

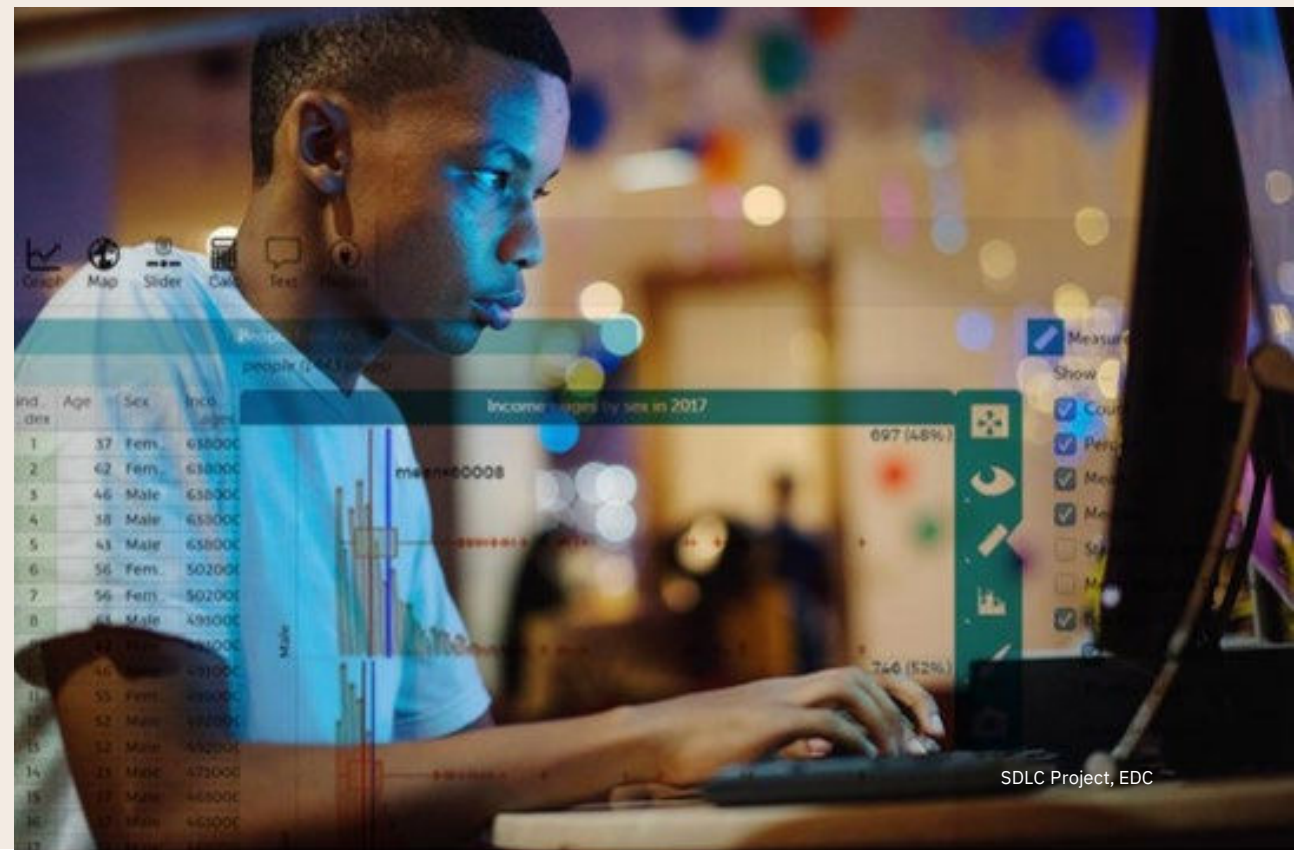


Supporting critical data literacy for civic engagement and social justice

Paderborn Colloquium on Data Science and Artificial Intelligence in School

Josephine Louie

Wednesday June 19, 2024



EDC At-A-Glance



1958

EDC was founded by MIT scholars and researchers



300+

Projects managed annually by EDC

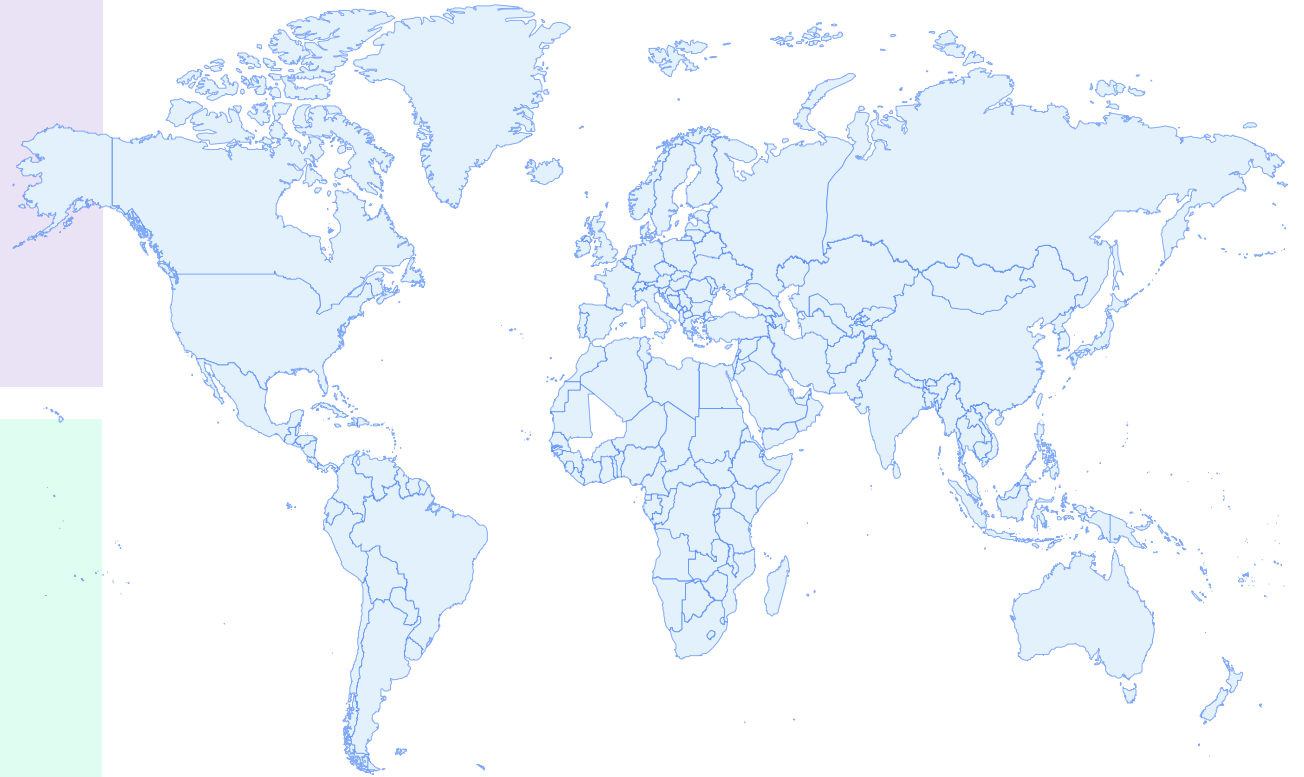


80 + 50

Countries

States in the U.S.

REGIONS: Africa, Asia, Europe, Latin America and the Caribbean, Middle East, and the United States



What role could critical data literacy play in promoting civic engagement and social justice?

Defining terms

critical **data** literacy civic engagement social justice

“Facts or information, especially when examined and used to find out things or to make decisions.”

- Oxford Learner’s Dictionary

“Data are not just numbers, they are numbers with a context.”

- Cobb & Moore, 1997, p. 801

Data are not just numbers with a context, they are pieces of information that we create, categorize, and count.

Data are information that we have decided are worth counting.

Defining terms

critical **data literacy** civic engagement social justice

- Ability to interpret, assess, and communicate understandings of data from our everyday lives (Gal, 2002)
- Understanding of and experience with the data investigation process
 - Formulating questions that can be answered with data
 - Assembling data to address the questions
 - Using statistical and other tools to analyze the data
 - Interpreting results, summarizing conclusions, and communicating findings
- Ability to engage in multivariable reasoning
