From a Living Wage to School Segregation: Middle Grades Modeling to Understand our World

Dr. Mathew D. Felton-Koestler
Ohio University

In the chat:
Name
School/organization
Grade levels
Anything else!

The Consortium for Mathematics and its Applications

Agenda

- **My Work and Context**
- Math Modeling Process
- Task 1: A Living Wage
- Task 2: School Segregation
- Thank you and questions

Context

- Ohio University in Athens, OH
- Teach math methods for future middle grades (4-9) teachers
- Summer camps for middle school students (grades 7-8)
- Ohio adopted the Common Core in 2010
  - Modified/updated in 2017
  - Modeling (SMP4 and high school) was not changed

My Work: Equity in Math Ed

- Equitable participation through Complex Instruction
  - Task design
  - Teacher moves
- Viewing students in terms of their strengths
  - Funds of knowledge (strengths outside of the classroom)
  - Mathematical strengths
- Math as a tool for understanding social and political issues
  - Teaching math for social justice
  - Critical mathematics

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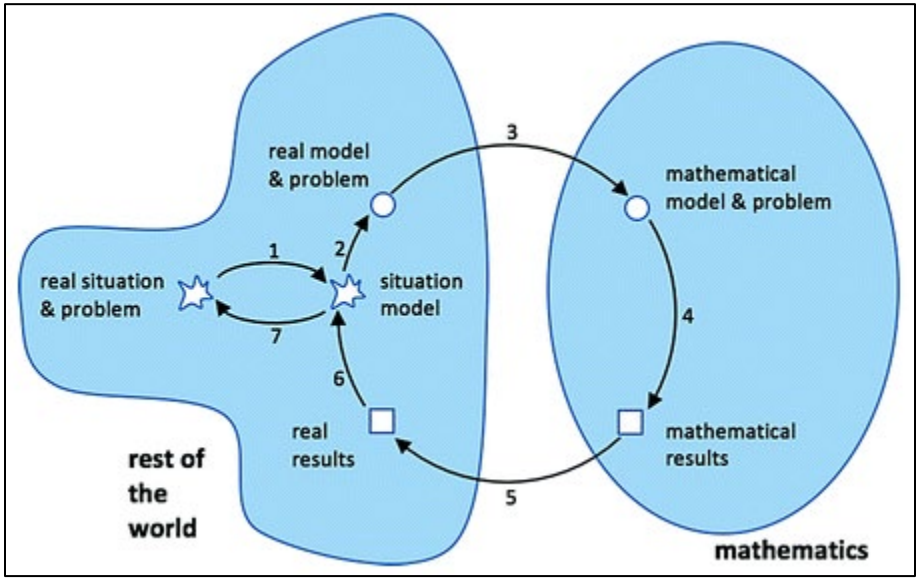
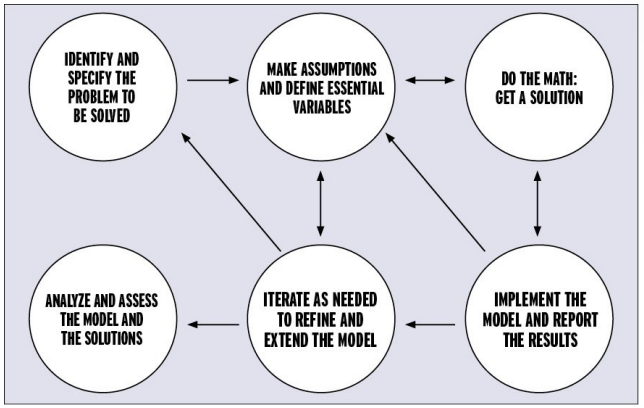
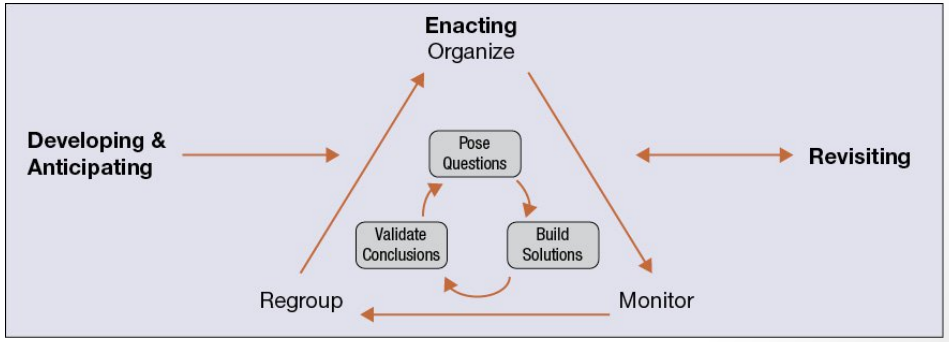
Math Modeling Process



Blum & Ließ (2005)

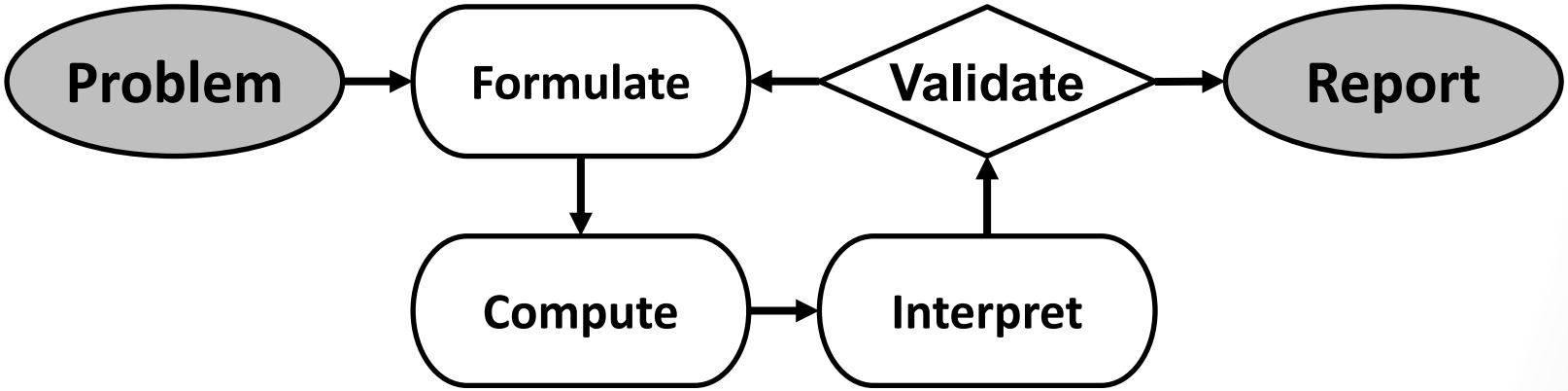


GAIMME (2016)

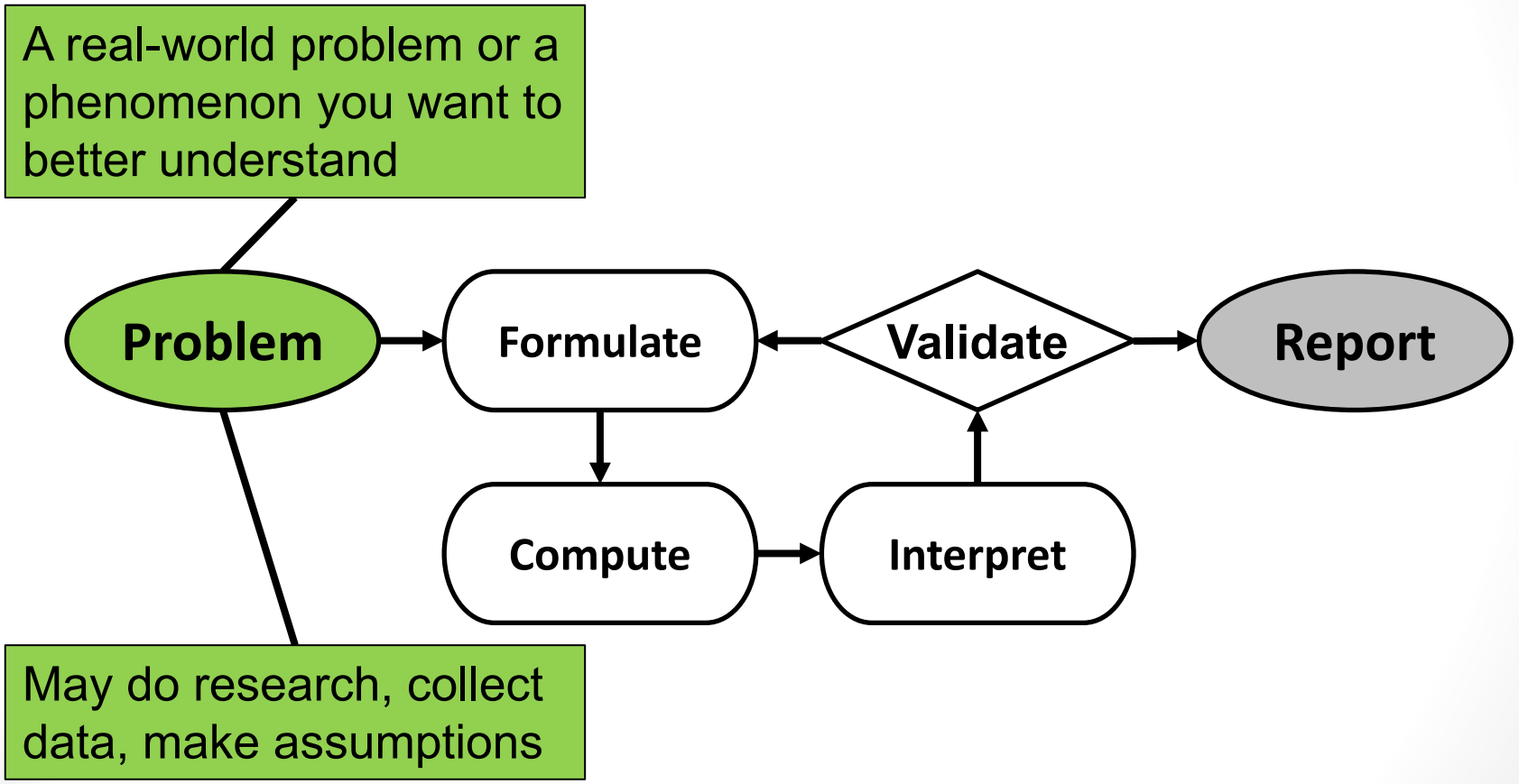


Carlson et al. (2016)

