For those who offered suggestions, the most common response among youth were improvements to the equipment used at the tournaments (24%) and the scheduling (17%).
- As seen in Figure 1 above, time management also appears to be an issue for youth. Only one-third of youth respondents strongly agreed that there was enough time between matches to make necessary repairs.

Skills gained through VEX Robotics program

Overall, the majority of students said that they learned at least "some" information from the VEX Robotics program, and two-thirds felt that they learned a lot (66%). When asked about the most interesting thing they learned, 29 percent of youth cited the technical skills they gained. Adults were asked about the most important skill students had learned while working on their robots; the most common response was problem solving (40%).

Youth and adults were also asked about specific skills students may have learned while working with their team. Both groups were most likely to say that youth had learned "working by trial and error" very well (youth: 73%, adults: 72%), followed by problem solving and using imagination or creativity. They were least likely to say that students had learned time management or teamwork (i.e., reaching agreement and motivation) very well (Figure 2).

2. Skills learned through working with a team, youth and adults

	Very well		Somewhat well		Not very well or not at all	
How well did youth learn…	**Adults**	**Youth**	**Adults**	**Youth**	**Adults**	**Youth**
Working by trial and error	72%	73%	26%	21%	2%	7%
Problem solving	65%	64%	32%	28%	1%	8%
Imagination or creativity	62%	65%	36%	28%	2%	6%
Visualizing (e.g., seeing a concept in your mind)	57%	60%	37%	32%	6%	8%
Leadership	50%	58%	42%	34%	8%	8%
Keeping the team motivated	42%	50%	48%	36%	10%	14%
Reaching agreement with your teammates	40%	45%	52%	40%	9%	15%
Making the most of your time	37%	41%	48%	42%	15%	17%

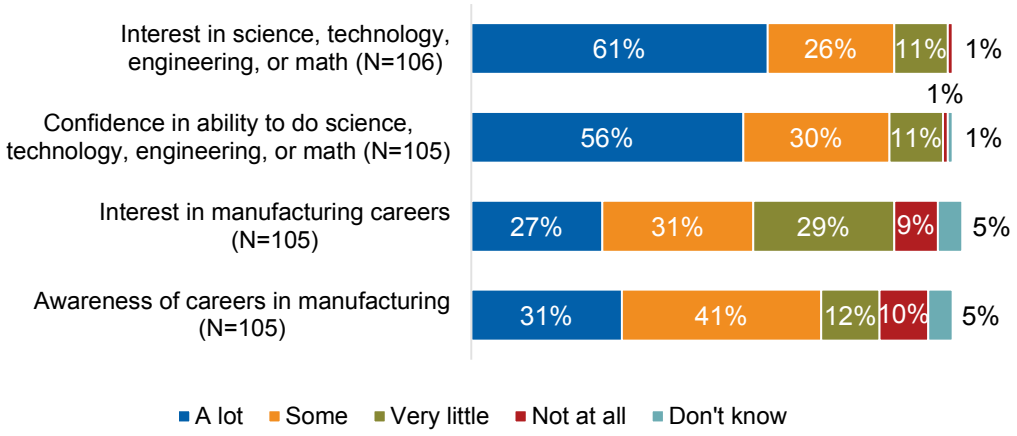
Note: Percentages may not equal 100, due to rounding. Adults (N=152-153); Youth (N=106-107).

