360° Summer Robotics Camps

Survey of youth participants

Introduction

An important aspect of the 360° ATE Regional Center (360°) mission is to expose students to and increase enthusiasm for STEM-related careers. To this end, 360° and its partners hold technology and manufacturing summer camps for youth.

Survey methodology

To help understand the impact of these summer camps, 360° staff members distributed self-administrated questionnaires to participants at the end of each camp. The same questions are asked of all campers.

In total, 244 youth participants completed the survey from 11 different camps, hosted by: Bemidji State University; Central Lakes College; Girl Scouts in Bemidji (two different camps); Lake Superior College; Minneapolis Community & Technical College; Northland Community & Technical College at three locations: East Grand Forks campus, Greenbush Public Library, and Thief River Falls campus; Riverland Community College; and St. Cloud Technical and Community College. Camp sizes ranged from 5 to 63 participants.

Findings from the survey are outlined below and detailed data tables are appended to this report. Also, readers should bear in mind that the pre-post questions (which analyze changes in attitude over time) were asked during the same survey. Participants were asked to recall their opinions from a time before they attended camp.

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Demographics

Boys outnumbered girls in camp attendance (66% to 34%). Most of the individual camps had a male majority, with the exception of the two Girl Scout camps, where all participants were girls, and the camp hosted by Riverland Community College (53% female).

The average age of youth who participated in the survey was 12 years old, and students ranged from grade 4 through college. Survey participants primarily identified themselves as white (81%), and less than 10 percent of participants identified with any other racial or ethnic group.

The majority of participants (84%) reported that at least one of their parents had attended college, with two-thirds (67%) saying that both had attended. Ten percent were unsure whether or not their parents had attended college.

Summary

This section outlines key findings from the survey.

- Nearly all youth (98%) said they liked their camp, with 85 percent saying they liked it a lot.
- The majority of participants (52%) said that the best thing about camp was building robots or doing other hands-on work.
- One-quarter of participants said there was nothing they would do to make camp better, but for those who offered suggestions, the top recommendation was having more time to build.
- Interest in STEM and confidence in personal ability rose as a result of the camps.
- Awareness and perceptions of manufacturing careers also increased. In fact, of all pre-post questions asked, the greatest positive change occurred in perceptions of manufacturing careers. This was especially true for girls.
- Youth most often described manufacturing careers as fun, exciting, or creative; very few used negative adjectives.
- Along with awareness and perceptions of manufacturing careers, interest in careers also rose; however, the increase was less dramatic than in other pre-post questions.

Detailed findings

This section provides more detailed results from the summer camp surveys, specifically satisfaction with the summer camps, the knowledge and skills that youth developed through their participation, and how the camps changed interest and confidence in STEM, as well as perceptions of manufacturing careers.

Satisfaction with camps

When asked about their overall opinion of the camp they attended, nearly all youth (98%) said they liked it at least a little bit and 85 percent liked it a lot.

The survey asked participants to explain why they initially wanted to attend their camp, and the most common answer was because the camp sounded fun or exciting (31%). Other top answers were to build robots or do other hands-on work (19%), because the participant had previous interest in some aspect of the camp, such as robots or electronics (16%), or to learn something new (14%).

After attending, the majority of youth said that the best thing about camp was building robots or doing other hands-on work (52%). The next most common response was using their final product in some way, such as robot wrestling or demolition derby (14%) (Figure 1).

1. Best thing about camp (N=231)

Best thing about camp	N	%
Hands-on work/Building robots	121	52%
Using the final product (e.g. demolition derby, wrestling)	33	14%
Meeting new people	23	10%
Other camp things (e.g. swimming, food, counselors)	23	10%
Being creative/designing	13	6%
Everything	10	4%
It was fun (unspecified)	10	4%
Learning something new	10	4%
Staying in the dorms	5	2%
Trying different classes/projects	4	2%
Other	9	4%

Note: *Percentages equal more than 100% as respondents were able to give multiple reasons; Open-ended responses to the questions were coded into the above categories.*

When asked if they would refer their friends to the summer camp they attended, 62 percent said "yes, definitely" and another 30 percent said "yes, maybe." Two percent would not recommend their camp and seven percent were unsure if they would.