- Habit of mind that constantly interrogates the data throughout the investigation process
 - How were measurements made?
 - What type of data were collected?
 - What was the study design?

(Bargagliotti et al., 2020)

Defining terms

critical data literacy civic engagement social justice

- Awareness of all the data that are collected from us
- Understanding of algorithms and what they do
- Attention to the ethical impacts of collecting and using large-scale data from others

(D'Ignazio & Bhargava, 2015)

Defining terms

critical data literacy civic engagement social justice

- Ability to **read** and **write** the world with data
 - To gain social and political awareness
 - To develop social agency
 - To build pride in one's cultural and social identity

(Freire, 1970/2012; Gutstein, 2003, 2006; Louie, 2022)

Defining terms

critical data literacy **civic engagement** social justice

→ Taking action to improve life for people in collective society

“Civic engagement means **working to make a difference in the civic life of our communities** and **developing the combination of knowledge, skills, values and motivation to make that difference**. It means **promoting the quality of life in a community**, through both political and non-political processes.”

“A morally and civically responsible individual **recognizes himself or herself as a member of a larger social fabric** and therefore **considers social problems to be at least partly his or her own**; such an individual is **willing to see the moral and civic dimensions of issues**, to **make and justify informed moral and civic judgments**, and to **take action** when appropriate.”

