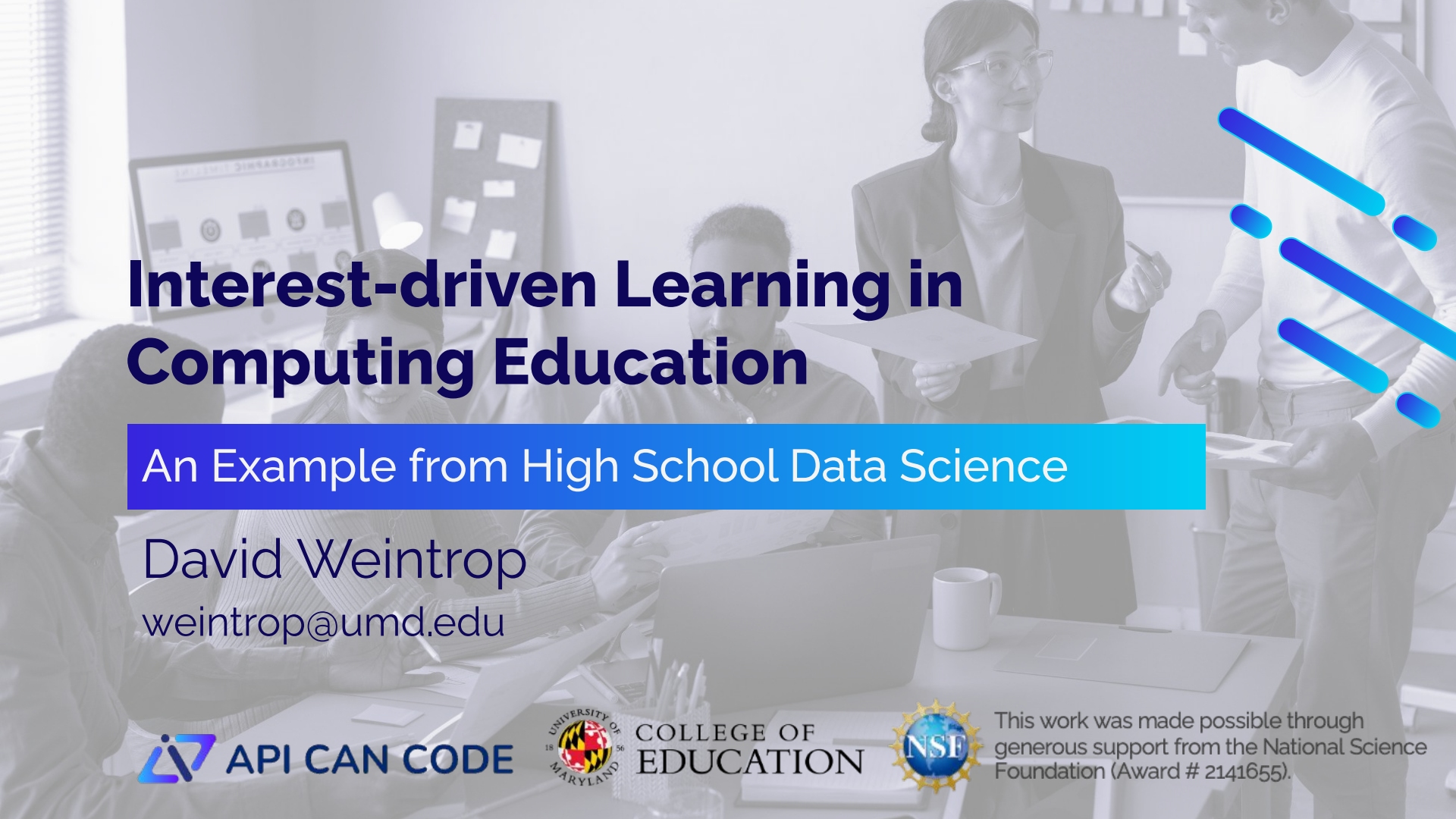

Interest-driven Learning in Computing Education

An Example from High School Data Science

David Weintrop
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API CAN CODE

UNIVERSITY OF MARYLAND COLLEGE OF EDUCATION

This work was made possible through generous support from the National Science Foundation (Award # 2141655).

The API Can Code Team

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Postdoctoral Researcher

Peter F Moon

Postdoctoral Researcher

Yue Xin

Doctoral Student

Introduction & Motivation

In our increasingly **computationally-driven world**, it is imperative to provide opportunities for all students to **learn foundational computer science concepts and practices** as part of their K-12 education.

Introduction & Motivation

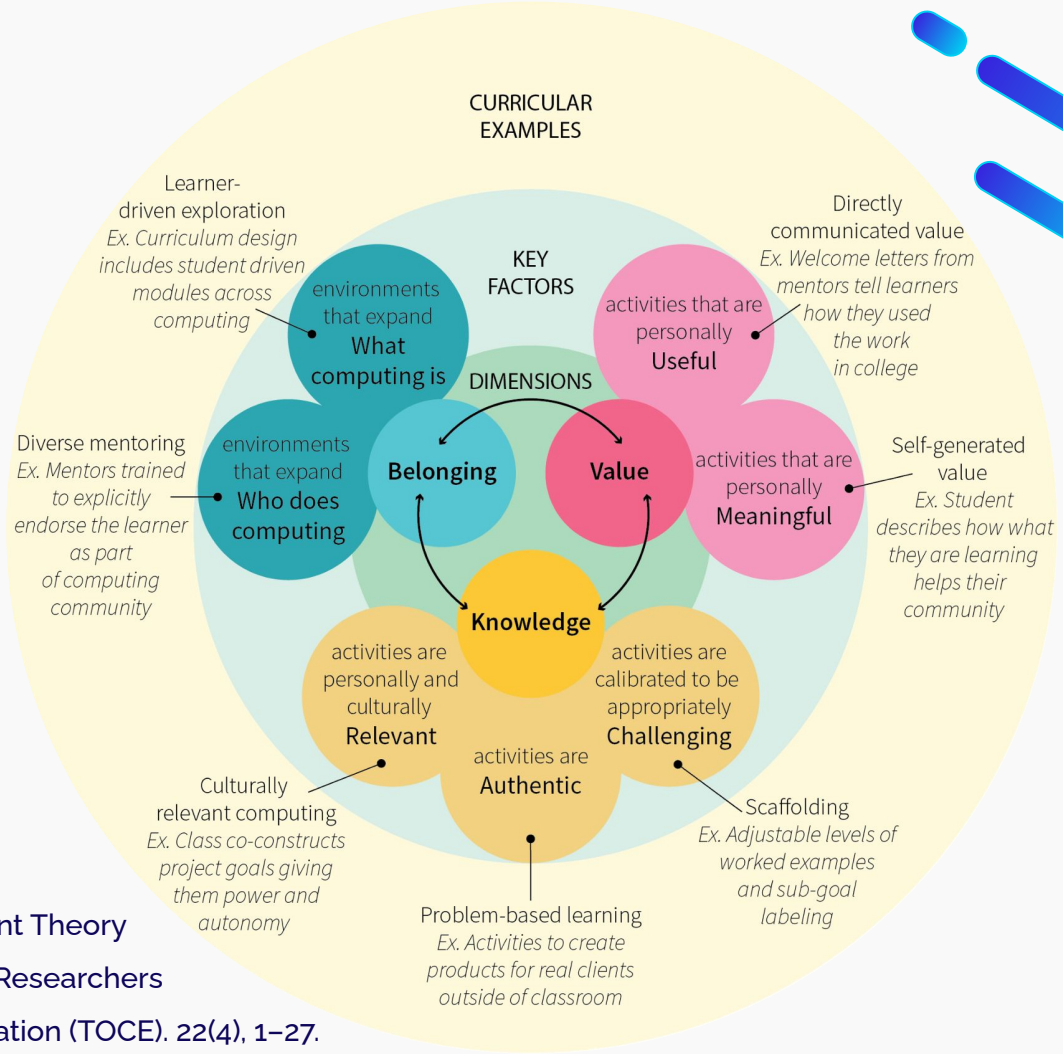
Providing learning experiences that **resonate with students' experiences and identities** can **deepen engagement** and **increase** the likelihood of **knowledge acquisition**.