One-quarter of youth participants said there was nothing they would do to make their camp better. For those who offered suggestions, the top recommendations were focused on providing more of what the camp was already offering rather than offering something new. These responses included having more time to build (11%), followed closely by having more or different parts to work with (10%), and more classes or projects to work on (9%).

Learning from camp

Youth were asked about what they learned at their respective camps and, in all categories, the majority said they learned at least something (Figure 2). The greatest number of participants (54%) said they learned a lot about manufacturing and making things. Fewer youth reported learning a lot about careers in manufacturing; however roughly three-quarters (76%) learned some or a lot and, as seen in the sections below, awareness and perceptions of manufacturing careers generally increased between the beginning and end of camp.

2. Learning at camp

How much did you learn about the following at camp?

	A lot	Some	Very little	Not at all
Manufacturing and making things (N=237)	54%	35%	10%	2%
Finding solutions to problems (N=238)	48%	39%	8%	4%
Working together in teams (N=241)	46%	35%	14%	5%
Science, technology, engineering, and math (N=240)	38%	48%	9%	5%
Careers in manufacturing (N=239)	36%	40%	16%	7%

Interest and confidence in STEM

In general, the 360° summer camps did a lot to increase interest and confidence in STEM for youth participants.

Although participants clearly entered camp with a strong interest in science, technology, engineering, and math (45% said they had a lot of interest), this interest rose by 19 percentage points, to 64 percent, by the end of camp.

This increase in interest was more dramatic for girls than it was for boys, but girls also started out with a lower level of interest in STEM. Thirty percent of girls reported they had a lot of interest in STEM at the beginning of camp and 57 percent said the same at the end (compared to 54% and 67% of boys).

Similarly, youth confidence in STEM abilities rose throughout their camp attendance. Less than half (41%) reported they had "a lot" of confidence in their abilities before camp and nearly two-thirds (64%) reported the same after the camp.

Boys were more confident at the beginning and end of camp than girls. Nearly half (48%) started with high levels of confidence and over 72 percent finished camp with high levels of confidence. While girls' confidence in their STEM abilities rose over the course of their camp participation, slightly less than half (48%) said they had a lot of confidence by the end of camp (up from 27% pre-camp).

The length of a camp may also play a role in the increased confidence of campers. While the confidence of participants rose by 13 percentage points for camps that lasted less than one day, it rose by 24 and 25 percentage points for camps that lasted over several days. It should be noted, however, that the shortest camps (<1 day) were for Girl Scouts, and gender may have played a role in the smaller increase in confidence. Also, only five survey participants attended a camp that lasted for more than one week, so while the increase appears dramatic (40 percentage points), it is based on a much smaller number (Figure 3).

3. Pre/Post confidence in STEM abilities by length of camp

Confident in ability to do science, technology, engineering, or math (% saying "a lot")	Before camp	After camp	Change
Less than 1 day (N=36)	19%	32%	+13
2-3 days (N=68)	43%	67%	+24
4-7 days (N=128)	46%	71%	+25
More than 1 week (N=5)	20%	60%	+40

Awareness and perceptions of manufacturing careers

In addition to increasing interest and confidence in STEM, the summer camps made youth more aware of manufacturing careers and greatly improved their perceptions of these careers (Figure 4). By the end, 52 percent of participants said they had "a lot" of awareness, versus 28 percent at the beginning of camp. This awareness increased for both boys and girls; however, as with other categories, boys started out with a higher level of awareness.

There was also a greater increase in awareness of manufacturing careers for camps that lasted more than one day.

4. Awareness of manufacturing careers (pre- and post-camp)

Aware of manufacturing careers	Before camp (N=235)	After camp (N=235)	Change
A lot	28%	52%	+24
Some	42%	34%	-8
Very little	20%	9%	-11
Not at all	10%	5%	-5

Of all the pre-post questions asked in the survey, the greatest change came in the perceptions that youth have of manufacturing careers. Only 29 percent of youth reported they thought of manufacturing careers as good before camp, while 61 percent said the same after attending camp (Figure 5). Almost half (45%) of participants increased their opinion of manufacturing careers. This includes movement upward from any level, whether that is "I didn't think about them" to "I think they are just OK" or "I thought they were just OK" to "I think they are good."