Changes in perceptions of STEM and manufacturing

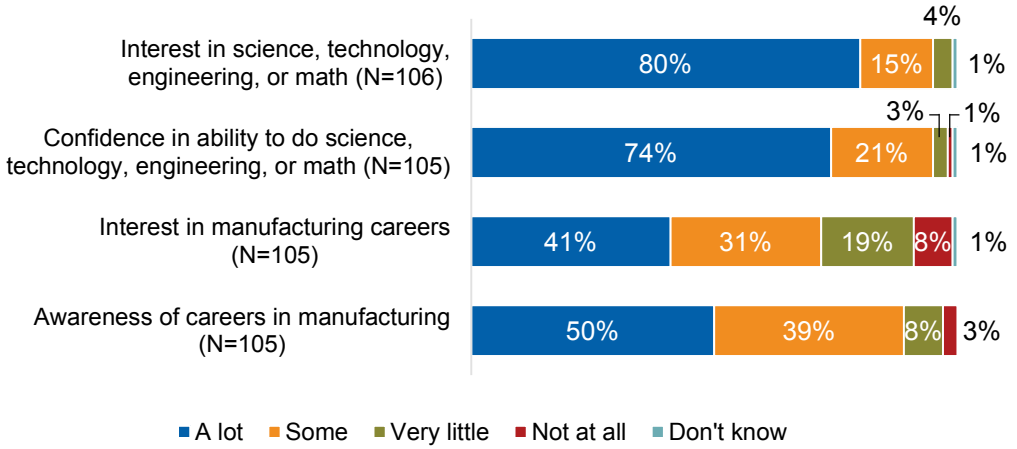
One of the main goals of these surveys is to gauge how youth perceptions of STEM and manufacturing may have changed after their participation in the VEX Robotics program. Both surveys asked participants to rate youth level of interest and confidence in STEM, as well as interest, awareness, and perceptions of manufacturing careers.

In all areas, there was an increase in the percentage of youth respondents saying that their perceptions had changed a lot. It is worth noting that interest and confidence in STEM was already quite high (Figures 3 and 4).

3. Youth perceptions, pre-VEX



4. Youth perceptions, post-VEX



Youth and adults were also asked about their overall perceptions of manufacturing careers. After participating in the VEX Robotics program, 89 percent of adults and 51 percent of youth thought manufacturing careers were "good" (Figure 5). Adults had more positive perceptions of manufacturing careers than youth, both before and after the program.

5. Perceptions of manufacturing careers, youth and adults

How do you feel about manufacturing careers…	Before		After		Change	
	Adults	Youth	Adults	Youth	Adults	Youth
Think they are good	50%	23%	89%	51%	+39	+28
Think they are just OK	35%	45%	8%	31%	-27	-14
Don't think they are good	2%	4%	0%	2%	-2	-2
Don't think about them	9%	19%	1%	7%	-8	-12
I am not sure	4%	9%	1%	9%	-3	0

Note: Percentages may not equal 100, due to rounding. Adults (N=149); Youth (N=105-106).

To further gauge perceptions of manufacturing careers, youth were given a list of 10 adjectives–5 positive and 5 negative–that could be associated with these careers. The most common words selected were advanced and creative (Figure 6). Youth were least likely to select the more negative adjectives of dark (6%), dangerous (20%), and dirty (29%).

6. Words that describe manufacturing careers, youth (N=103)

Which words best describe your thoughts about manufacturing careers? (Check as many as you would like.)	N	%
Advanced	71	69%
Creative	71	69%
Fun	54	52%
Modern	50	49%
Hard	47	46%
Noisy	47	46%
Exciting	45	44%
Dirty	30	29%
Dangerous	21	20%
Dark	6	6%

Note: Percentages equal more than 100, as respondents could choose multiple responses.

While youth awareness and perceptions of manufacturing careers increased after the VEX Robotics program, less than one-third felt that it was very likely that they would actually consider a career in a manufacturing field. On the other hand, the majority said they were very likely to consider a career in STEM (Figure 7).

7. Likelihood of pursuing STEM or manufacturing, youth (N=103-104)

After participating in the VEX Robotics program, how likely are you to…	Very likely		Somewhat likely		Not very/Not at all likely		I'm not sure	
	N	%	N	%	N	%	N	%
Take elective STEM courses in high school?	83	80%	14	13%	4	4%	3	3%
Consider studying STEM in college?	73	70%	19	18%	8	8%	4	4%
Consider a career in STEM?	72	70%	17	17%	11	11%	3	3%
Consider a career in manufacturing?	30	29%	37	36%	30	29%	6	6%

Note: Percentages may not equal 100, due to rounding.

Finally, respondents were asked how the VEX Robotics program could better incorporate information about manufacturing and STEM careers. Adult respondents suggested that the program organizers have more information about career options available at the tournaments, which could include presentations by local area companies at booths. Youth said they would like to see new challenges incorporated into the tournaments that are aligned with real manufacturing and STEM careers. Like the adult respondents, they also suggested having more local area career representatives available to present at the tournaments.