Introduction & Motivation

Interest is a critical driver for learning.

Designing computational learning opportunities based around interest can meaningfully impact **engagement** and **learning outcomes**.

Meet the Integrated Interest Development for Computing Education framework

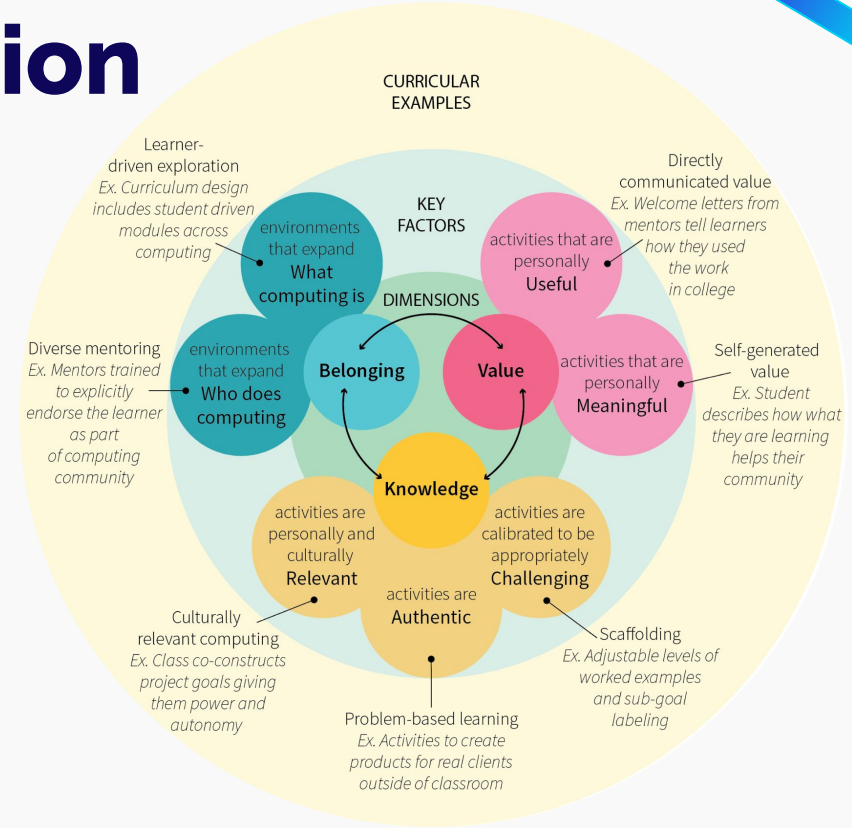


Michaelis, J. & Weintrop, D. (2022). Interest Development Theory in Computing Education: A Framework and Toolkit for Researchers and Designers. ACM Transactions on Computing Education (TOCE). 22(4), 1–27.

Interest-driven Learning in Computing Education

Knowledge:

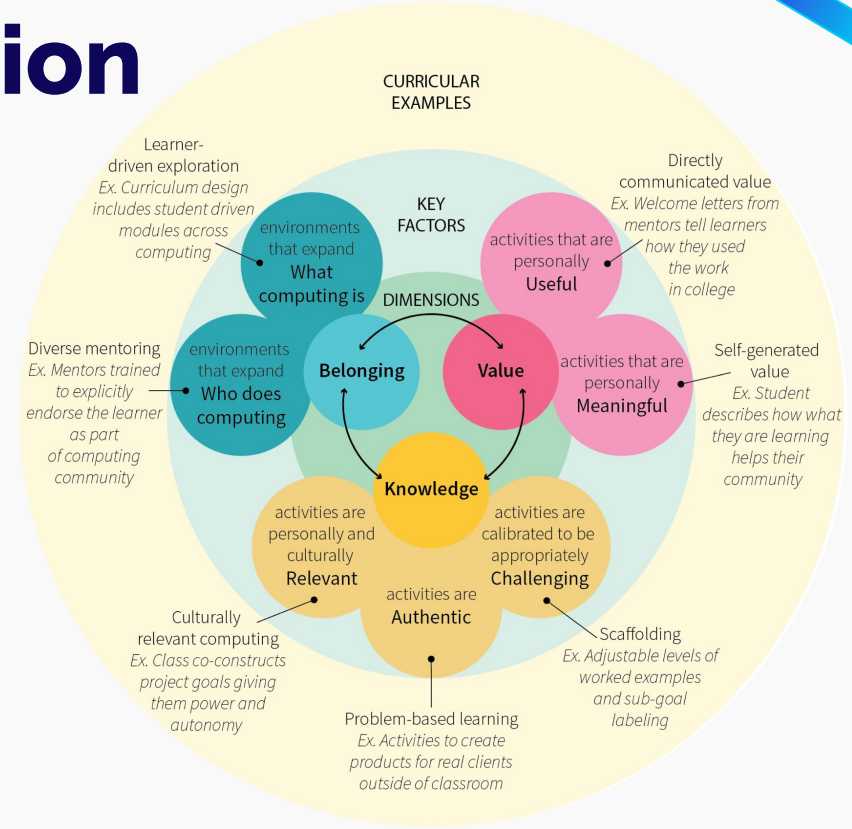
The more you know, the more interested you are; the more interested you are, the more you want to know.