Girls, in particular, experienced a jump in positive perceptions towards manufacturing careers, from 23 percent before camp to 63 percent after camp.

The length of a camp did not appear to make a big difference in changing perceptions; all groups saw large increases in campers who said that manufacturing careers are good. However, youth who attended a camp for more than four days had the greatest change in positive perceptions.

5. Perceptions of manufacturing careers (pre- and post-camp)

Perceptions of manufacturing careers	Before camp (N=232)	After camp (N=234)	Change
I thought/think they were/are good	29%	61%	+32
I thought/think they were/are just OK	37%	27%	-10
I didn't/don't think they were/are good	4%	1%	-3
I didn't/don't think about them	18%	2%	-16
I'm not sure	12%	9%	-3

Youth were also asked to consider adjectives that describe manufacturing careers, both in open-ended and structured question formats. When asked which words come to mind when they think of someone in a manufacturing career, the most common response was "fun or exciting" (24%). Other top responses included "hands-on or building" (14%), words that related to general fields, like "technology, "robotics," or "science" (12%), and "industry" (11%). Very few participants offered negative adjectives, such as "boring or dull" (3%).

In a structured question that provided 10 adjectives (5 positive and 5 negative), the most common responses were that manufacturing careers are creative (73%) and fun (68%). Again, negative adjectives, such as dark, dangerous, or dirty, were not selected as often by participants. The negative adjective selected most often was "noisy" (45%).

Given their increased awareness and positive perceptions of manufacturing, it is not surprising that interest in manufacturing careers also increased; however, this increase was less dramatic. Over one-quarter of participants (27%) said they had a lot of interest in manufacturing careers before camp, whereas 42 percent said the same after camp (Figure 6). Both boys and girls increased their interest in manufacturing careers, with 48 percent of boys and 32 percent of girls expressing "a lot" of interest by the end of camp.

Youth who attended longer camps (more than one day) appeared to have increased interest in manufacturing careers.

6. Interest in manufacturing careers (pre- and post-camp)

Interested in manufacturing careers	Before camp (N=235)	After camp (N=237)	Change
A lot	27%	42%	+15
Some	31%	35%	+4
Very little	31%	13%	-18
Not at all	11%	9%	-2

Conclusion

Overall, the findings from the summer camp surveys are positive and do not suggest any critical issues for 360° to consider at this point. Respondents had a high level of satisfaction with the camps, youth are engaged and learning, and the camps appear to have a positive impact on perspectives regarding STEM and manufacturing careers, particularly for girls.

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Demographics

A1. Number of participants (N=244)

	N	%
Riverland College	63	26%
Central Lakes College	32	13%
St. Cloud	32	13%
Lake Superior College	23	9%
Girl Scouts (Group A)	19	8%
Girl Scouts (Group B)	18	7%
Bemidji State University	16	7%
Northland-East Grand Forks	15	6%
Northland-Thief River Falls	11	5%
Northland-Greenbush	10	4%
Minneapolis	5	2%

A2. Gender (N=241)

	N	%
Male	158	66%
Female	83	34%

A3. Camp by gender

	Male	Female
Riverland College (N=60)	47%	53%
Central Lakes College (N=32)	97%	3%
St. Cloud (N=32)	88%	12%
Lake Superior College (N=23)	78%	22%
Girl Scouts (Group A) (N=18)	0%	100%
Girl Scouts (Group B) (N=19)	0%	100%
Bemidji State University (N=16)	94%	6%
Northland-East Grand Forks (N=15)	87%	13%
Northland-Thief River Falls (N=11)	100%	0%
Northland-Greenbush (N=10)	90%	10%
Minneapolis (N=5)	100%	0%

A4. Age (N=239)

	N	%
9 years old	22	9%
10 years old	27	11%
11 years old	49	21%
12 years old	29	12%
13 years old	44	18%
14 years old	32	13%
15 years old	18	8%
16 years old	11	5%
17 years old	7	3%

Average age
12 years old

A5. Grade level (N=241)

	N	%
Grade 4	21	9%
Grade 5	30	12%
Grade 6	49	20%
Grade 7	38	16%
Grade 8	38	16%
Grade 9	27	11%
Grade 10	22	9%
Grade 11	10	4%
Grade 12	4	2%
College	2	1%