- Ehrlich, 2000, pp. vi and xxvi

Defining terms

critical data literacy civic engagement **social justice**

- Social justice involves the idea of distributive justice, and group inequalities in:
 - Income and assets
 - Opportunities for work and employment
 - Access to knowledge
 - Health services, social security, a safe environment
 - Civic and political participation

(United Nations, 2006)

→ Based on these definitions, critical data literacy leads to civic engagement and an orientation toward promoting social justice

Data projects with critical data literacy and civics learning goals

Strengthening Data Literacy across the Curriculum Project (SDLC)

- Early-stage research and development effort, funded by the National Science Foundation
- Goal to promote interest in and understanding of fundamental data literacy practices among secondary school students from groups underrepresented in STEM

→ go.edc.org/usdata



Strengthening Data Literacy across the Curriculum Project (SDLC)

Two modules

Investigating Income Inequality in the U.S.



Investigating Immigration in the U.S.



Strengthening Data Literacy across the Curriculum Project (SDLC)

Investigating Income Inequality in the U.S.



Lesson 1.

What is income inequality?

Lesson 2.

How do we learn about people's incomes in the U.S.?

Sample Individuals from ACS Survey

Cases (12 cases)

index	Age	Sex	Marital_s tatus	Numbe... _children	Family_s ize	Educati... e_recode	Race-mu lti	Hispanic	Birthp ce
1	39	Female	Marrie...	2	4	Associa...	Other r...	Mexican	Califor
2	68	Female	Divorced	0 childr...	1	Master,...	Black/A...	Not His...	Texas
3	28	Female	Never ...	1 childr ...	2	Bachel...	Black/A...	Not His...	Indian
4	37	Female	Never ...	0 childr...	1	Master,...	White	Not His...	New Jo
5	48	Female	Marrie...	4	6	Master,...	White	Not His...	North
6	30	Female	Marrie...	0 childr...	2	1 or mo...	Other r...	Other	Texas
7	25	Male	Never ...	0 childr...	3	1 or mo...	White	Not His...	Indian
8	50	Male	Marrie...	2	6	Some s...	Other r...	Mexican	Mexic
9	63	Male	Marrie...	0 childr...	2	Doctor...	White	Not His...	Michig
10	34	Male	Marrie...	2	4	High sc...	Chinese	Not His...	China
11	44	Male	Marrie...	4	6	1 or mo...	Black/A...	Not His...	Texas
12	48	Male	Marrie...	4	6	Associa...	White	Not His...	Califor

Read over all of the questions on this page and answer the ones circled in blue.

13197082

Person 1

1 Please copy the name of Person 1 from page 2, then continue answering questions below.

Last Name: _____

First Name: _____ MI: _____

2 Where was this person born?

In the United States - Print name of state.

Outside the United States - Print name of foreign country, or Puerto Rico, Guam, etc.

3 Is this person a citizen of the United States?

Yes, born in the United States. → SKIP to question 10a

Yes, born in Puerto Rico, Guam, the U.S. Virgin Islands, or Northern Marianas

Yes, born abroad of U.S. citizen parent or parents

Yes, U.S. citizen by naturalization - Print year of naturalization: ____

No, not a U.S. citizen

4 When did this person come to live in the United States? If this person came to live in the United States more than once, print latest year. Year: _____

5 At any time in the LAST 3 MONTHS, has this person attended school or college?

No, has not attended in the last 3 months → SKIP to question 11

Yes, public school, public college

Yes, private school, private college, home school

Nursery school, preschool

Kindergarten

Grade 1 through 12 - Specify grade 1 - 12: _____

College undergraduate years (freshman to senior)

Graduate or professional school beyond a bachelor's degree. (For example: MEd or PhD program, or medical or law school)

6 What grade or level was this person attending? Mark ALL ONE(S).

No schooling completed

NURSERY OR PRESCHOOL THROUGH GRADE 12

Nursery school

Kindergarten

Grade 1 through 11 - Specify grade 1 - 11: _____

12th grade - NO DIPLOMA

HIGH SCHOOL GRADUATE

Regular high school diploma

GED or alternative credential

COLLEGE OR SOME COLLEGE

Some college credit, but less than 1 year of college credit

1 or more years of college credit, no degree

Associate's degree (for example: AA, AS)

Bachelor's degree (for example: BA, BS)

AFTER BACHELOR'S DEGREE

Master's degree (for example: MA, MS, MEd, MEd, MDiv, MEdM)

Professional degree beyond a bachelor's degree (for example: Ed.S, DVM, LL.M., JD)

Doctorate degree (for example: PhD, EdD)

7 What is the highest degree or level of school this person has COMPLETED? Mark ALL ONE(S) currently enrolled, past the previous grade or highest degree received.

8 This question focuses on the person's BACHELOR'S DEGREE. Please print below the specific majors of any BACHELOR'S DEGREES this person has received. (For example: chemical engineering, elementary teacher education, organizational psychology)

9 What is this person's ancestry or ethnic origin? (For example: Italian, Jamaican, African Am., Cambodian, Cape Verdean, Norwegian, Dominican, French Canadian, Afghan, Korean, Lebanese, Polish, Nigerian, Mexican, Taiwanese, Ukrainian, and so on.)