Interest-driven Learning in Computing Education

Value:

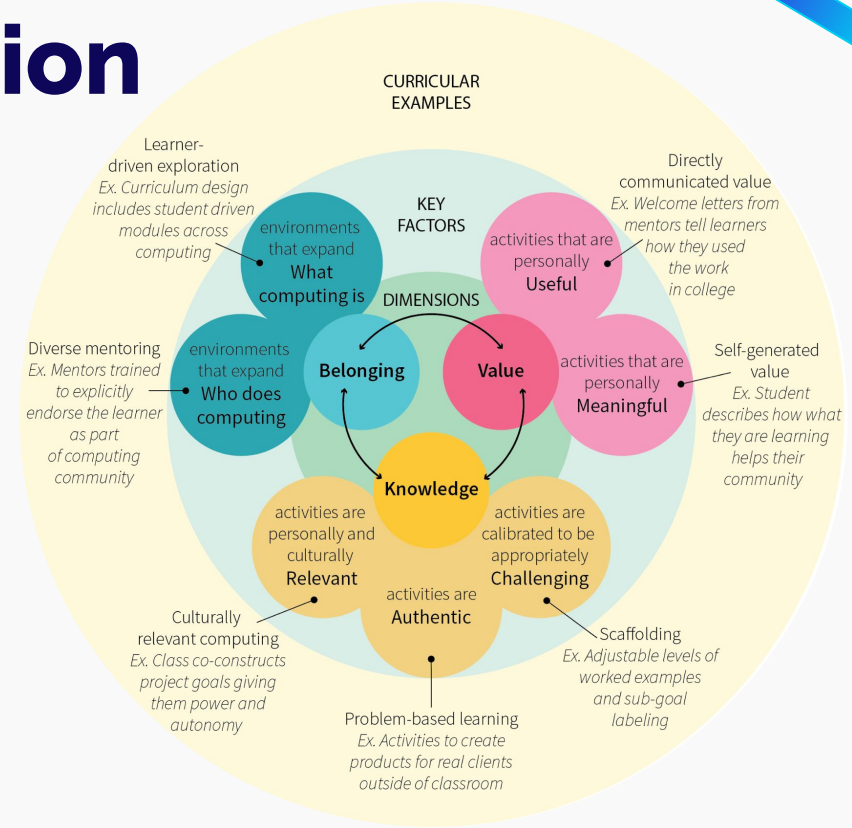
The more you care, the more interested you are; the more interested you are, the more you care.

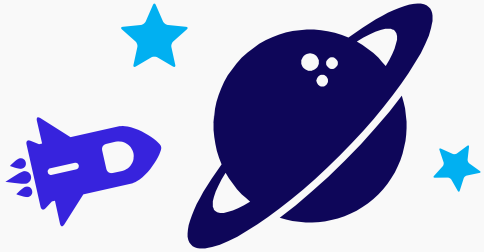


Interest-driven Learning in Computing Education

Belonging:

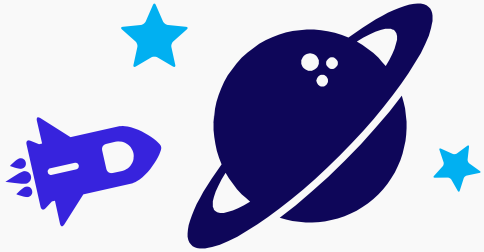
The more you connect to a topic, the more interested you become.





Research Goal

Introduce high-school students to **computational foundations of data science** by having them **explore meaningful and authentic data** that **align with their interests**.



Designing an Interest Driven Curriculum

Create a data science curriculum that

- students find engaging and compelling
- informed by their values and voices

Participatory Design

- A research methodology that involves the end-users in the design process to ensure the outcome reflects their voices, values, and needs.
- PD was found to be effective in improving learning materials and curriculum development, as well as identifying students' interests.

(Coenraad et al., 2022; DiSalvo & DiSalvo, 2014)

Settings & Participants

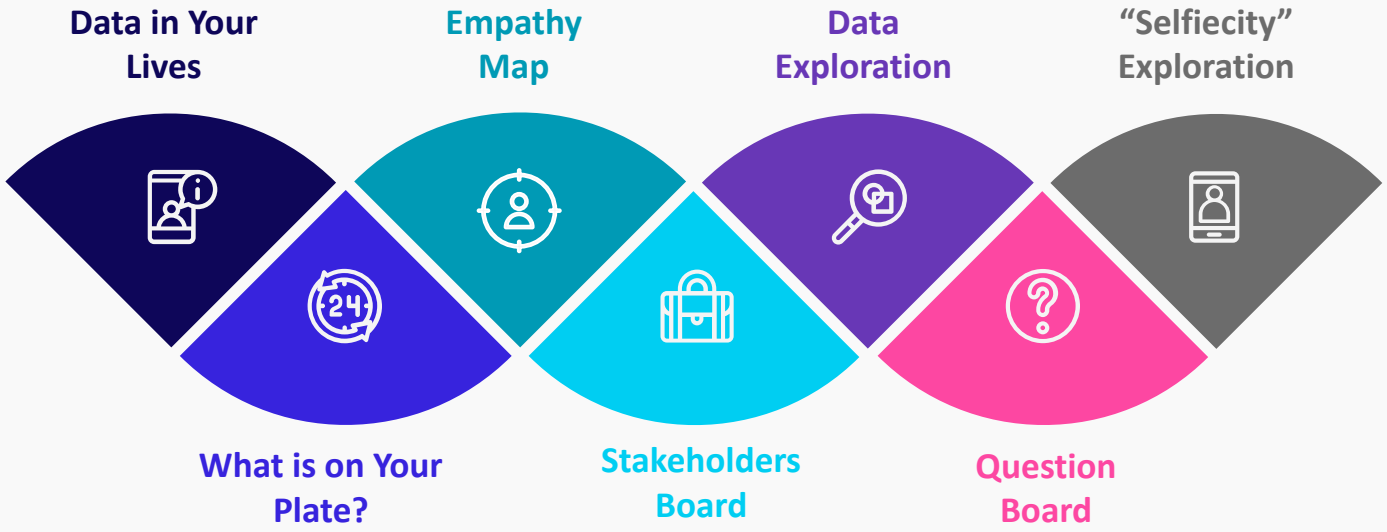
Urban, public charter high school

28 9-12 grade students

Gender	N
Male	17
Female	11
Race	
Black or African American	22
Native American	2
Hispanic	1
White	1