Issues to consider

As we have found in past surveys, the 360 Manufacturing Center of Excellence, through the VEX Robotics program, has successfully built awareness and positive perceptions of STEM and manufacturing careers. Youth also showed increased interest in studying and pursuing STEM careers and reported developing the skills needed for these fields, such as learning by trial and error, problem solving, and creativity.

However, while youth awareness of manufacturing careers and perceptions of those careers has increased, youth are not considering manufacturing careers in the same way they would STEM careers. In order to further increase interest in manufacturing careers, 360 and the VEX Robotics program should consider including more local employers in the tournaments and connecting participants to local manufacturing professionals.

Other suggestions for improving the program include:

- Improved communication to parents and teachers about the logistics and rules of the tournaments, especially for those who are new to the program.
- More opportunities for teams to participate in tournaments around the state. This could include longer registration periods, more tournaments, or more teams allowed to participate per tournament.
- More guidance for youth on how to manage their time well; time management appears to be a weaker skill for youth.

Incorporating these suggestions should help to strengthen an already strong and well-liked program.

Appendix

Youth consent form

VEX Robotics Tournaments
Consent language for photo release form

To help improve the VEX Robotics competitions, Wilder Research has been asked by Minnesota's VEX organizers (360 Center of Excellence) to survey participants. Wilder will be sending out a brief web-based survey to students, parents, and teachers who participated in the tournament to help improve future VEX Robotics competitions. Participation in the survey is voluntary and all answers will be kept confidential.

If you are willing to complete a survey, please provide your name and email address below. We would also like your permission to send the survey to your child who participated in the VEX Robotics competition.

Your name (please print):

_____

Your email address:

_____ _____

☐ I give my permission for Wilder Research to send a survey link to my child for a one-time, follow-up survey on the St. Cloud VEX Robotics competition.

Child's name:

_____

Child's email address (if different from parent):

_____

Child's team name:

_____

☐ I DO NOT give my permission for Wilder Research to send a survey link to my child.

If you have any questions about this evaluation, please email Matthew Steele at Wilder Research (matthew.steele@wilder.org).

Your signature: _____

Date: _____

Data tables: Youth survey

Y1. Satisfaction with the overall VEX Robotics program (N=112)

	N	%
Very satisfied	78	70%
Somewhat satisfied	33	29%
Not very satisfied	1	1%
Not at all satisfied	0	0%

Y2. Would recommend the VEX Robotics program to other students (N=112)

	N	%
Yes, definitely	84	75%
Yes, maybe	22	20%
No	3	3%
I'm not sure	3	3%

Note: Percentages do not equal 100 due to rounding.

Y3. Satisfaction with the VEX Robotics tournaments (N=112)

	N	%
Very satisfied	64	57%
Somewhat satisfied	44	39%
Not very satisfied	4	4%
Not at all satisfied	0	0%

Y4a. Tournaments attended (N=107)

Hosted by…	N	%
St. Cloud Technical & Community College (State tournament)	67	63%
Osseo Senior High	62	58%
Riverland Community College	25	23%
Bemidji State University	24	22%
Northland Community & Technical College	22	21%
St. Cloud Technical & Community College (VEX IQ)	12	11%
Other	52	49%

Note: Percentages equal more than 100, as respondents could choose multiple responses.

Y4b. Number of other tournaments attended (N=52)

If "other tournament" please specify how many other tournaments you attended	N	%
1	29	56%
2	20	38%
3	3	6%

Y5. Number of scrimmages attended (N=107)

	N	%
None	29	27%
1-3	42	39%
4-6	6	6%
7-9	0	0%
10 or more	1	1%
Don't know	29	27%

Y6. Skills learned through working with robots (N=106-107)

	Very well		Somewhat well		Not very well or not at all	
How well did you learn…	N	%	N	%	N	%
Making design changes	63	59%	38	36%	6	6%
Working with materials (e.g., metals)	60	56%	35	33%	12	11%
Building to specifications	55	51%	44	41%	8	7%
Electricity, batteries, or charges	53	50%	35	33%	18	17%
Gear ratios	43	41%	45	42%	18	17%
Stability and weight distribution	41	38%	44	41%	22	21%
Computer programing	31	29%	27	25%	48	45%
Sensors or other electronic components	12	11%	38	36%	56	53%

Note: Percentages may not equal 100, due to rounding.

