STEAM Academy Impact & Outcomes: 2022 Calendar Year

February, 2023

City of Aurora

TinkRworks

APS Training Academy

Executive Summary

- Following a highly-successful 2021 STEAM program, City of Aurora, TinkRworks, and APS Training Academy (APS) joined forces again in 2022 to provide hands-on STEAM programming for underserved K - 8th grade children within the City. The program, known as the Aurora STEAM Academy, had an overall goal to spark an interest in children to explore STEAM opportunities in the future and also instill within them the confidence to pursue STEAM-related opportunities they might not otherwise choose to do.

- Relative to 2021 when only two STEAM projects were chosen for delivery to participants, 2022 saw a year where nine different STEAM projects were chosen for delivery to children. All of these projects 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.

- 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, 2,029 students participated in the 2022 program—a huge step-up in participation compared with the 2021 program which saw 625 participants. High levels of diversity were exhibited within the participant base:
  - Of the total participants, 63% were either Hispanic/Latinx or Black/African American
  - 52% of participants were male; 46% were female
  - 24% of participants self-identified as females who were either Hispanic/Latinx or Black/African American—a historically critically-important segment that remains highly underserved for STEAM exposure
  - 72% 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 growth in confidence linked to both building/creating as well as to computer programming. 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.
  - **Confidence levels grew significant:** Participants who initially were uncertain or thought they outright lacked skills needed to succeed at building/creating and/or computer programming exhibited strong growth around their confidence to perform these activities following the completion of their STEAM projects.
  - **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 growing their confidence to pursue key STEAM-related activities in the future. Additionally, enjoyment by all participants was also clearly evident as was a very strong desire to take additional Aurora STEAM Academy programs.

Agenda

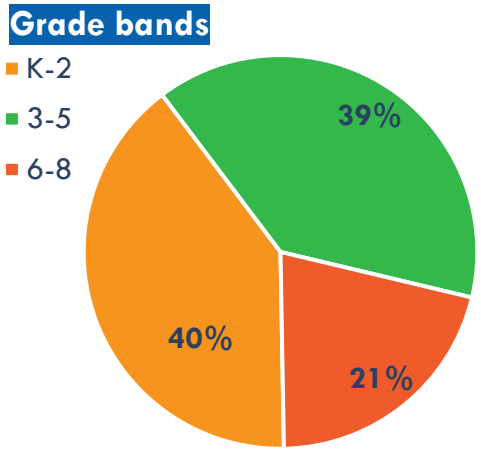
1	**STEAM Academy demographics**
2	Trends over the years
3	Highlighted outcomes
4	Appendix: methodology & detailed analyses

