



STEAM Academy Impact & Outcomes: 2021 Calendar Year

January, 2022

City of Aurora

TinkRworks

APS Training Academy

Executive Summary



- On the heels of a successful summer 2020 STEAM pilot program, City of Aurora, TinkRworks, and APS Training Academy (APS) created a partnership in 2021 known as the Aurora STEAM Academy to provide hands-on STEAM programming for underserved 1st- 8th grade children within the City. The overall goal of the effort was to spark an interest in children to explore STEAM opportunities in the future and also assimilate knowledge around key STEAM topics.
- Two different STEAM projects were chosen for delivery to children, both of which immersed children in project-based learning (PBL) environments and provided them a holistic STEAM experience, weaving together elements of design, building, electronics integration, and computer programming; at the end of their projects, the children kept everything that they created. The two projects were:
 - **Art Alive:** 1st – 4th graders participated in this project which focused on bringing artwork to life—with lights, sounds, and motion—as people observed the artwork.
 - **RoverBot:** 4th – 8th graders worked to create their own robots which they could program to perform different functions the children desired, such as moving, sensing, & reacting to the robot’s environment.
- These projects were delivered using STEAM projects and curriculum from TinkRworks, facilitation and implementation from APS, and access to students, infrastructure, and funding from City of Aurora. In total, 625 students participated in the program with high levels of diversity:
 - Of the total participants, 55% were either Hispanic or Black/African American
 - 55% of participants were male; 45% were female
 - 64% of participant households fell within the 0 – 50 AMI segment
- To measure the overall enjoyment and enrichment gained through the effort, surveys were distributed to participants both before taking their classes and upon completion to understand student attitudes and knowledge assimilation. The survey data was then collated, analyzed, and synthesized to yield overall outcomes.
- Outcomes were objectively derived using a formalized methodology. These outcomes are presented in detail as part of this document; key takeaways of the analysis include the following:
 - **Diverse population targets achieved:** Overall targets for ethnic and gender diversity achieved as well as AMI targets.
 - **Children have strong desires around creating/building items and computer-programming:** Going into the program, children overwhelmingly indicated they have a very strong desire to create/build “something” and use computer programming to “bring their creation to life”.
 - **Enjoyment exceeded expectations around creation & programming:** Results showcased that enjoyment of children in the specific areas of creating/building exceeded their ingoing expectations & desires.
 - **Those initially hesitant were transformed into enthusiasts:** Students who initially were not looking forward to STEAM programming responded with “I loved it” when asked about their enjoyment level upon completion of their participation.
 - **Knowledge assimilation clearly showcased:** Students clearly and empirically demonstrated knowledge gain around key content areas such as science, technology, and coding.
 - **Children seek more STEAM Academy opportunities:** Participants overwhelmingly expressed an interest in taking additional STEAM Academy programming opportunities.
- Outcomes highlight that the ingoing goal of sparking interest in STEM activities as well as assimilating knowledge were both met and exceeded by participants. Additionally, enjoyment by all participants was also clearly evident as was a very strong desire to take additional Aurora STEAM Academy programs.

Document structure



1 Data-collection methodology

2 STEAM Academy demographics

3 Impact of younger-age program: Art Alive

4 Impact of older-age program: RoverBot

City of Aurora STEAM Academy Impact: Data-collection methodology



Program overview

Pre and post surveys were given to City of Aurora participants during the City of Aurora's STEAM Academy 2021 programming:

- Two sets of projects were delivered by TinkRworks across 1st – 8th graders. Students were banded into two groups:
 - Art Alive: targeted ages of 6 – 9
 - RoverBot: targeted ages of 9 – 14
- Focus was on understanding the impact of STEAM Academy programming across a variety of factors:
 - Desire to engage in STEM programming
 - Experience level with technology and desire to use technology to solve problems
 - Desire for creating/building & computer programming
 - Level of enjoyment during overall STEM-programming experience
 - Knowledge assimilation

Participant population

In total, 625 students participated in STEAM Academy projects in 2021:

- Art Alive: 353 participants, RoverBot: 272 participants
- Diverse set of demographics achieved:
 - 55% of participants were either Black/African American or Hispanic
 - Nearly equal splits of male students to female participants: 55% males to 45% females
 - 64% of participants were from 0 – 50 AMI income bracket
- Diverse set of venues also utilized, including Main Baptist, Community, and APS Training Academy—pilot programs also successfully run onsite at schools

City of Aurora STEAM Academy Impact: Data-collection methodology (continued)



Survey details

- Pre and post surveys administered by APS staff
 - Pre surveys collected key demographic information, prior STEM experiences¹, incoming desire to engage in activities, and ingoing content knowledge
 - Post survey asked similar questions to pre surveys but also added dimensions around enjoyment of projects and also around desire to pursue further STEM opportunities
- Students entered inputs directly onto computerized forms; APS staff supported students in case issues arose (e.g., understanding of questions and/or technological issues)
- Parents not involved in computer-entry process

Data analysis details

- All analysis was performed solely on submitted survey results; anecdotal information outside of surveys was not incorporated
- Unless indicated otherwise, pre-survey data was used in demographic information for each program while only paired surveys (i.e., surveys were definitive student linkage between pre post surveys) were used to showcase mindset shifts, attitude changes, and knowledge assimilation
- Overall submitted rates were as follows:
 - Art Alive (targeted ages of 6 – 9):
 - ❖ Pre survey: 228 respondents
 - ❖ Post survey: 146 respondents
 - ❖ Paired surveys: 88
 - RoverBot:
 - ❖ Pre survey: 181 respondents
 - ❖ Post survey: 131 respondents
 - ❖ Paired surveys: 64

Document structure



- 1 Data-collection methodology
- 2 STEAM Academy demographics**
- 3 Impact of younger-age program: Art Alive
- 4 Impact of older-age program: RoverBot

Aurora STEAM Academy: Demographics for 2021 programs

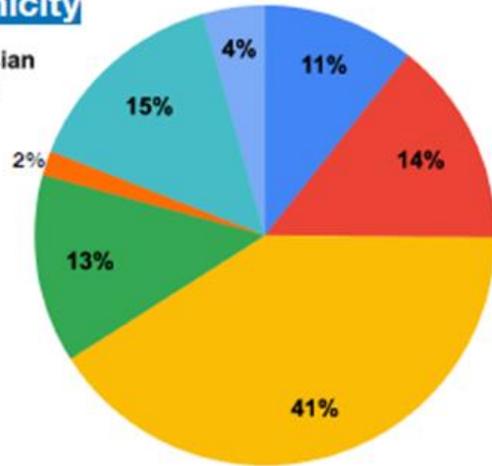


625

Students Served

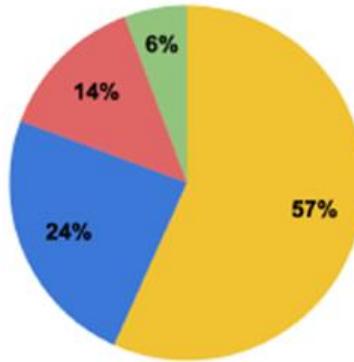
Race/Ethnicity

- White Caucasian
- Black/African American
- Hispanic
- Asian
- Native
- Multiracial
- Prefer not to answer