10a How well does this person speak English? Very well Well Not well Not at all

10b What is this language? _____

11 Did this person live in this house or apartment 1 year ago? Person is under 1 year old → SKIP to question 1E Yes, this house → SKIP to question 1F No, outside the United States and Puerto Rico - Print name of foreign country, or U.S. Virgin Islands, Guam, etc., below: _____ then SKIP to question 1E

12 Where did this person live 1 year ago? Address (Number and street name): _____ Name of city, town, or post office: _____ Name of U.S. county or municipio in Puerto Rico: _____ Name of U.S. state or Puerto Rico: _____ ZIP Code: _____

Strengthening Data Literacy across the Curriculum Project (SDLC)

Investigating Income Inequality in the U.S.



Lesson 3.

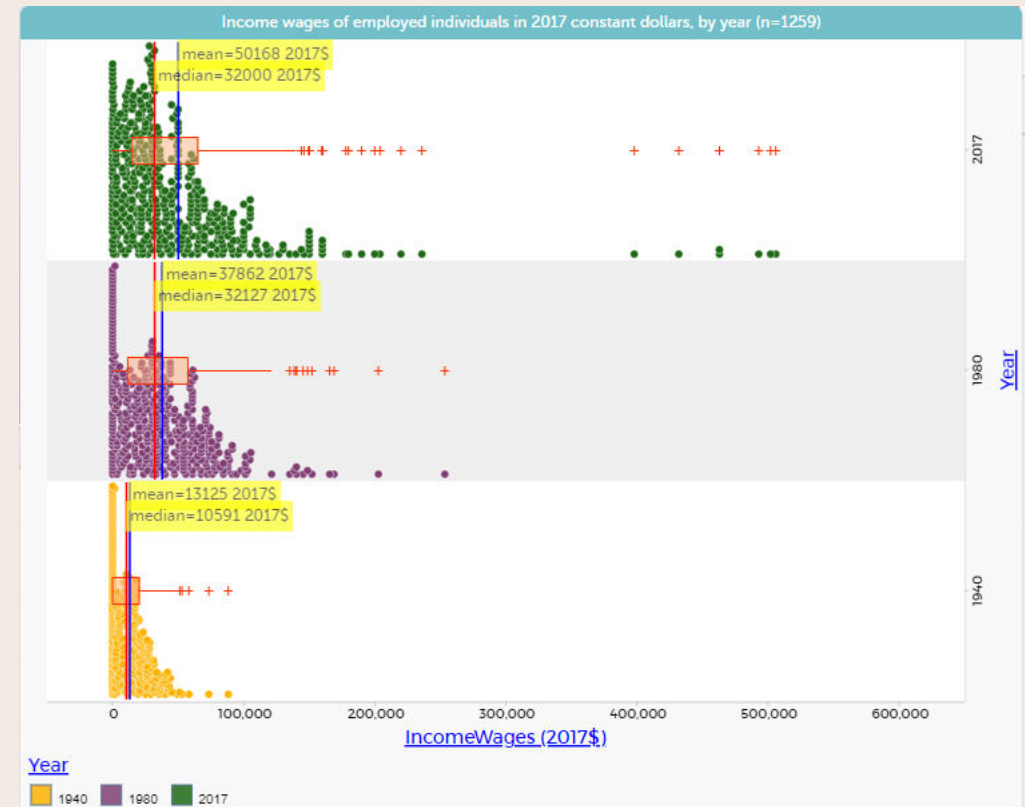
What is the average income in the U.S., and how accurately can we measure it?

Lesson 4.

How have middle-income earners been doing over time?

Lesson 5.

How have higher- and lower-income earners been doing over time?



Strengthening Data Literacy across the Curriculum Project (SDLC)

Investigating Income Inequality in the U.S.



Lesson 6.

