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Quantum Science & Engineering Center

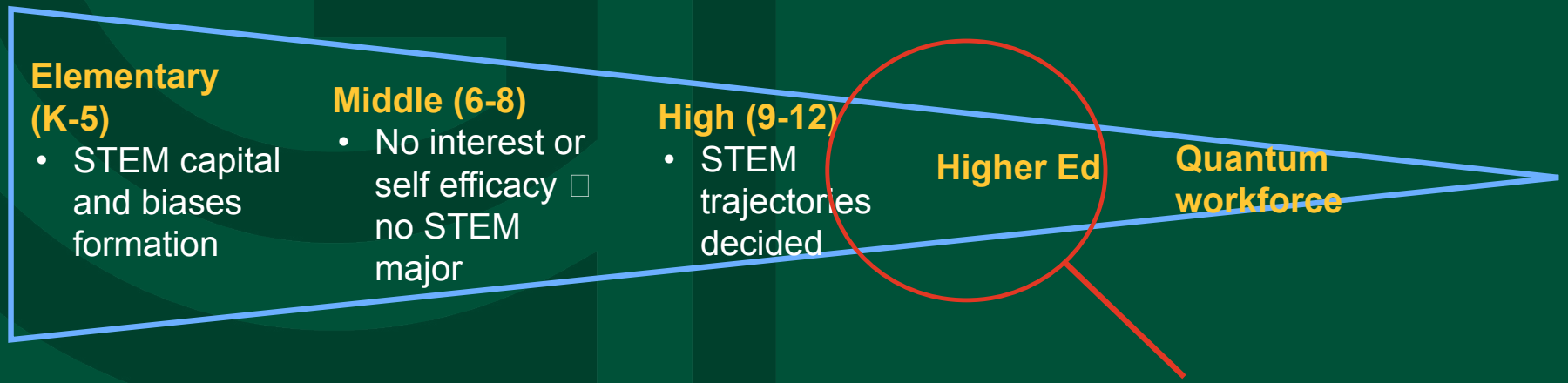
K-12 QUANTUM EDUCATION PROGRAMS

ACCESS & REACH IN THE U.S.

CSAAPT, College of William and Mary, Williamsburg, VA
October 10, 2026

Laura M. Akesson, Nancy Holincheck, Jessica L. Rosenberg

Why K-12?



A lack of information limits our ability to measure progress or set goals in addressing gaps in diversity of participation (socioeconomic, geographical, etc.)

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Definitions

- **Quantum programs:** outside-of-school-day, organized events
- **Student programs:** participants are K-12 students
- **Teacher programs:** participants are K-12 teachers

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Broadly, what should be the **outcomes** of K-12 quantum education?

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Perspectives on K-12 program **outcomes**

10 interviews with program leaders

AFFECTIVE →

"...get kids excited… feeling like they can be a scientist."

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AFFECTIVE →

"...get kids excited… feeling like they can be a scientist."

"...increase young students' interest and also confidence in pursuing quantum science."

"…quantum literacy."

"…we're shifting from awareness into deeper understanding and commitment."

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Perspectives on K-12 program **outcomes**

10 interviews with program leaders

AFFECTIVE →

"...cultivating STEM identity, belonging STEM interest…"

"...get kids excited… feeling like they can be a scientist."

"...increase young students' interest and also confidence in pursuing quantum science."

"…quantum literacy."

"…we're shifting from awareness into deeper understanding and commitment."

→ PRACTICAL

"Workforce development."

"...knowledge of what that career pathway could look like."

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Perspectives on K-12 program **outcomes**

10 interviews with program leaders

FOR the TEACHERS!

"...every STEM-associated class… biology, chemistry,...math… need to have some connection to the quantum…"

"… a democratic citizenry, understand the importance… terms of our global positioning…

…and a very clear vision of how do you bring this into a classroom"

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Perspectives on K-12 program **outcomes**

10 interviews with program leaders

FOR the TEACHERS!