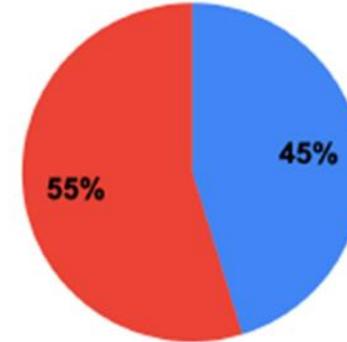
Served at

- APS Training Academy
- Main Baptist
- Community
- School



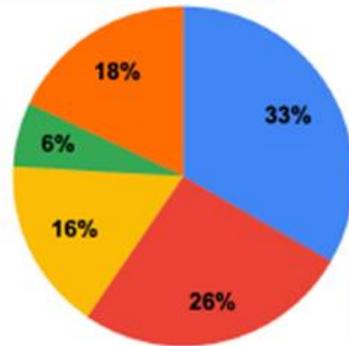
Gender

- Female
- Male



School District

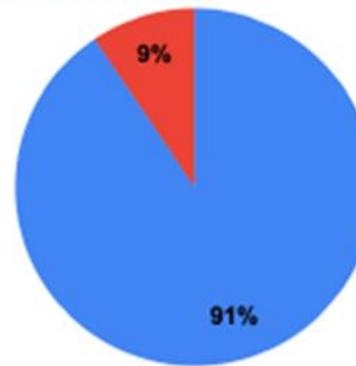
- D131
- D129
- D204
- D308
- Other*



* Homeschooled or Aurora Private/Religious School

Residents

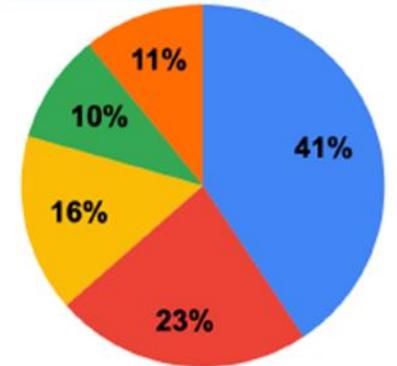
- Aurora
- Other*



* Not living in Aurora but attending an Aurora school

Income Bracket

- 0-30 AMI
- 30-50 AMI
- 50-80 AMI
- 80-100 AMI
- OVER 100

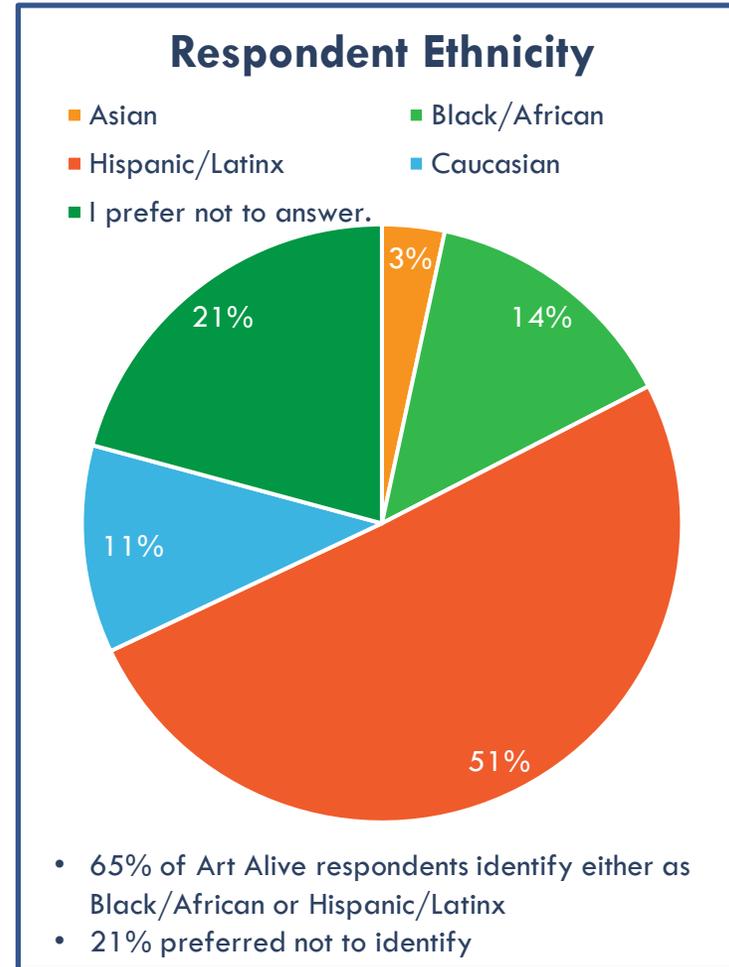
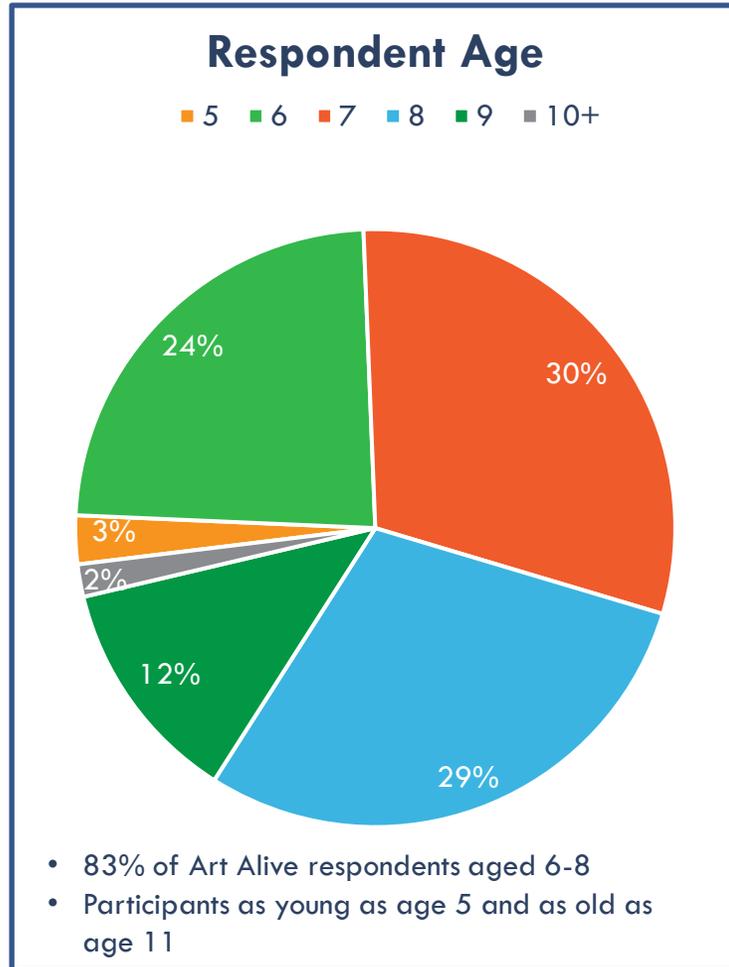


Document structure



- 1 Data-collection methodology
- 2 STEAM Academy demographics
- 3 Impact of younger-age program: Art Alive**
- 4 Impact of older-age program: RoverBot

Demographics for younger-aged program: Art Alive (N = 228¹)



¹ Number of respondents completing initial Art Alive surveys

Ingoing experiences and expectations for Art Alive: Limited experience but something they look forward to doing