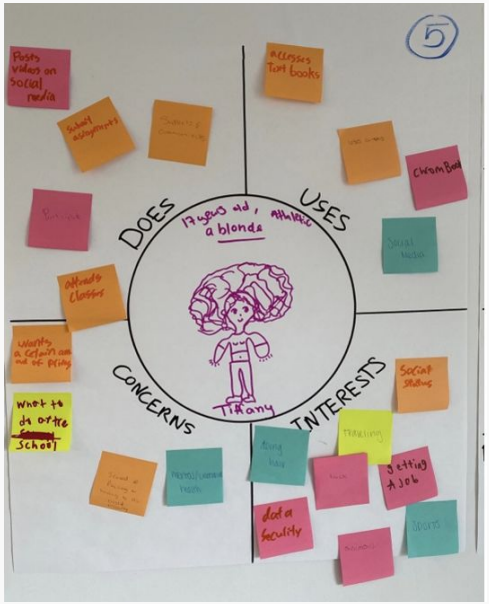
Participatory Design Activities

Discussions and 7 hands-on design activities:



Empathy Map

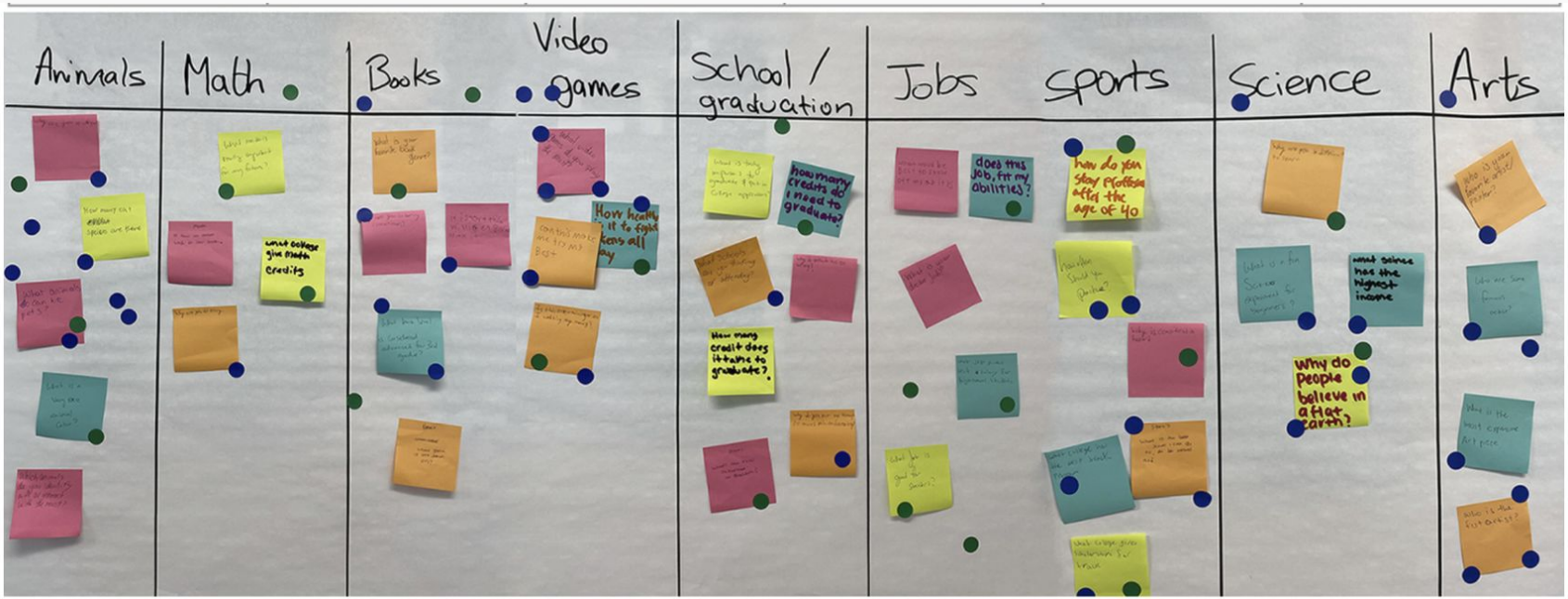
A User-Centered Design concept of a persona (Miaskiewicz & Kozar, 2011)



Code	Examples
Where	"Social Media (e.g., Instagram, Twitter)"; "Netflix"; "Hulu"; "Canvas"; "Google"; "Online shopping"; "iMessage"
Concerns	"Being tracked by the apps used"; "Being recorded without his consent"; "Someone wants to use your data against you"
Area of Interest	"Sports"; "Social Media"; "Video Games"; "Music"; "Movies and TV Shows"; "Animals"

Question Board

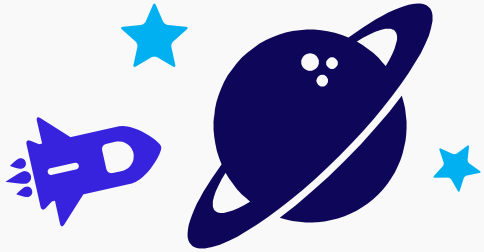
Students brainstormed and voted on questions of interest



Data Collection and Analysis

- Audio and video recordings, design artifacts, survey
- Open coding approach to Identifying emerging themes (Saldaña, 2016)

Code	Definition
What	Student-provided definitions of data
Who	Student-provided entities and organizations interested in data
Why	Student-provided reasons for entities and organizations to collect data
Where	Student-articulated sources of data (i.e., defining where data comes from)
Concerns	Student-articulated issues regarding the collection, storage, sharing, and use of data
Area of Interest	Student-articulated topics they are interested in



Meet

API CAN CODE

The API Can Code Curriculum

An interest-driven curriculum that introduces high-school students to computational foundations of data science by having them **explore meaningful and authentic data that align with their interests using APIs**.