"...every STEM-associated class… biology, chemistry,...math… need to have some connection to the quantum…Imagine how that would look if a kid's going through high school and let's say eight of their courses mention quantum at some point."

"… a democratic citizenry, understand the importance… terms of our global positioning…

…and a very clear vision of how do you bring this into a classroom"

Keeping it real i^2

"...the outcomes of K12 education have and should remain very regional…"

"...if thinking quantum gets someone to stick with the math …we've done our job."

"…thinking about what can we do, what should we do, and how many resources should go into those…efforts that may or may not have the outcomes we think..."

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Perspectives on K-12 program **outcomes**

10 interviews with program leaders

SOCIAL JUSTICE

"...keeping it diverse from the get-go."

"...introduce a new group of faces that would not have necessarily considered quantum…"

"...I would hope in, the next 10 to 15 years that there's both the person who's a post-doc and coming from across the world, and there's the post-doc who literally started off in our K12 program."

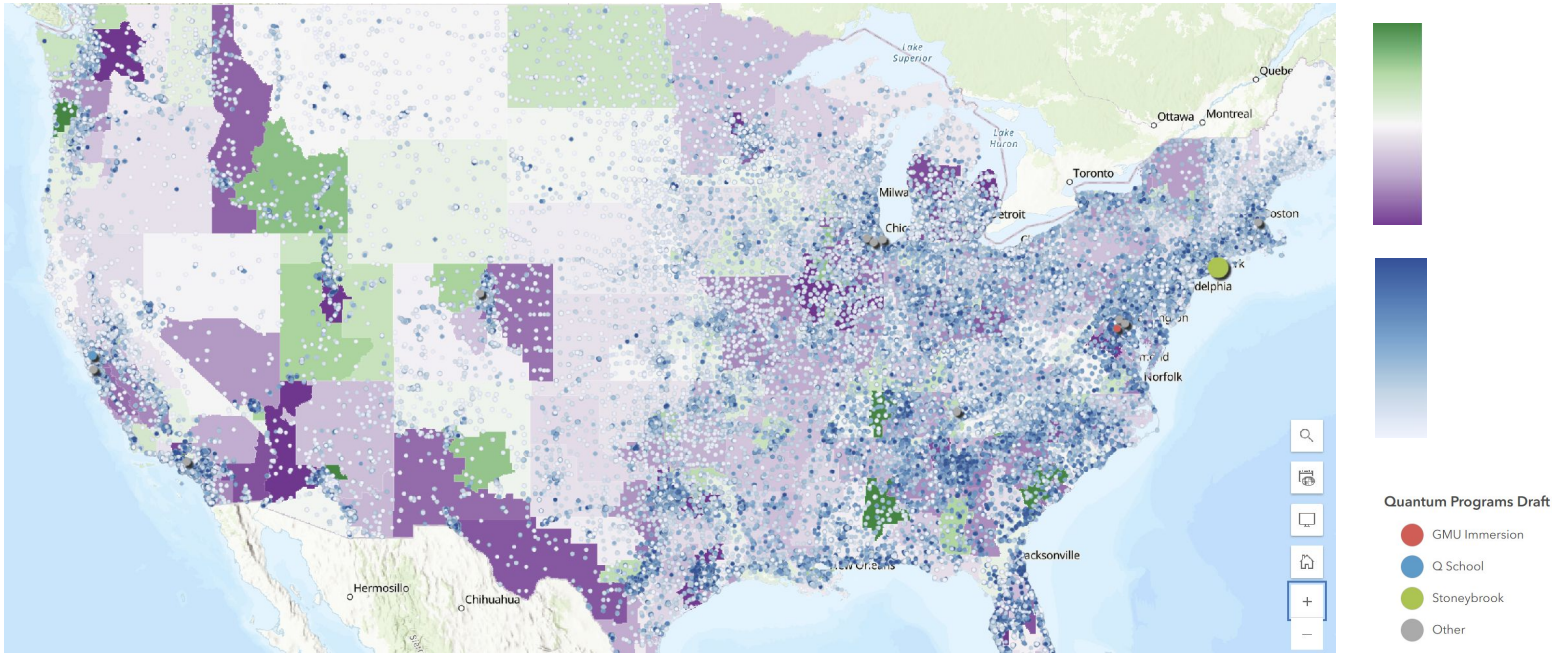
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Considering these outcomes/goals,