2022 STEAM Academy Demographics

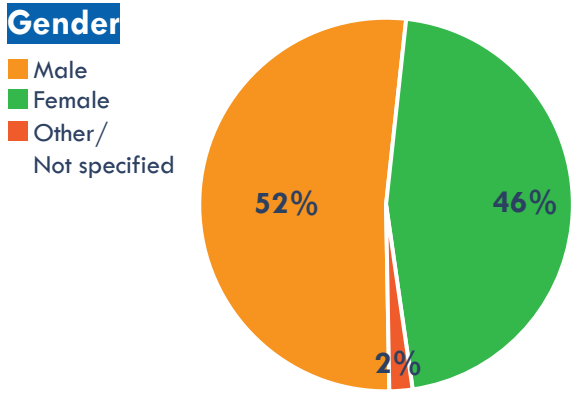
2,029

Students served

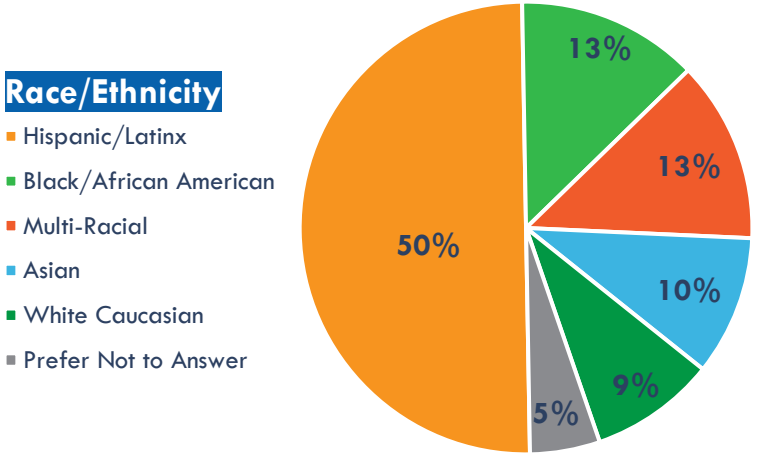
Grade bands



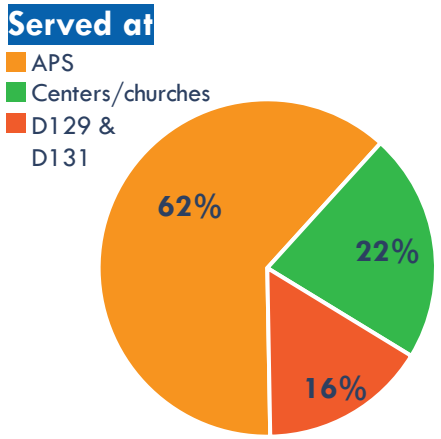
Gender



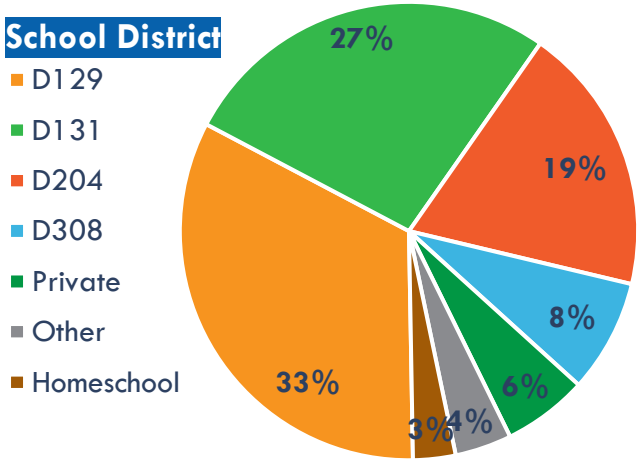
Race/Ethnicity



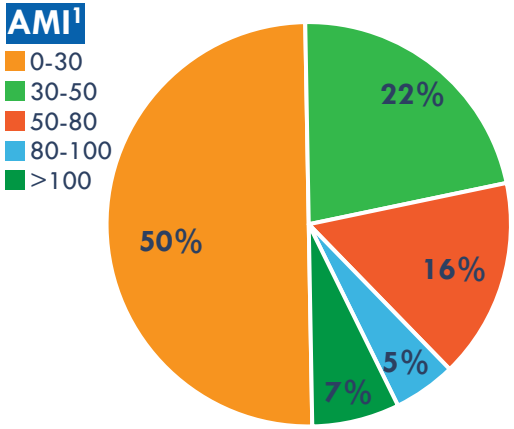
Served at



School District



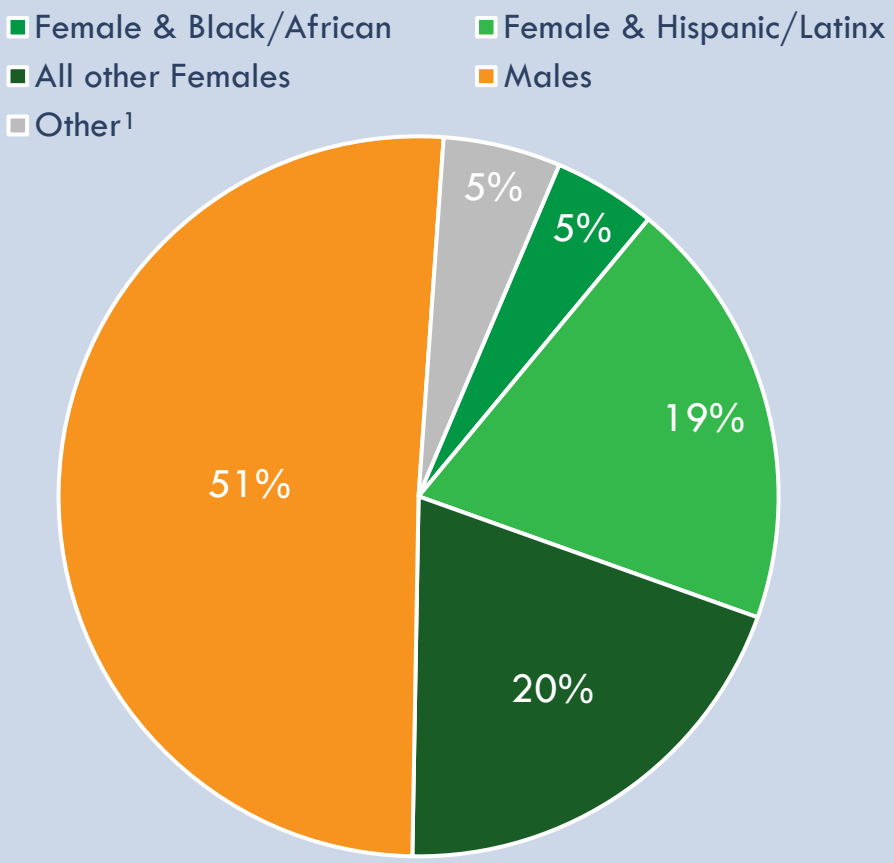
AMI[1]



1 AMI = Area Medium Income (%)

Point of interest— Segmentation Deep Dive: (N = 777)

Segmentation details



Key highlights

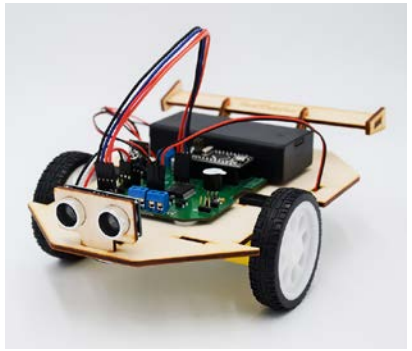
- 24% of respondents identified as Female ***and*** either Black/African or Hispanic/Latinx
- *STEAM accessibility & opportunity being provided to a historically (vastly) underserved segment*

1 Comprised of both "Other" and "I prefer not to answer"

Nine projects across K-8 leads to diverse opportunities

Project name	Project-kit count
1. Smart Lamp	544
2. Art Electric	542
3. TinkRbot	199
4. Lauchpad	154
5. Pampered Plant	133
6. Pushes, Pulls and Pins	133
7. Planetary Pathways	119
8. STEAM Academy	107
9. Weather Station	98

