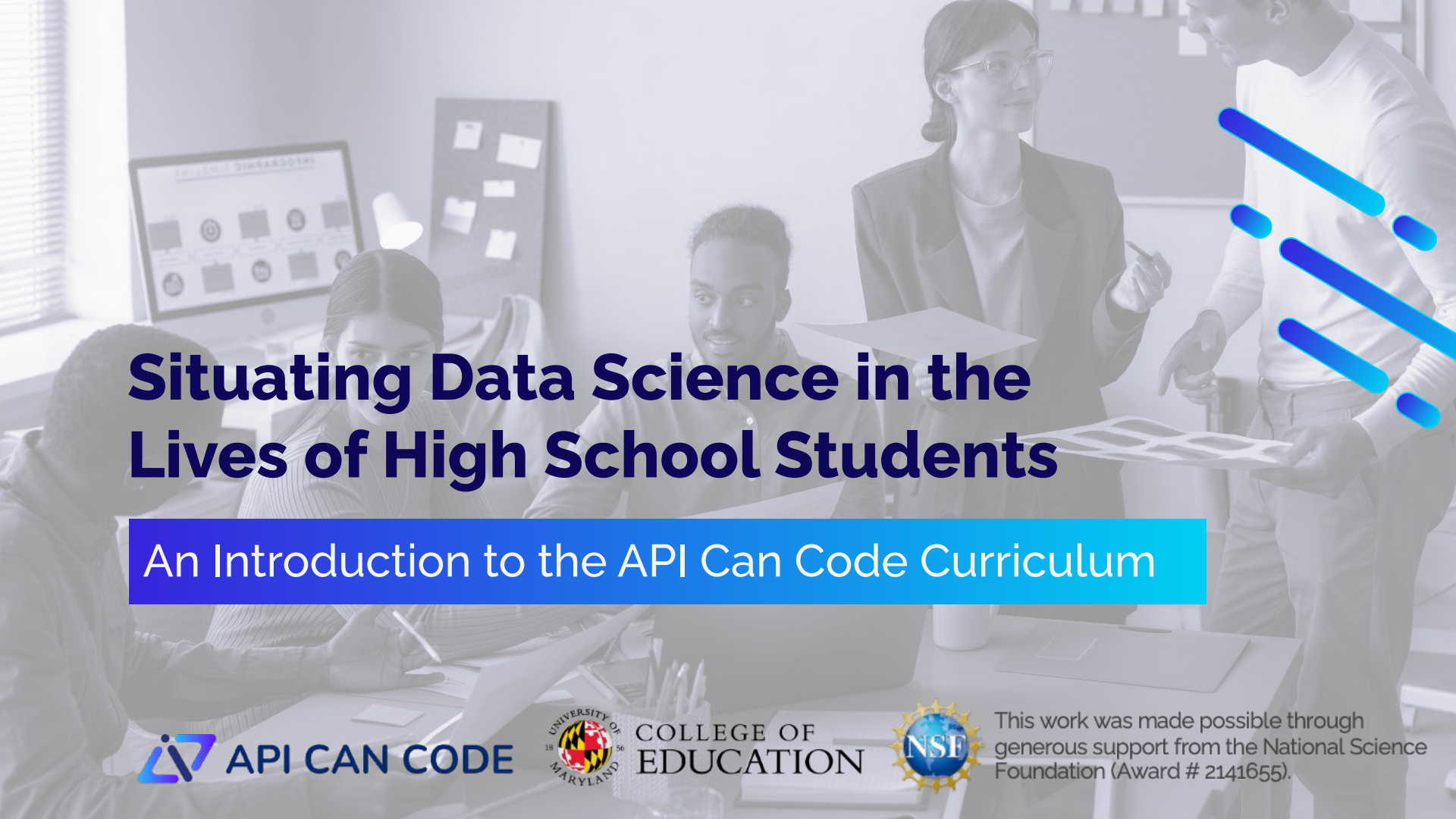


Situating Data Science in the Lives of High School Students

An Introduction to the API Can Code Curriculum

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

David Weintrop

Principal Investigator

Rotem Israel-Fishelson

Postdoctoral Researcher

Peter F Moon

Postdoctoral Researcher

Yue Xin

Doctoral Student

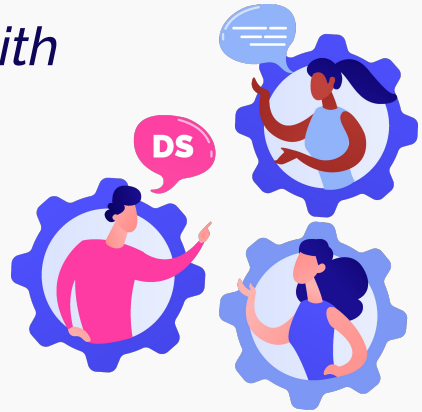
Introduction & Motivation

In our increasingly data-driven world, it is imperative to provide opportunities for all students to learn foundational data science concepts and practices as part of their K-12 education. (Belitz et al., 2023)