Y7. Skills learned through working with a team (N=106-107)

How well did you learn…	Very well		Somewhat well		Not very well or not at all	
	N	%	N	%	N	%
Working by trial and error	77	73%	22	21%	7	7%
Imagination or creativity	69	65%	32	28%	6	6%
Problem solving	68	64%	30	28%	8	8%
Visualizing (e.g., seeing a concept in your mind)	64	60%	34	32%	8	8%
Leadership	61	58%	36	34%	9	8%
Keeping yourself and the team motivated	54	50%	38	36%	15	14%
Reaching agreement with your teammates	48	45%	43	40%	16	15%
Making the most of your time	44	41%	45	42%	18	17%

Note: Percentages may not equal 100, due to rounding.

Y8. Level of agreement with statements about the program (N=107-108)

	Strongly agree		Somewhat agree		Somewhat disagree		Strongly disagree	
	N	%	N	%	N	%	N	%
The tournament made me want to be in the program next year.	75	69%	27	25%	2	2%	4	4%
Our team worked to manage our time at the tournament.	53	50%	37	35%	12	11%	5	5%
I got some good ideas from studying other robots.	68	64%	33	31%	4	4%	2	2%
I got some good ideas from talking to other competitors.	53	50%	44	41%	7	7%	3	3%
There was enough time between matches to make repairs, charge batteries, etc.	35	33%	52	49%	16	15%	4	4%

Note: Percentages may not equal 100, due to rounding.

Y9. Friends and family watched the tournament (N=108)

Did one or more of your friends or family come to watch the tournament(s)?	N	%
Yes	94	87%
No	13	12%
I'm not sure	1	1%

Y10a. Ways parents and adults helped youth in program (N=100)

	N	%
Provided transportation	81	81%
Provided space for your team to meet	45	45%
Helped your team plan	28	28%
Helped you with research	23	23%
Worked with you on the robot	19	19%
Other	23	23%

Note: Percentages equal more than 100, as respondents could choose multiple responses.

Y10b. Other ways parents and adults helped youth in program (N=23)

	N	%
Food preparation	6	26%
Fundraising	6	26%
Personal support	4	17%
Event coordination	3	13%
Other	7	30%

Note: Percentages equal more than 100, as respondents could give more than one response. Responses were coded into the above categories.

Y11. Interest in science, technology, engineering, or math (N=106)

	Pre-VEX Robotics program	Post-VEX Robotics program	Change
A lot	61%	80%	+19
Some	26%	15%	-11
Very little	11%	4%	-7
Not at all	1%	0%	-1
Don't know	0%	1%	+1

Note: Percentages may not equal 100, due to rounding.

Y12. Confidence in ability to do science, technology, engineering, or math (N=105)

	Pre-VEX Robotics program	Post-VEX Robotics program	Change
A lot	56%	74%	+18
Some	30%	21%	-9
Very little	11%	3%	-8
Not at all	1%	1%	0
Don't know	1%	1%	0

Note: Percentages may not equal 100, due to rounding.

Y13. Interest in manufacturing careers (N=105)

	Pre-VEX Robotics program	Post-VEX Robotics program	Change
A lot	27%	41%	+14
Some	31%	31%	0
Very little	29%	19%	-10
Not at all	9%	8%	-1
Don't know	5%	1%	-4

Note: Percentages may not equal 100, due to rounding.

Y14. Awareness of careers in manufacturing (N=105)

	Pre-VEX Robotics program	Post-VEX Robotics program	Change
A lot	31%	50%	+19
Some	41%	39%	-2
Very little	12%	8%	-4
Not at all	10%	3%	-7
Don't know	5%	0%	-5

Note: Percentages may not equal 100, due to rounding.