Total count 2,029



TinkRbot

Smart Lamp

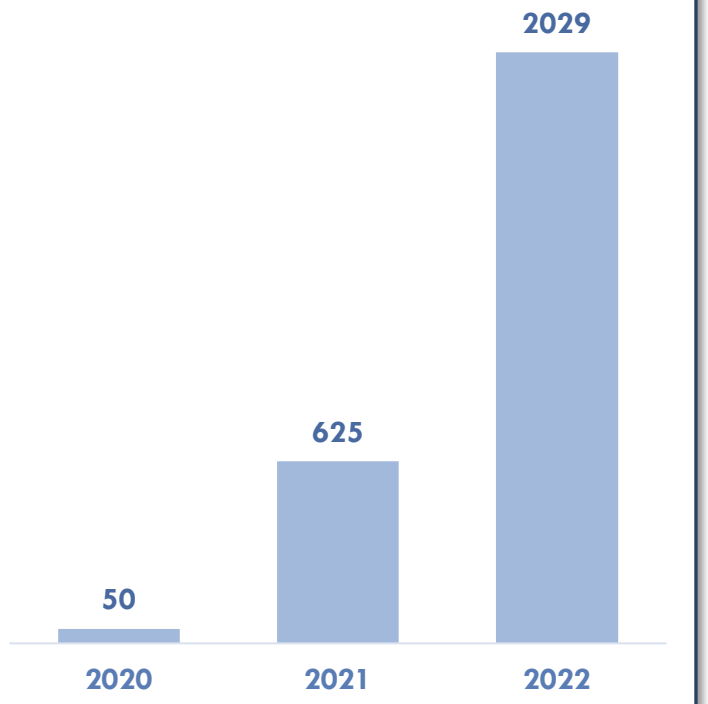
Pampered Plant

Agenda

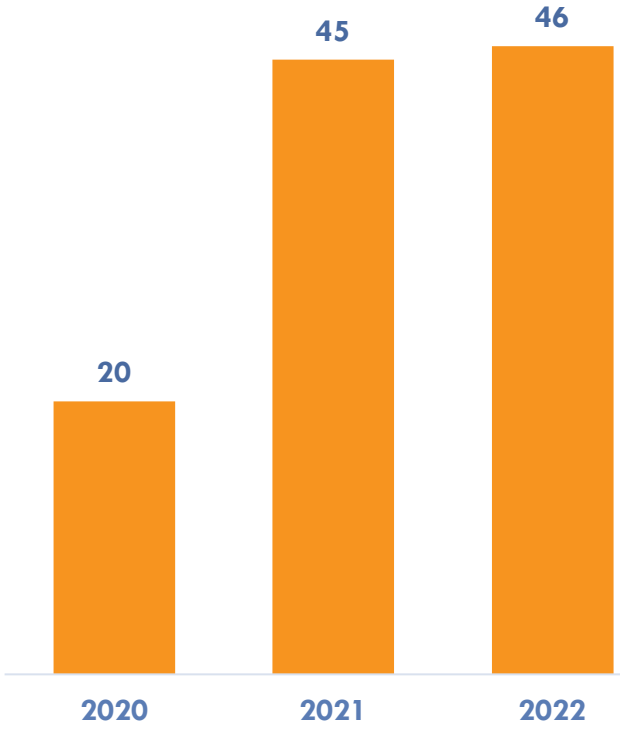
1	STEAM Academy demographics
2	**Trends over the years**
3	Highlighted outcomes
4	Appendix: methodology & detailed analyses

Key highlights over the years: Growing the right way

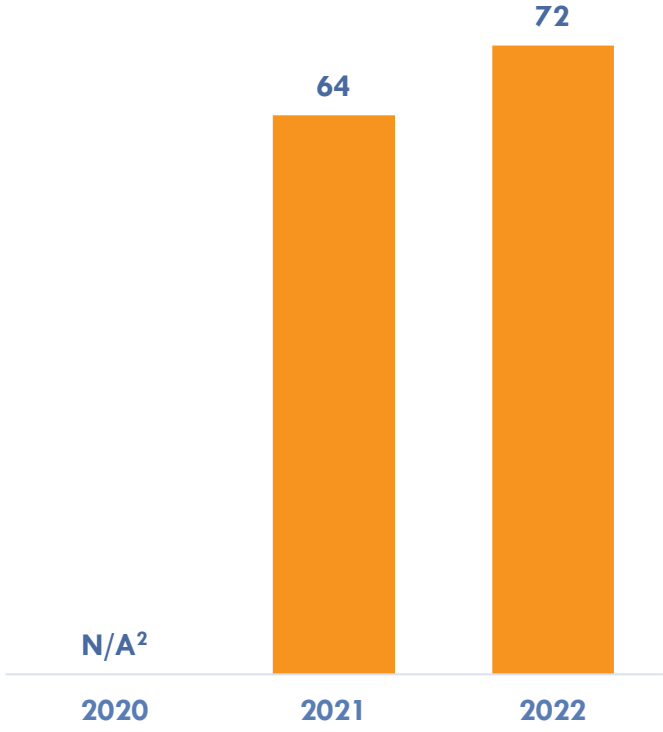
Program participants



% self-identified females



AMI < 50%[1]

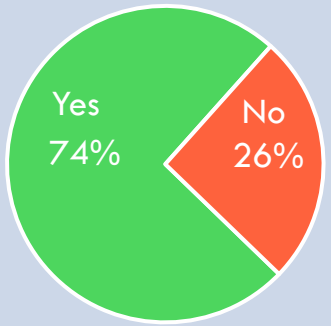


1 Participants residing in households with Area Median Incomes of <= 50%
2 AMI not measured in 2020

The difference a year makes: 2022 vs. 2021
Participation expands as a result of accessibility

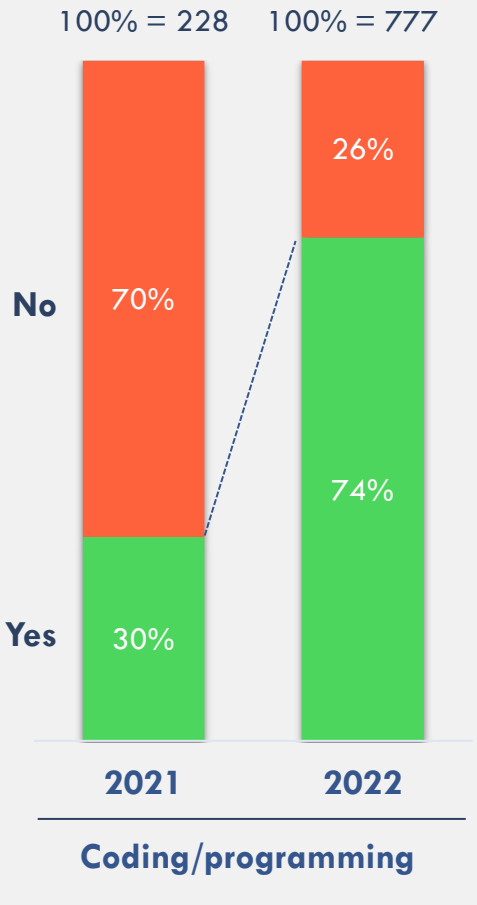
Participation question:

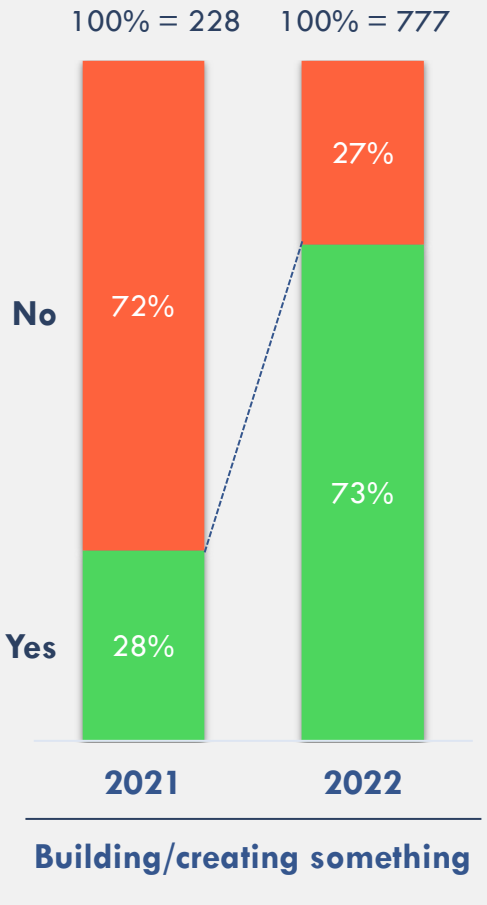
1. Have you built a STEAM project before[1]?



Experience question:

1. Have you ever coded or programmed before?
2. Have you ever built a project that has electronic parts?





1 N = 777 respondents

Agenda

1	STEAM Academy demographics
2	Trends over the years
3	**Highlighted outcomes**
4	Appendix: methodology & detailed analyses

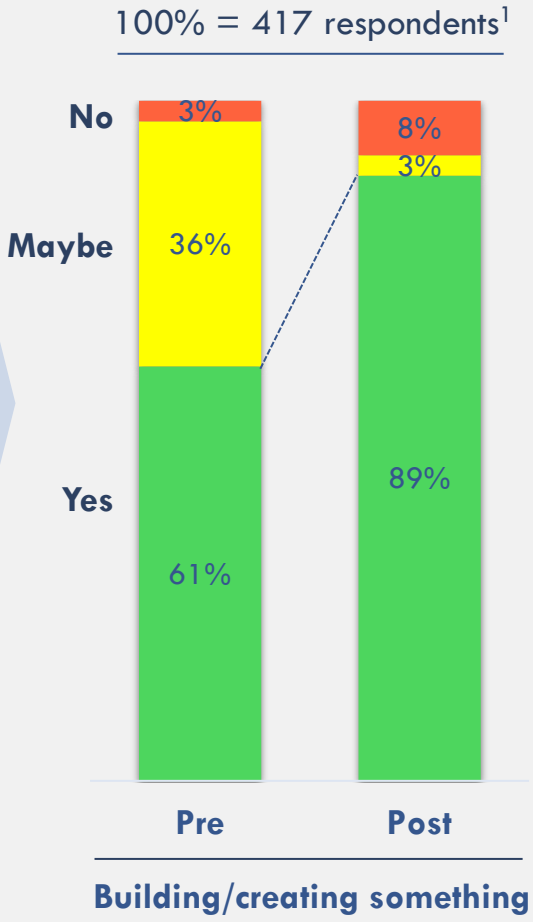
Confidence grew dramatically as a result of program participation

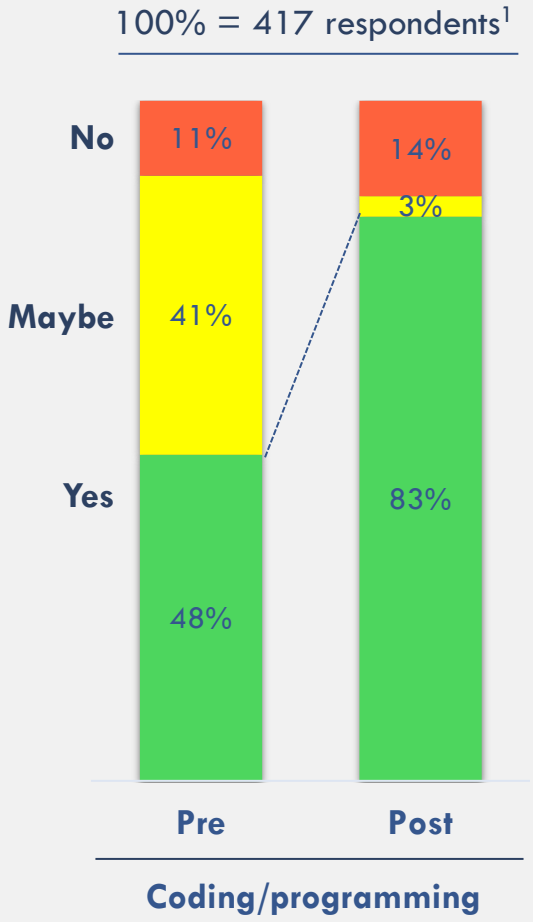
Self-efficacy questions:

Do you think you are good at…

1. Building/creating something
2. Coding/computer programming

- Yes
- No
- Maybe





Key takeaways

- Self-efficacy grew vastly in both belief around ability to build/create and code/program
- Many participants were unsure of their abilities going into effort (i.e., "maybe"); this same segment displayed significant "boost" in confidence following participation

1 Only matched survey responses were included, i.e., sets of data where pre-survey and post-survey data could be definitely matched.