Introduction & Motivation

"Data science bridges disciplines and thus should be introduced and taught across the curriculum in K-12 schools to help develop informed users of data… All subjects in school should recognize the contribution of data to their discipline and take curricular approaches that integrate data with disciplinary lessons where appropriate."

(NCTM, NSTA, ASA, NCSS, and CSTA joint position, April 2024)



Introduction & Motivation

Harnessing data that resonates with students' experiences and aspirations can deepen engagement and increase the likelihood of knowledge acquisition.

(Brooks et al., 2021; Lee et al., 2021)

Intro to Our Research Project

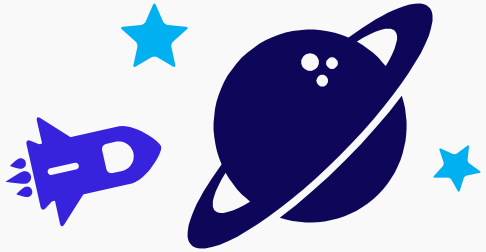
Goal of research:

- Understand the state of Data Science in K-12
- Explore how to teach Data Science to High School students in ways that draw on their interests & identities

High Level Research Project Breakdown

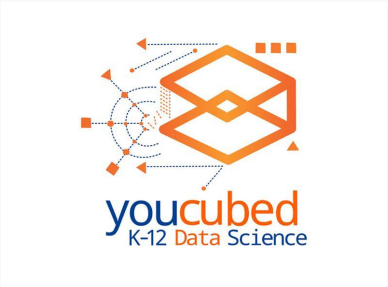
Step 1: Study current high school Data Science

Step 2: Design, teach, and study an interest-driven high school data science curriculum



Studying the Landscape of Data Science

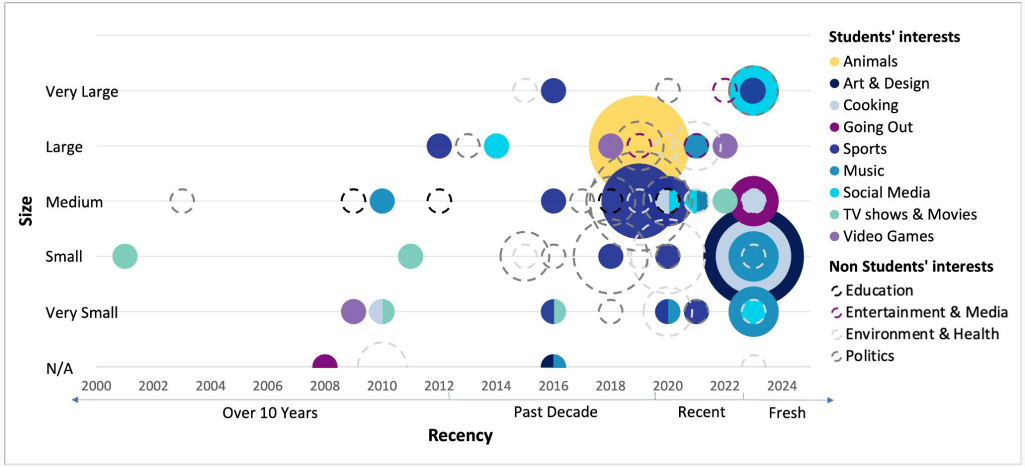
Data Science Curricula



Type Tech Language Topic Size Recency Proximity Interests

Data in K-12 Data Science

Analysis of **296 datasets across 4 curricula** and examination of their **alignment with the students' interests** (Based on data from our PD)



Israel-Fishelson, R., Moon, P. F., Tabak, R. & Weintrop, D. (2024). **Understanding the data in K-12 data science**. *Harvard Data Science Review*, 6(2).