The Curricular Units

Unit 1: Data in Learners' Lives

- 1.1 Introduction to Data
- 1.2 Data Collection and its Purpose
- 1.3 Using Data: the DIKW Model
- 1.4 Sources of Data
- 1.5 Evaluating Datasets
- 1.6 Data Collection: Impact and Equity

Unit 2: Computational Foundations of Data Science

- 2.1 What is Data Science?
- 2.2 Manual Data Processing
- 2.3 Intro to Programming with EduBlocks
- 2.4 Accessing Data with APIs using RapidAPI
- 2.5 Preparing Data for Analysis
- 2.6 Data Analysis in Practice

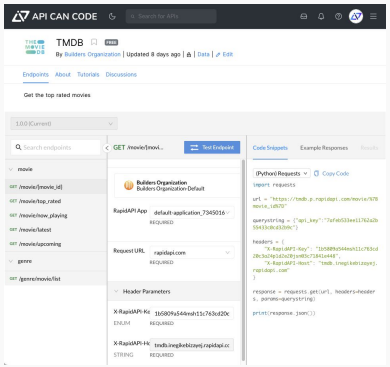
Unit 3: Data Science Practices

- 3.1 Introduction to Data Visualization
- 3.2 Exploratory Analysis with CODAP
- 3.3 Graphs and Figures: One Variable
- 3.4 Graphs and Figures: Two Variables
- 3.5 Statistical Testing
- 3.6 Linear Models

The Curricular Approach

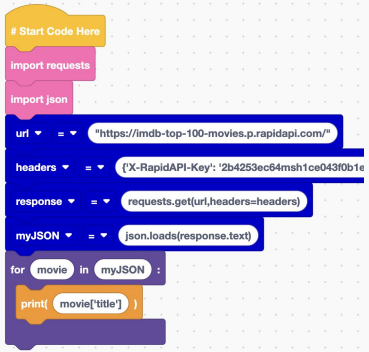
Unit 1:
Data in
Learners' Lives

Rapid



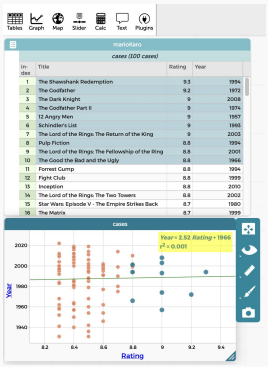
Unit 2:
Computational
Foundations

edublocks



Unit 3:
Data Science
Practices

CODAP



Final Project: Doing Data Science

1. Finding Data students care about
2. Generating Research Questions
3. Manipulating Data
4. Visualizing Data
5. Communicating the results

An API Can Code Example

"How much does a house in my neighborhood cost?"