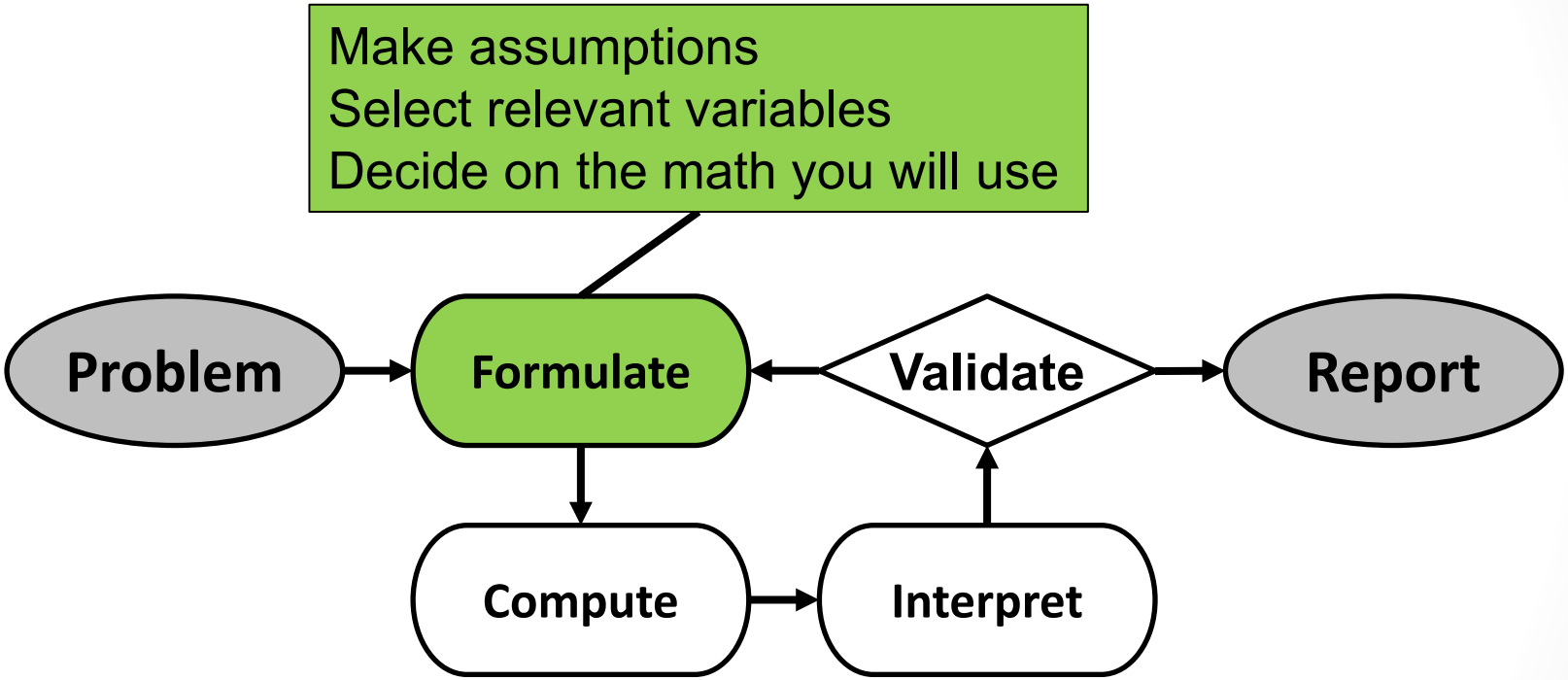
Common Core Standards



Common Core Standards



Common Core Standards



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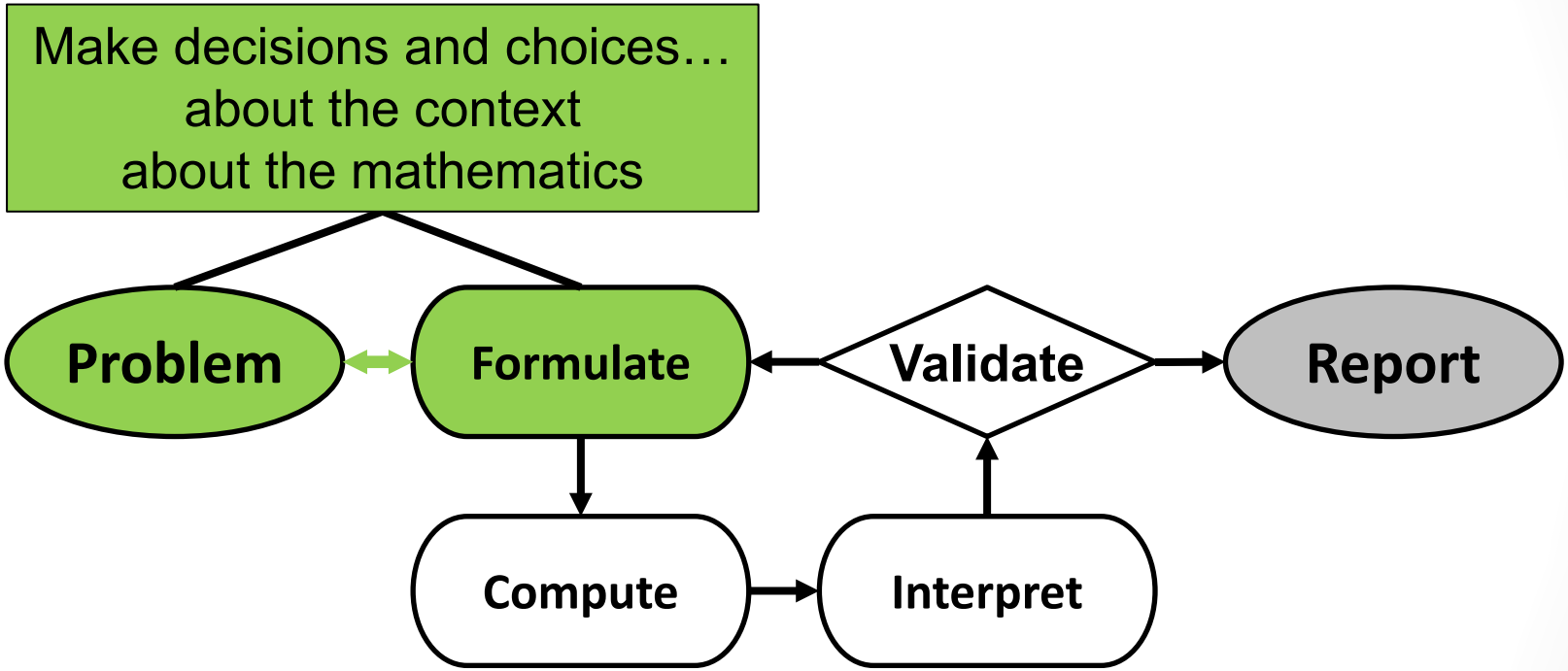
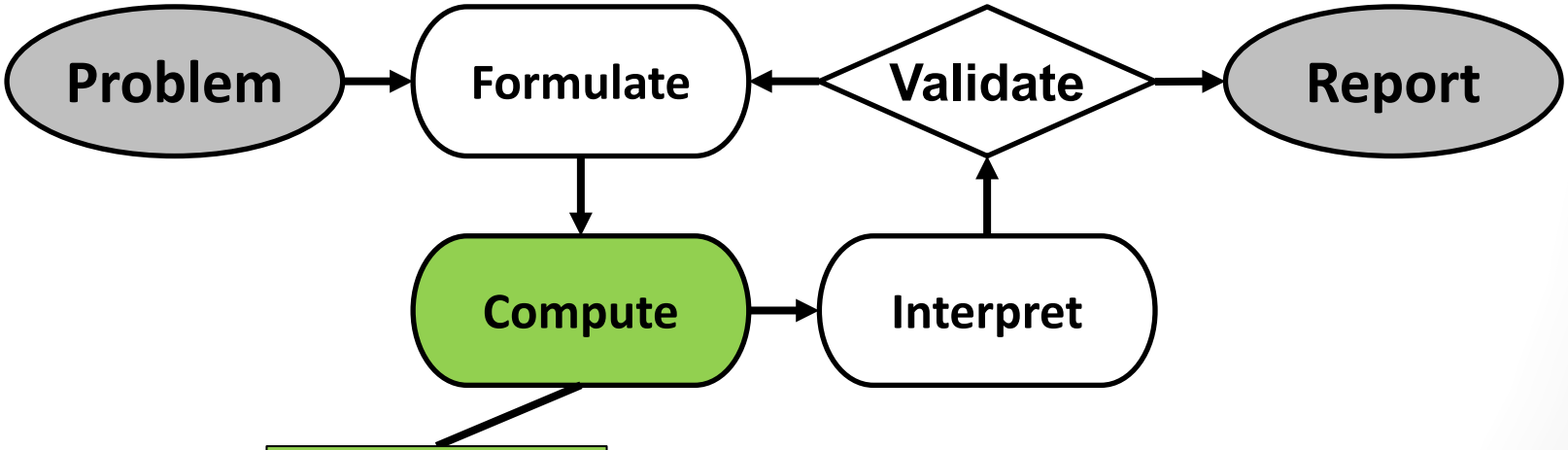
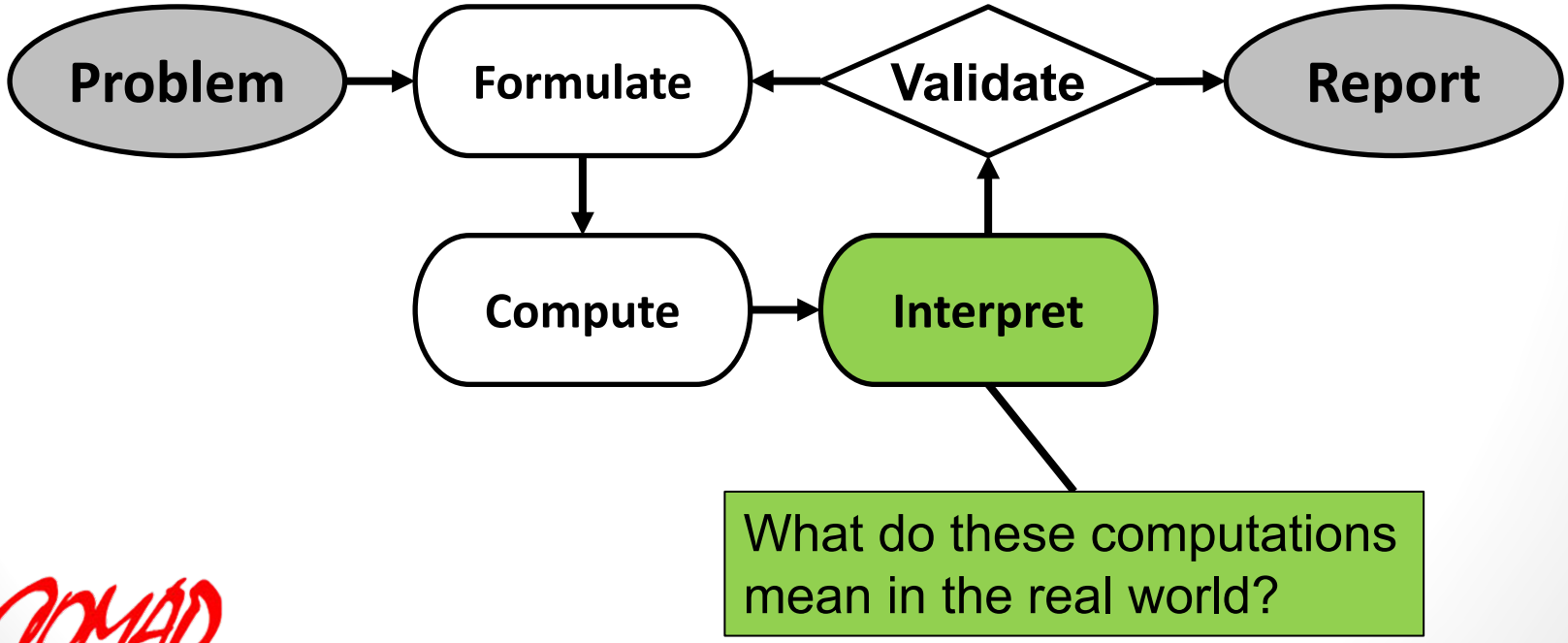