A6. Race/Ethnicity (N=235)

	N	%
White or Caucasian	191	81%
American Indian or Native American	17	7%
Bi- or multi-racial	13	6%
Hispanic, Chicano, or Latino	7	3%
Asian American or Pacific Islander	6	3%
African American or Black	1	<1%

A7. Camp by race/ethnicity

	Black	American Indian	Asian	Hispanic	White	Multi-racial
Riverland College (N=57)	0%	7%	0%	7%	84%	2%
Central Lakes College (N=32)	0%	0%	0%	0%	94%	6%
St. Cloud (N=32)	0%	0%	9%	3%	88%	0%
Lake Superior College (N=23)	4%	0%	4%	0%	74%	17%
Girl Scouts (Group A) (N=17)	0%	47%	0%	0%	29%	24%
Girl Scouts (Group B) (N=18)	0%	17%	11%	0%	72%	0%
Bemidji State University (N=16)	0%	6%	0%	0%	94%	0%
Northland-East Grand Forks (N=14)	0%	7%	0%	0%	93%	0%
Northland-Thief River Falls (N=11)	0%	0%	0%	0%	82%	18%
Northland-Greenbush (N=10)	0%	0%	0%	0%	100%	0%
Minneapolis (N=5)	0%	0%	0%	40%	60%	0%

A8. Parents attended college (N=213)

	N	%
Yes, both	158	67%
Yes, one	41	17%
No, neither	14	6%
Don't know	24	10%

Participant responses

A9. Overall opinion of camp (N=240)

Opinion of camp	N	%
I liked it a lot	204	85%
I liked it a little bit	31	13%
I did not like it very much	4	2%
I did not like it at all	1	<1%

A10. Reasons for coming to summer camp (N=229)

Reasons for coming to camp	N	%
It sounded fun/exciting	72	31%
To build robots/Hands-on work	44	19%
I had previous interest in some aspect of the camp (e.g. robots, electronics, building)	36	16%
To learn something new	33	14%
To stay in a dorm/Learn more about college	18	8%
It was fun last year/I wanted to come back	15	7%
Someone made me go	10	4%
To meet new people	5	2%
My friend was attending	2	1%
To get away from home	2	1%
Other	10	4%

Note: *Percentages equal more than 100% as respondents were able to give multiple reasons; Open-ended responses to the questions were coded into the above categories.*

A11. Best thing about camp (N=231)

Best thing about camp	N	%
Hands-on work/Building robots	121	52%
Using the final product (e.g. demolition derby, wrestling)	33	14%
Meeting new people	23	10%
Other camp things (e.g. swimming, food, counselors)	23	10%
Being creative/designing	13	6%
Everything	10	4%
It was fun (unspecified)	10	4%
Learning something new	10	4%
Staying in the dorms	5	2%
Trying different classes/projects	4	2%
Other	9	4%

Note: *Percentages equal more than 100% as respondents were able to give multiple reasons; Open-ended responses to the questions were coded into the above categories.*

A12. Referring friends (N=239)

Would refer friends to camp	N	%
Yes, definitely	147	62%
Yes, maybe	72	30%
No	4	2%
I'm not sure	16	7%

A13. Improving camp (N=214)

What could make camp better	N	%
Nothing	53	25%
More time to build	24	11%
More/different parts to work with	22	10%
More classes/projects	20	9%
More free time/leisurely activities	13	6%
Longer/better lunches	13	6%
Bigger/more advanced robots	9	4%
Dividing younger from older kids	7	3%
If camp lasted longer	7	3%
Getting my own supplies	5	2%
Learning more about college	5	2%
Having a better partner	3	1%
Winning	2	1%
Other	40	19%

Note: *Percentages equal more than 100% as respondents were able to give multiple reasons; Open-ended responses to the questions were coded into the above categories.*

A14. Learning at camp

How much did you learn about the following at camp?