Access the Zillow dataset

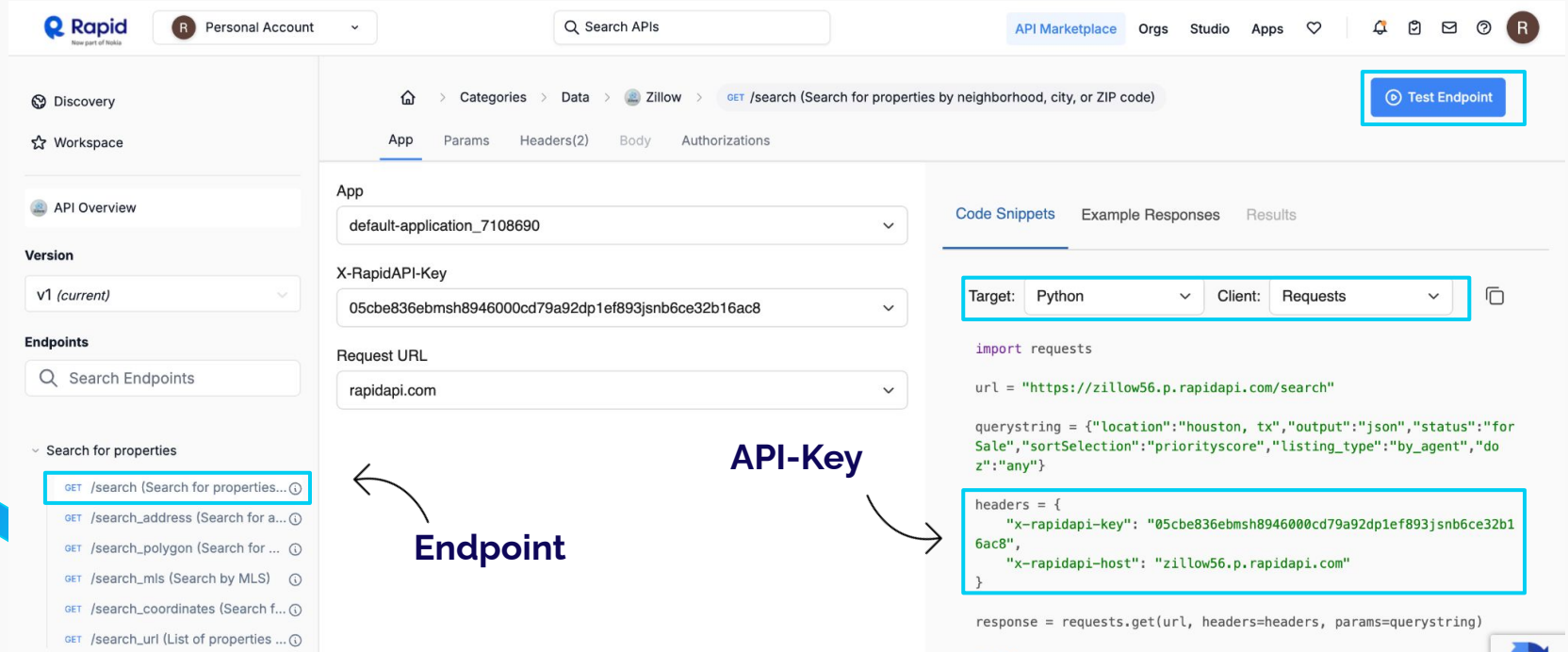
Identify questions about this dataset

Filter data from the API source

Create data visualizations and interpret

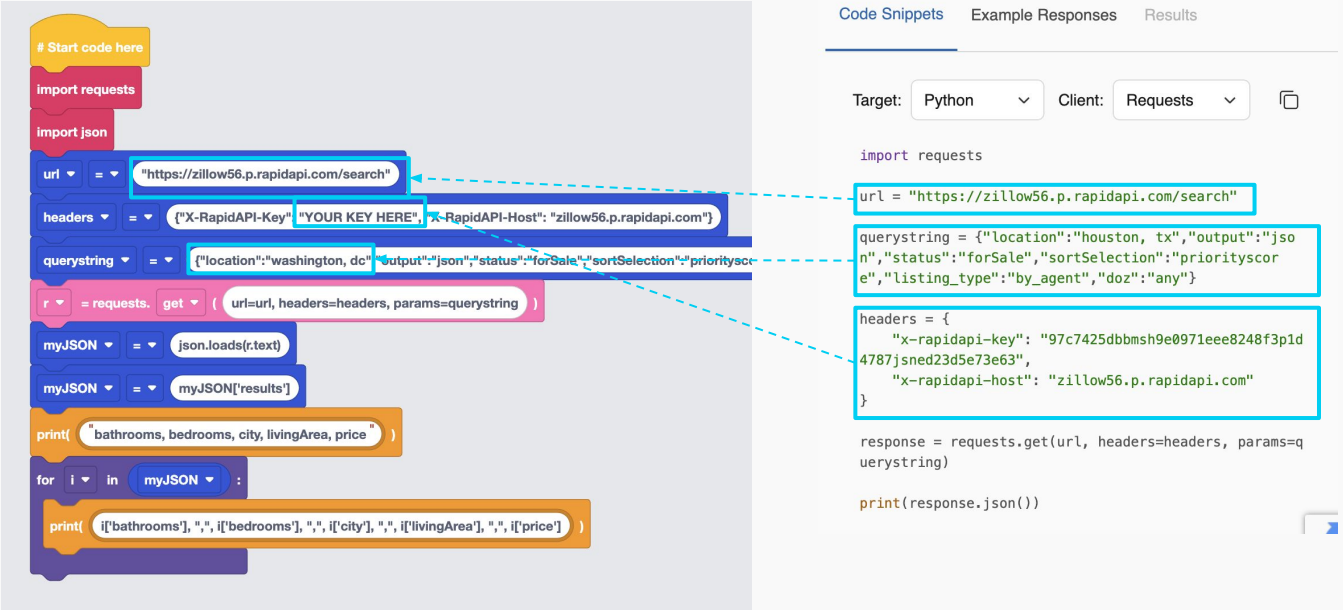
Access the Zillow Dataset

Choose the **"/search properties by neighborhood, city, or ZIP code" endpoint** and **find your API-Key** in the code snippets.



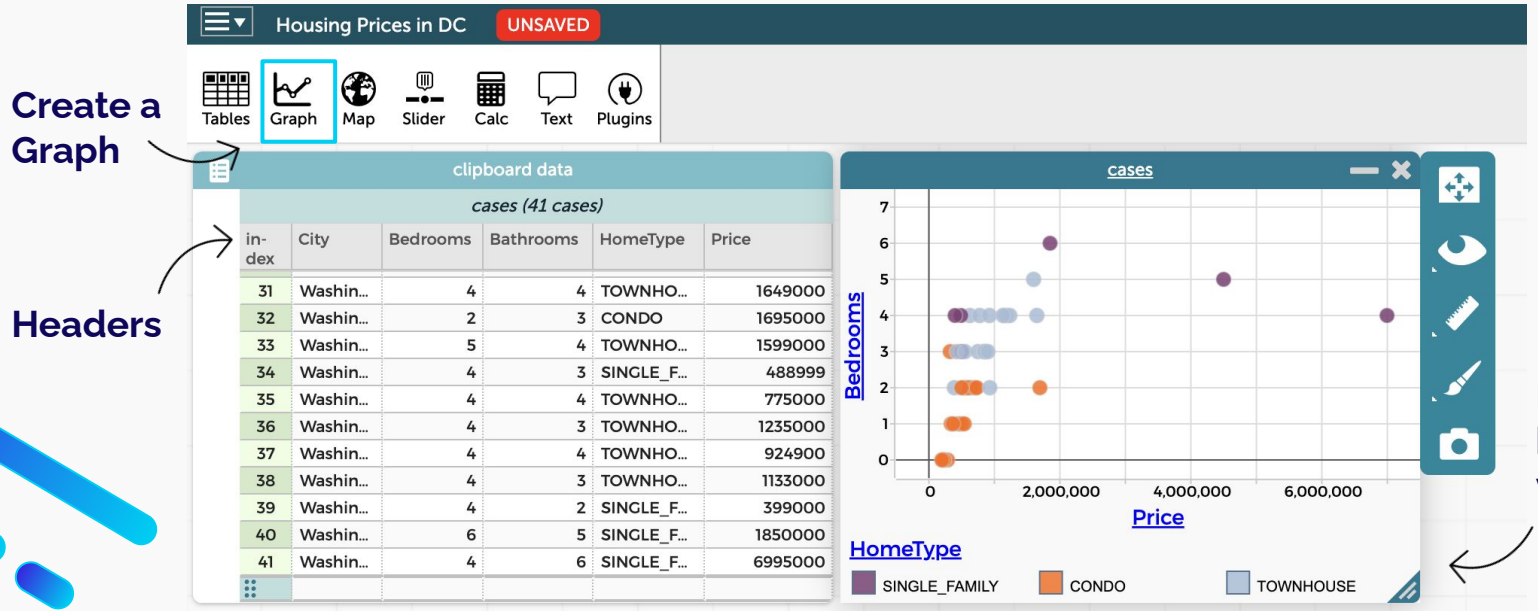
Retrieve & Filter the Data

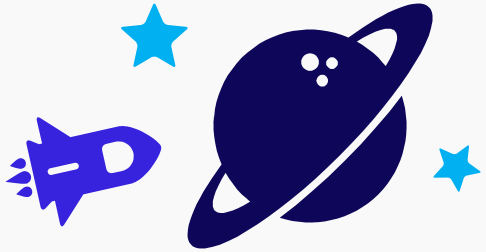
- Open this EduBlocks program (Clone, rename, and save!)
- **Insert your API-Key** and **change the location**



Create Data Visualization

- **Create a new graph** and **drag** the relevant **headers** to the x and y axis