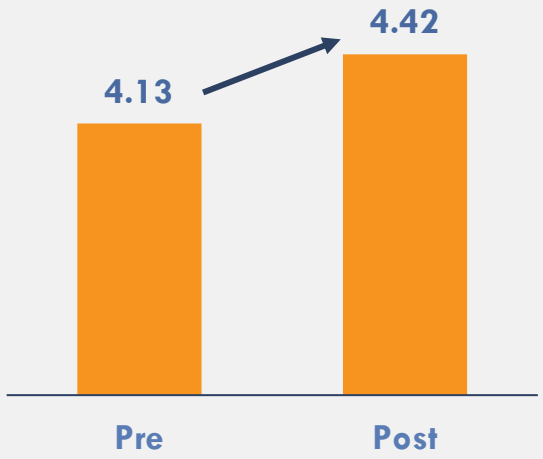
Participant interest levels: A very strong desire to do more

POST-SURVEY QUESTION

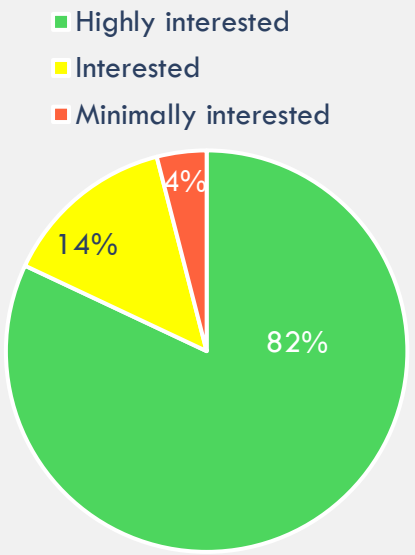
Rate your interest in STEAM on a scale of 1-5, with 5 being the highest:

- 1 – No interest
- 2
- 3 – I'm interested
- 4
- 5 – Very interested

Matched respondents (N = 417)
Maximum level = 5.0



Interest segmentation[1] (N = 417)



Key takeaways

- Participants come in interested with STEAM and their interest expands further through the program
- Participants are highly-interested in STEAM overall

1 "Highly interested" are respondents with scores of 4 or 5; "interested" are respondents with scores of 3; "minimally interested" are respondents with scores of 1 or 2

Agenda

1	STEAM Academy demographics
2	Trends over the years
3	Highlighted outcomes
4	**Appendix: methodology & detailed analyses**

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 2022 programming:

- Nine sets of TinkRworks' projects were delivered by APS across K – 8th grade students in City of Aurora.

- Focus was on understanding the impact of STEAM Academy programming across a variety of factors:
  - Desire to engage in STEM programming
  - Desire for creating/building & computer programming
  - Level of enjoyment during overall STEM-programming experience
  - Confidence assimilation related to program participation

Participant population

In total, 2029 students participated in STEAM Academy projects in 2022:

- Diverse set of demographics achieved:
  - 63% of participants were either Black/African American or Hispanic
  - Nearly equal splits of male students to female participants: 52% males to 46% females
  - 24% of surveyed respondents identified as female and either Black/African American or Hispanic/Latinx
  - 72% of participants were from 0 – 50 AMI income bracket
  - Participants came from diverse set of schools within and neighboring Aurora

- Diverse set of venues also utilized, including Main Baptist, Community, and APS Training Academy—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
- One set of paired surveys distributed to K-2 students; similar but slightly different set of paired surveys distributed to 3-8 grade students
  - Pre surveys collected key demographic information, prior STEAM experiences, incoming desire to engage in activities, and confidence levels to build and computer-program
  - 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)

Data analysis details

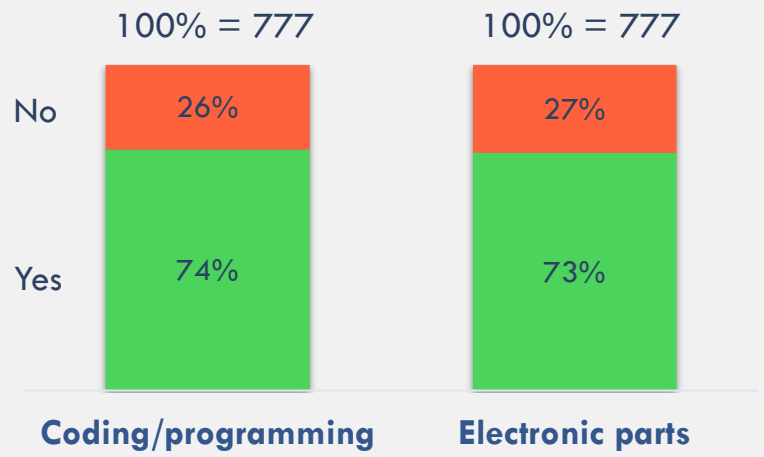
- All analysis was performed solely on submitted survey results; anecdotal information outside of surveys was not incorporated
- Unless indicated otherwise, pre-survey data was used in demographic information for each program while only paired surveys (i.e., surveys were definitive student linkage between pre post surveys) were used to showcase mindset shifts, attitude changes, and confidence assimilation
- Overall submitted rates were as follows:
  - K-2 grade students:
    - ❖ Pre survey: 360 respondents
    - ❖ Post survey: 305 respondents
    - ❖ Paired surveys: 205
  - 3-8 grade students:
    - ❖ Pre survey: 417 respondents
    - ❖ Post survey: 269 respondents
    - ❖ Paired surveys: 212

Ingoing experiences and expectations: Strong experience and excitement

QUESTION ASKED

1. Have you ever coded or programmed before?
2. Have you ever built a project that has electronic parts?

Ingoing experience level of respondents



QUESTION ASKED

In this project, are you looking forward to…

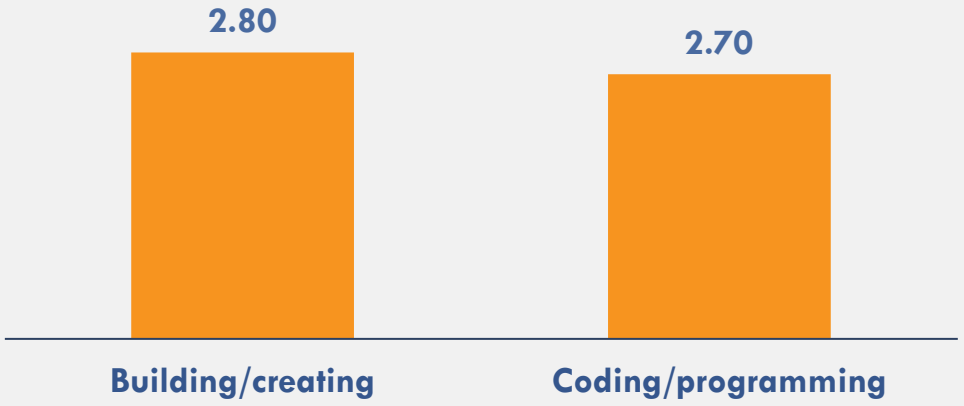
Select the answer that best represents how you feel:

1. Building/creating something
2. Coding/computer programming

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

Average expectations (N = 777)

Maximum = 3.00



Experiences surpassed initial student expectations even with high levels of incoming 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
2. Coding/computer programming

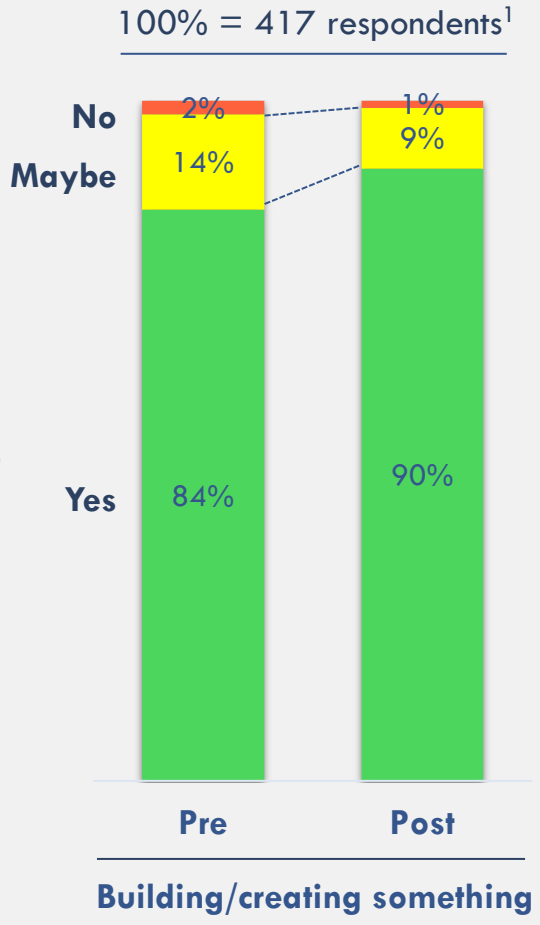
- Yes
- No
- Maybe

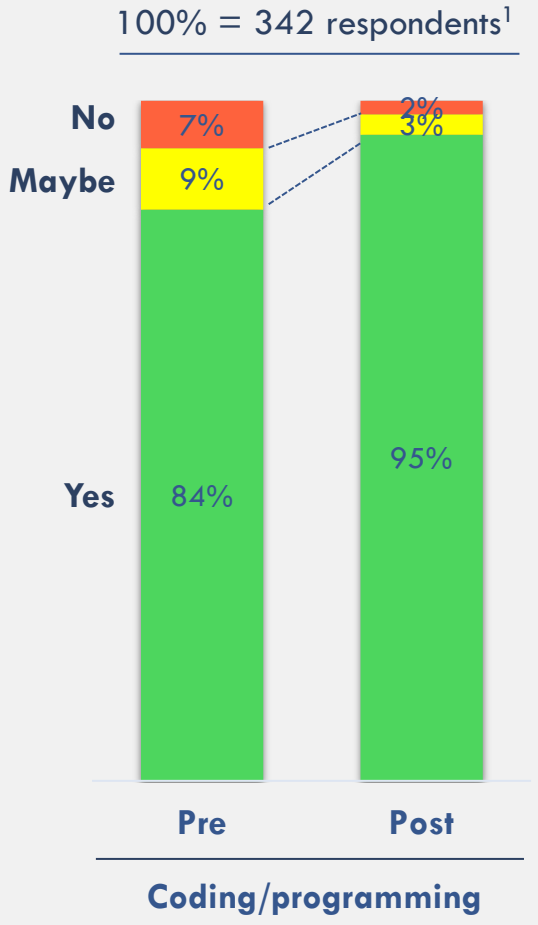
POST-SURVEY QUESTION ASKED

In this project, did you enjoy _____?
Select the answer that best represents how you feel:

1. Building/creating something
2. Coding/computer programming

- I loved it
- It was ok
- I didn't like it



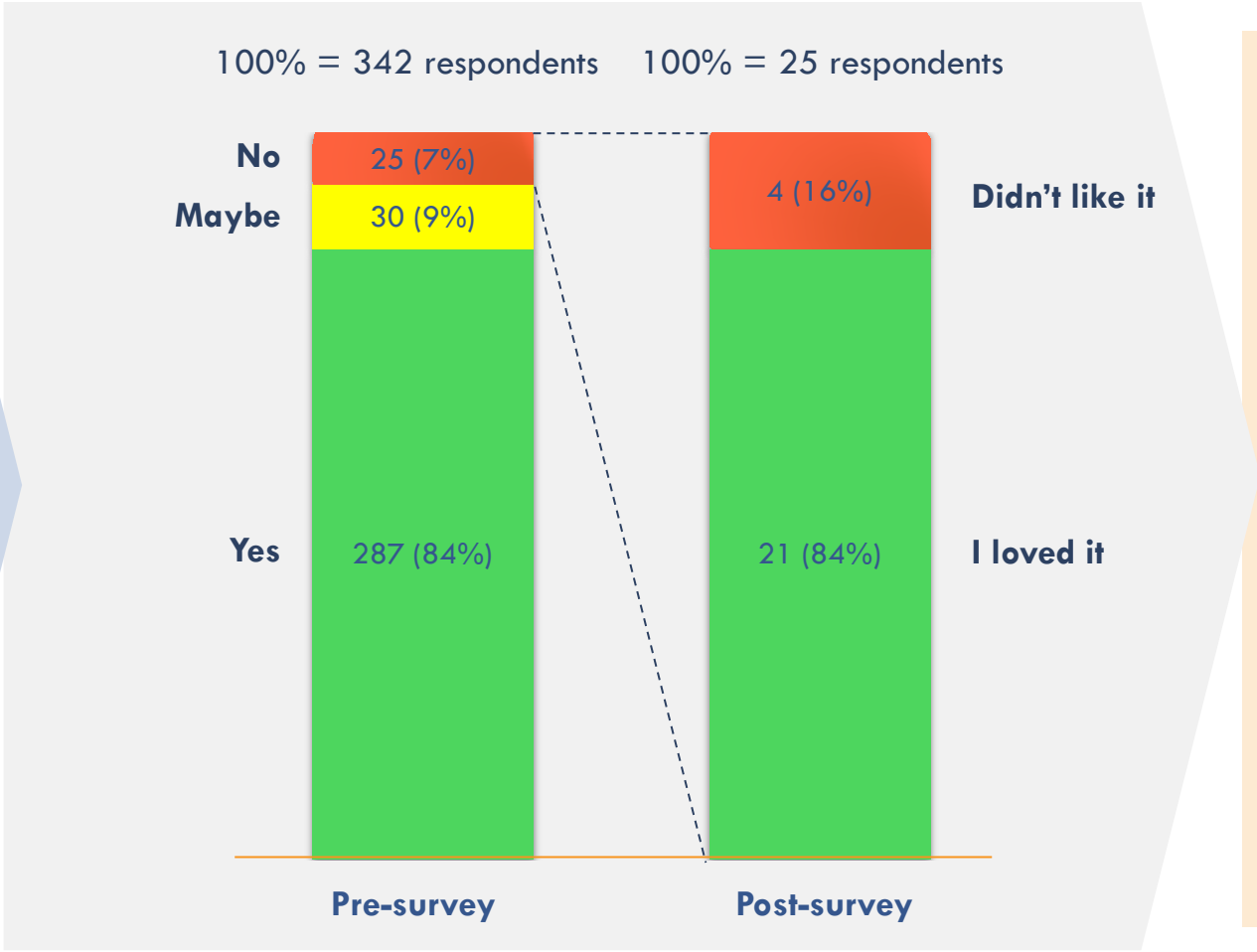


1 Only matched survey responses were included, i.e., sets of data where pre-survey and post-survey data could be definitely matched.

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?



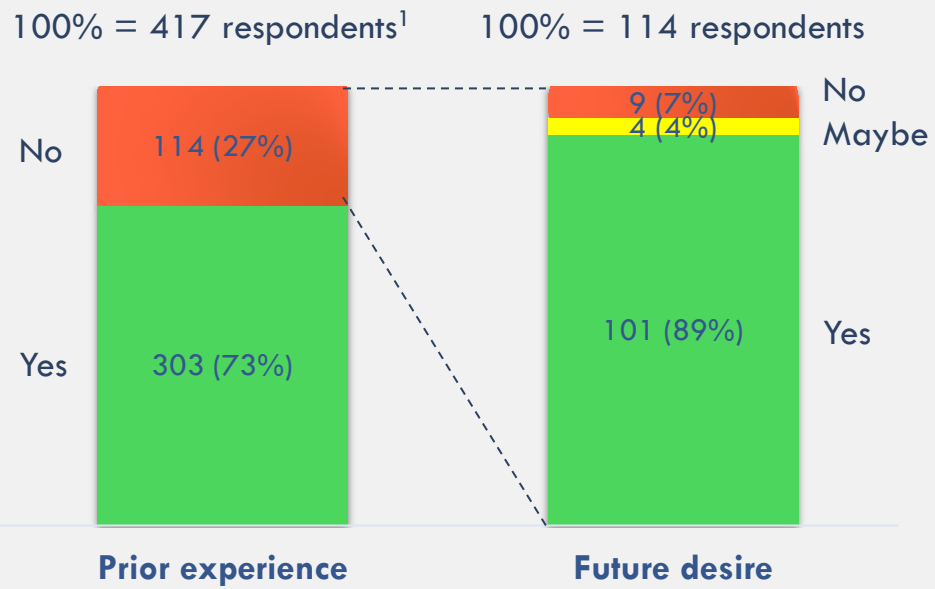
Key takeaways

- 84% of respondents who were not looking forward to coding/computer programming initially responded they "loved it" following the project—significant shift
- Similar trends existed in participants who initially were not looking forward to building & creating—92% favorable rating following project participation

Previously inexperienced students in STEAM show large interest in pursing coding & building moving forward

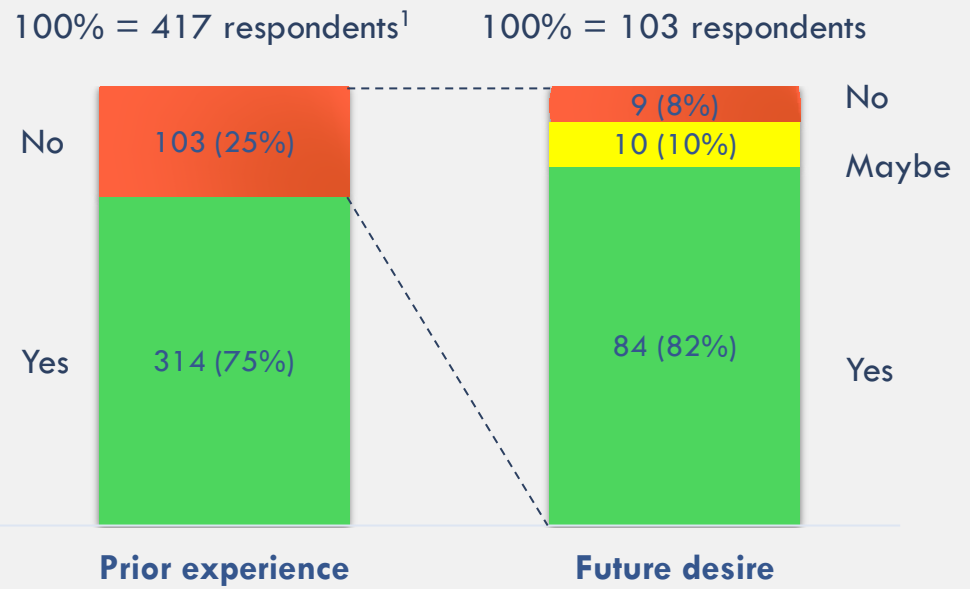
Motivational spark: students inexperienced with electronics

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?



