

Interest-driven Learning in Computing Education

An Example from High School Data Science

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The API Can Code Team



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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

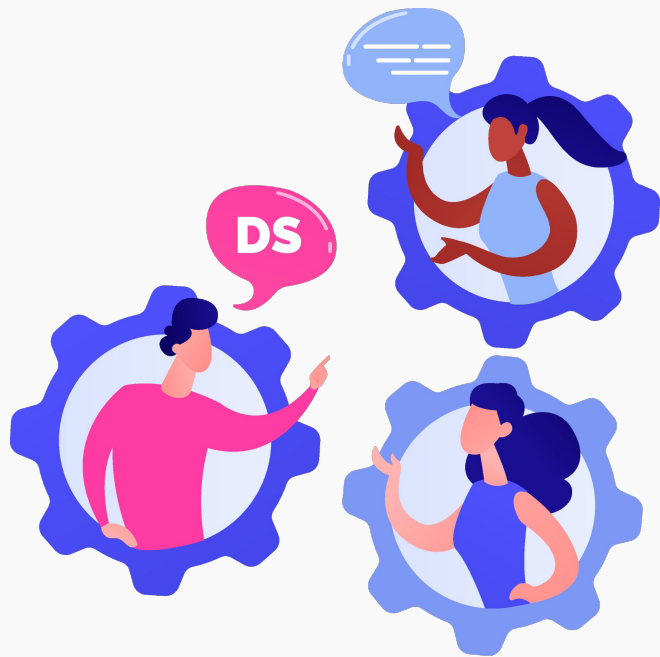
Providing learning experiences that **resonate with students' experiences and identities** can **deepen engagement** and **increase** the likelihood of **knowledge acquisition**.



Introduction & Motivation

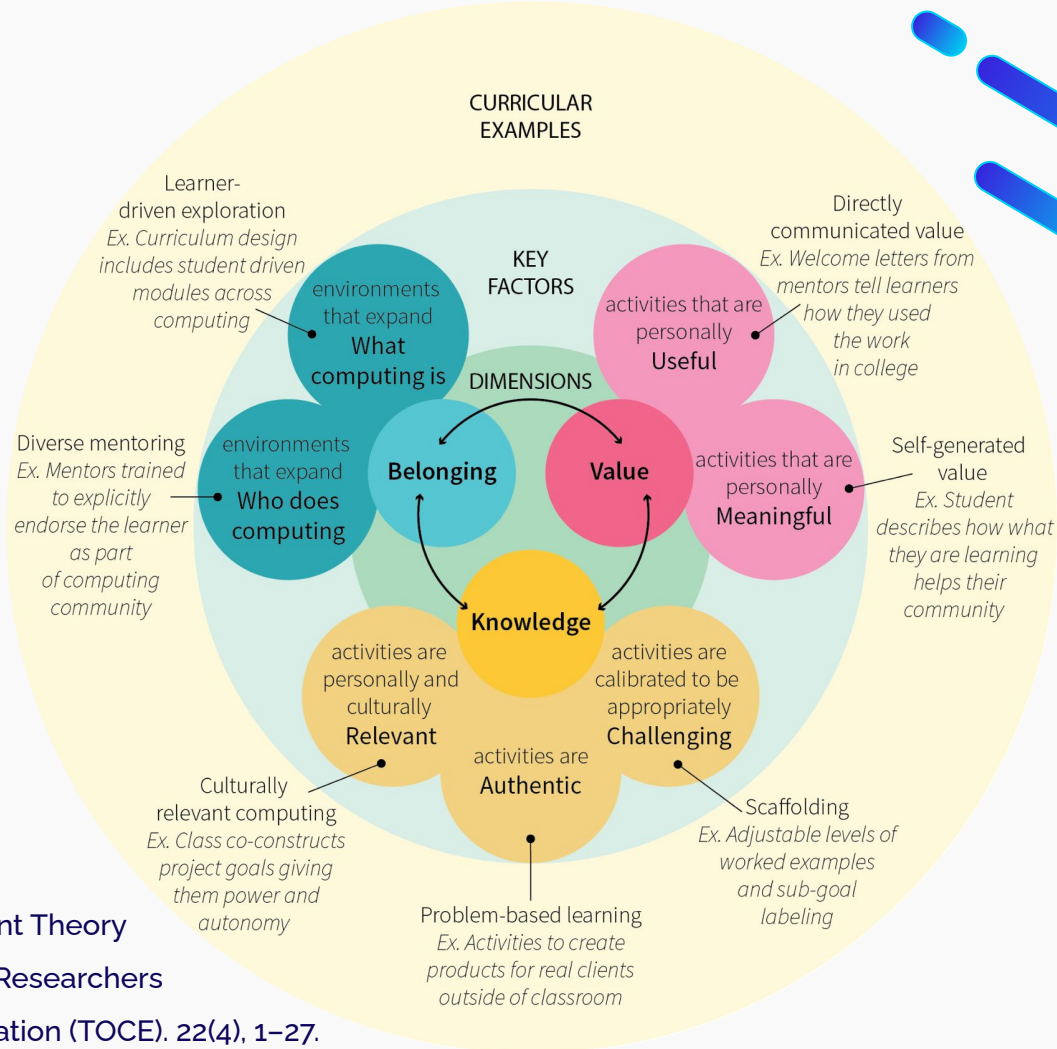
Interest is a critical driver for learning.