Common Core Standards



Carry out calculations based on your model

Common Core Standards



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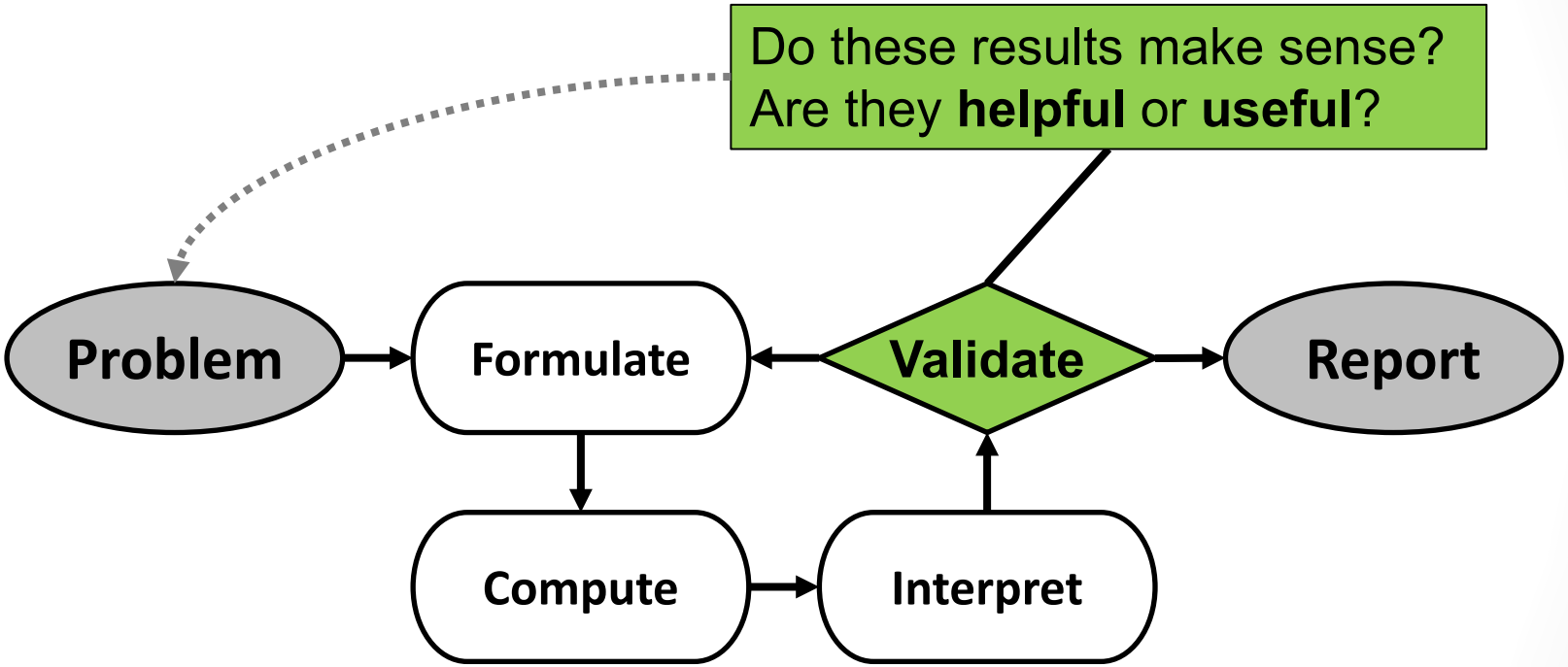

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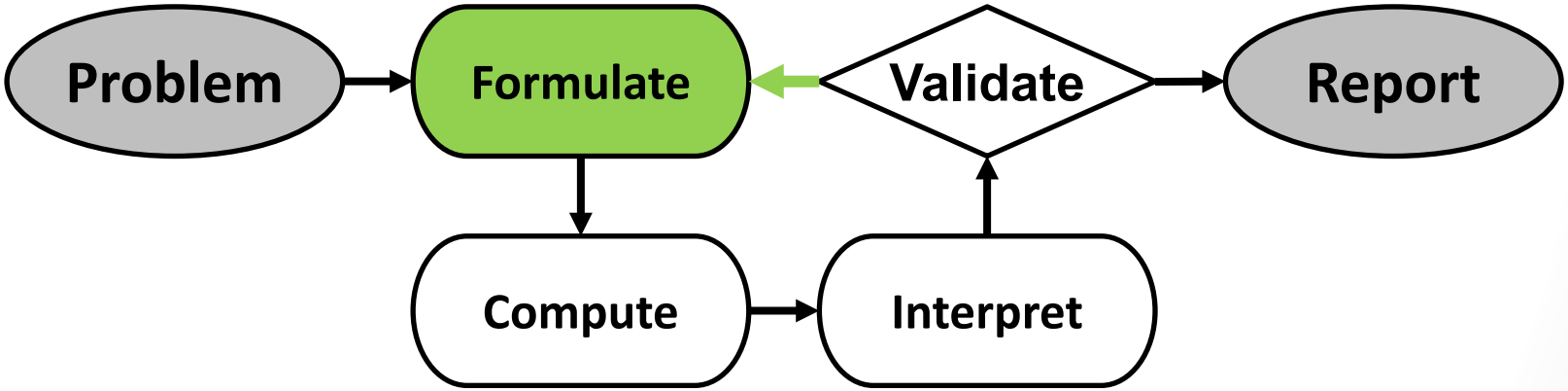