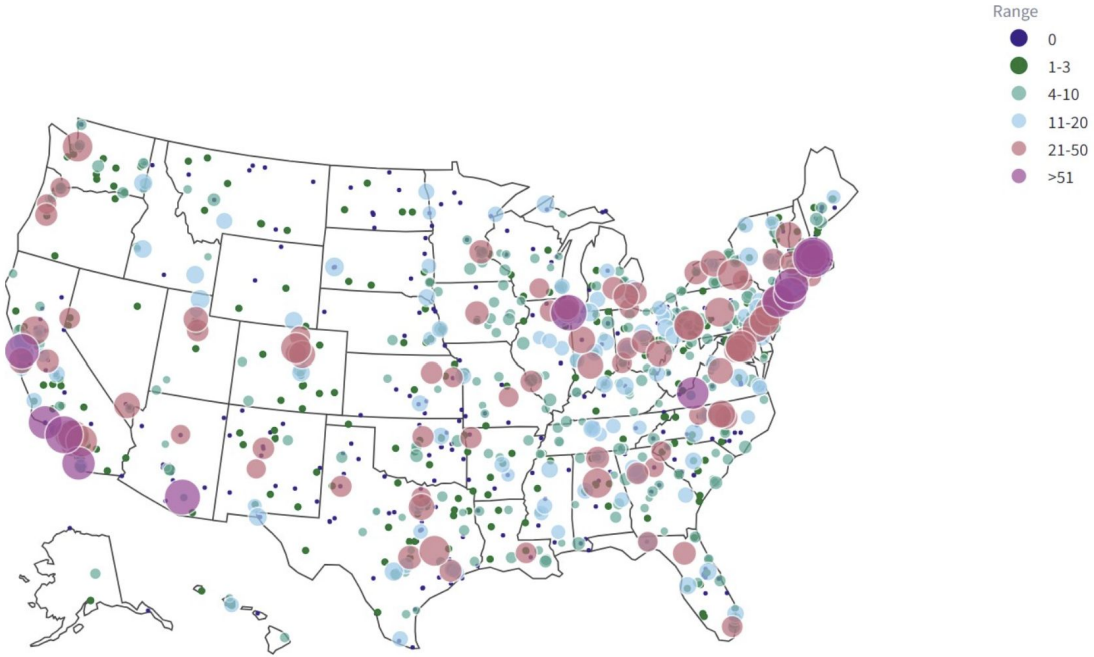
- Where are these programs and where should the be?
- What geographic/societal factors are most important to consider?
- In terms of workforce development, where might there be support for K-12 programs (universities, labs, industries)?
- Who should be involved?

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Good maps show data. Great maps convey stories.



Quantum Information Science and Technology in Undergraduate Institutions



Map of quantum-related coursework in the United States. Each bubble corresponds to an institution. The size and color of the bubble indicates the total number of quantum-related courses.

- QIS courses and degrees are **disproportionately found at large research universities**. This effect is very large.
- Institutions with a high percentage of undergraduates receiving Pell grants offer significantly fewer QIS courses, indicating that **low-income students may have fewer opportunities to access QIS coursework**.
- We find no statistically significant correlation between status as a URM-serving institution and number of QIS courses offered, once other factors are controlled for.