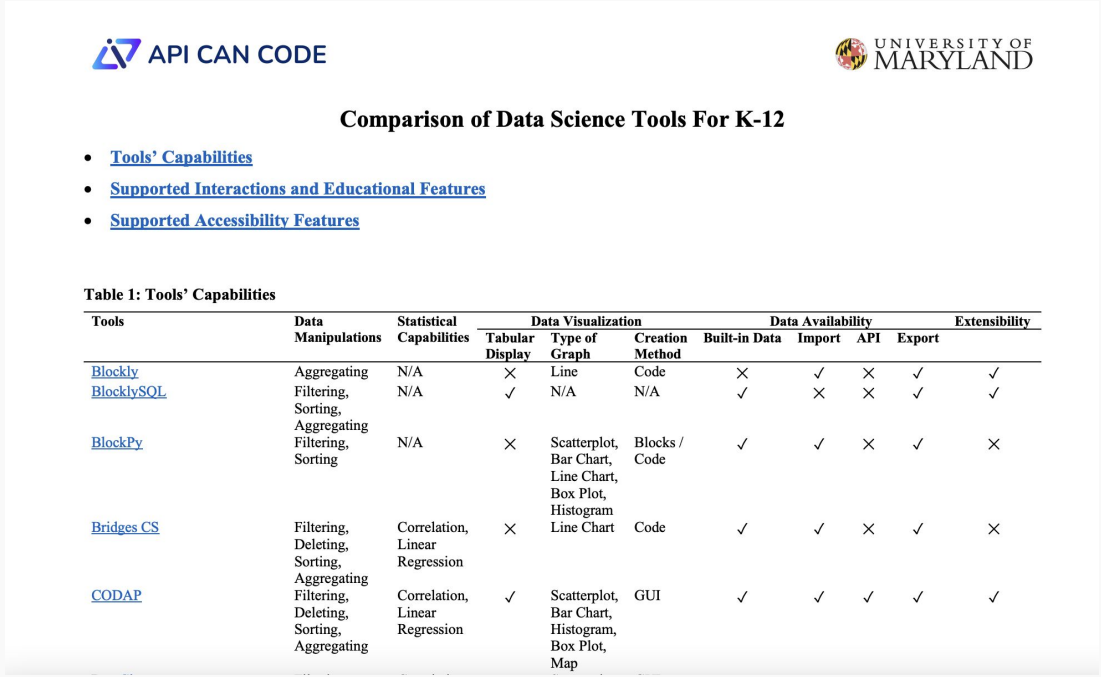
K-12 Data Science Tools

Reviews **30 data science tools** used, or designed to be used, in K-12 data science education. Several attributes are used including **accessibility**.

RQ1: What capabilities does the tool possess regarding data science practices, data visualisation, statistical calculations, and extensibility?
RQ2: How do users interact with the tool, and how might the interaction support learning?
RQ3: What accessibility features does the tool provide?
RQ4: If the tool uses a block-based programming approach, what types of blocks does the tool include to support students learning data science?

Israel-Fishelson, R., Moon, P. F., Tabak, R., & Weintrop, D. (2023). **Preparing students to meet their data: An evaluation of K-12 data science tools**. *Behaviour & Information Technology*, Taylor & Francis.

K-12 Data Science Tools



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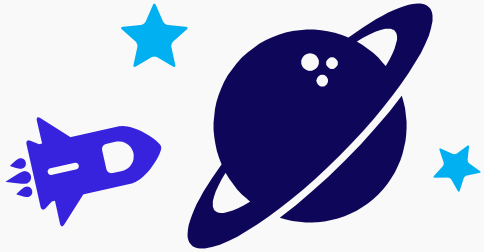
Comparison of Data Science Tools For K-12

- Tools' Capabilities
- Supported Interactions and Educational Features
- Supported Accessibility Features

Table 1: Tools' Capabilities

Tools	Data Manipulations	Statistical Capabilities	Data Visualization			Data Availability				Extensibility
			Tabular Display	Type of Graph	Creation Method	Built-in Data	Import	API	Export	
Blockly	Aggregating	N/A	×	Line	Code	×	✓	×	✓	✓
BlocklySQL	Filtering, Sorting, Aggregating	N/A	✓	N/A	N/A	✓	×	×	✓	✓
BlockPy	Filtering, Sorting	N/A	×	Scatterplot, Bar Chart, Line Chart, Box Plot, Histogram	Blocks / Code	✓	✓	×	✓	×
Bridges CS	Filtering, Deleting, Sorting, Aggregating	Correlation, Linear Regression	×	Line Chart	Code	✓	✓	×	✓	×
CODAP	Filtering, Deleting, Sorting, Aggregating	Correlation, Linear Regression	✓	Scatterplot, Bar Chart, Histogram, Box Plot, Map	GUI	✓	✓	✓	✓	✓