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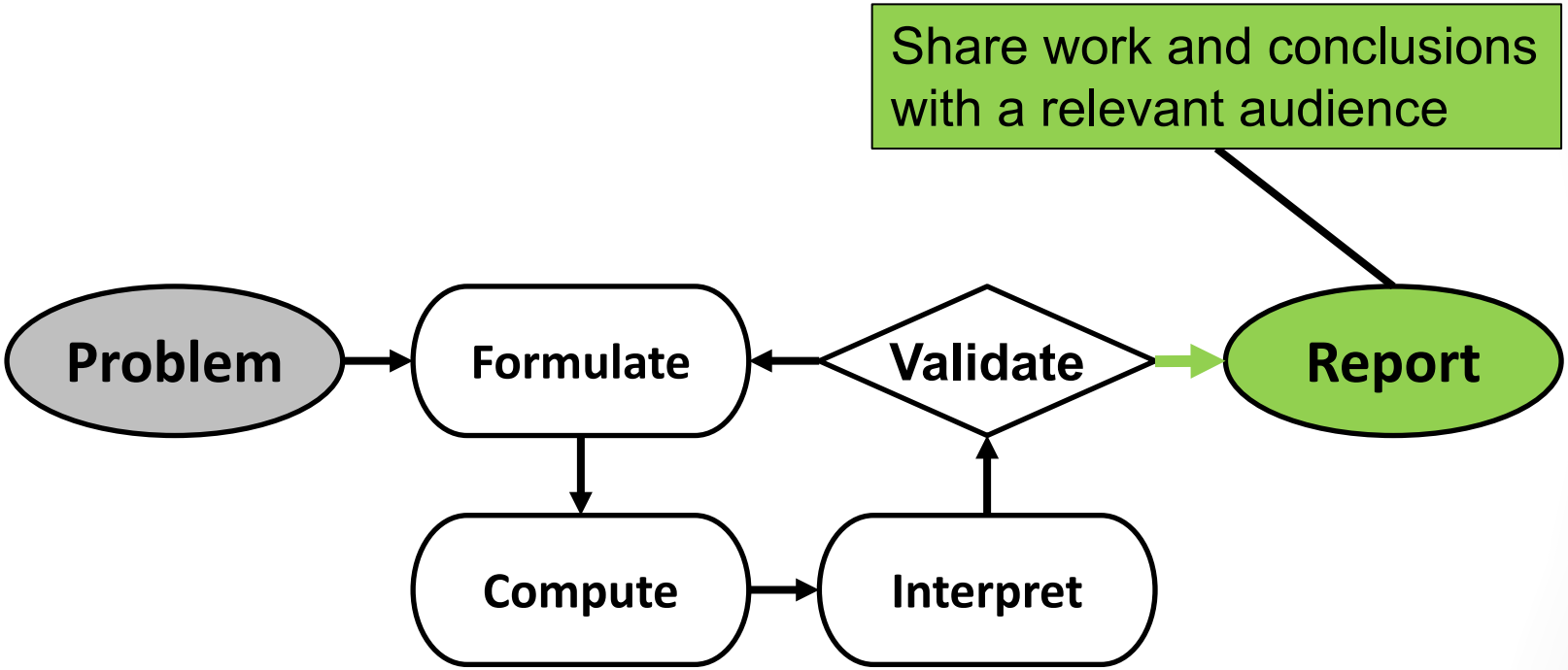
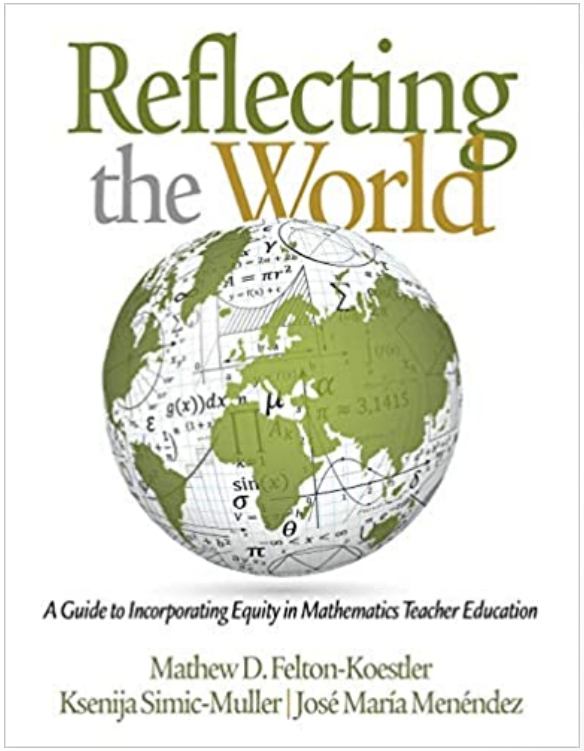


Agenda

- My Work and Context
- Math Modeling Process
- **Task 1: A Living Wage**
- Task 2: School Segregation
- Thank you and questions

A Living Wage: Introduction

- Determine a **living wage** for different families and compare to the **minimum wage**
- Many iterations
- Future teachers (K-8)
- Current teachers (K-8)
- Summer camp for 7th and 8th graders



A Living Wage

Task: Determine the **hourly wage (dollars per hour)** that workers in a (hypothetical) family need to cover their basic expenses.

A Living Wage: Task

Determine the **hourly wage (dollars per hour)** that workers in a family need to cover their basic expenses.

- One Adult, No Kids
- One Adult, Two Kids
- Two Adults (one working), Two Kids
- Two Adults (both working), Two Kids

Initial Info

What are some essential costs families must pay for to get by?

or

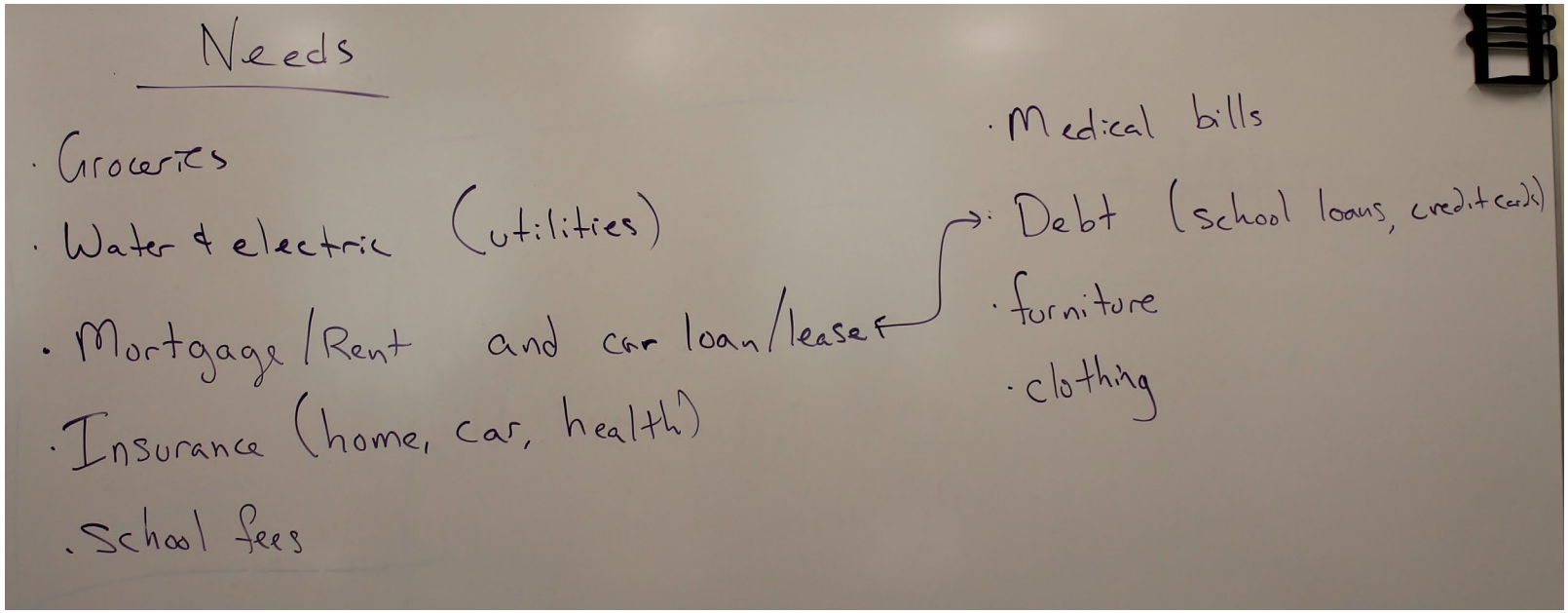
If we're finding the hourly wage, then…

What information do we need?
What do we need to consider?

In the chat:

Share some ideas!