https://www.rit.edu/quantumeducationandworkforce/education-landscape

A. R. Piña, et. al., arXiv:2505.00104.

J. C. Meyer, et. al., Phys. Rev. Phys. Educ. Res. 20, 010131 (2024).

K-12 Quantum education STUDENT and TEACHER programs

Legend

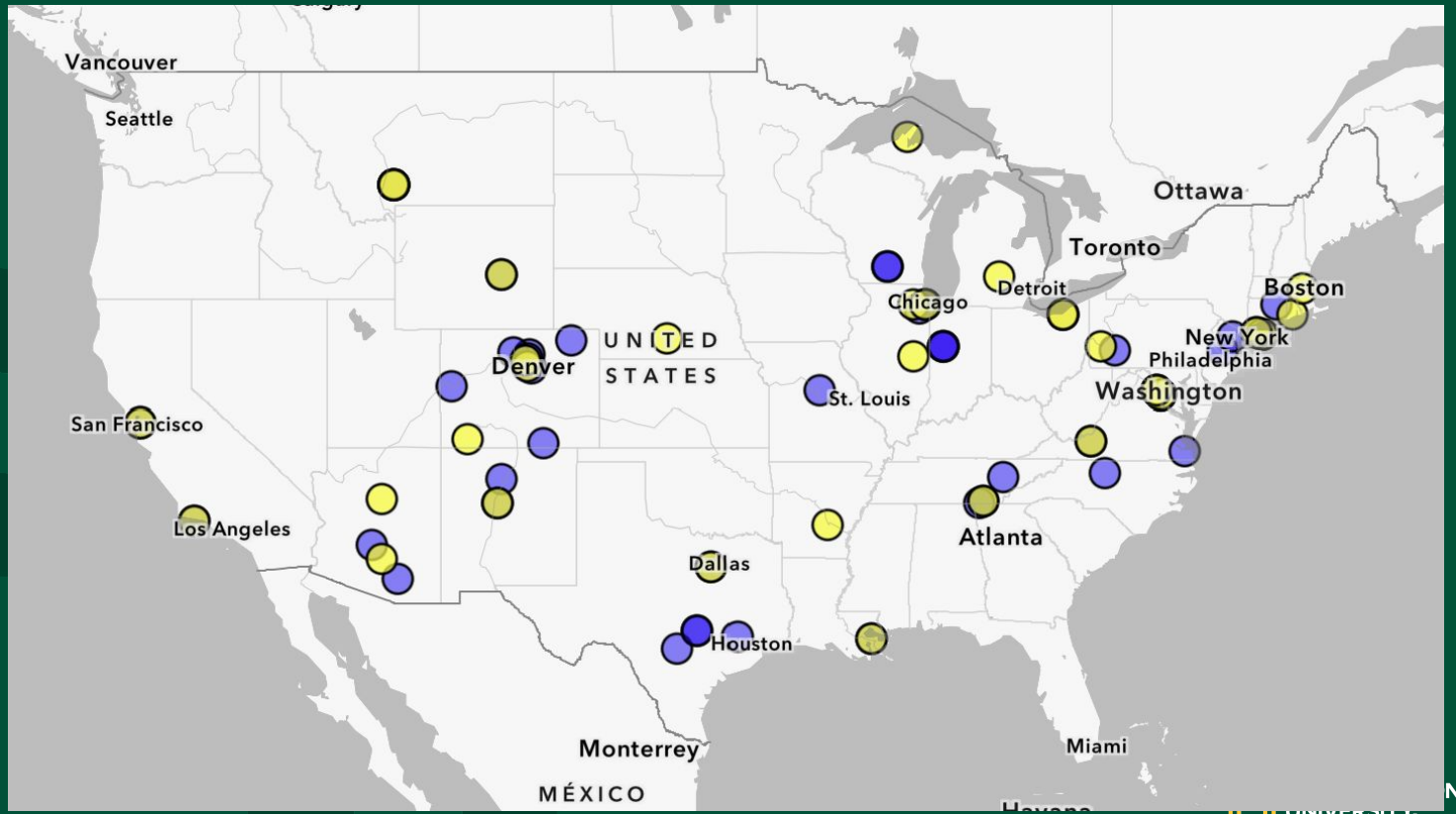
STUDENT programs

$n_{stu} = 34$