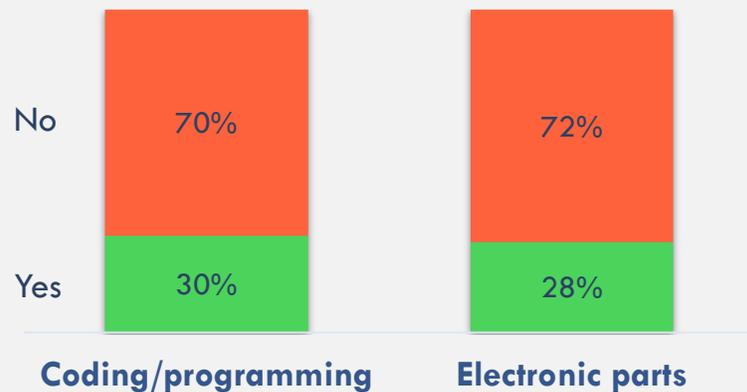


QUESTION ASKED

1. Do you have prior experience in coding or programming?
2. Have you ever built a project that has electronic parts?

Ingoing experience level of respondents (N = 228)

100% = 228 respondents



QUESTION ASKED

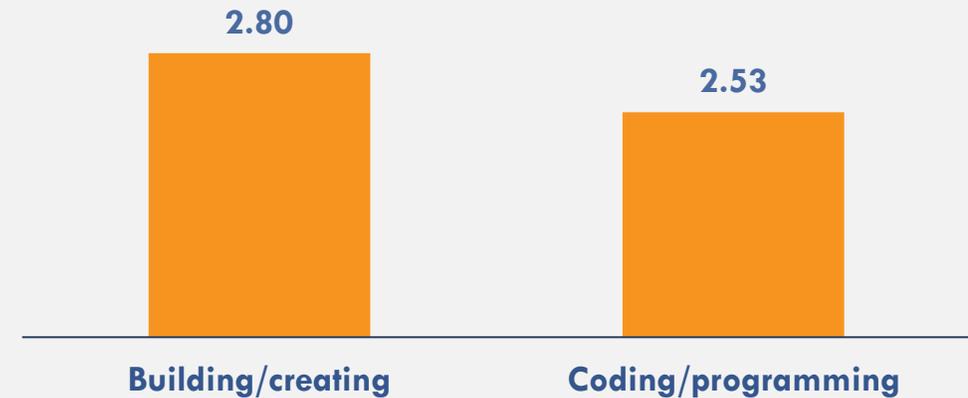
In this project, are you looking forward to...

Select the answer that best represents how you feel:

1. Building/creating something
 2. Coding/computer programming
- Yes (3)
 - Maybe (2)
 - No (1)

Average expectations (N = 228)

Maximum = 3.00



Art Alive: Experiences surpassed initial student expectations



PRE-SURVEY QUESTION ASKED

In this project, are you looking forward to _____ ?

Select the answer that best represents how you feel:

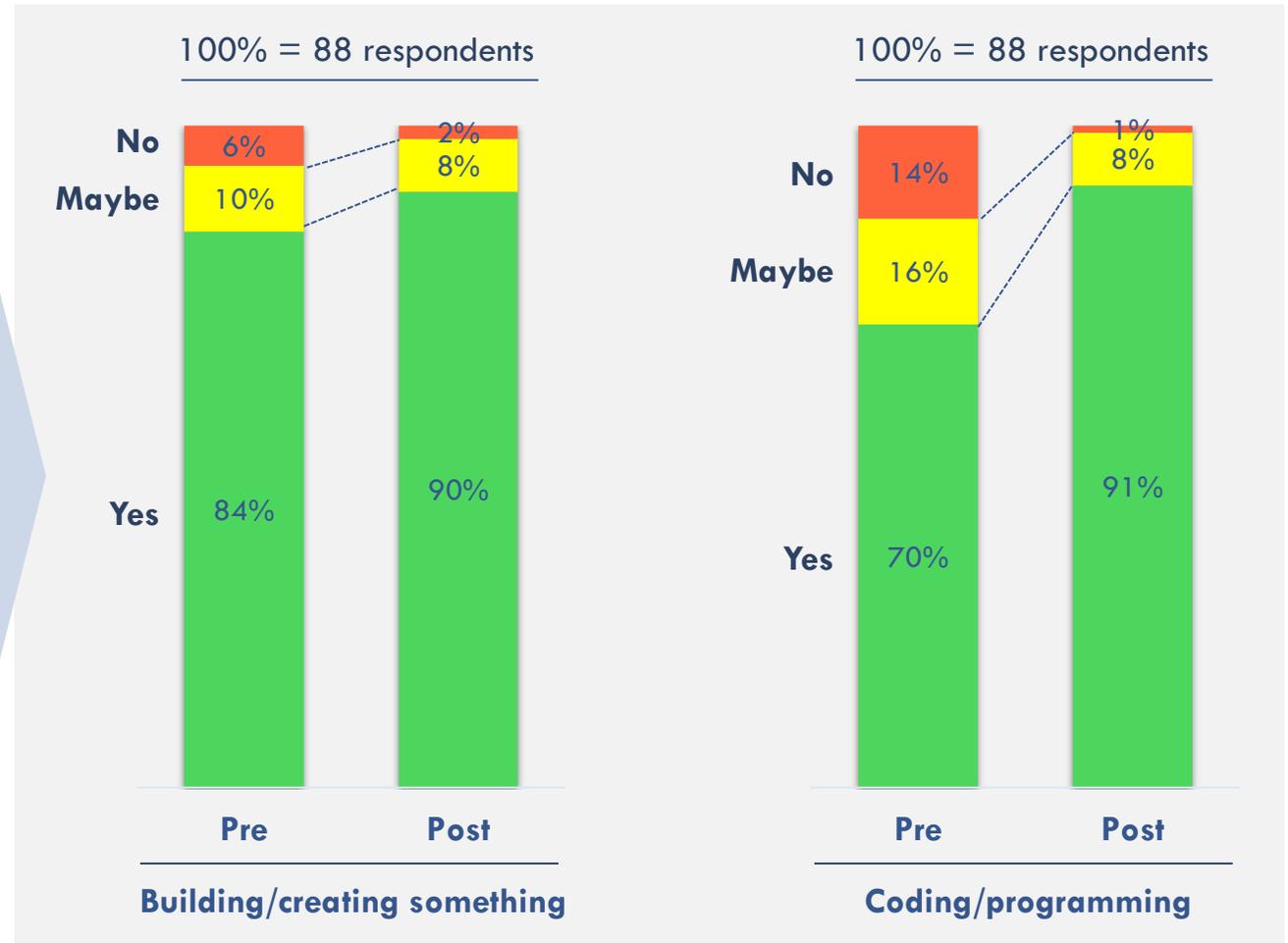
- | | | |
|--------------------------------|---|---------|
| 1. Building/creating something | } | • Yes |
| 2. Coding/computer programming | | • No |
| | | • Maybe |

POST-SURVEY QUESTION ASKED

In this project, did you enjoy _____ ?