Needs


Needs
· Groceries
· Water & electric (utilities)
· Mortgage / Rent and car loan/lease
· Insurance (home, car, health)
· School fees
· Medical bills
· Debt (school loans, credit cards)
· furniture
· clothing

Needed Info/Considerations

- Family size and ages
- Childcare needs
- Location (cost of living)
- Healthcare costs
- Transportation
- Education
- Phone, tv, and internet

Data Provided

Living Wage | calculator

livingwage.mit.edu

Food	Lower-cost food; all meals made at home
Child Care	4-year old and 9-year old
Medical	Insurance, visits, prescriptions, and supplies
Housing	Efficiency or 2-bedroom; includes utilities
Transportation	Upkeep, gas, loan, insurance, and public transport
Civic*	Cost of engaging in basic activities that enrich the lives of Americans (e.g., reading, education, hobbies, entertainment)
Other	Clothing, toiletries, and housekeeping supplies
Taxes	Taxes

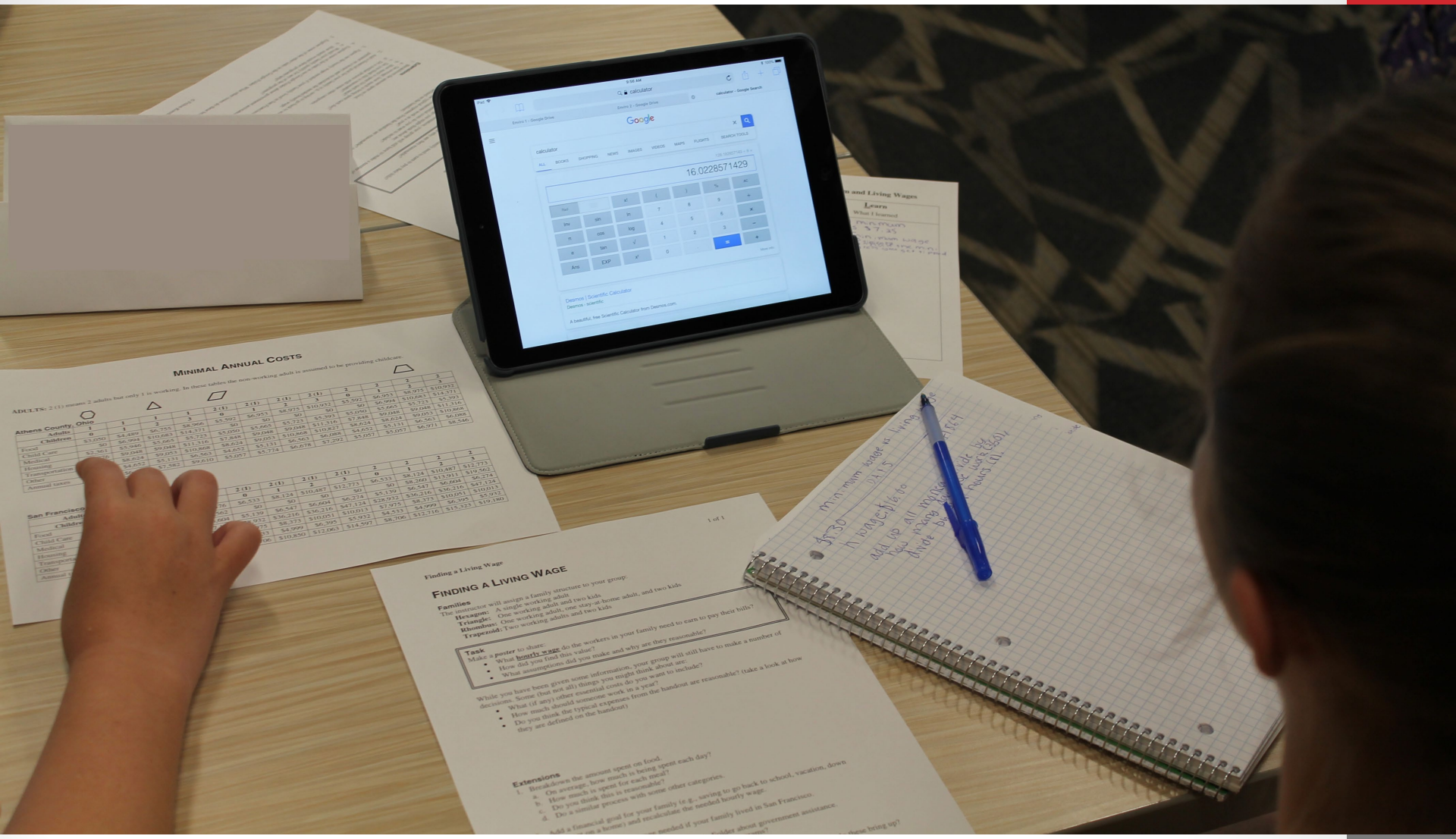
COMAP

Families to Analyze

- One Adult, No Kids
- One Adult, Two Kids
- Two Adults (one working), Two Kids
- Two Adults (both working), Two Kids

2 Adults (both work), 2 Kids

Annual Expenses	
Food	$9,063
Childcare	$10,926
Health	$6,830
Housing	$9,192
Transportation	$11,557
Other	$6,378
Taxes	$9,012


Minimal Annual Costs
Finding a Living Wage
Finding a Living Wage
Families
Task
Extensions
16.0228571429

How Would You Solve This?

Task: Determine the **hourly wage (dollars per hour)** that workers in this family need to cover their basic expenses.

How would you approach this problem?

What assumptions would you make?

In the chat or "raise hand"

Share some ideas!

2 Adults (both work) 2 Kids	
Food	$9,063
Childcare	$10,926
Health	$6,830
Housing	$9,192
Transportation	$11,557
Other	$6,378
Taxes	$9,012

Strategies and Assumptions

- Add up to find total expenses for the year
- Weeks in a year
  - 52 weeks (no time off ***or*** paid time off)
  - 50 weeks (two unpaid weeks off)
  - 4 weeks per month × 12 months = 48 weeks
- Hours in a week
  - 40 hours as typical
  - Higher: consider other costs (e.g., childcare) and overtime
  - Availability of hours

TRIANGLE

daily plan

- hourly wage: [redacted] $21.00
- method: we added up all the money then divided it by how many days pe year she works. Then w divided that by eight because that's how ma
- was that she would ge weekends off. We think this is more reasonable/realistic
- She works for 261 days for 8 hours a day
- are reasonable
- money per year = $14864

emergency plan

- hourly wage: $16.00
- method: We added up all the money we use. then we dived it by the number of days we work. We then dived that
- One assumption that we made was that the adult would work a lot. This was not reasonable, but it was our first try.
- The adult works for 350 days a year for $8 [redacted] a day.
- We think the right expences from the handout were reasonable.
- Amount of money made in a year: $44,864

Kids:

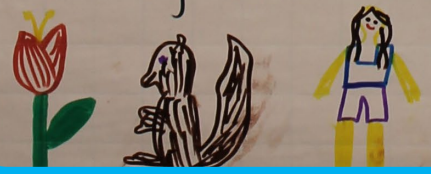
Tulip: age 4

Squirrel: age 9

Job: amusement park attendent

FAMILY PORTRAIT

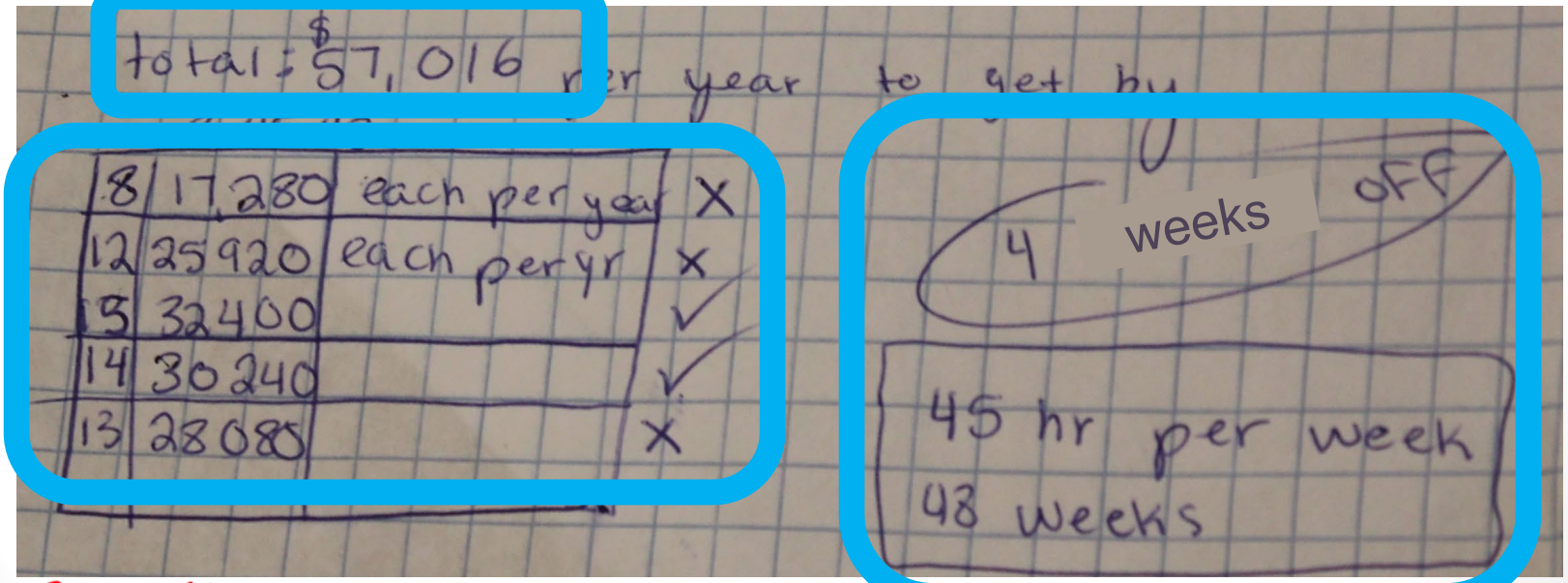
1 working mom + 2 kids



Guess and Check

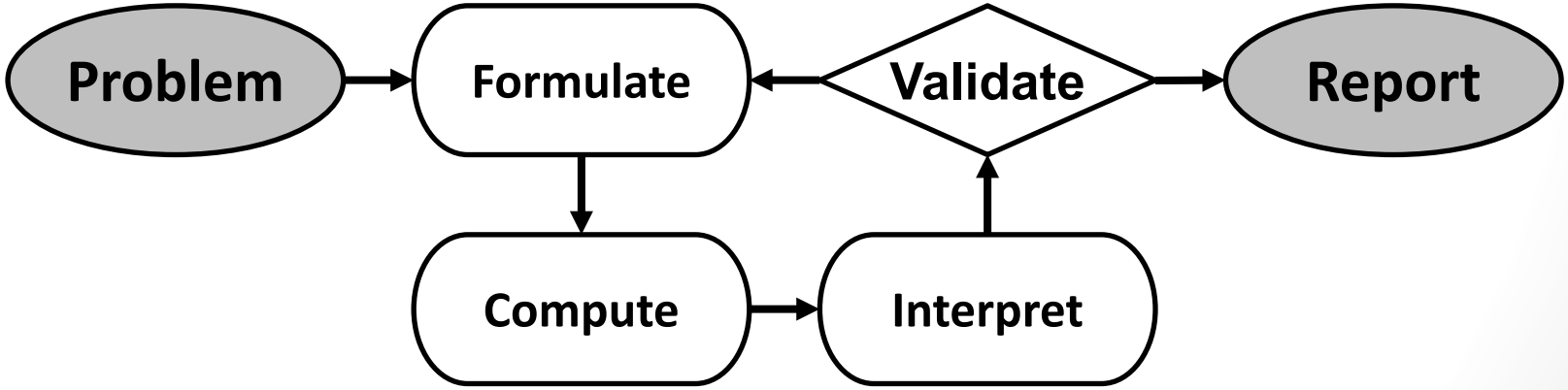
Total expenses: $57,016 | Two workers, each needs: $28,508