Y15. Impressions of manufacturing careers before and after competition (N=105-106)

	Pre-VEX Robotics program	Post-VEX Robotics program	Change
Thought they were good	23%	51%	+28
Thought they were just OK	45%	31%	-14
Didn't think they were good	4%	2%	-2
Didn't think about them	19%	7%	-12
I am not sure	9%	9%	0

Y16. Words that describe manufacturing careers (N=103)

Which words best describe your thoughts about manufacturing careers? (Check as many as you would like.)	N	%
Advanced	71	69%
Creative	71	69%
Fun	54	52%
Modern	50	49%
Hard	47	46%
Noisy	47	46%
Exciting	45	44%
Dirty	30	29%
Dangerous	21	20%
Dark	6	6%

Note: Percentages equal more than 100, as respondents could choose multiple responses.

Y17. Likelihood of pursuing STEM or manufacturing (N=103-104)

After participating in the VEX Robotics program, how likely are you to…	Very likely		Somewhat likely		Not very or not at all likely		I'm not sure	
	N	%	N	%	N	%	N	%
Take elective STEM courses in high school?	83	80%	14	13%	4	4%	3	3%
Consider studying STEM in college?	73	70%	19	18%	8	8%	4	4%
Consider a career in STEM?	72	70%	17	17%	11	11%	3	3%
Consider a career in manufacturing?	30	29%	37	36%	30	29%	6	6%

Note: Percentages may not equal 100, due to rounding.

Y18. Amount learned from the VEX Robotics Program (N=101)

	N	%
Learned a lot	67	66%
Learned some	25	25%
Learned a little	8	8%
Did not learn anything	1	1%

Y19. Most interesting thing learned (N=77)

	N	%
Technical skills	22	29%
Teamwork	17	22%
Problem solving/strategizing	14	18%
Ideation/working with different ideas	8	10%
Insight about personal abilities	7	9%
Hands-on work skills	7	9%
Time management	4	5%
Communication skills	3	4%
Other	10	13%

Note: Percentages equal more than 100, as respondents could give more than one response. Responses were coded into the above categories.

Y20. Suggestions for improving the VEX Robotics program (N=67)

	N	%
None	26	39%
Equipment improvements	13	19%
Schedule improvements	10	15%
Other competition logistics improvements	9	13%
Staff improvements	4	6%
Participant improvements	2	3%
Other	4	6%

Note: Percentages equal more than 100, as respondents could give more than one response. Responses were coded into the above categories.

Y21. Suggestions for better relating robotics to careers (N=61)

	N	%
Nothing/Doing well	15	25%
Don't know	13	21%
Suggestions for new challenges/components of VEX programs (i.e., ideas for expanding program)	8	13%
Disseminate information/Have presenters or career reps	7	11%
More advertising/getting community involved	5	8%
Showing actual use of robots/concepts in typical manufacturing/STEM jobs	4	7%
Use or highlight specific skills	4	7%
Other	6	10%

Y22. Age of youth (N=100)

	N	%
8 to 12 years old	18	18%
13 to 14 years old	28	28%
15 to 16 years old	34	34%
17 to 18 years old	20	20%

Average age
15 years old

Y23. Gender of youth (N=100)

	N	%
Male	72	72%
Female	28	28%

Y24. Race and ethnicity of youth (N=100)

	N	%
White or Caucasian	81	81%
Hispanic, Chicano, or Latino	5	5%
Asian American or Pacific Islander	3	3%
African American or Black	1	1%
American Indian or Native American	1	1%
Don't know or prefer not to answer	8	8%

Y25. Type of group in which youth was involved (N=100)

	N	%
A high school team	67	67%
A middle school team	23	23%
An elementary school team	4	4%
Boy Scouts or Girl Scouts	2	2%
4-H	0	0%
Other (please specify)	4	4%

Note: Percentages do not equal 100 due to rounding. "Other" responses included, "Neighborhood team," "A mix of high school team and middle school team," "Friend group non-affiliated with school," and "Afterschool program."

Y26. School or group affiliation (N=86)

	N	%
Mankato area schools	14	16%
Osseo area schools	10	12%
Windom area schools	8	9%
Austin area schools	6	7%
Marshall area schools	5	6%

Note: All other categories had fewer than 5 respondents and were excluded from this table.