Select the answer that best represents how you feel:

- | | | |
|--------------------------------|---|--------------------|
| 1. Building/creating something | } | • I loved it |
| 2. Coding/computer programming | | • It was ok |
| | | • I didn't like it |

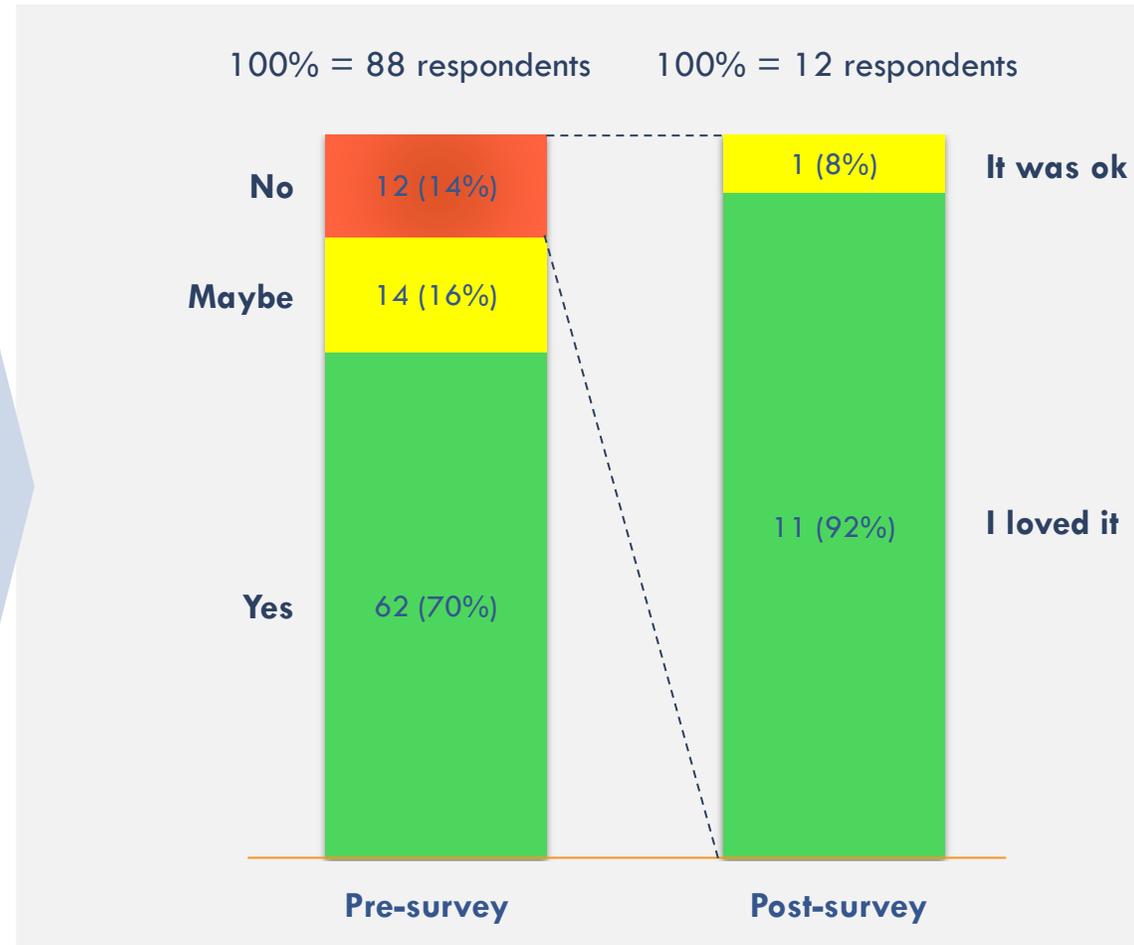


Art Alive: Those initially hesitant were transformed into enthusiasts



Deeper analysis

For those answering “no” around whether they looked forward to coding / programming, how did they respond post survey when asked how they enjoyed it?



Key takeaways

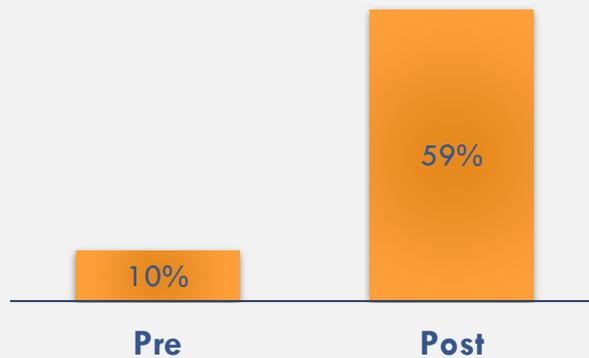
- 92% of Art Alive students who were not looking forward to coding/computer programming initially responded they “loved it” following the project
- Not a single student from the initial segment above stated they didn’t like coding after the program

Knowledge assimilation in Art Alive: Enrichment as well as enjoyment (Page 1 of 2)



1. Question: What does CAD stand for?
Answer: Computer Aided Design

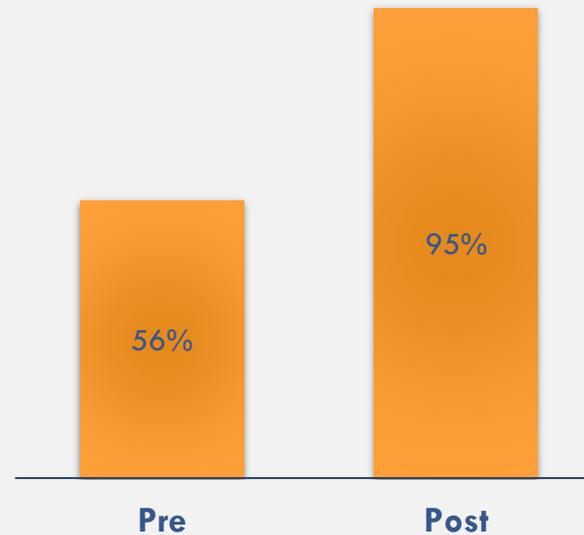
100% = 88 respondents



Percentage of respondents
with correct answer

2. Question: What does the “T” in STEAM
stand for?
Answer: Technology

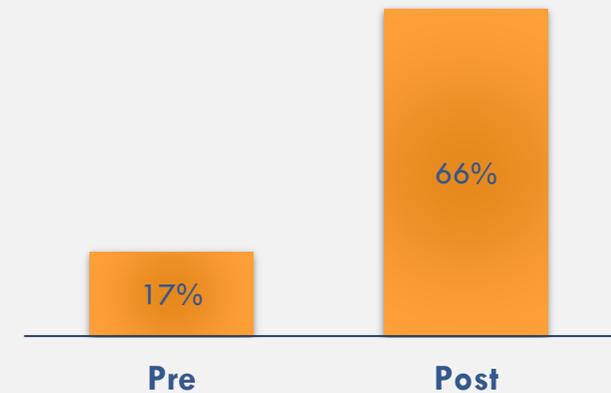
100% = 88 respondents



Percentage of respondents
with correct answer

3. Question: What are the three primary
colors of light?
Answer: Red, Green, & Blue

100% = 88 respondents



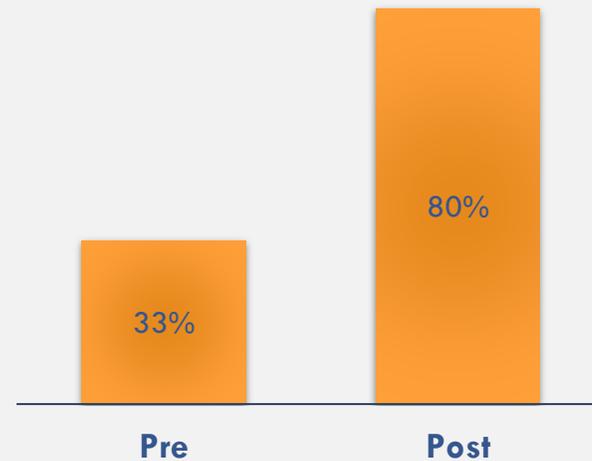
Percentage of respondents
with correct answer

Knowledge assimilation in Art Alive: Enrichment as well as enjoyment (Page 2 of 2)