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



Meet the Integrated Interest Development for Computing Education framework

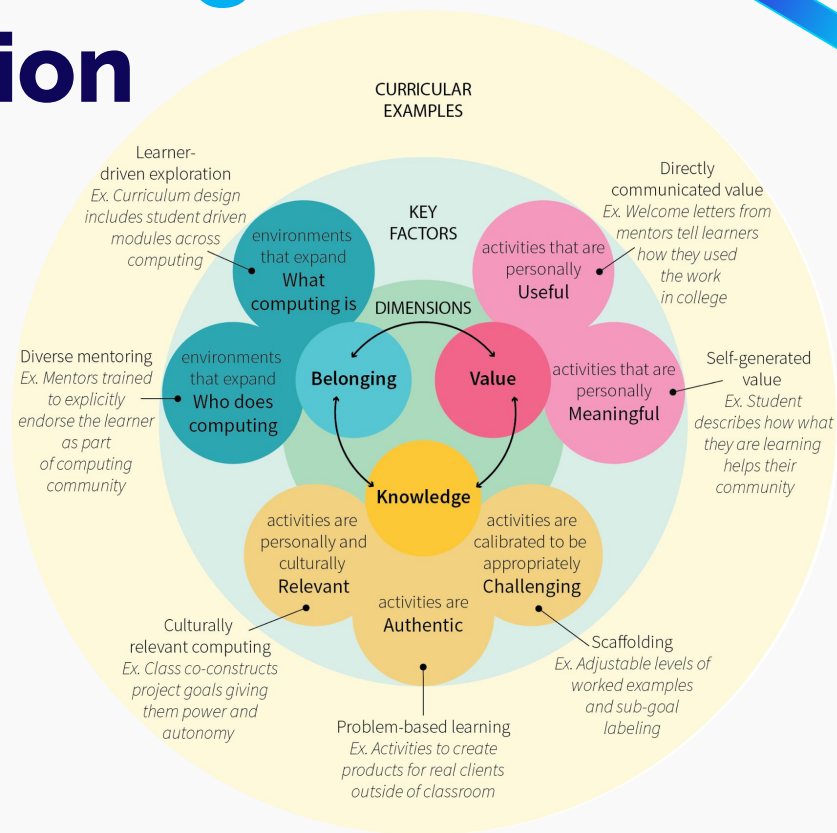
Michaelis, J. & Weintrop, D. (2022). Interest Development Theory
in Computing Education: A Framework and Toolkit for Researchers
and Designers. ACM Transactions on Computing Education (TOCE). 22(4), 1–27.



Interest-driven Learning in Computing Education

Knowledge:

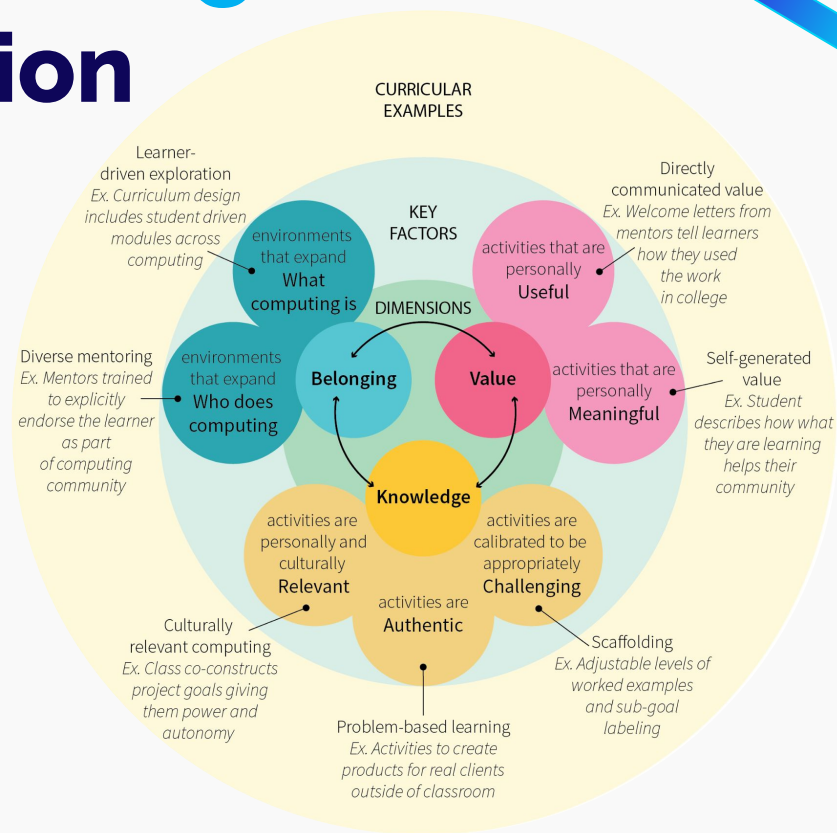
The more you know, the more interested you are; the more interested you are, the more you want to know.



Interest-driven Learning in Computing Education

Value:

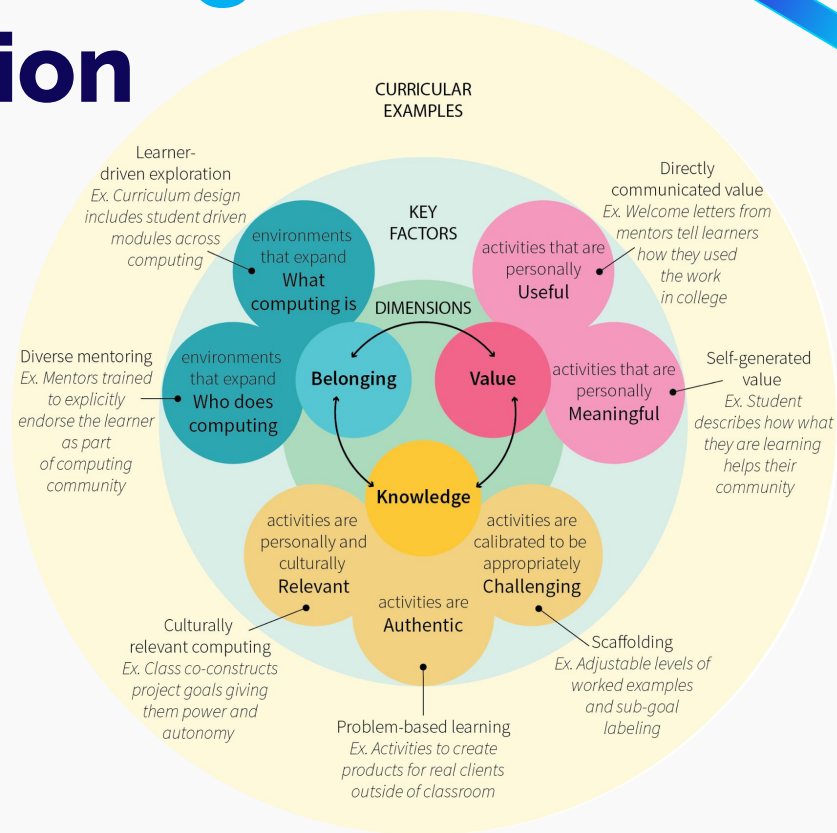
The more you care, the more interested you are; the more interested you are, the more you care.