Interest-driven Learning in API Can Code

Integrating Students' Area of Interest

Topic	Lessons	Examples of Datasets
Social Media	1.2, 1.4, 2.4, 3.5	TikTok's Privacy Issues, Facebook Report
Music	1.5, 2.5	Billboard Hot 100 API
Sports	1.4, 2.6, 3.1, 3.5	NFL game scores, NBA API
Video Games	2.3, 2.5	Mario Kart Data
Movies & TV Shows	1.2, 1.6, 2.3, 2.4	IMDB Top 100 Movies API
Animals	1.5, 3.2, 3.3	Mammals Data, Four Seals Data
School / Education	1.4, 1.6, 2.2, 3.1, 3.3, 3.4	Schools' locations, Choosing a Collage
Going Out	3.2, 3.4	Roller Coasters Data
Environment & Health	1.1, 1.3, 3.1, 3.6	Plastic Bottle Waste, Earthquakes (USGS)
Food / Cooking	1.4, 1.5, 2.1, 3.2, 3.3	Starbucks Yearly Data, Food Deserts
Money / Jobs	1.1, 3.3, 3.5	Data Science Salaries,
Community	1.3, 1.4, 1.5, 1.6, 2.1, 3.5	DC COVID-19 Data, Zillow API

Integrating Students' Area of Interest

	Unit 1						Unit 2						Unit 3					
	1.1	1.2	1.3	1.4	1.5	1.6	2.1	2.2	2.3	2.4	2.5	2.6	3.1	3.2	3.3	3.4	3.5	3.6
Social Media		X		X			X			X							X	
Music					X						X							
Sports				X								X	X				X	
Video Games									X		X						X	
Movies & TV Shows		X				X			X	X			X					
Animals					X									X	X			
School / Education				X		X		X					X		X	X		
Going Out														X		X		
Environment & Health	X			X									X					X
Food / Cooking				X	X		X							X	X			
Money / Jobs	X														X		X	
Community			X	X	X	X	X	X									X	

Integrating Students' Area of Interest

What dimensions of interest-driven learning are present?

		Unit 1: Data in Learners' Lives						Unit 2: Computational Foundations of Data Science						Unit 3: Data Science Practices					
		1.1	1.2	1.3	1.4	1.5	1.6	2.1	2.2	2.3	2.4	2.5	2.6	3.1	3.2	3.3	3.4	3.5	3.6
Knowledge	Challenge			×	×	×	×	×	×	×	×	×	×		×	×	×	×	×
	Relevance		×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	
	Authenticity							×	×	×	×	×	×		×	×	×	×	×
Value	Personal Meaning	×	×	×	×	×	×	×			×	×						×	
	Usefulness		×			×	×	×	×					×	×		×	×	
Belonging	What Data Science is?	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×
	Who Does Data Science?	×	×	×	×	×	×	×					×		×	×	×		×

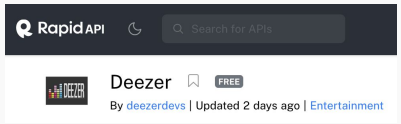
Final Project: Doing Data Science

“Is Jhené Aiko a star?”

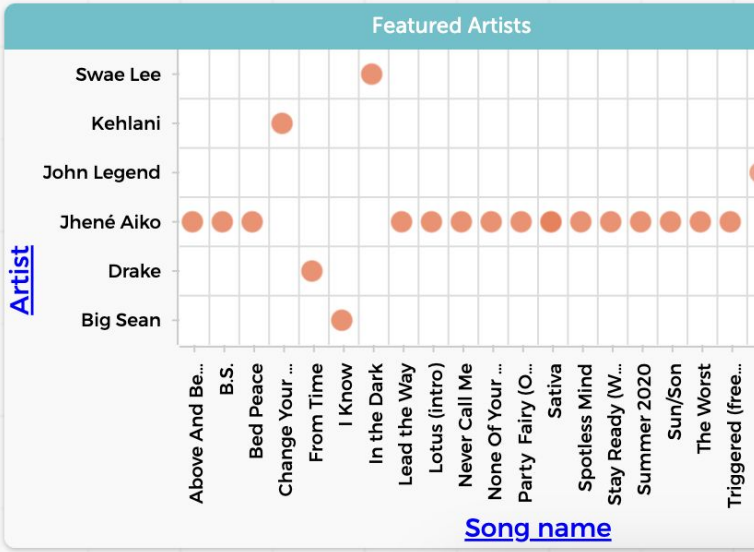
Final Project: Doing Data Science

"Is Jhené Aiko a star?"

DEEZER

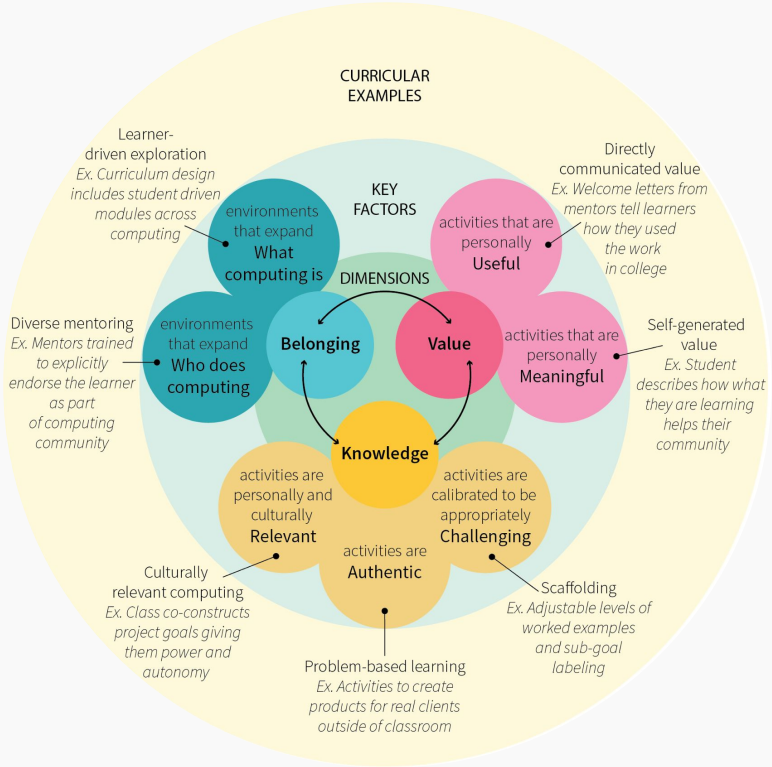



```
# Start code here
import requests
import json
url = "https://deezerdevs-deezer.p.rapidapi.com/search"
headers = {"X-RapidAPI-Key": "e2f29b2b80mshd2c4cf79aa84cacp119f2ejsn80180e7f58
querystring = {"q":"Jhene Aiko"}
r = requests.get(url=url, headers=headers, params=querystring)
myJSON = json.loads(r.text)
myJSON = myJSON['data']
print("Song name, Album, Artist, Duration, Rank")
for i in myJSON:
    print(i["title"], ",", i["album"]["title"], ",", i["artist"]["name"], ",", i['duration'], ",", i['rank'])
```



Final Project: Doing Data Science

"Is Jhené Aiko a star?"