https://go.umd.edu/APICC_DS_Tools



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

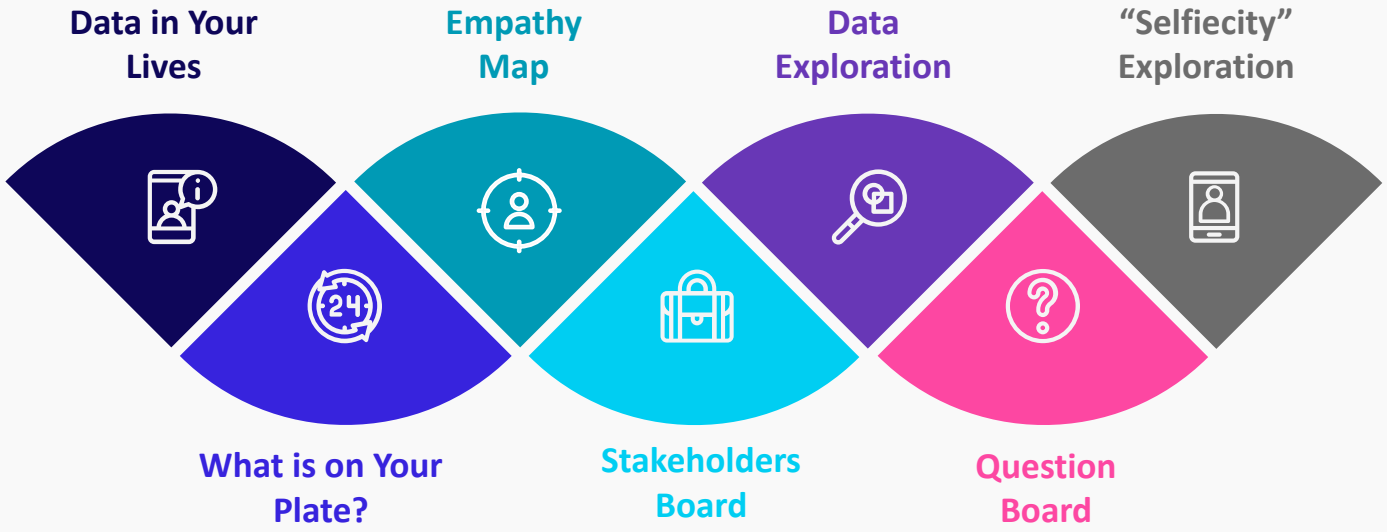
Urban, public charter high school

28 9-12 grade students

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

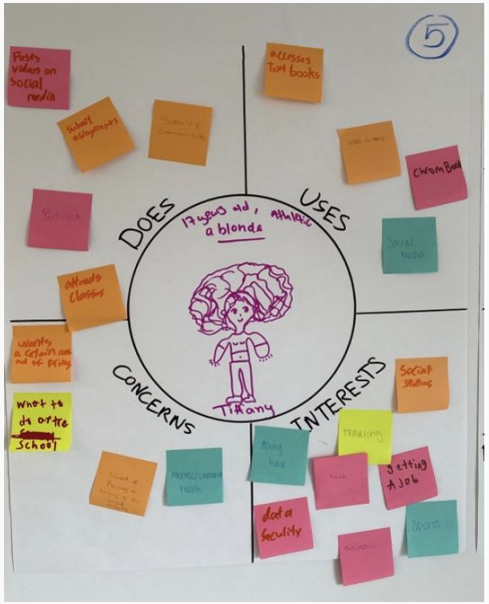
Participatory Design Activities

Discussions and 7 hands-on design activities:

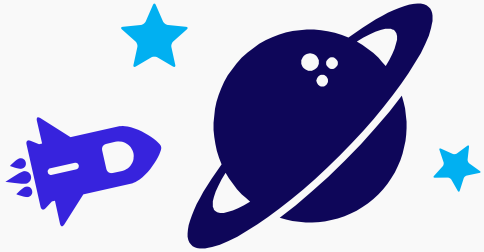


Empathy Map

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"



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**.