TEACHER programs

$n_{teach} = 51$

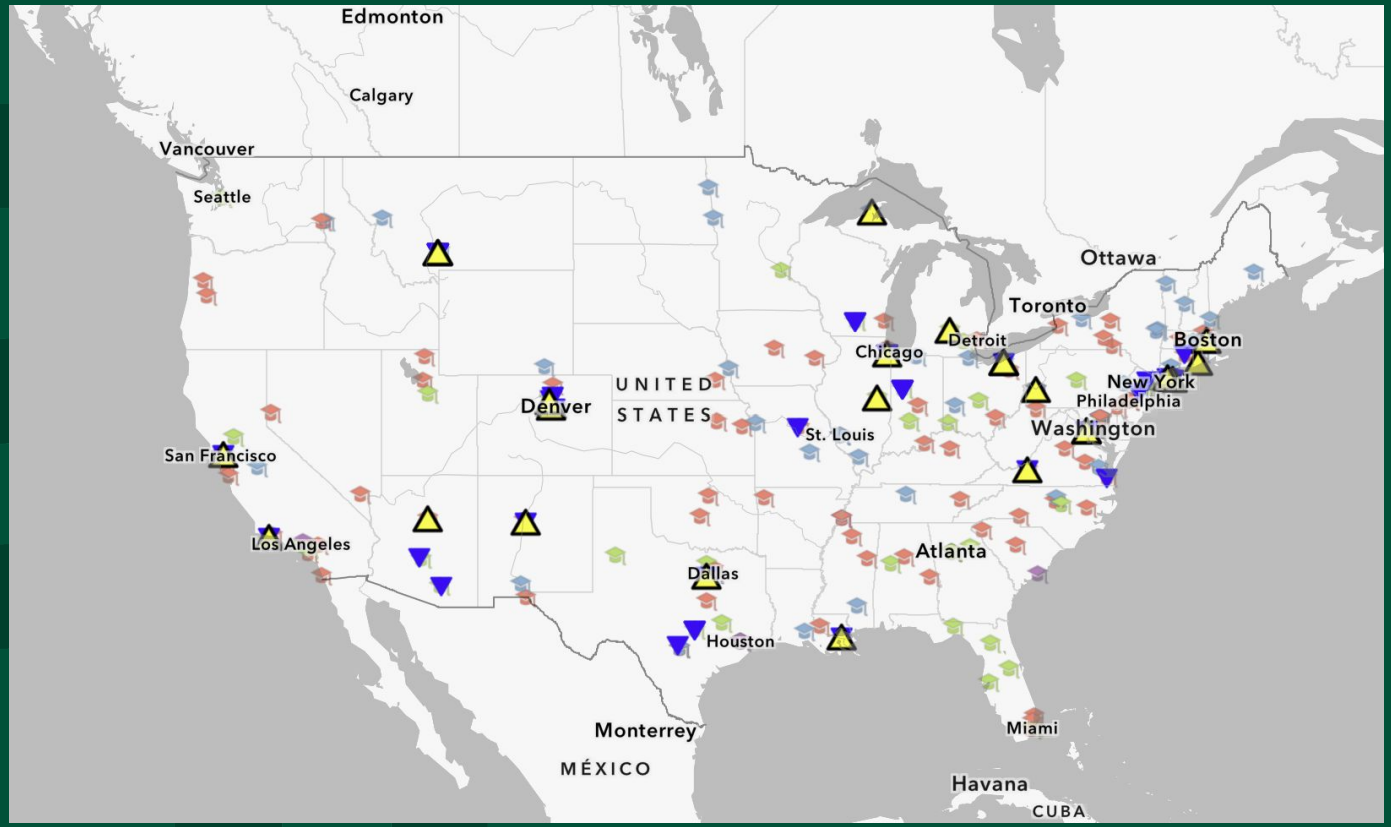
(6 overlap, separate points)



Proximity to R1 institutions

Legend

- Student programs within 20 miles of an R1 institution
  n_{stu} = 24 (71%)
- Teacher programs within 20 miles of an R1 institution
  n_{teach} = 37 (73%)