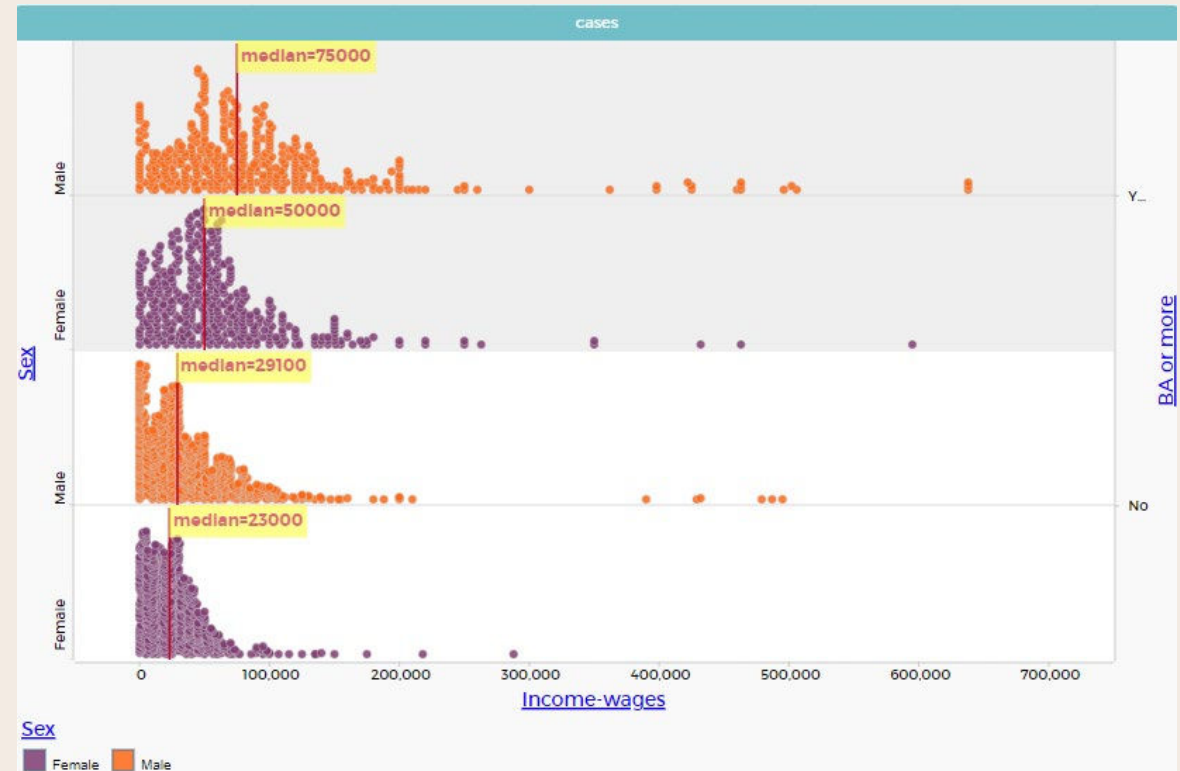
How much income inequality exists between men and women in the U.S?

Lesson 7.

Does education explain the wage gap between men and women?

Final project

Does another variable explain the wage gap between men and women?



Strengthening Data Literacy across the Curriculum Project (SDLC)

Investigating Income Inequality in the U.S.

Signs of success

- Tested with mathematics and statistics teachers and their students in 6 low-income, racially diverse high schools in urban Northeast districts in fall/winter 2019/2020
- Students' **interests** in data analysis and **understanding** of statistics concepts grew significantly

- (Louie et al., 2022)



Strengthening Data Literacy across the Curriculum Project (SDLC)

Investigating Income Inequality in the U.S.

Signs of greater social and political awareness



“I didn’t realize so many people were making \$10,000 to nothing.”

- *Student in Will’s class*

“They really latched onto the fact that 25 percent of the country makes less than \$15,000 a year and what that means, and really how shocking that is.”

- *Teacher Bella*

“They got more and more outraged that no matter what the education level was, the male median [income] was always larger than the female median and sometimes quite a bit larger. And they just kept going, ‘But that’s not fair.’”

- *Teacher Rachel*

Strengthening Data Literacy across the Curriculum Project (SDLC)

Investigating Income Inequality in the U.S.

Signs of greater individual and social agency



“I thought the module treated us more like students and less like children... because it asked for our input as opposed to telling us, hey, this is [it], learn about it.”

- Student in Will's class

“I liked the income inequality data more than the statistics lessons we usually do because of the fact that it felt like we were our own statisticians analyzing data.”

- Another student in Will's class

“You always hear about it, like there's income inequality between genders, and when we actually did the data it was like, oh wow, this is real. People aren't just making things up. This is a real problem, and maybe hopefully we can figure something out.”

- A student in Julie's class

Strengthening Data Literacy across the Curriculum Project (SDLC)

Investigating Immigration in the U.S.



Lesson 1.

Who are immigrants in the U.S.?

Lesson 2.

What can we learn about immigration from the American Community Survey?

Lesson 3.

What percentage of the U.S. population are immigrants?

Claims:

"Immigrants are taking over."

"Most immigrants are Mexican."

"Immigrants don't work."

"Immigrants aren't educated."

Strengthening Data Literacy across the Curriculum Project (SDLC)

Investigating Immigration in the U.S.



Lesson 4.