An API Can Code Example

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

Access the Zillow dataset

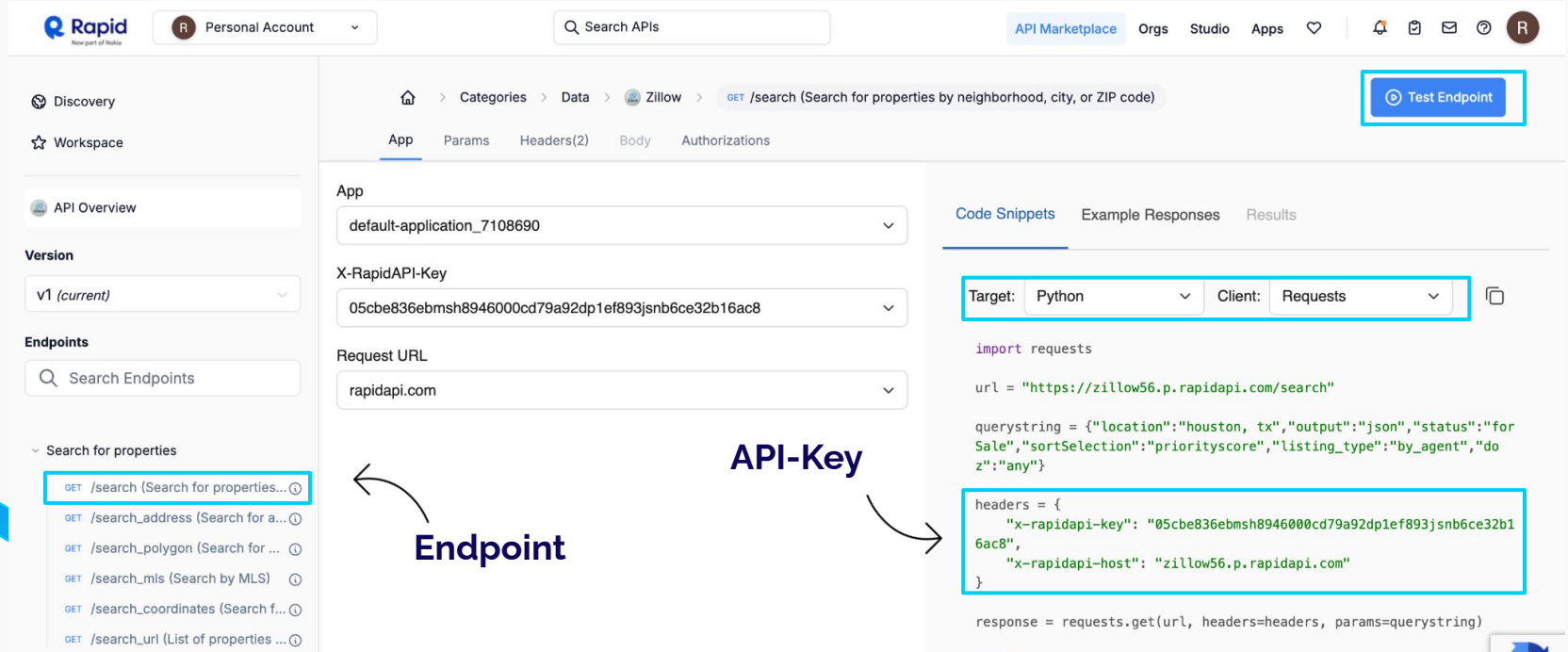
Identify questions about this dataset

Filter data from the API source

Create data visualizations and interpret

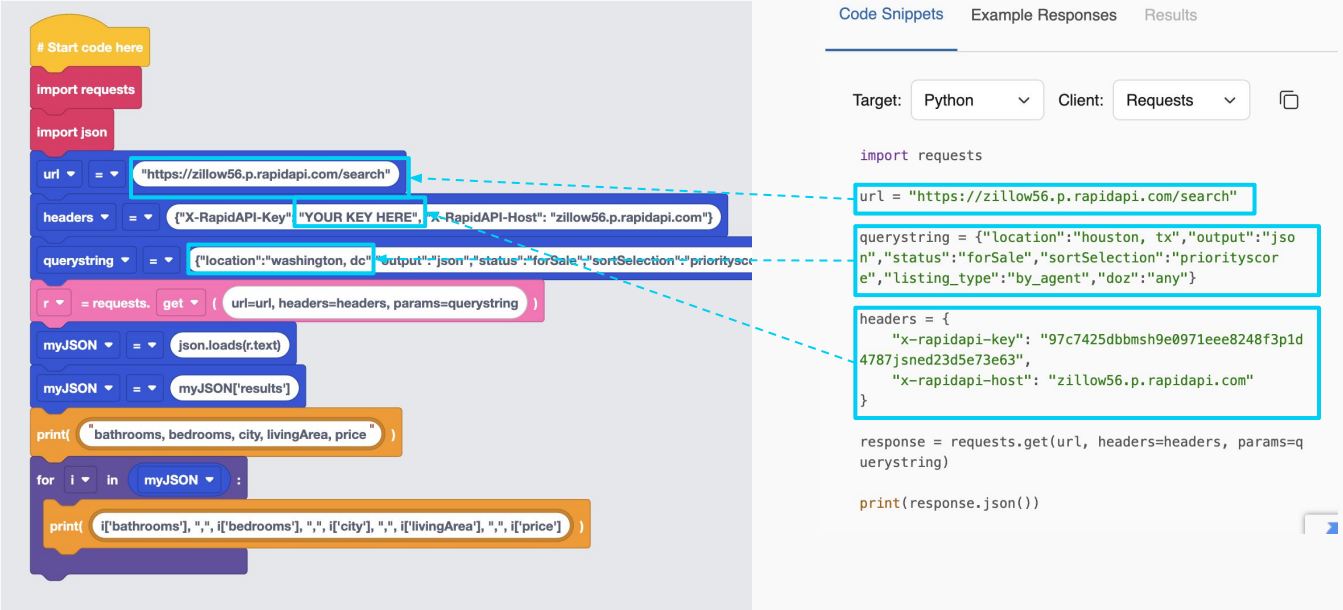
Access the Zillow Dataset

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



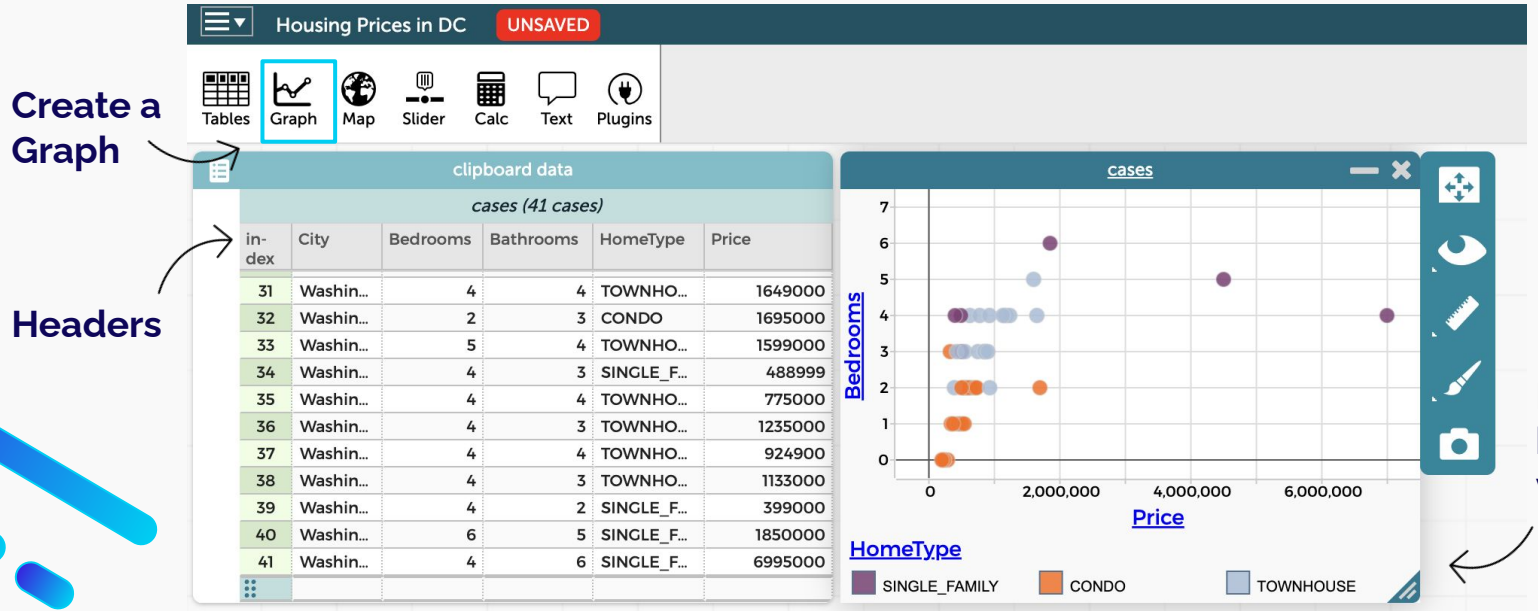
Retrieve & Filter the Data

- 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