	A lot	Some	Very little	Not at all
Manufacturing and making things (N=237)	54%	35%	10%	2%
Finding solutions to problems (N=238)	48%	39%	8%	4%
Working together in teams (N=241)	46%	35%	14%	5%
Science, technology, engineering, and math (N=240)	38%	48%	9%	5%
Careers in manufacturing (N=239)	36%	40%	16%	7%

A15. Interest in STEM (pre- and post-camp)

Interested in science, technology, engineering, or math	Before camp (N=240)	After camp (N=241)	Change
A lot	45%	64%	+19
Some	32%	27%	-5
Very little	16%	7%	-9
Not at all	6%	2%	-4

A16. Pre/Post interest in STEM for girls

Interested in science, technology, engineering, or math	Before camp (N=83)	After camp (N=83)	Change
A lot	30%	57%	+27
Some	36%	30%	-6
Very little	22%	10%	-12
Not at all	12%	4%	-8

A17. Pre/Post interest in STEM for boys

Interested in science, technology, engineering, or math	Before camp (N=155)	After camp (N=155)	Change
A lot	54%	67%	+13
Some	30%	26%	-4
Very little	14%	6%	-8
Not at all	3%	1%	-2

A18. Pre/Post interest in STEM by length of camp

Interested in science, technology, engineering, or math (% saying "a lot")	Before camp	After camp	Change
Less than 1 day (N=37)	30%	51%	+21
2-3 days (N=67)	48%	61%	+13
4-7 days (N=131)	49%	69%	+20
More than 1 week (N=5)	40%	40%	0

Note: *It is important to note that, for all "length of camp" tables, only 5 survey respondents participated in a camp that was more than 1 week long; therefore, the change in percentage looks more dramatic than in other categories.*

A19. Confidence in STEM abilities (pre- and post-camp)

Confident in ability to do science, technology, engineering, or math	Before camp (N=237)	After camp (N=241)	Change
A lot	41%	64%	+23
Some	41%	29%	-12
Very little	13%	4%	-9
Not at all	6%	3%	-3

A20. Pre/Post confidence in STEM abilities for girls

Confident in ability to do science, technology, engineering, or math	Before camp (N=81)	After camp (N=83)	Change
A lot	27%	48%	+21
Some	40%	42%	+2
Very little	21%	4%	-17
Not at all	12%	6%	-6

A21. Pre/Post confidence in STEM abilities for boys

Confident in ability to do science, technology, engineering, or math	Before camp (N=154)	After camp (N=155)	Change
A lot	48%	72%	+24
Some	40%	22%	-18
Very little	9%	5%	-4
Not at all	3%	2%	-1

A22. Pre/Post confidence in STEM abilities by length of camp

Confident in ability to do science, technology, engineering, or math (% saying "a lot")	Before camp	After camp	Change
Less than 1 day (N=36)	19%	32%	+13
2-3 days (N=68)	43%	67%	+24
4-7 days (N=128)	46%	71%	+25
More than 1 week (N=5)	20%	60%	+40

Note: *It is important to note that, for all "length of camp" tables, only 5 survey respondents participated in a camp that was more than 1 week long; therefore, the change in percentage looks more dramatic than in other categories.*

A23. Awareness of manufacturing careers (pre- and post-camp)

Aware of manufacturing careers	Before camp (N=235)	After camp (N=235)	Change
A lot	28%	52%	+24
Some	42%	34%	-8
Very little	20%	9%	-11
Not at all	10%	5%	-5

A24. Pre/Post awareness of manufacturing careers for girls

Aware of manufacturing careers	Before camp (N=81)	After camp (N=81)	Change
A lot	17%	44%	+27
Some	46%	40%	-6
Very little	25%	11%	-14
Not at all	12%	5%	-7

A25. Pre/Post awareness of manufacturing careers for boys

Aware of manufacturing careers	Before camp (N=153)	After camp (N=152)	Change
A lot	34%	57%	+23
Some	40%	31%	-9
Very little	18%	7%	-11
Not at all	9%	5%	-4

A26. Pre/Post awareness of manufacturing careers by length of camp

Aware of manufacturing careers (% saying "a lot")	Before camp	After camp	Change
Less than 1 day (N=37)	11%	28%	+17
2-3 days (N=67)	31%	55%	+24
4-7 days (N=126)	33%	57%	+24
More than 1 week (N=5)	0%	50%	+50

Note: *It is important to note that, for all "length of camp" tables, only 5 survey respondents participated in a camp that was more than 1 week long; therefore, the change in percentage looks more dramatic than in other categories.*