Data tables: Adult survey

A1. Role the VEX Robotics program? (N=161)

	N	%
Parent	116	72%
Coached a VEX Robotics team (N=116)	3	3%
Teacher/Coach	45	28%
Had a child in the tournament (N=45)	12	27%

A2. Satisfaction with the overall VEX Robotics program

	Parent (N=116)		Teacher/Coach (N=45)		All Adults (N=161)	
	N	%	N	%	N	%
Very satisfied	93	80%	29	64%	122	76%
Somewhat satisfied	21	18%	15	33%	36	22%
Not very satisfied	2	2%	1	2%	3	2%
Not at all satisfied	0	0%	0	0%	0	0%

Note: Percentages may not equal 100, due to rounding.

A3. Would recommend the VEX Robotics program to other adults?

	Parent (N=116)		Teacher/Coach (N=45)		All Adults (N=161)	
	N	%	N	N	%	N
Yes, definitely	101	87%	41	91%	142	88%
Yes, maybe	12	10%	2	4%	14	9%
No	0	0%	0	0%	0	0%
I'm not sure	3	3%	2	4%	5	3%

Note: Percentages may not equal 100, due to rounding.

A4. Satisfaction with the VEX Robotics tournaments?

	Parent (N=110)		Teacher/Coach (N=41)		All Adults (N=151)	
	N	%	N	%	N	%
Very satisfied	82	75%	25	61%	107	71%
Somewhat satisfied	27	25%	15	37%	42	28%
Not very satisfied	1	1%	1	2%	2	1%
Not at all satisfied	0	0%	0	0%	0	0%

Note: Percentages may not equal 100, due to rounding.

A5. Tournaments your children or students attended

	Parent (N=110)		Teacher/Coach (N=42)		All Adults (N=152)	
Hosted by…	N	%	N	%	N	%
Bemidji State University	21	19%	12	29%	33	22%
Osseo Senior High	59	54%	13	31%	72	47%
Northland Community & Technical College	25	23%	16	38%	41	27%
Riverland Community College	37	34%	12	29%	49	32%
St. Cloud Technical & Community College (VEX IQ)	21	19%	7	17%	28	18%
St. Cloud Technical & Community College (State tournament)	86	78%	21	50%	107	70%
Other	38	36%	18	43%	56	37%

Note: Percentages equal more than 100, as respondents could choose multiple responses.

A6. Number of scrimmages your children or students attended

	Parent (N=109)		Teacher/Coach (N=43)		All Adults (N=152)	
	N	%	N	%	N	%
None	16	15%	15	35%	31	20%
1-3	49	45%	23	54%	72	47%
4-6	19	17%	5	12%	24	16%
7-9	3	3%	0	0%	3	2%
10 or more	7	6%	0	0%	7	5%
Don't know	15	14%	0	0%	15	10%

Note: Percentages may not equal 100, due to rounding.

A7. Skills <u>your child</u> learned through working with a team (N=109-110)

(Parents only)	Very well	Somewhat well	Not very well	Not at all	Don't know
Working by trial and error	75%	23%	1%	0%	1%
Imagination or creativity	67%	30%	1%	0%	2%
Problem solving	65%	33%	1%	0%	1%
Visualizing (e.g., seeing a concept in your mind)	63%	33%	4%	0%	1%
Leadership	57%	33%	8%	0%	2%
Keeping the team motivated	48%	42%	6%	2%	3%
Reaching agreement with teammates	42%	49%	6%	2%	1%
Making the most of time	41%	47%	10%	1%	1%

Note: Percentages may not equal 100, due to rounding.

A8. Skills <u>your students</u> learned through working with a team (N=43)

(Teachers/Coaches only)	Very well	Somewhat well	Not very well	Not at all	Don't know
Problem solving	65%	33%	2%	0%	0%
Working by trial and error	60%	35%	5%	0%	0%
Imagination or creativity	47%	49%	5%	0%	0%
Visualizing (e.g., seeing a concept in your mind)	42%	47%	12%	0%	0%
Reaching agreement with teammates	33%	58%	7%	2%	0%
Leadership	30%	63%	7%	0%	0%
Keeping the team motivated	26%	58%	16%	0%	0%
Making the most of time	26%	49%	23%	2%	0%

Note: Percentages may not equal 100, due to rounding.