The Curricular Approach

Unit 1:
Data in
Learners' Lives

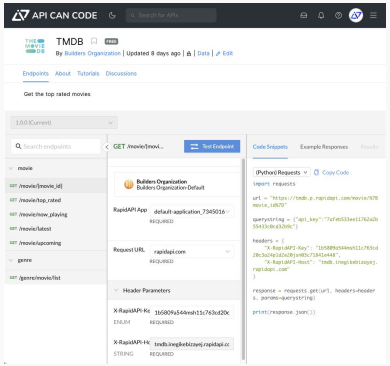
Rapid

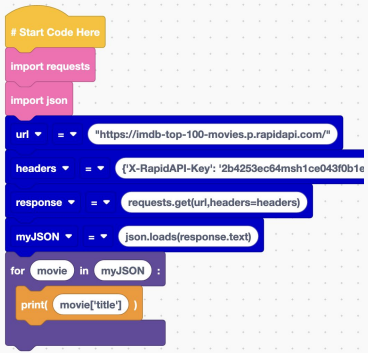
Unit 2:
Computational
Foundations

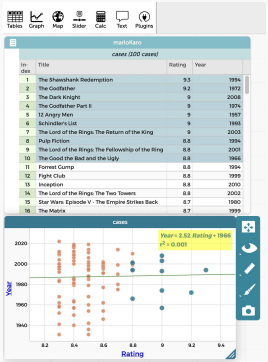
edublocks

Unit 3:
Data Science
Practices

CODAP





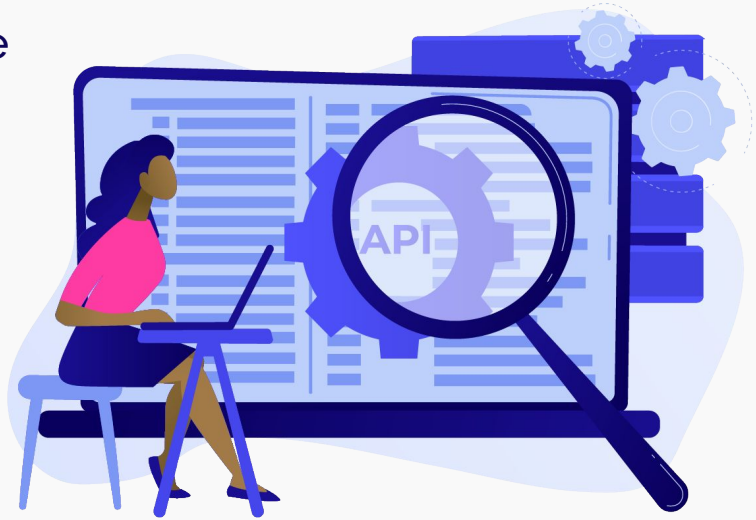


Unit 1: Data in Learners' Lives

1. Introduction to Data
2. Data Collection and its Purpose
3. Using Data
4. Sources of Data
5. Evaluating Data Sources
6. Building a Survey for Data Collection

Unit 2: Computational Foundations of Data Science

1. What is Data Science?
2. Manual Data Processing
3. The Role of Programming in Data Science
4. Accessing Data with APIs
5. Preparing Data for Analysis
6. Manipulating Data



Unit 3: Data Science Practices

1. Introduction to Data Visualization
2. Exploratory Analysis with CODAP
3. Graphs and Figures: One Variable
4. Graphs and Figures: Two Variables
5. Statistical Testing
6. Linear Models