4. Question: Sound travels in...
Answer: Waves

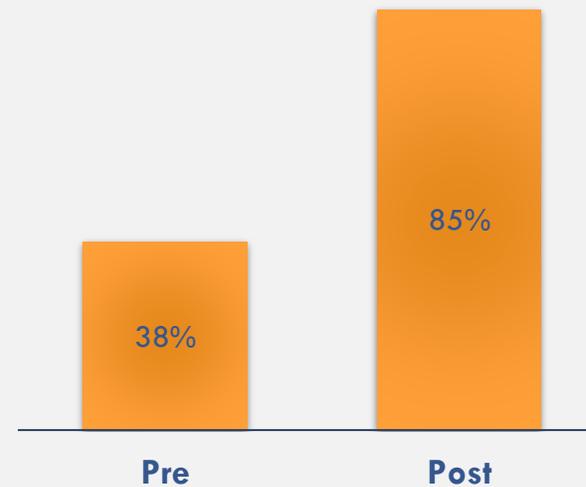
100% = 88 respondents



Percentage of respondents
with correct answer

5. Question: Sound is made when
something...
Answer: Vibrates

100% = 88 respondents



Percentage of respondents
with correct answer

Previously inexperienced students in STEAM show large interest in pursuing coding & building moving forward: Art Alive

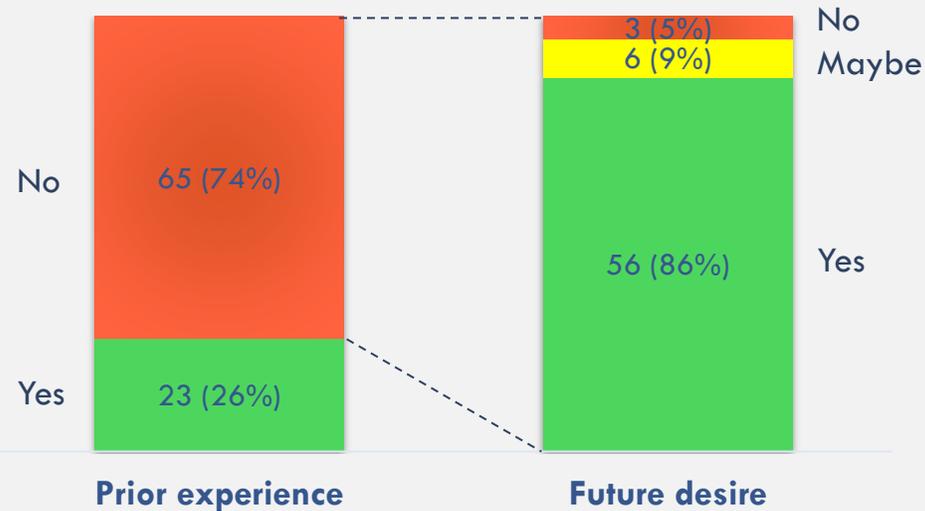


Motivational spark: students inexperienced with electronics

1. Pre: Have you ever built a project that has electronic parts?
2. Post: For those answering “no”, now that you’ve completed this project, in the future would you want to build something again?

100% = 88 respondents

100% = 65 respondents

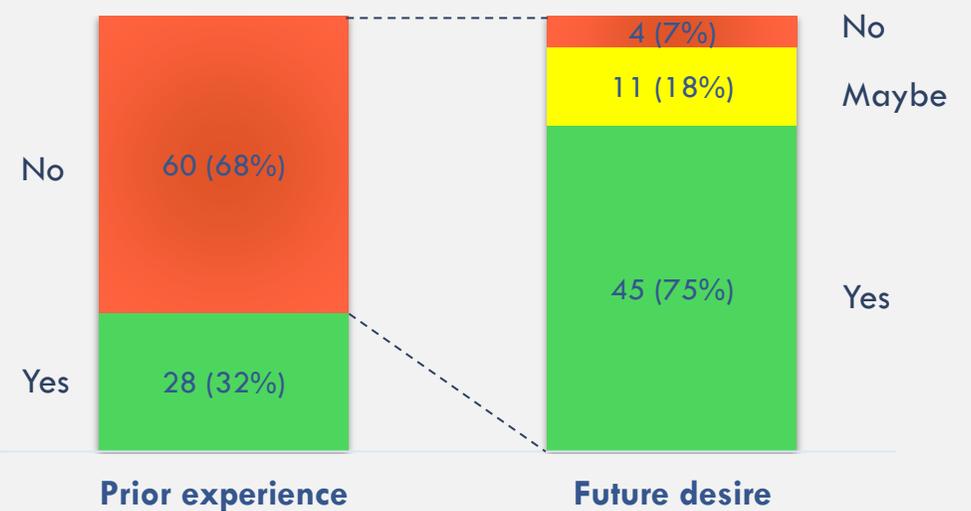


Motivational spark: students inexperienced with coding

1. Pre: Do you have prior experience in coding or programming?
2. Post: For those answering “no”, now that you’ve completed this project, in the future would you want to code again?

100% = 88 respondents

100% = 60 respondents



STEAM Academy impact for Art Alive: Students show very strong desire to do more



POST-SURVEY QUESTION

Would you like to participate in another STEAM Academy project?

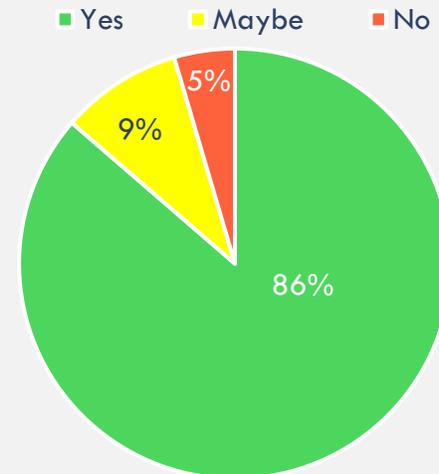
- Yes (3)
- Maybe (2)
- No (1)

Art Alive (N = 88):
Maximum level = 3.00

2.82

Desire to take another
STEAM Academy project

Art Alive (N = 88):
Segmentation



Key takeaways

- Participants have strong desire for more STEAM Academy programming
- Participants don't just like it—they REALLY like it

Document structure



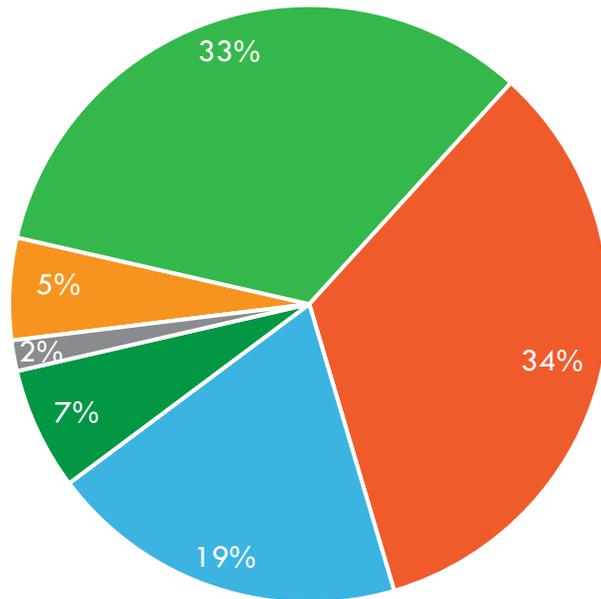
- 1 Data-collection methodology
- 2 STEAM Academy demographics
- 3 Impact of younger-age program: Art Alive
- 4 Impact of older-age program: RoverBot**