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

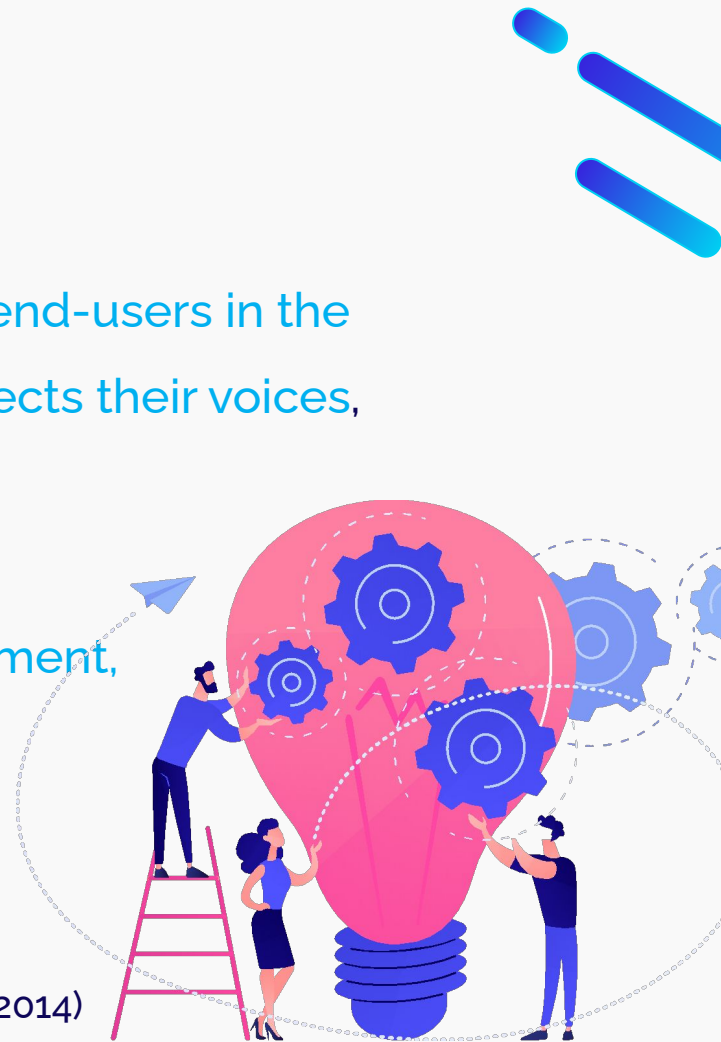
students find engaging and compelling

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



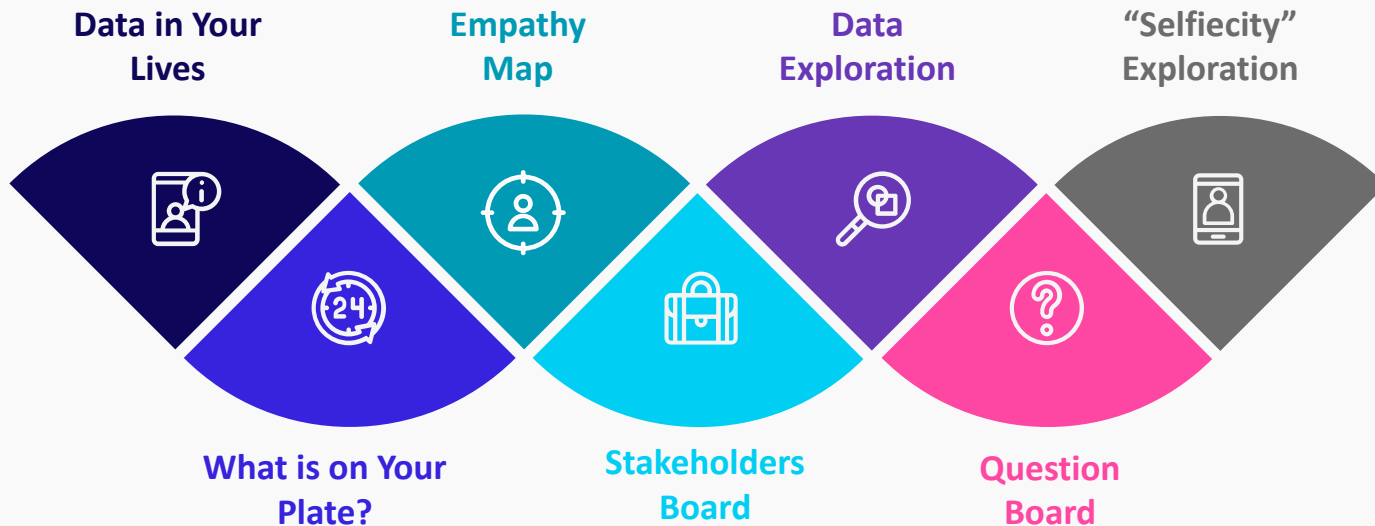
28 9-12 grade students

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

Animals	Math	Books	Video games	School / graduation	Jobs	sports	Science	Arts
- What are the most interesting animals? - What are the most dangerous animals? - What are the most intelligent animals? - What are the most beautiful animals? - What are the most useful animals? - What are the most interesting animals? - What are the most dangerous animals? - What are the most intelligent animals? - What are the most beautiful animals? - What are the most useful animals?	- What are the most interesting math problems? - What are the most difficult math problems? - What are the most useful math problems? - What are the most beautiful math problems? - What are the most interesting math problems? - What are the most difficult math problems? - What are the most useful math problems? - What are the most beautiful math problems? - What are the most interesting math problems? - What are the most difficult math problems?	- What are the most interesting books? - What are the most difficult books? - What are the most useful books? - What are the most beautiful books? - What are the most interesting books? - What are the most difficult books? - What are the most useful books? - What are the most beautiful books? - What are the most interesting books? - What are the most difficult books?	- What are the most interesting video games? - What are the most difficult video games? - What are the most useful video games? - What are the most beautiful video games? - What are the most interesting video games? - What are the most difficult video games? - What are the most useful video games? - What are the most beautiful video games? - What are the most interesting video games? - What are the most difficult video games?	- What are the most interesting school / graduation questions? - What are the most difficult school / graduation questions? - What are the most useful school / graduation questions? - What are the most beautiful school / graduation questions? - What are the most interesting school / graduation questions? - What are the most difficult school / graduation questions? - What are the most useful school / graduation questions? - What are the most beautiful school / graduation questions? - What are the most interesting school / graduation questions? - What are the most difficult school / graduation questions?	