A9. Skills <u>children/students</u> learned through working with a team (N=152-153)

(All adults)	Very well	Somewhat well	Not very well	Not at all	Don't know
Working by trial and error	72%	26%	2%	0%	1%
Problem solving	65%	32%	1%	0%	1%
Imagination or creativity	62%	36%	2%	0%	1%
Visualizing (seeing a solution in the mind)	57%	37%	6%	0%	1%
Leadership	50%	42%	8%	0%	1%
Keeping the team motivated	42%	48%	9%	1%	1%
Reaching agreement with teammates	40%	52%	7%	2%	1%
Making the most of time	37%	48%	14%	1%	1%

Note: Percentages may not equal 100, due to rounding.

A10. Child/Student interest in science, technology, engineering, or math

	Parent (N=108)			Teacher/Coach (N=40-41)			All Adults (N=148-149)		
	Pre-VEX	Post-VEX	Change	Pre-VEX	Post-VEX	Change	Pre-VEX	Post-VEX	Change
A lot	47%	82%	+35	30%	71%	+41	43%	79%	+36
Some	44%	18%	-26	63%	29%	-34	49%	21%	-28
Very little	7%	0%	-7	8%	0%	-8	7%	0%	-7
Not at all	1%	0%	-1	0%	0%	0	1%	0%	-1
Don't know	0%	0%	0	0%	0%	0	0%	0%	0

Note: Percentages may not equal 100, due to rounding.

A11. Child/Student confidence in ability to do science, technology, engineering, or math

	Parent (N=108)			Teacher/Coach (N=40-41)			All Adults (N=148-149)		
	Pre-VEX	Post-VEX	Change	Pre-VEX	Post-VEX	Change	Pre-VEX	Post-VEX	Change
A lot	43%	80%	+37	20%	58%	+38	36%	74%	+38
Some	46%	20%	-26	58%	39%	-19	49%	26%	-23
Very little	10%	0%	-10	23%	2%	-21	14%	1%	-13
Not at all	0%	0%	0	0%	0%	0	0%	0%	0
Don't know	1%	0%	-1	0%	0%	0	1%	0%	-1

Note: Percentages may not equal 100, due to rounding.

A12. Child/Student interest in manufacturing careers

	Parent (N=108)			Teacher/Coach (N=40-41)			All Adults (N=148-149)		
	Pre-VEX	Post-VEX	Change	Pre-VEX	Post-VEX	Change	Pre-VEX	Post-VEX	Change
A lot	15%	37%	+22	8%	41%	+33	13%	38%	+25
Some	31%	44%	+13	48%	54%	+6	36%	47%	+11
Very little	38%	12%	-26	38%	2%	-36	38%	9%	-29
Not at all	13%	4%	-9	3%	0%	-3	10%	3%	-7
Don't know	3%	3%	0	5%	2%	-3	3%	3%	0

Note: Percentages may not equal 100, due to rounding.

A13. Child/Student awareness of manufacturing careers

	Parent (N=108)			Teacher/Coach (N=40-41)			All Adults (N=148-149)		
	Pre-VEX	Post-VEX	Change	Pre-VEX	Post-VEX	Change	Pre-VEX	Post-VEX	Change
A lot	9%	43%	+34	13%	51%	+38	10%	45%	+35
Some	37%	46%	+9	33%	46%	+13	36%	46%	+10
Very little	41%	9%	-32	45%	0%	-45	42%	7%	-35
Not at all	8%	0%	-8	5%	0%	-5	7%	0%	-7
Don't know	5%	2%	-3	5%	2%	-3	5%	2%	-3

Note: Percentages may not equal 100, due to rounding.

A14. Adult impressions of manufacturing careers before and after competition

	Parent (N=108)			Teacher/Coach (N=41)			All Adults (N=149)		
	Pre-VEX	Post-VEX	Change	Pre-VEX	Post-VEX	Change	Pre-VEX	Post-VEX	Change
Thought they were good	42%	88%	+46	71%	93%	+22	50%	89%	+39
Thought they were just OK	39%	10%	-29	24%	2%	-22	35%	8%	-27
Didn't think they were good	3%	0%	-3	0%	0%	0	2%	0%	-2
Didn't think about them	13%	2%	-11	0%	0%	0	9%	1%	-8
I am not sure	4%	0%	-4	5%	5%	0	4%	1%	-3

Note: Percentages may not equal 100, due to rounding.