Assume 45 hours/week for 48 weeks



Modeling Process

- Introductory or “light” modeling
- Limited assumptions primarily about hours worked
- Validation focuses on reasonableness



Discussion

Living Wage | calculator

livingwage.mit.edu

Are the values reasonable? (e.g., meals work out to around $25/day for a family of four)

Current fed min wage: $7.25

Current Ohio min wage: $8.70

How should we set the minimum wage? Why?

What additional data do you want?

In the chat or "raise hand"

Thoughts on these questions?

What would you want to discuss with students?

Family	Living Wage
1 Adult	$14.18
1 Adult, 2 Kids	$35.13
2 Adults (1 works) 2 Kids	$29.71
2 Adults (both work) 2 Kids	$19.69

COMAP

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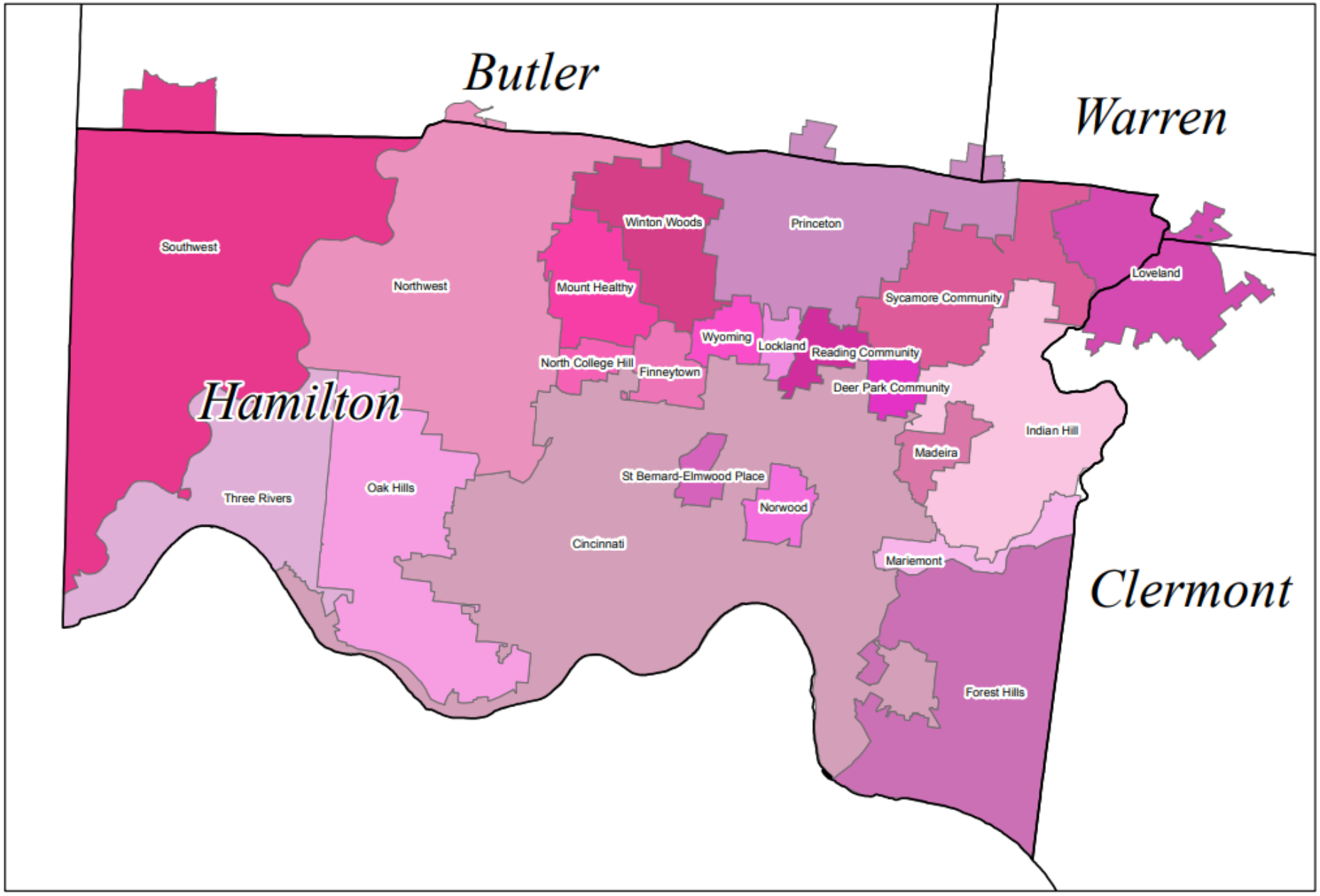
School Segregation

Hamilton County is concerned with school segregation. They have hired you to help them determine if they should be worried about the levels of racial/ethnic segregation across the ***school districts*** within the county.

Work as a group to decide what to tell Hamilton County. Your response must include a strong mathematical justification.

Hamilton County



https://education.ohio.gov/getattachment/Topics/Data/Ohio-Educational-Directory-System-OEDS/2016-School-District-Map.pdf

2018-19 Enrollment by Race/Ethnicity in Hamilton County

District Name	White	Multiracial	Indian	Hispanic	Black	Asian
Cincinnati Public Schools	8,308	2,267	37	2,400	22,436	529
Deer Park Community City	910	108	0	61	102	36
Finneytown Local	461	117	0	65	585	116
Forest Hills Local	6,404	325	0	232	137	164
Indian Hill Exempted Village	1,519	104	0	94	70	216
Lockland Local	183	55	3	53	246	1
Loveland City	3,947	149	1	146	83	102
Madeira City	1,295	54	2	67	18	39
Mariemont City	1,463	61	1	49	20	22
Mt Healthy City	406	323	2	178	2,170	32
North College Hill City	129	123	3	35	1,263	2
Northwest Local	4,143	973	6	454	2,575	446
Norwood City	1,273	108	4	235	270	2
Oak Hills Local	6,350	407	2	214	333	91
Princeton City	1,232	336	9	1,581	2,329	249
Reading Community City	1,225	81	0	54	144	19
Southwest Local	3,380	96	3	100	19	21
St Bernard-Elmwood Place City	431	101	8	50	310	4
Sycamore Community City	3,405	352	1	350	419	872
Three Rivers Local	1,941	89	2	46	20	19
Winton Woods City	367	308	2	753	2,073	244
Wyoming City	1,498	150	2	47	219	55
Total	**50,270**	**6,687**	**88**	**7,264**	**35,841**	**3,281**

Talking about Race and Ethnicity

White	Multiracial	Indian	Hispanic	Black	Asian

- Where do these terms come from?
- What do they mean?
- Who decides on these terms?
- Why might some people be uncomfortable with how they are labeled by the government?

In the chat or "raise hand"

What questions do you have about these terms?

What would you want your students to think about?

Talking about Race and Ethnicity

White	Multiracial	Indian	Hispanic	Black	Asian

Understanding Hispanic and Latino

- Latino is about geography (does someone trace their roots to Latin America)
- Hispanic is about connections to Spanish language and culture, but is often used as a proxy for Latino
- Sometimes Hispanic overlaps with racial groups in data sets, sometimes it does not (here it does not)
- Latine is an emerging gender-neutral and trans-inclusive version of Latino

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Total	**50,270**	**6,687**	**88**	**7,264**	**35,841**	**3,281**

In the chat or "raise hand"