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

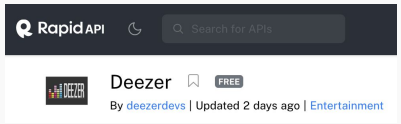
Final Project: Doing Data Science

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

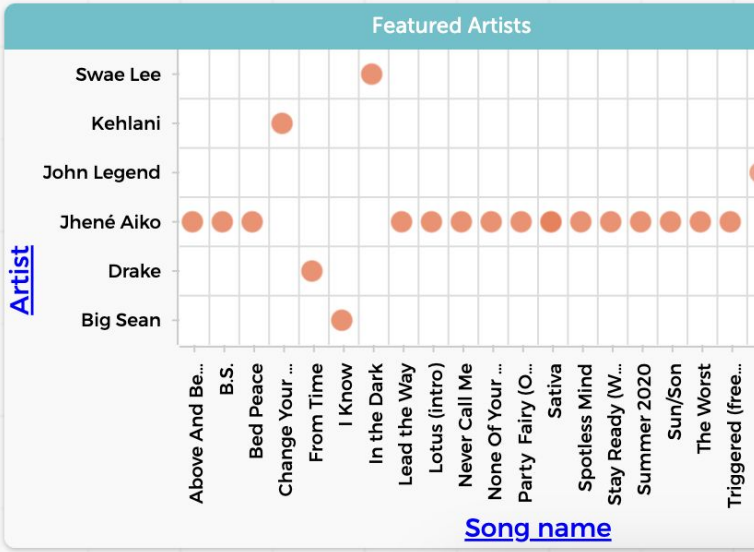
Final Project: Doing Data Science

"Is Jhené Aiko a star?"

DEEZER

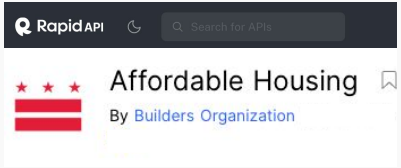


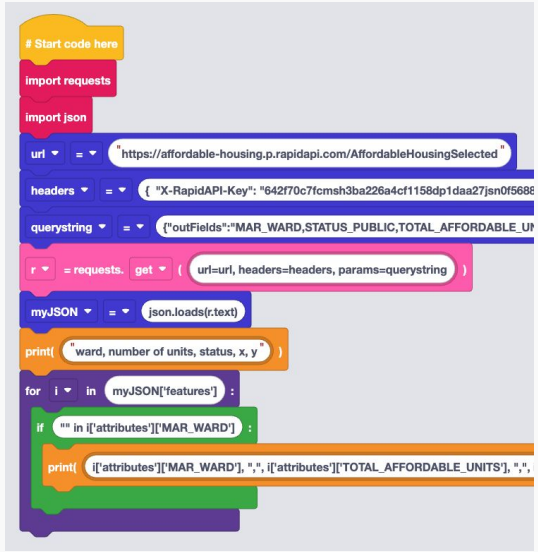

```
# Start code here
import requests
import json
url = "https://deezerdevs-deezer.p.rapidapi.com/search"
headers = {"X-RapidAPI-Key": "e2f29b2b80mshd2c4cf79aa84cacp119f2ejsn80180e7f58
querystring = {"q":"Jhene Aiko"}
r = requests.get(url=url, headers=headers, params=querystring)
myJSON = json.loads(r.text)
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'])
```

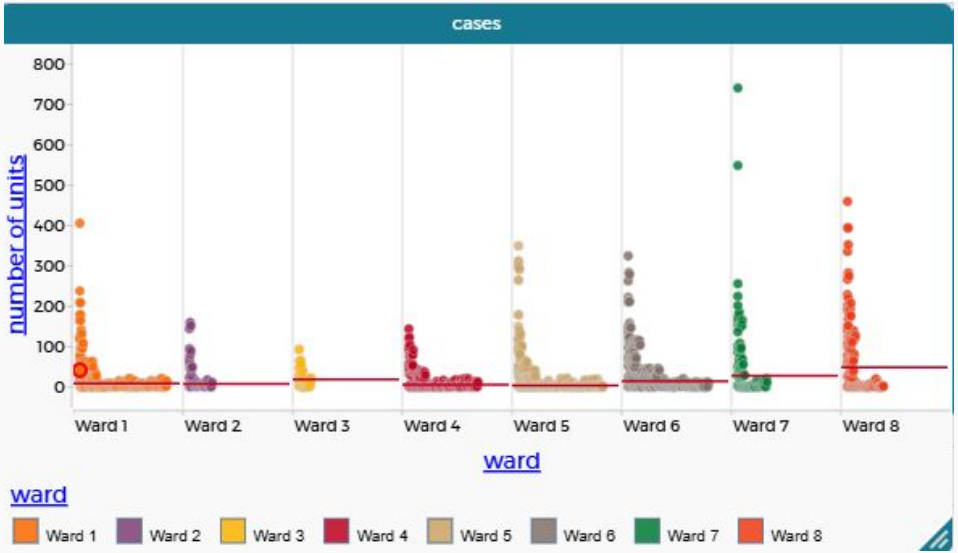


Final Project: Doing Data Science

"Which Ward has the most affordable houses?"







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****

Current Status & Next Steps

- Just finished 2nd classroom implementation
- Analyzing classroom data
- Looking for new schools/districts to partner with

Thank You

Questions?

http://apicancode.umd.edu

Scan me

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