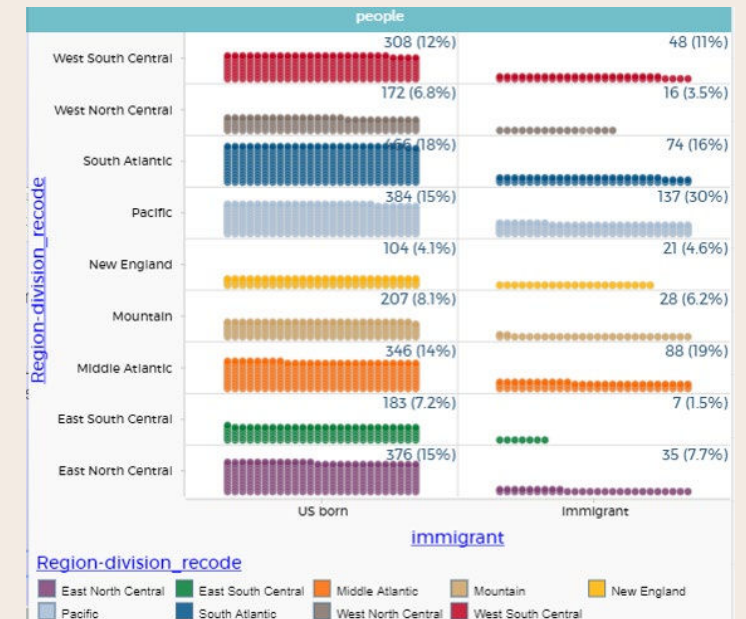
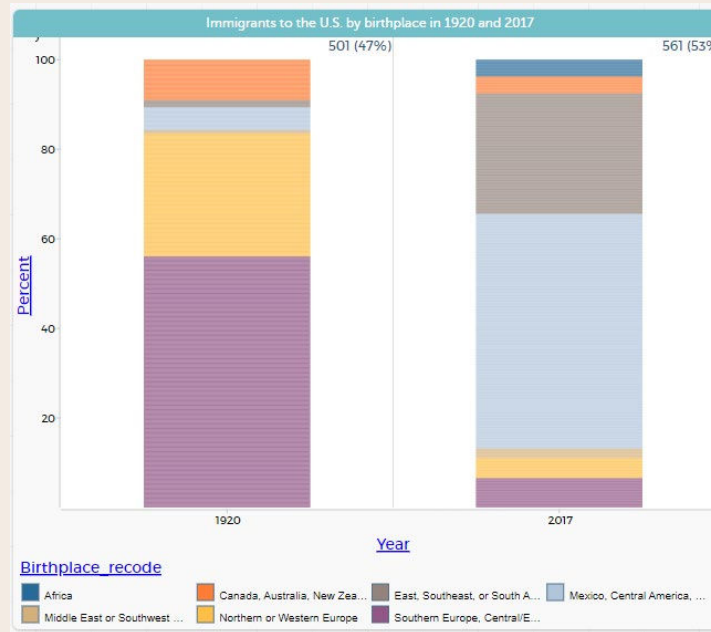
Are there more immigrants in the U.S. today than in previous years?

Lesson 5.

Where have most immigrants been coming from?

Lesson 6.

Where have immigrants settled in the U.S.?



Strengthening Data Literacy across the Curriculum Project (SDLC)

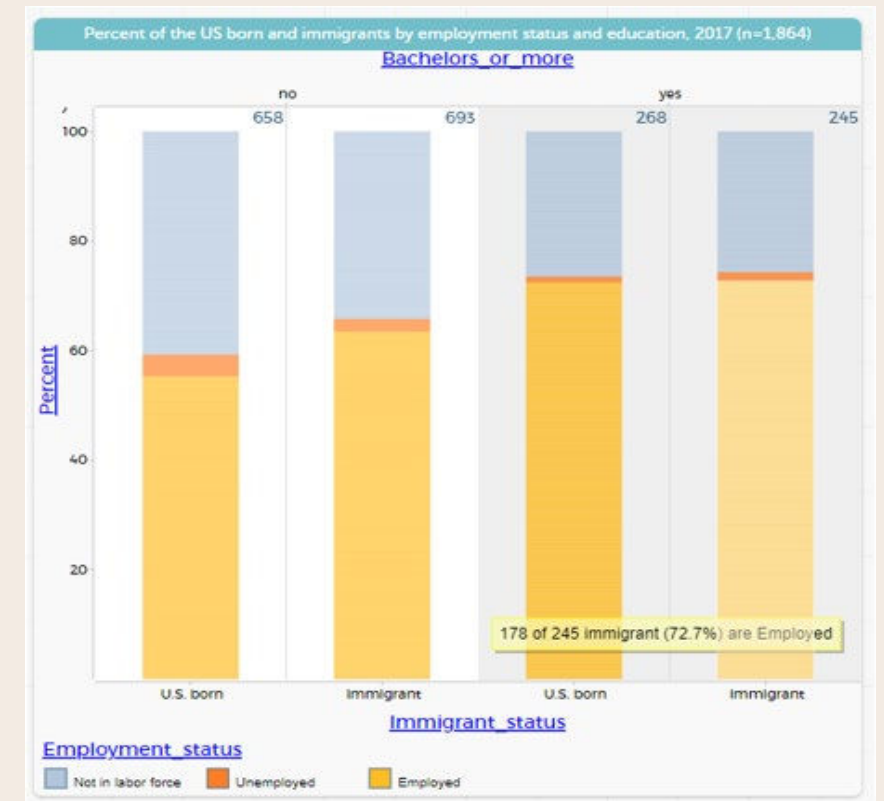
Investigating Immigration in the U.S.



Lesson 7.

Are immigrants as likely as the U.S. born to be in the labor force?