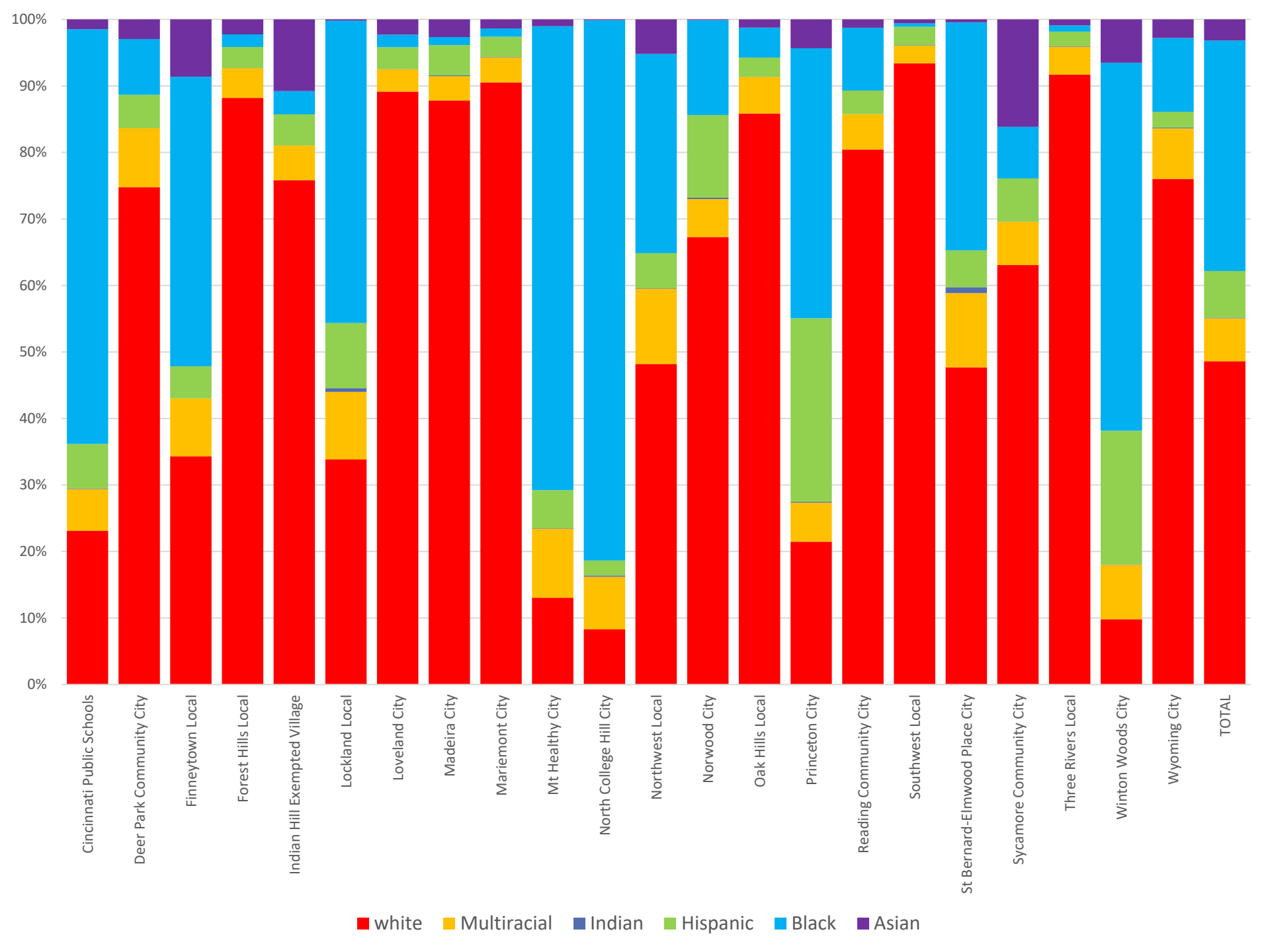
How might you approach this task?

Strategies/Ideas

- Convert to percentages

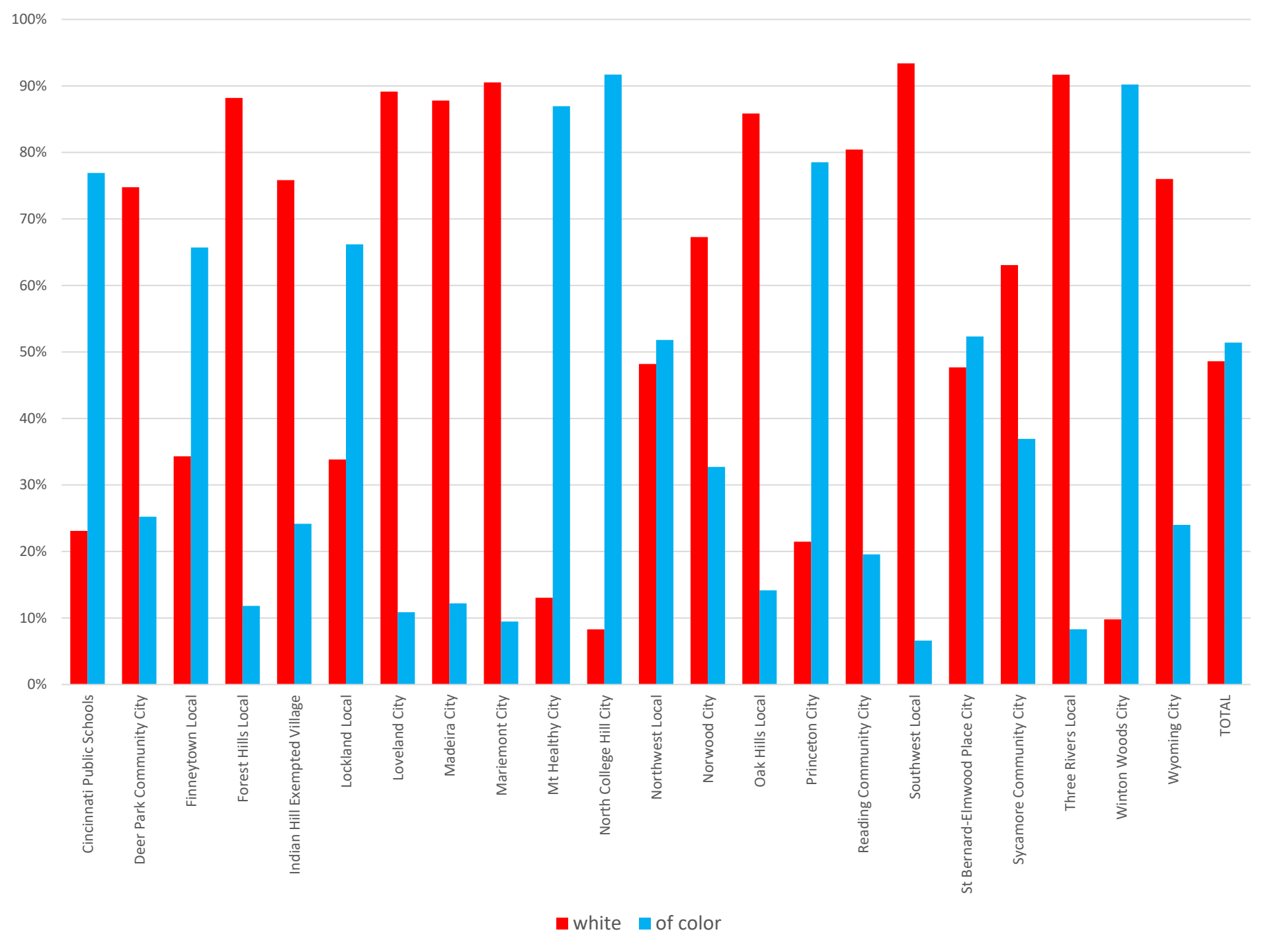
Strategies/Ideas

- Convert to percentages
- Representing the data:
  - **Stacked bar graphs**


100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Cincinnati Public Schools
Deer Park Community City
Finneytown Local
Forest Hills Local
Indian Hill Exempted Village
Lockland Local
Loveland City
Madeira City
Mariemont City
Mt Healthy City
North College Hill City
Northwest Local
Norwood City
Oak Hills Local
Princeton City
Reading Community City
Southwest Local
St Bernard-Elmwood Place City
Sycamore Community City
Three Rivers Local
Winton Woods City
Wyoming City
TOTAL
white
Multiracial
Indian
Hispanic
Black
Asian

Strategies/Ideas

- Convert to percentages
- Representing the data:
  - Stacked bar graphs (all groups)
  - **Double bar graphs (white vs. students of color)**


100%
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Three Rivers Local
Winton Woods City
Wyoming City
TOTAL
white
of color