Demographics for older-aged program: RoverBot



Respondent Age (N = 181)

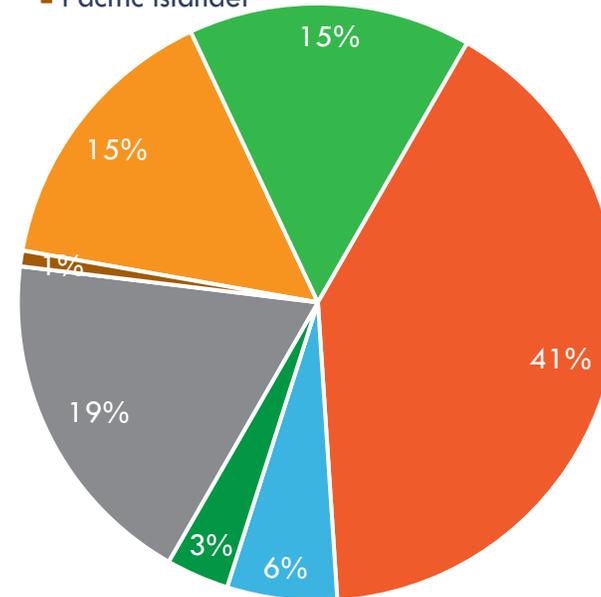
8 9 10 11 12 13+



- 86% of RoverBot respondents aged 9-11
- Participants as young as age 8 and as old as age 14

Respondent Ethnicity¹(N = 118)

Asian Black/African
Hispanic/Latinx Caucasian
Native American Other
Pacific Islander



- 56% of RoverBot respondents identify either as Black/African or Hispanic/Latinx

¹ Based upon respondents who identified with listed ethnicities; does not include no responses or "prefer not to say"; 63 additional respondents selected "preferred not to respond"

Ingoing experiences and expectations for RoverBot: Some experience already and solid expectations

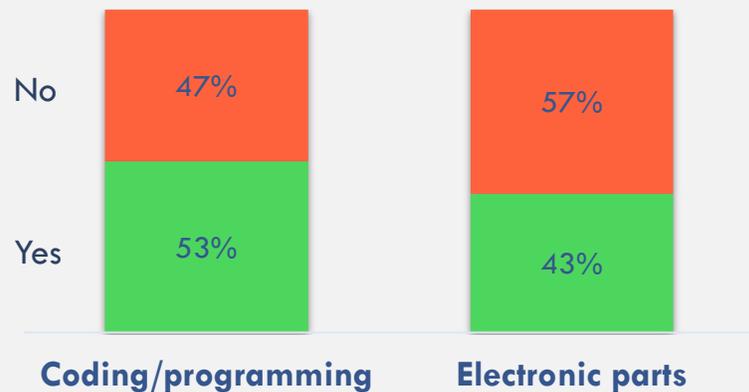


QUESTION ASKED

1. Do you have prior experience in coding or programming?
2. Have you ever built a project that has electronic parts?

Ingoing experience level of respondents (N = 181)

100% = 181 respondents



QUESTION ASKED

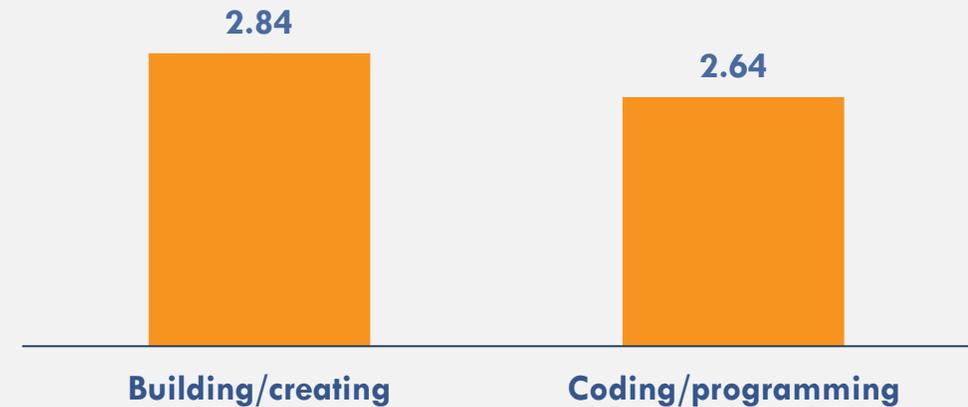
In this project, are you looking forward to...

Select the answer that best represents how you feel:

1. Building/creating something
 2. Coding/computer programming
- } • Yes (3)
• Maybe (2)
• No (1)

Average expectations (N = 181)

Maximum = 3.00



RoverBot: Experiences surpassed high initial student expectations



PRE-SURVEY QUESTION ASKED

In this project, are you looking forward to _____ ?

Select the answer that best represents how you feel:

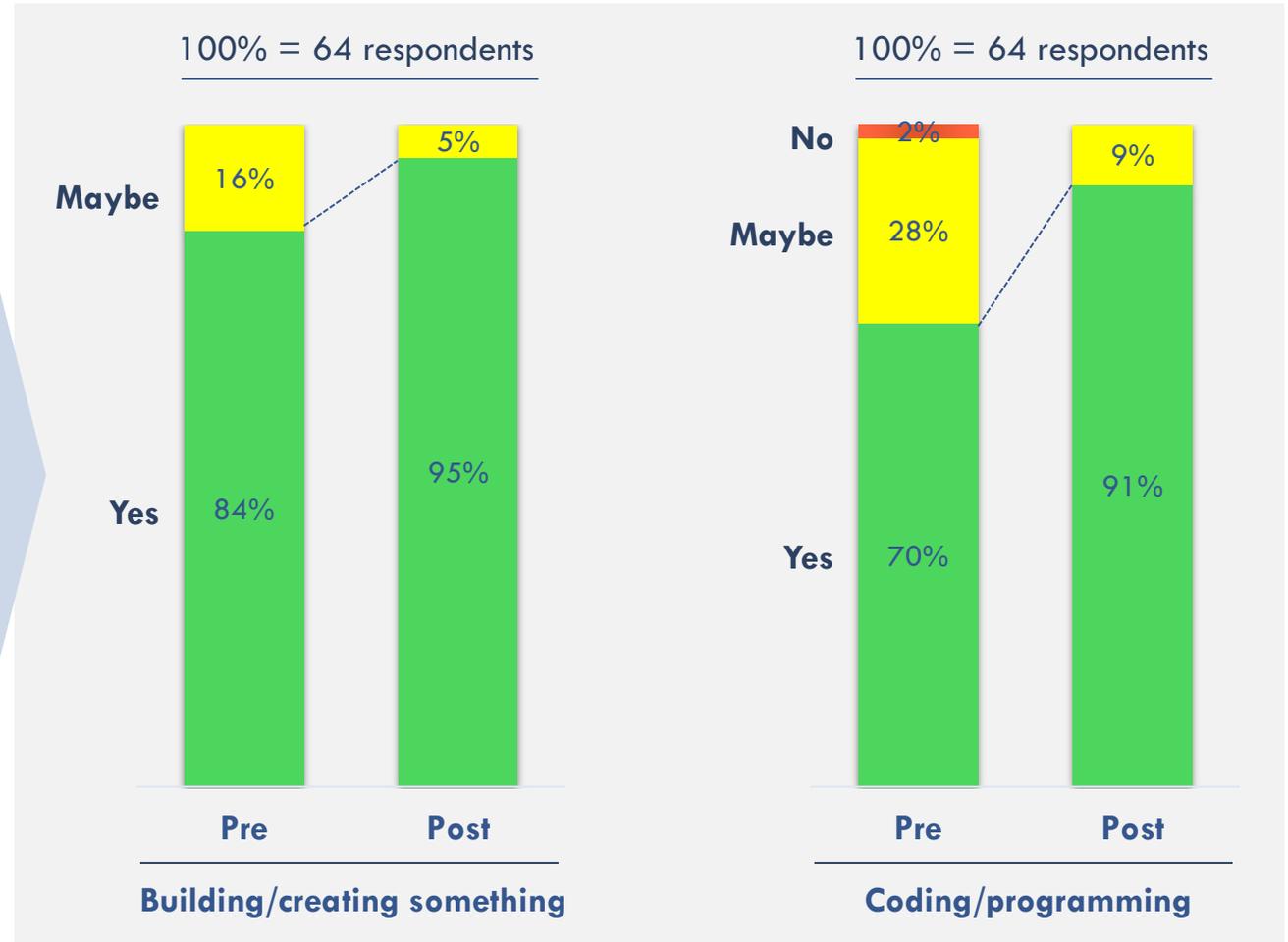
- | | | |
|--|---|--|
| <ol style="list-style-type: none"> 1. Building/creating something 2. Coding/computer programming | } | <ul style="list-style-type: none"> • Yes • No • Maybe |
|--|---|--|