What about when you consider education levels?



Strengthening Data Literacy across the Curriculum Project (SDLC)

Investigating Immigration in the U.S.

Explored outcomes in a Social Studies classroom

- Piloted with a U.S. history teacher and two of her classrooms in a racially diverse, low-income high school in an urban Northeast district in spring 2019
- Conducted two 60-minute interviews with the teacher and examined student work, including responses to assignment prompts



Strengthening Data Literacy across the Curriculum Project (SDLC)

Investigating Immigration in the U.S.



Signs of more critical views of data

“Having a graph for students to look at [with] pre-selected information isn’t making them think about where the information comes from, and how it’s collected... That’s the value in the [SDLC] investigation. They had to bring a critical eye to it and think about their role in putting [the data] together.”

- Teacher Maura

“I wonder how they get the data and also if they know the people that they have the info from.”

- Student

“What criteria is need[ed] to be met to be classified as an immigrant and U.S. born if you came here when you were little?”

- Student

“I wonder why some people’s birth place is unknown.”

- Student

Strengthening Data Literacy across the Curriculum Project (SDLC)

Investigating Immigration in the U.S.



Data can help students construct their views of society

“I found a lot of success with students... because you’re not telling them what the story is going to be, they kind of see it for themselves.”

- *Teacher Maura*

“Especially with students...who might feel like politically, [the] curriculum might not align with them, the data investigation actually gets them before they get to that point [of political resistance], where they’re saying, ‘Oh, this is a thing that exists.’”

- *Teacher Maura*

“I feel like the lesson... how we talk about time periods of immigration and groups, I think that this cautions students from oversimplifying anything about it, which I really appreciated.”

- *Teacher Maura*

Innovation Pathways to Data Careers

- Initiative to develop and test a pathway of high school courses to build students' skills for data careers
 - Civics + Data
 - Data Visualization
 - Python + Data
- Funded by the National Science Foundation



Innovation Pathways to Data Careers

Civics + Data



Course scope and sequence, excerpts (~14 weeks)

Unit name	Essential questions	Data learning objectives and tasks
1. Culture building and data	What is data? How can data help tell a story?	Begin to understand data-driven arguments <i>Example task: Argue if vaccines should be mandatory in schools</i>
4. Local governments	Where does most of the power lay, in the state or federal system?	Evaluate poll validity <i>Example task: Examine public views on a topic of interest</i>
7. Data visualizations*	How can we create compelling data visualizations?	Learn to create pivot tables and bar and other charts, clean and filter data, using CODAP and Google Sheets <i>Example task: Analyze retail sales data to inform marketing strategy</i>
8. Civics project	How can we use data to communicate an effective argument?	Identify an issue, conduct research, integrate & analyze data, create visuals, advocate

*Based on activities from Knaflic, (2015). Storytelling with data: A data visualization guide for business professionals.

Innovation Pathways to Data Careers

Civics + Data



Pilot implementation

- Taught by a social studies/civics teacher as part of the Innovation Pathway in a racially diverse, low-income high school in an urban, Northeast district in fall/winter 2022/2023
- Conducted one 60-minute interview with the teacher and a 60-minute focus group interview with 7 students

Innovation Pathways to Data Careers

Civics + Data



School bathrooms: Data helped build dialogue and trust

Student: I feel like the way we presented [the data], it helped us make a connection with admin... Now we're more aware of what they're doing, and they're more aware of what we're thinking, so that we can finally start bringing it all together.

Interviewer: What did data add to that conversation? Because presumably you could you have done the same thing without data?

Student: I feel like if we didn't have the data, they wouldn't have the trust... The data actually presented how the students feel, it was more overwhelming than they probably thought.

Innovation Pathways to Data Careers

Civics + Data



City potholes: Data led to civic action

Student: The classes gave at least me and my group, awareness. We came into our project really negative, 'cause we knew a lot of roads in [town] had a lot of problems, and we just felt like the city didn't care. But through our data and just learning more about road maintenance and public works, we realized the city just doesn't have, they're just trying their best and they don't have that much of their own data.

Interviewer: You realize they don't have as much of their own data?

Student: Well, yeah, they don't follow, they don't know how or what the people feel, 'cause they're not talking to them.

Interviewer: Do you think they appreciated the data you gave them?

Student: Yeah, I think they did, 'cause we are gonna continue working with them, during our next course.

...

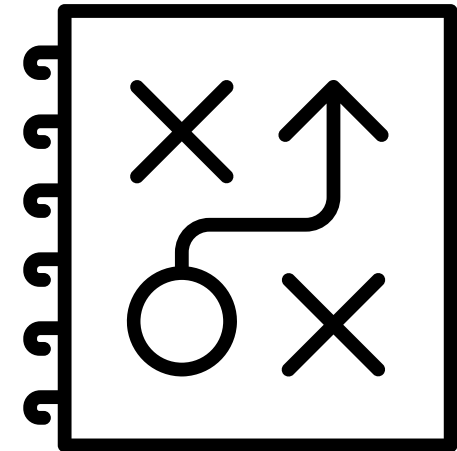
Interviewer: What do you hope to do next with that continuation?