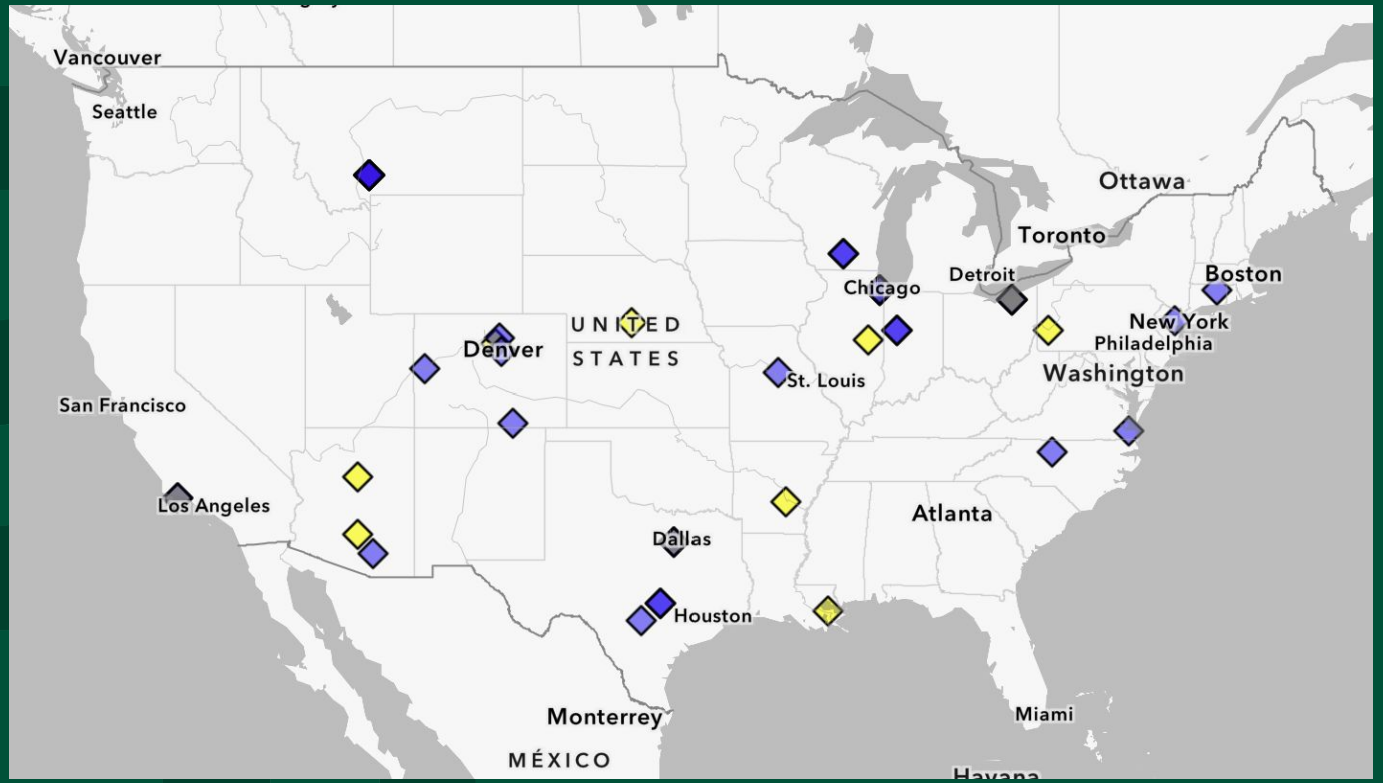


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Programs occurring in low-income communities

Legend

- Student programs within a low-income community
  n_{stu} = 15 (44%)
- Teacher programs within a low-income community
  n_{teach} = 26 (51%)