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?

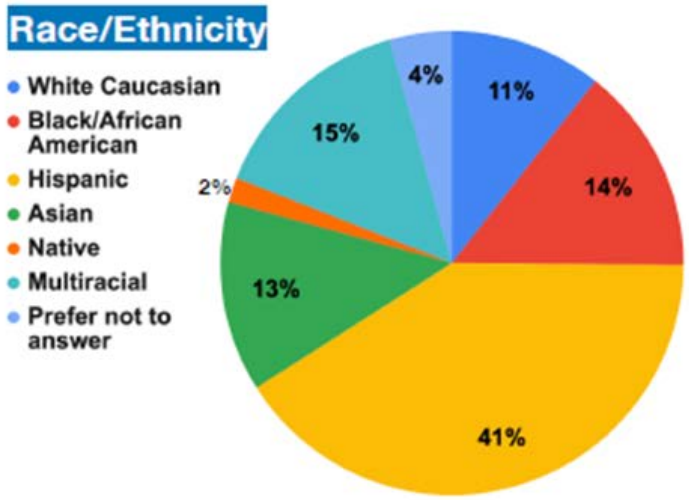


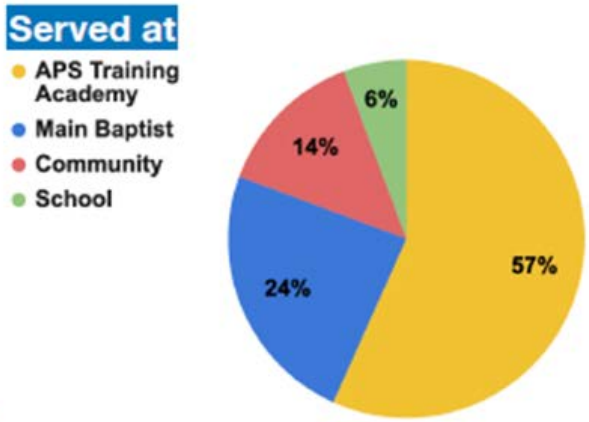
1 Only matched respondents considered, i.e., those who completed both pre- and post-surveys and could definitively be identified

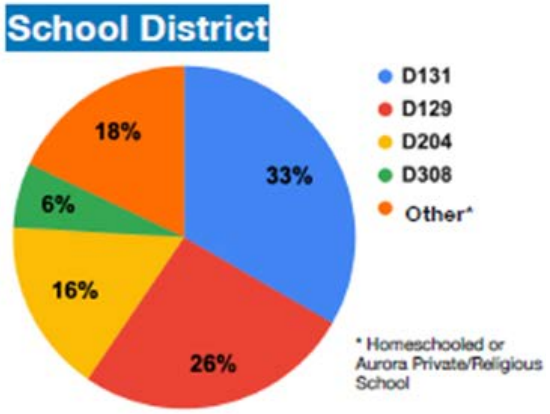
Aurora STEAM Academy: Demographics for 2021 programs

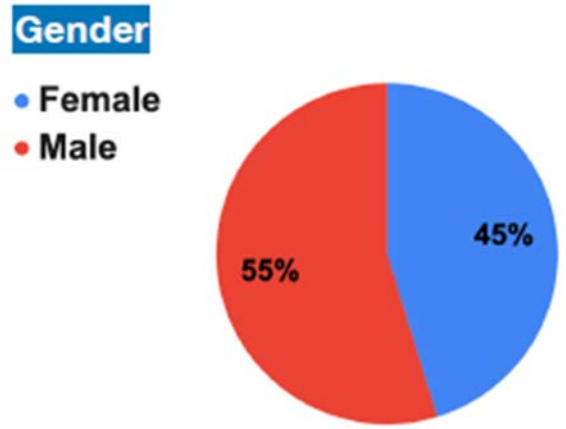
625

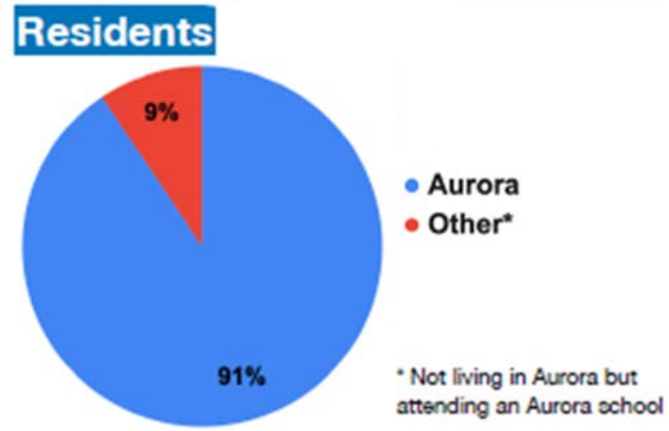
Students Served

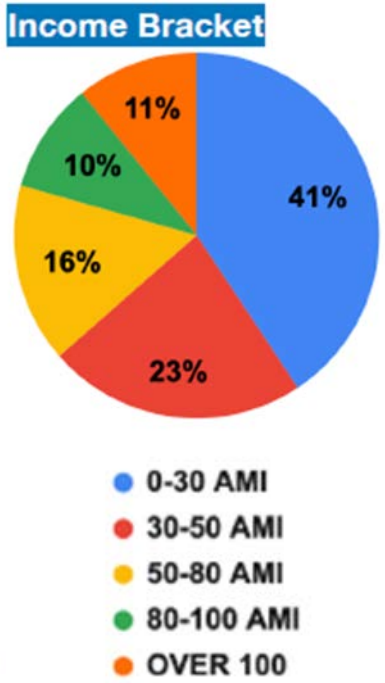












Source: APS Training Academy