Strategies/Ideas

- Convert to percentages
- Representing the data:
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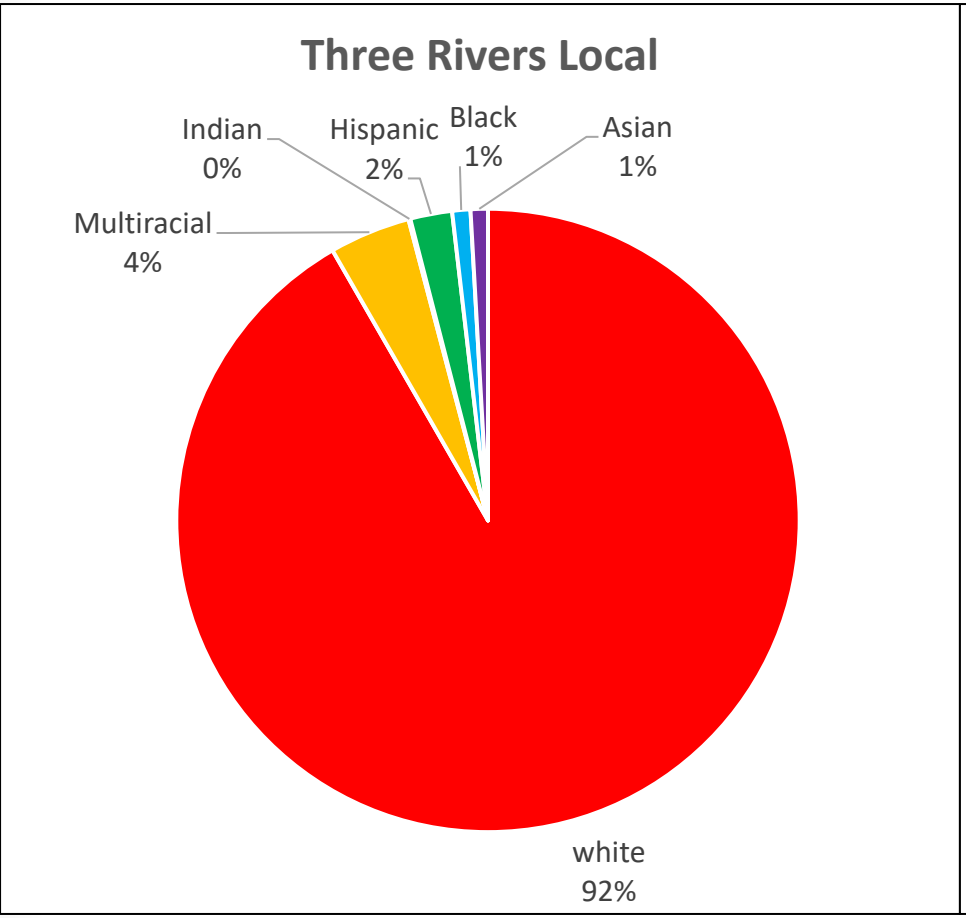
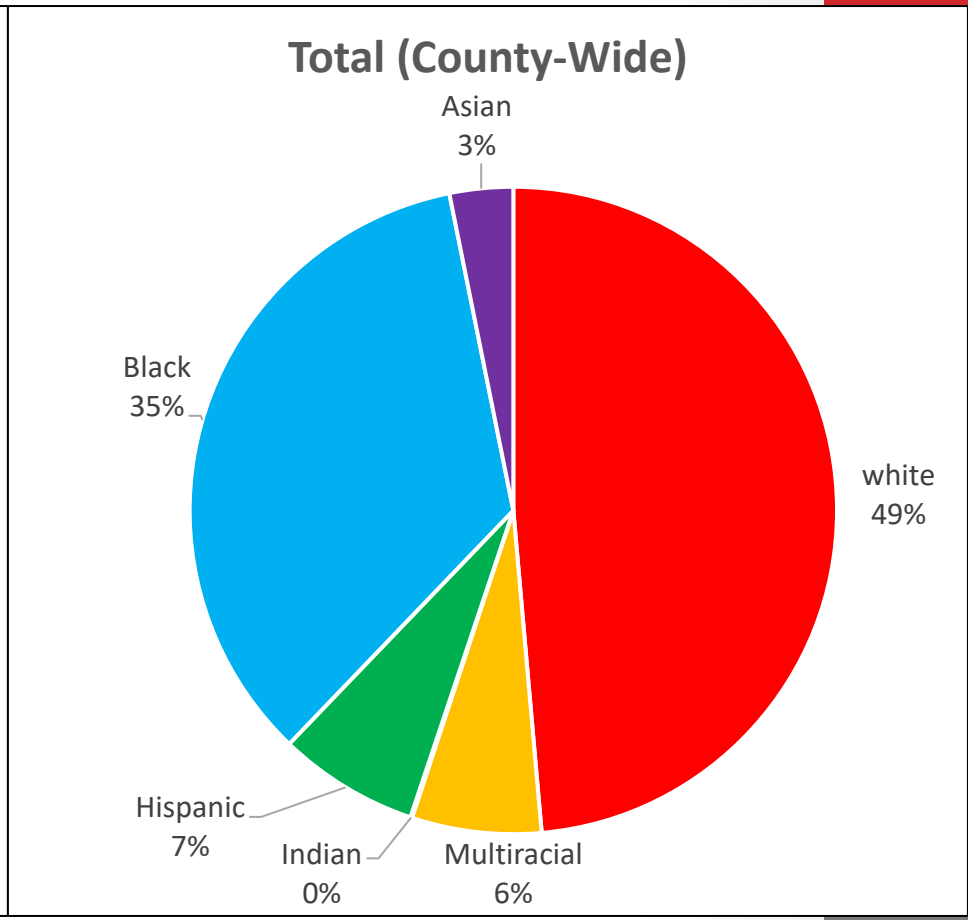
  - Double bar graphs (white vs. students of color)
  - **Selected pie charts**


Three Rivers Local
Indian
0%
Hispanic
2%
Black
1%
Asian
1%
Multiracial
4%
white
92%


Total (County-Wide)
Asian
3%
Black
35%
white
49%
Hispanic
7%
Indian
0%
Multiracial
6%

Strategies/Ideas

- Convert to percentages
- Representing the data:
  - Stacked bar graphs (all groups)
  - Double bar graphs (white vs. students of color)
  - Selected pie charts
- Identifying segregation
  - Visual scan of the graphs to identify disparities
  - Cut offs
    - more than 60% of one race
    - more than +/- 10% relative to the county
  - Classifying (e.g., predominately white) and comparing to state report cards (letter grades)

In the chat or "raise hand"

What might your students do?

What conversations would you want to have?

Discussion

- What are some advantages of (school) integration and what are some of the problems with segregation?
- Why might some students and families of color be wary of integration?
- What do you know about why things are like this?

Resources/Additional Info

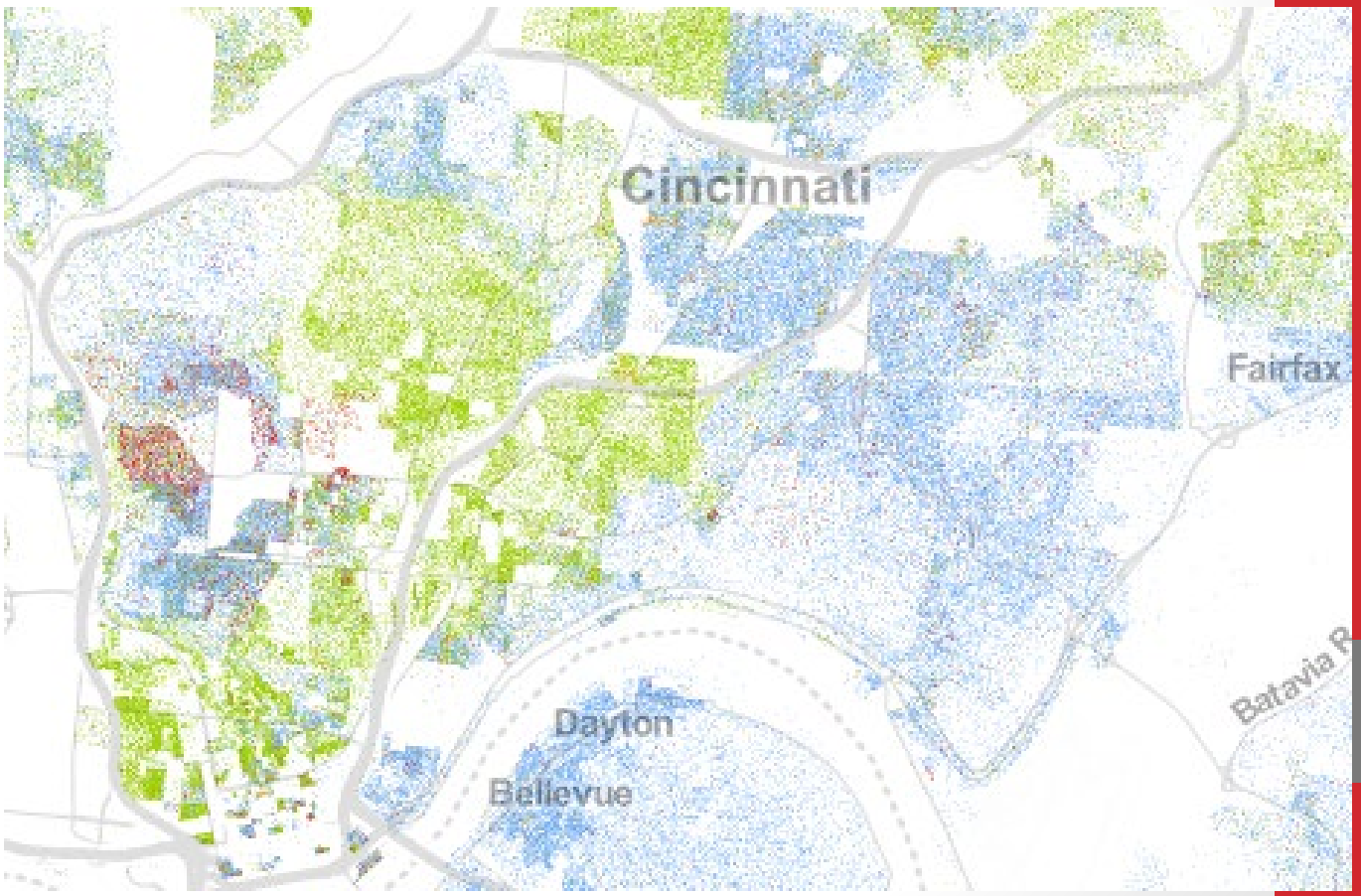
Resources/Additional Info

Racial Dot Map: https://demographics.virginia.edu/DotMap/index.html

2010 Census Block Data

1 Dot = 1 Person

- White
- Black
- Asian
- Hispanic
- Other Race / Native American / Multi-racial



Readings/Videos

60 years after 'Brown' same-race schools remain. The Cincinnati Enquirer.

The return of school segregation in eight charts. PBS Frontline.

Brown II [subsection of *Brown v. Board of Education*]. Wikipedia.

The disturbing history of the suburbs [Video]. Adam Ruins Everything.

Housing segregation and redlining in America [Video]. NPR Code Switch. [warning: explicit language]

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- Task 2: School Segregation
- **Thank you and questions**

Thank You!

Dr. Mathew D. Felton-Koestler (felton@ohio.edu)

Ohio University

YouTube:
https://www.youtube.com/c/MathyMattMathandtheWorld

Website:
https://feltonkoestler.wixsite.com/realworldmath