- What are the most interesting jobs? - What are the most difficult jobs? - What are the most useful jobs? - What are the most beautiful jobs? - What are the most interesting jobs? - What are the most difficult jobs? - What are the most useful jobs? - What are the most beautiful jobs? - What are the most interesting jobs? - What are the most difficult jobs?	- What are the most interesting sports? - What are the most difficult sports? - What are the most useful sports? - What are the most beautiful sports? - What are the most interesting sports? - What are the most difficult sports? - What are the most useful sports? - What are the most beautiful sports? - What are the most interesting sports? - What are the most difficult sports?	- What are the most interesting science questions? - What are the most difficult science questions? - What are the most useful science questions? - What are the most beautiful science questions? - What are the most interesting science questions? - What are the most difficult science questions? - What are the most useful science questions? - What are the most beautiful science questions? - What are the most interesting science questions? - What are the most difficult science questions?	- What are the most interesting arts questions? - What are the most difficult arts questions? - What are the most useful arts questions? - What are the most beautiful arts questions? - What are the most interesting arts questions? - What are the most difficult arts questions? - What are the most useful arts questions? - What are the most beautiful arts questions? - What are the most interesting arts questions? - What are the most difficult arts questions?

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

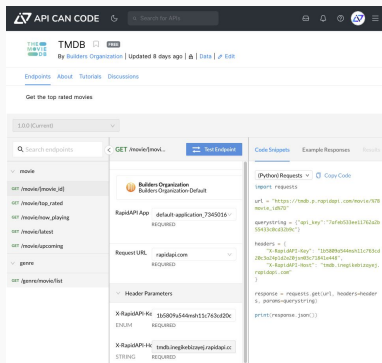
3.4 Graphs and Figures: Two Variables

3.5 Statistical Testing

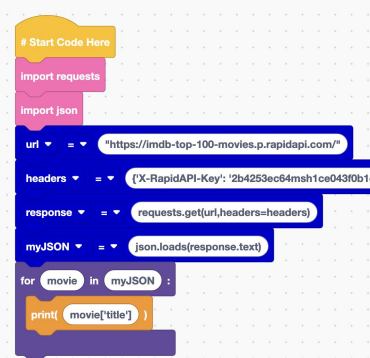
3.6 Linear Models

The Curricular Approach

Unit 1:
Data in
Learners' Lives



Unit 2:
Computational
Foundations



Unit 3:
Data Science
Practices



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.

The screenshot displays the Rapid API interface for the Zillow dataset. The left sidebar contains navigation options: Discovery, Workspace, API Overview, Version (v1 (current)), and Endpoints (Search Endpoints). The main panel shows the endpoint `GET /search` (Search for properties by neighborhood, city, or ZIP code) with a `Test Endpoint` button. The endpoint details include the App (default-application_7108690), X-RapidAPI-Key (05cbe836ebmsh8946000cd79a92dp1ef893jsnb6ce32b16ac8), and Request URL (rapidapi.com). The code snippets section shows a Python example using the `requests` library. The `headers` dictionary includes the `x-rapidapi-key` and `x-rapidapi-host`. The `Endpoint` label points to the endpoint name in the sidebar, and the `API-Key` label points to the `x-rapidapi-key` header in the code snippet.