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Quantum companies

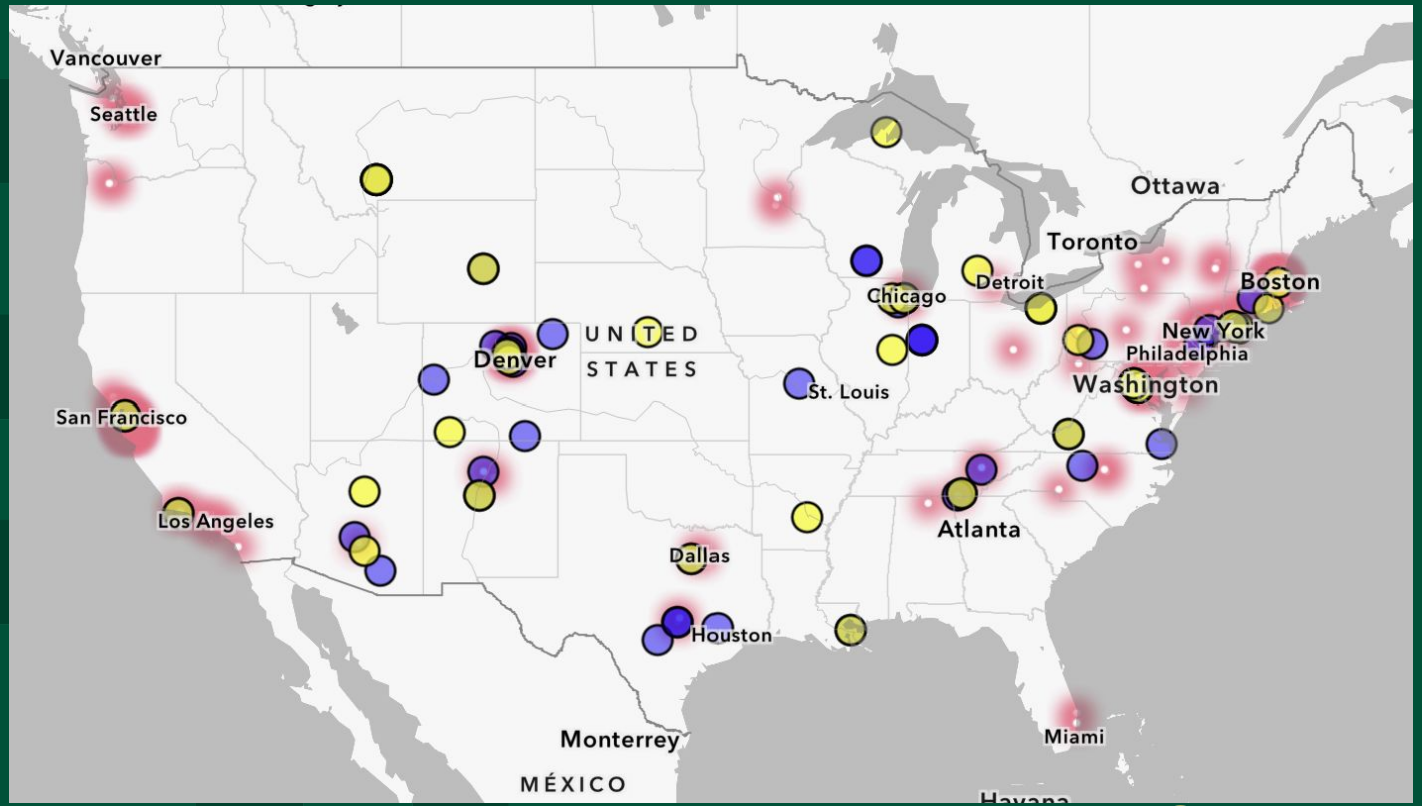
Legend

Student programs within 20 miles of a company

n_{stu} = 14 (41%)

Teacher programs within 20 miles of a company

n_{teach} = 23 (45%)