A15. Parents' level of agreement with statements about the program (N=107-108)

(Parents only)	Strongly agree	Somewhat agree	Somewhat disagree	Strongly Disagree	Don't know
The tournament made my child want to be in the program next year.	86%	9%	4%	0%	1%
My child got some good ideas from studying other robots.	79%	19%	1%	1%	1%
My child got some good ideas from talking to other competitors.	65%	27%	2%	1%	5%
My child worked to manage their time at the tournament.	65%	32%	1%	0%	2%
There was enough time between matches for teams to make repairs, charge batteries, etc.	59%	30%	7%	1%	4%

Note: Percentages may not equal 100, due to rounding.

A16. Teachers/Coaches' level of agreement with statements about the program (N=40)

(Teachers/Coaches only)	Strongly agree	Somewhat agree	Somewhat disagree	Strongly Disagree	Don't know
The tournament made my team members want to be in the program next year.	80%	10%	5%	0%	5%
My team members got some good ideas from studying other robots.	78%	15%	3%	0%	5%
My team members got some good ideas from talking to other competitors.	68%	28%	0%	0%	5%
There was enough time between matches for teams to make repairs, charge batteries, etc.	45%	45%	5%	0%	5%
My team members worked to manage their time at the tournament.	40%	55%	0%	0%	5%

Note: Percentages may not equal 100, due to rounding.

A17. Most important STEM skill students learned while working on their robot (N=105)

(All adults)	N	%
Problem solving	42	40%
Teamwork	16	15%
Engineering	13	12%
Programming	13	12%
Design	8	8%
Working with hands	7	7%
Time management	7	7%
Communication	4	4%
Other	20	19%

Note: Percentages equal more than 100, as respondents could give more than one response. Responses were coded into the above categories.

A18. Suggestions for improving the VEX Robotics program (N=69)

(All adults)	N	%
None	22	32%
Help with team responsibilities during tournament	8	12%
Proactive communication about tournament events	8	12%
Different divisions of competition	6	9%
More tournaments	5	7%
Improvements to tournament staff	4	6%
More openings for teams to participate in a tournament	4	6%
Other	12	17%

Note: Percentages equal more than 100, as respondents could list multiple suggestions. Responses were coded into the above categories.

A19. Suggestions for better relating robotics to careers (N=61)

(All adults)	N	%
Have presentations about future education/career opportunities (career booths, presenters, vendors, etc.)	14	23%
None/Doing well/Don't know	8	13%
Disseminate career information at tournaments	7	11%
More general involvement form manufacturers	7	11%
Facilitate connections with working professionals and college students for participants	6	10%
Field trips/visits to STEM/manufacturing businesses	5	8%
Other	19	31%

Note: Percentages equal more than 100, as respondents could give more than one response. Responses were coded into the above categories.

A20a. Team received a sponsorship (N=40)

(Teachers/Coaches only)	N	%
Yes	24	60%
No	16	40%

A20b. Amount of sponsorship received (N=24)

(Teachers/Coaches only)	N	%
Less than $500	5	21%
$501 to $1,500	10	42%
$1,501 to $2,000	2	8%
$2,001 to $2,500	2	8%
Over $2,500	5	21%

Note: Three respondent's that answered "over $2,500" and gave specific sponsorship amounts of, $5,500, $4,500, and $3,000.

A21. Employed in a STEM or manufacturing field (N=144)

(All adults)	N	%
Yes	75	52%
No	69	48%

A22. Gender of adult respondents, by primary role

	Parents (N=105)		Teachers/Coaches (N=38)	
	N	%	N	%
Female	72	69%	10	26%
Male	33	31%	28	74%

A23. Race and ethnicity of adult respondents (N=143)

	N	%
White or Caucasian	130	91%
Asian American or Pacific Islander	5	3%
Hispanic, Chicano, or Latino	2	1%
Multiracial	2	1%
African American or Black	0	0%
American Indian or Native American	0	0%
Prefer not to answer	4	3%