Endpoint

API-Key



Retrieve & Filter the Data

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

```
# Start code here
import requests
import json

url = "https://zillow56.p.rapidapi.com/search"
headers = {"X-RapidAPI-Key": "YOUR KEY HERE", "X-RapidAPI-Host": "zillow56.p.rapidapi.com"}
querystring = {"location": "washington, dc", "output": "json", "status": "forSale", "sortSelection": "priorityscore"}
r = requests.get(url=url, headers=headers, params=querystring)
myJSON = json.loads(r.text)
myJSON = myJSON['results']

print("bathrooms, bedrooms, city, livingArea, price")

for i in myJSON:
    print(i['bathrooms'], ",", i['bedrooms'], ",", i['city'], ",", i['livingArea'], ",", i['price'])
```

Code Snippets Example Responses Results

Target: Python Client: Requests

```
import requests

url = "https://zillow56.p.rapidapi.com/search"

querystring = {"location": "houston, tx", "output": "json", "status": "forSale", "sortSelection": "priorityscore", "listing_type": "by_agent", "doz": "any"}

headers = {
    "x-rapidapi-key": "97c7425dbbmsh9e0971eee8248f3p1d4787jsned23d5e73e63",
    "x-rapidapi-host": "zillow56.p.rapidapi.com"
}
```

```
response = requests.get(url, headers=headers, params=querystring)
```

```
print(response.json())
```

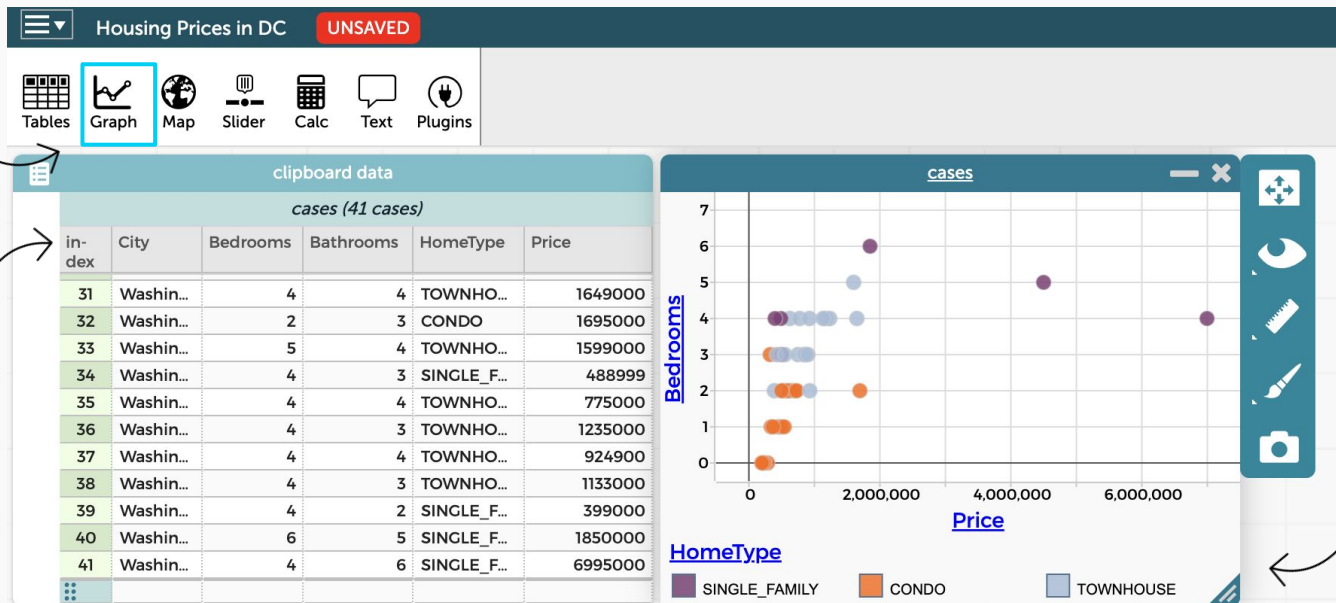


Create Data Visualization

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

Create a Graph

Headers



Drag-and-drop headers to visualize data



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

[illegible]

Integrating Students' Area of Interest

What dimensions of interest-driven learning are present?



Knowledge

Challenge

Relevance

Authenticity



Value

Personal
Meaning

Usefulness



Belonging

What Data
Science is?

Who Does
Data Science?

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

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2.5

2.6

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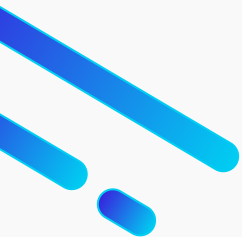
x

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Final Project: Doing Data Science

"Is Jhené Aiko a star?"