POST-SURVEY QUESTION ASKED

In this project, did you enjoy _____ ?

Select the answer that best represents how you feel:

- | | | |
|--|---|---|
| <ol style="list-style-type: none"> 1. Building/creating something 2. Coding/computer programming | } | <ul style="list-style-type: none"> • I loved it • It was ok • I didn't like it |
|--|---|---|

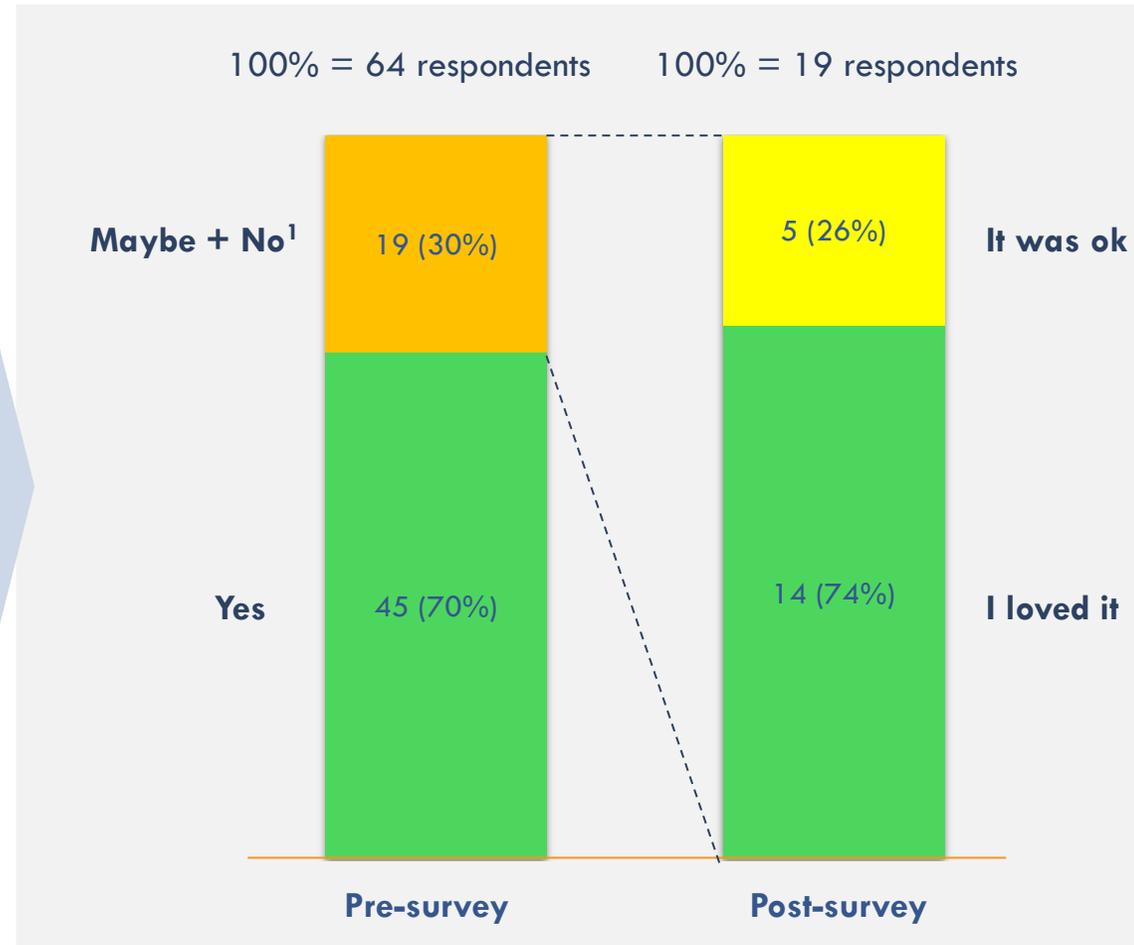


RoverBot: Those initially hesitant were transformed into enthusiasts



Deeper analysis

For those answering “no” or “maybe” around whether they looked forward to coding / programming, how did they respond post survey when asked how they enjoyed it?



Key takeaways

- 74% of RoverBot students who exhibited agnostic or negative aspects towards coding/computer programming initially responded they “loved it” following the project
- Not a single student from the initial segment above stated they didn’t like coding after the program

¹ These respondents are comprised of 18 who said “maybe” and 1 who said “no”

Knowledge assimilation in RoverBot: Enrichment as well as enjoyment (Page 1 of 2)

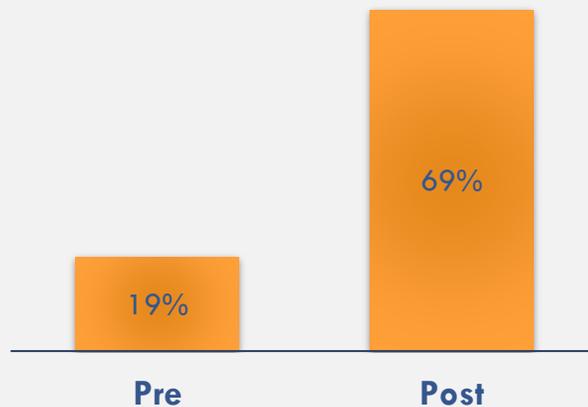


1. Question: The human eye has three different types of cone cells that each recognize a different color of light.

These colors are:

Answer: Red, Green, & Blue

100% = 88 respondents

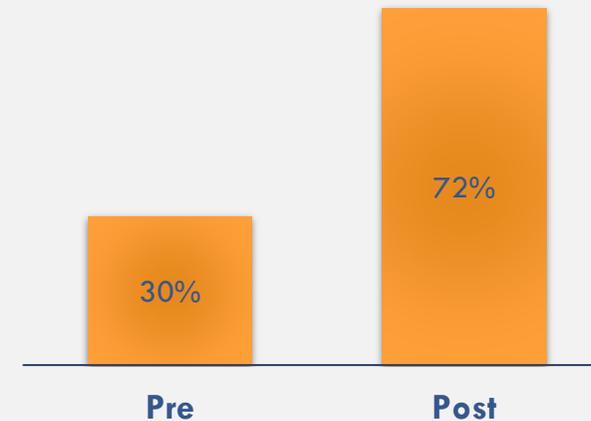


Percentage of respondents with correct answer

2. Question: What does the “if” programming block do?

Answer: Allows the robot to make decisions

100% = 88 respondents



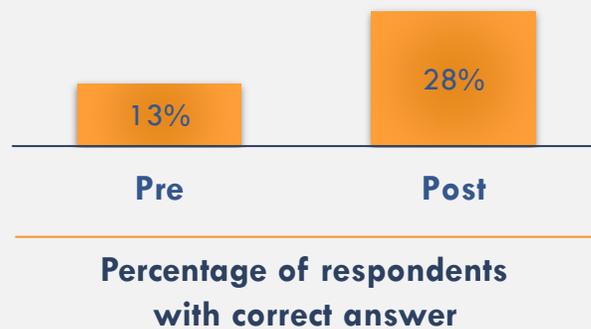
Percentage of respondents with correct answer

Knowledge assimilation in RoverBot: Enrichment as well as enjoyment (Page 2 of 2)



3. Question: What does LED stand for?
Answer: Light emitting diode

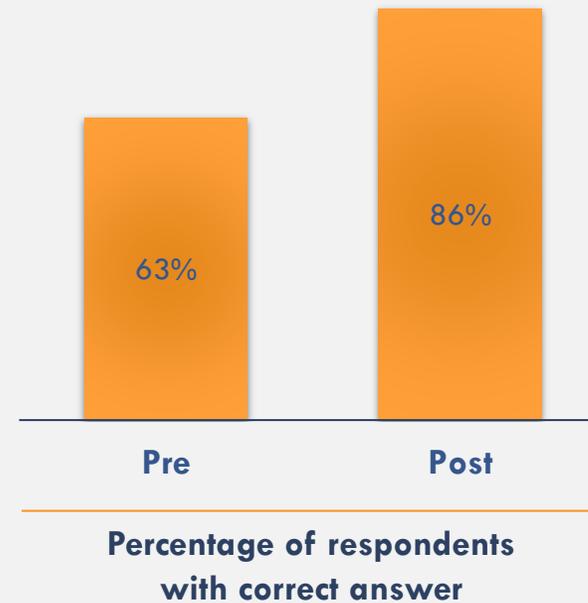
100% = 88 respondents



4. Question: Computer screens mix the primary colors of light to make colored pics. Each little square on a computer screen is called a:

Answer: Pixel

100% = 88 respondents



Previously inexperienced students in STEAM show large interest in pursuing coding & building moving forward: RoverBot

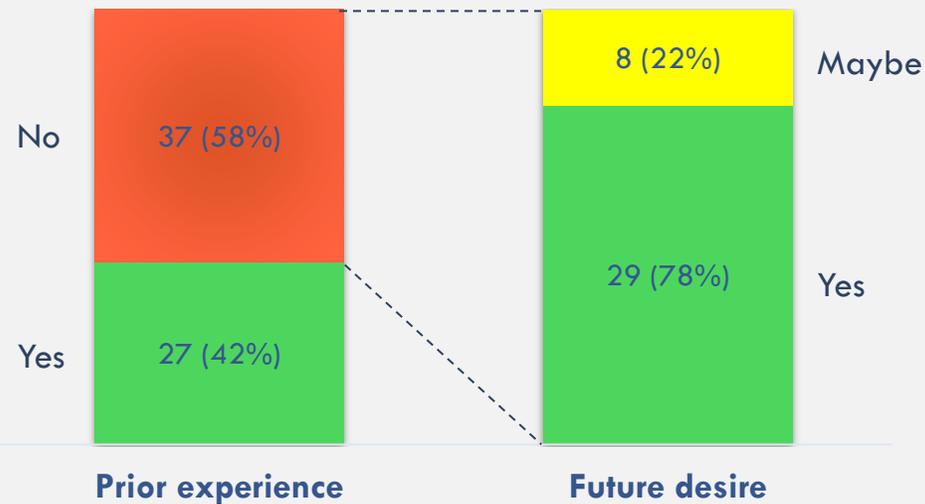


Motivational spark: students inexperienced with electronics

1. Pre: Have you ever built a project that has electronic parts?
2. Post: For those answering “no”, now that you’ve completed this project, in the future would you want to build something again?

100% = 64 respondents

100% = 37 respondents

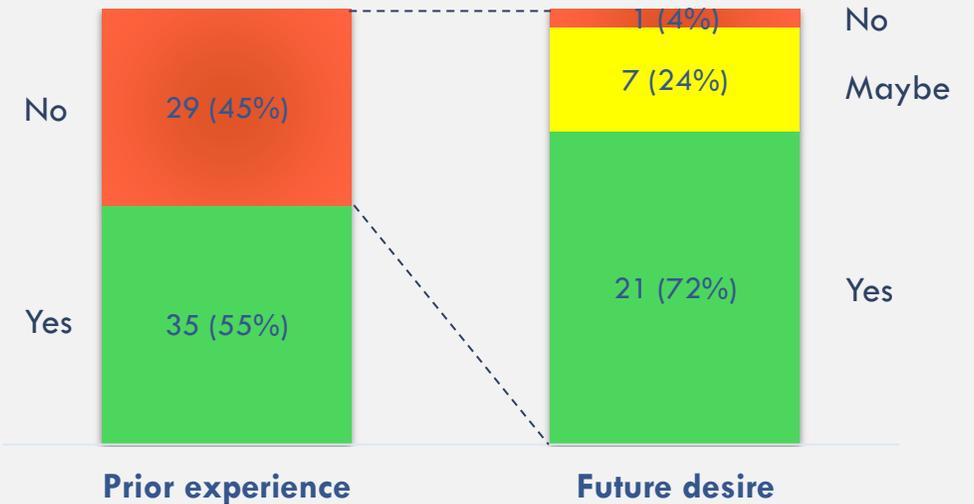


Motivational spark: students inexperienced with coding

1. Pre: Do you have prior experience in coding or programming?
2. Post: For those answering “no”, now that you’ve completed this project, in the future would you want to code again?

100% = 64 respondents

100% = 29 respondents



STEAM Academy impact for RoverBot: Let's do it again!



POST-SURVEY QUESTION

Would you like to participate in another STEAM Academy project?

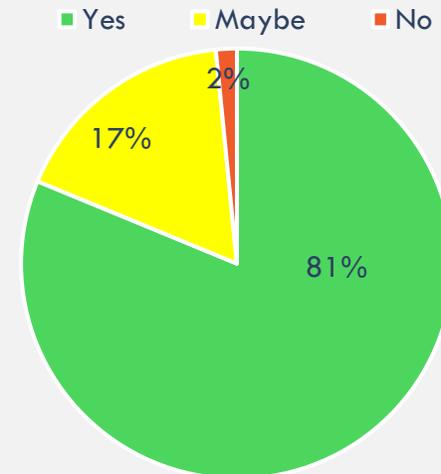
- Yes (3)
- Maybe (2)
- No (1)

RoverBot (N = 64):
Maximum level = 3.00

2.80

Desire to take another
STEAM Academy project

RoverBot (N = 64):
Segmentation



Key takeaways

- Participants have strong desire for more STEAM Academy programming
- Participants don't just like it—they REALLY like it