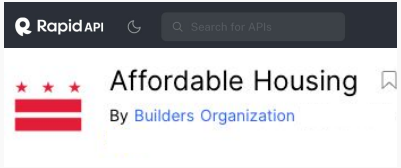


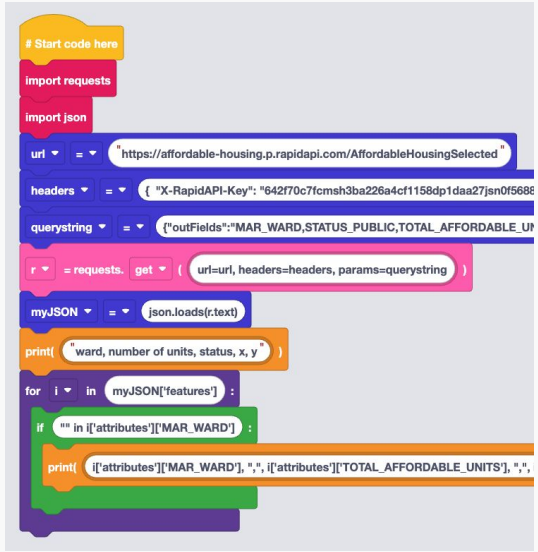
Final Project: Doing Data Science

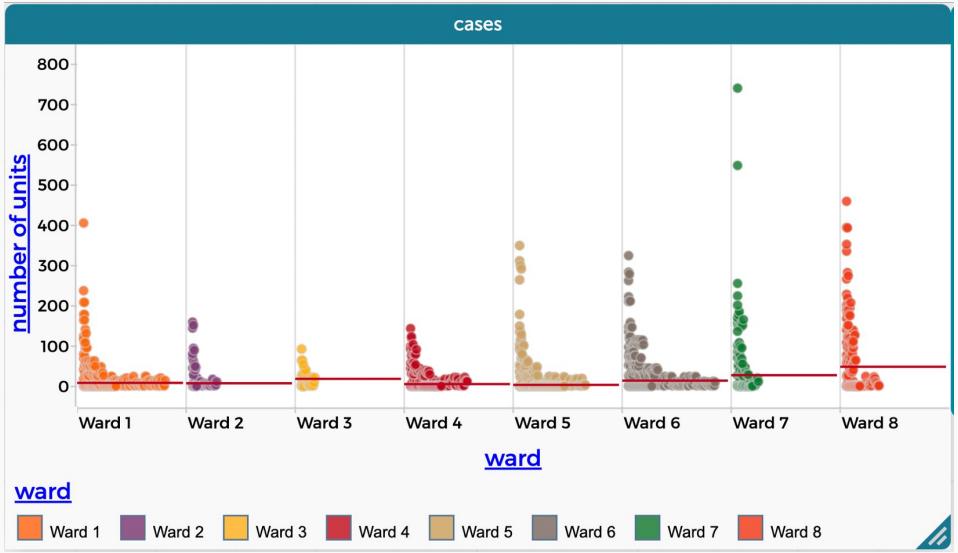
"Which Ward has the most affordable houses?"

Final Project: Doing Data Science

"Which Ward has the most affordable houses?"

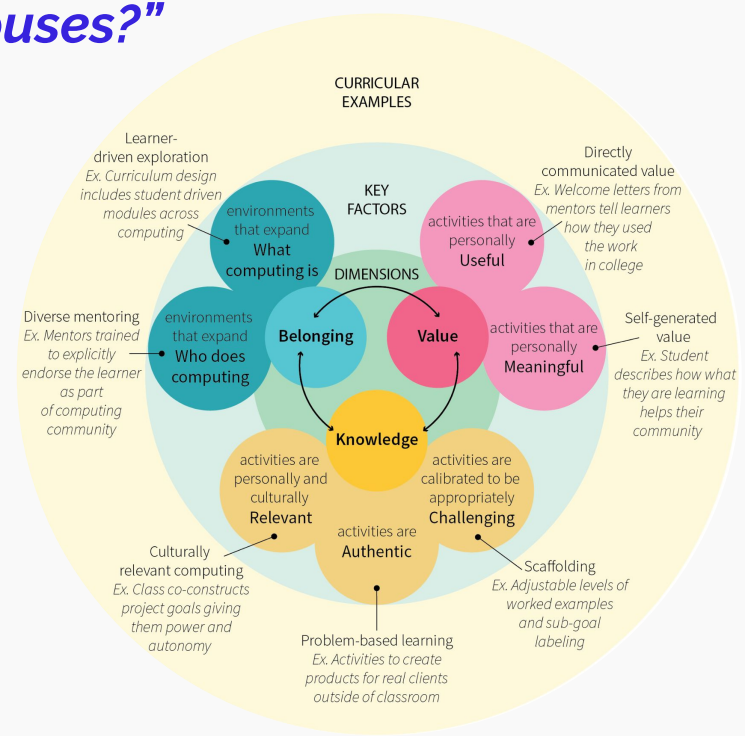






Final Project: Doing Data Science

"Which Ward has the most affordable houses?"



Conclusions

- **Interest** is a critical driver of **learning**
- **Students lived experiences** can provide an **authentic and compelling context for** situating **learning activities**.
- **Participatory Design** can be used to **incorporate students' voices, values, and ideas into** the design of **learning experiences**.

Practical Implications

- **Incorporate student interests:** Let students choose their own inquiry topics to promote agency and authentic engagement.
- **Contextualize relevance:** Explicitly connect classroom activities to careers, social issues, and everyday decisions to highlight the broader value of data literacy.
- **Use real-world examples:** Situate computational learning experiences in students' lived experiences with real topics/challenges from their lives

API Can Code at a Glance

Supportive Teacher Resources
Lesson plans, Ready-to-use slides, Videos, Discussion prompts, Assessment rubric

Student Learning Materials
Example programs, Exit tickets, FAQs, Glossary

Scaffolded Activities
Guided coding activities following the Use > Modify > Create structure

Meaningful Datasets
Datasets and APIs informed by student interests

Available online
Free

http://apicancode.umd.edu

Thank You

Questions?

http://apicancode.umd.edu

Scan me

API CAN CODE

UNIVERSITY OF MARYLAND COLLEGE OF EDUCATION

This work was made possible through generous support from the National Science Foundation (Award # 2141655).