A27. Perceptions of manufacturing careers (pre- and post-camp)

Perceptions of manufacturing careers	Before camp (N=232)	After camp (N=234)	Change
I thought/think they were/are good	29%	61%	+32
I thought/think they were/are just OK	37%	27%	-10
I didn't/don't think they were/are good	4%	1%	-3
I didn't/don't think about them	18%	2%	-16
I'm not sure	12%	9%	-3

A28. Pre/Post perceptions of manufacturing careers for girls

Perceptions of manufacturing careers	Before camp (N=69)	After camp (N=73)	Change
I thought/think they were/are good	23%	63%	+40
I thought/think they were/are just OK	46%	34%	-12
I didn't/don't think they were/are good	7%	1%	-6
I didn't/don't think about them	23%	1%	-22

A29. Pre/Post perceptions of manufacturing careers for boys

Perceptions of manufacturing careers	Before camp (N=135)	After camp (N=140)	Change
I thought/think they were/are good	37%	69%	+32
I thought/think they were/are just OK	40%	28%	-12
I didn't/don't think they were/are good	4%	1%	-3
I didn't/don't think about them	19%	3%	-16

A30. Pre/Post perceptions of manufacturing careers by length of camp

Perceptions of manufacturing careers (% saying "good")	Before camp	After camp	Change
Less than 1 day (N=32)	16%	48%	+32
2-3 days (N=56)	36%	63%	+27
4-7 days (N=114)	36%	73%	+37
More than 1 week (N=3)	33%	75%	+42

Note: *It is important to note that, for all "length of camp" tables, only 5 survey respondents participated in a camp that was more than 1 week long; therefore, the change in percentage looks more dramatic than in other categories.*

A31. Adjectives for manufacturing careers, open-ended (N=203)

Words that come to mind when thinking of someone in a manufacturing career	N	%
Fun/exciting	48	24%
Hands-on/building	29	14%
Technology/Robotics/Science	24	12%
Industry	23	11%
Hard-working	21	10%
Smart	18	9%
Creative/problem solving	17	8%
A good job	12	6%
Hard/difficult	9	4%
Person I know (e.g. relative)	9	4%
Repetitive	6	3%
Boring/dull	5	3%
Talented	4	2%
Nothing	2	1%
Other	29	14%

Note: *Percentages equal more than 100% as respondents were able to give multiple reasons; Open-ended responses to the questions were coded into the above categories.*

A32. Descriptions of manufacturing careers (N=238)

Words that best describe manufacturing careers	N	%
Creative	174	73%
Fun	161	68%
Exciting	127	53%
Advanced	121	51%
Modern	113	48%
Noisy	106	45%
Hard	81	34%
Dirty	74	31%
Dangerous	69	29%
Dark	14	6%

Note: *Percentages equal more than 100% as respondents were able to give multiple reasons*

A33. Interest in manufacturing careers (pre- and post-camp)

Interested in manufacturing careers	Before camp (N=235)	After camp (N=237)	Change
A lot	27%	42%	+15
Some	31%	35%	+4
Very little	31%	13%	-18
Not at all	11%	9%	-2

A34. Pre/Post interest in manufacturing careers for girls

Interested in manufacturing careers	Before camp (N=80)	After camp (N=82)	Change
A lot	18%	32%	+14
Some	26%	38%	+12
Very little	38%	20%	-18
Not at all	19%	11%	-8

A35. Pre/Post interest in manufacturing careers for boys

Interested in manufacturing careers	Before camp (N=154)	After camp (N=153)	Change
A lot	32%	48%	+16
Some	33%	34%	+1
Very little	28%	10%	-18
Not at all	7%	9%	+2

A36. Pre/Post interest in manufacturing careers by length of camp

Interested in manufacturing careers (% saying "a lot")	Before camp	After camp	Change
Less than 1 day (N=36)	14%	22%	+8
2-3 days (N=68)	24%	43%	+19
4-7 days (N=126)	33%	48%	+15
More than 1 week (N=5)	0%	40%	+40

Note: *It is important to note that, for all "length of camp" tables, only 5 survey respondents participated in a camp that was more than 1 week long; therefore, the change in percentage looks more dramatic than in other categories.*