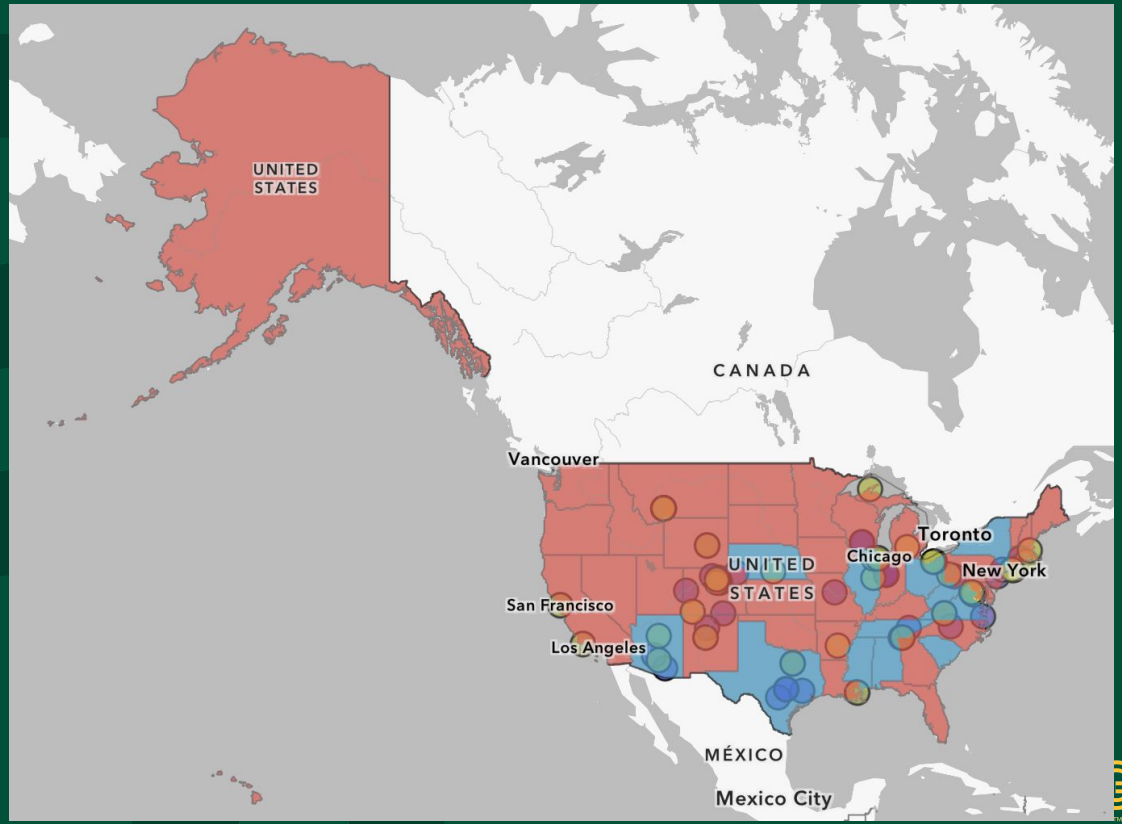


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States with “Quantum” in the standards (physics/computer science/chemistry)

n	39
y	12

29 states w NGSS or NGSS-aligned standards
WV, VA, TX, TN, SC, NY, NE, MS, OH, AL, IL
6 chem, 2 phys, 4 CS



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Map summary

	Within 20 miles of R1	Within 20 miles of DOE NL	Occurring in low-income area	Within 20 miles of a company
Student program (34 total)	24 = 71%	6 = 18%	15 = 44%	14 = 41%
Teacher program (51 total)	37 = 73%	10 = 20%	26 = 51%	23 = 45%

Presentation summary:

- The outcomes/goals of K-12 quantum education varies; considering them is important as we make plans for the future
- Geographic characteristics matter for some outcomes more than others

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What's next?

- **Sustainability and Scaling in K-12**
  - **What role does identity of the program leader play?**
  - **Role of local, state, federal government? of industry?**
  - **Role of higher education?**
- **Champions and networks**



Thank you!

Please reach out with questions, comments, etc.

Laura M Akesson

lakesson@gmu.edu

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