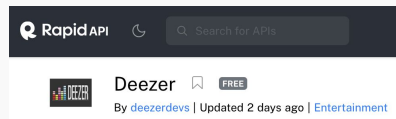


Final Project: Doing Data Science

"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": "e2f29b2b80mshd2c4cf79aa84caccp119f2ejan80180e7f58"}

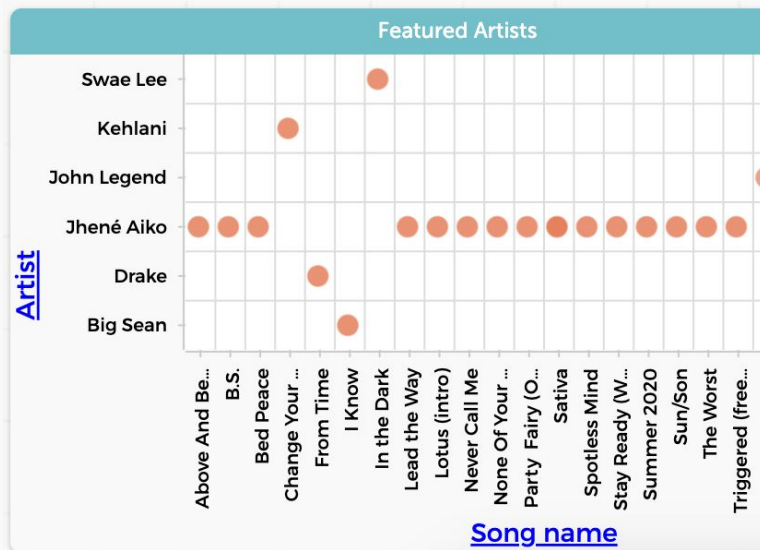
querystring = {"q": "Jhené Aiko"}

r = requests.get(url=url, headers=headers, params=querystring)

myJSON = json.loads(r.text)
myJSON = myJSON["data"]

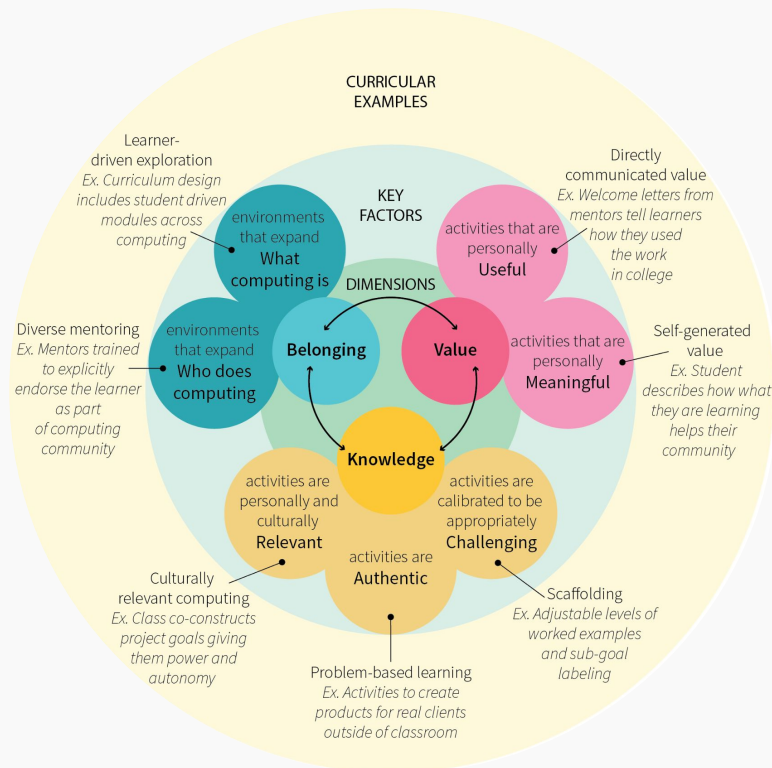
print("Song name, Album, Artist, Duration, Rank")

for i in myJSON:
    print([i["title"], i["album"]["title"], i["artist"]["name"], i["duration"], i["rank"]])
```



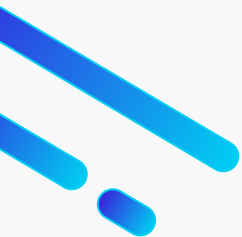
Final Project: Doing Data Science

"Is Jhené Aiko a star?"



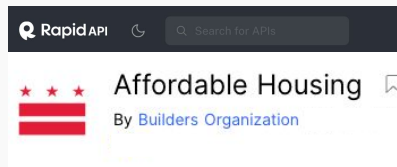
Final Project: Doing Data Science

“Which Ward has the most affordable houses?”



Final Project: Doing Data Science

“Which Ward has the most affordable houses?”