Student: I think we're going to try to push, I guess motivate people to report more problems.

Some challenges and ways forward

A few challenges

- Teachers may not feel prepared to support critical data literacy
- Difficult to find space in packed curricula
- Certain terms (e.g., social justice, social inequality) may be politically fraught
- Discussions of race may be inevitable and require skilled facilitation (Philip et al., 2016)



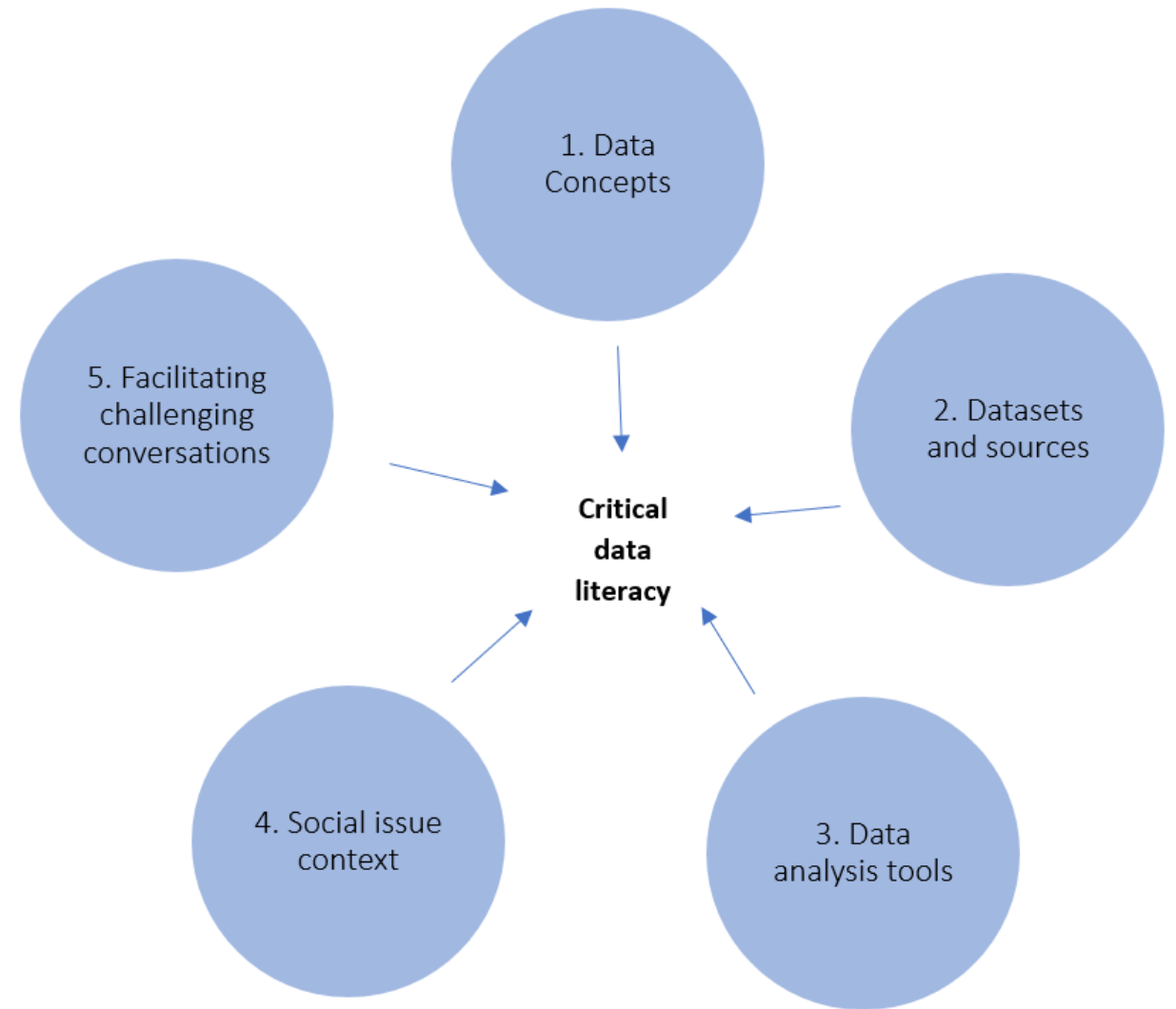
Needed supports for teachers

- Interdisciplinary sets of knowledge and practices (Louie et al., 2023)
- Confidence and motivation to support students' abilities to

Read Write

Speak Act

(in) the world with data



The opportunity awaits

“I think we need to do more of [this work] in school, to be honest with you. A lot of people are afraid to talk about [these] issues... If more kids tackle it head-on, they’ll have a better understanding of how our world really works.”

- Student, SDLC project

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Thank you

Merci

Gracias

شكرا

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