```
# Start code here
import requests
import json

url = "https://affordable-housing.p.rapidapi.com/AffordableHousingSelected"

headers = {
    "X-RapidAPI-Key": "642f70c7fcmsh3ba226a4cf1158dp1daa27jsn0f5688"
}

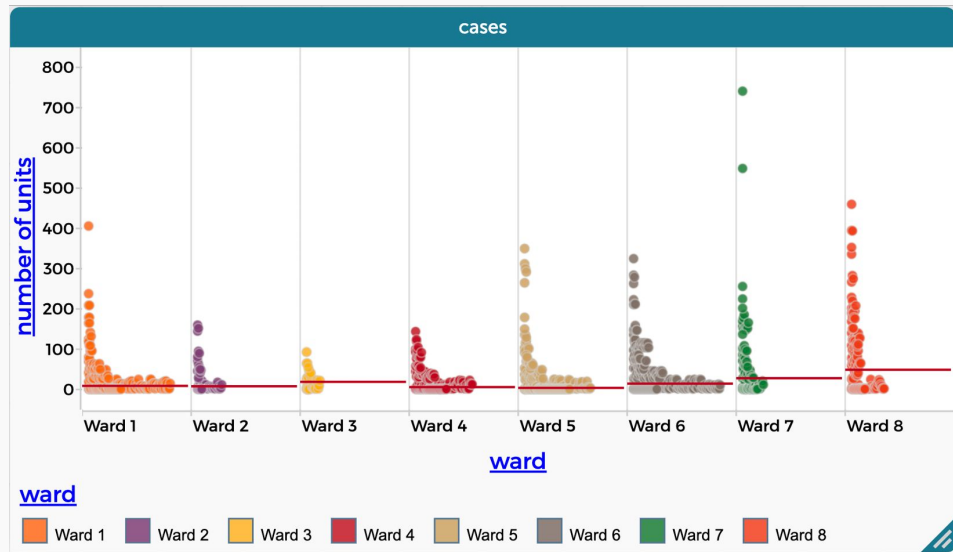
querystring = {"outFields": "MAR_WARD,STATUS_PUBLIC,TOTAL_AFFORDABLE_UNITS"}

r = requests.get(url=url, headers=headers, params=querystring)

myJSON = json.loads(r.text)

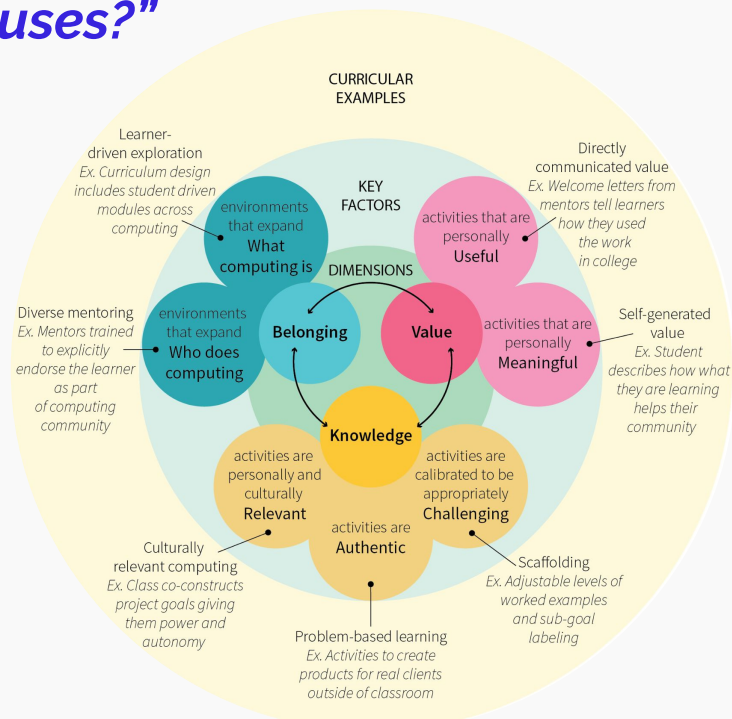
print("ward, number of units, status, x, y")

for i in myJSON['features']:
    if "MAR_WARD" in i['attributes']:
        print(i['attributes']['MAR_WARD'], " ", i['attributes']['TOTAL_AFFORDABLE_UNITS'], " ")
```



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



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