PhysTEC Regional Network of Southeast New York

Virtual Meeting

December 8, 2020

Physics Teacher Education Coalition

Improving the Education of Future Physics Teachers

PhysTEC NY PROJECT GOALS

- Increase the recruitment and retention of physics teacher candidates.
- Improve physics teacher preparation.
- Advance precollege physics teaching, learning, and participation.

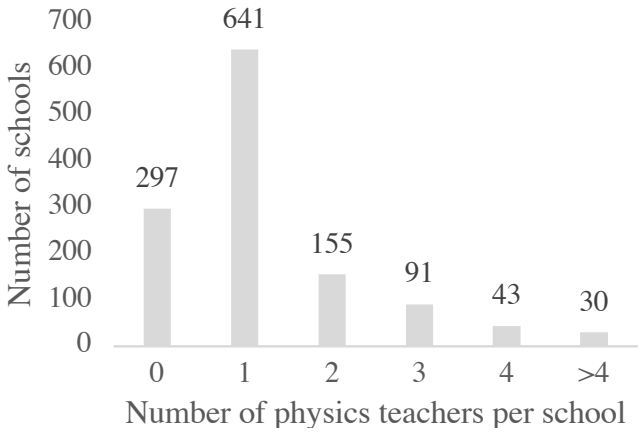


Figure 1. Physics teacher distribution in New York State. 2016-17

Krakehl, R., Kelly, A. M., Sheppard, K., & Palermo, M. (2020). Physics teacher isolation, contextual characteristics, and student achievement. *Physical Review Physics Education Research, 16*(2), 020117. https://doi.org/10.1103/PhysRevPhysEducRes.16.020117

PhysTEC NY Network Partners

Higher Education

- Adelphi University
- CUNY
- Fordham University
- Hofstra University
- Hunter College CUNY
- Mercy College
- NYU Steinhardt
- Stony Brook University
- Teachers College, Columbia

Physics Teacher Professional Organizations

- Long Island Physics Teacher Association
- New York State Master Teacher Program
- Physics Club of New York
- STEM Teachers NYC

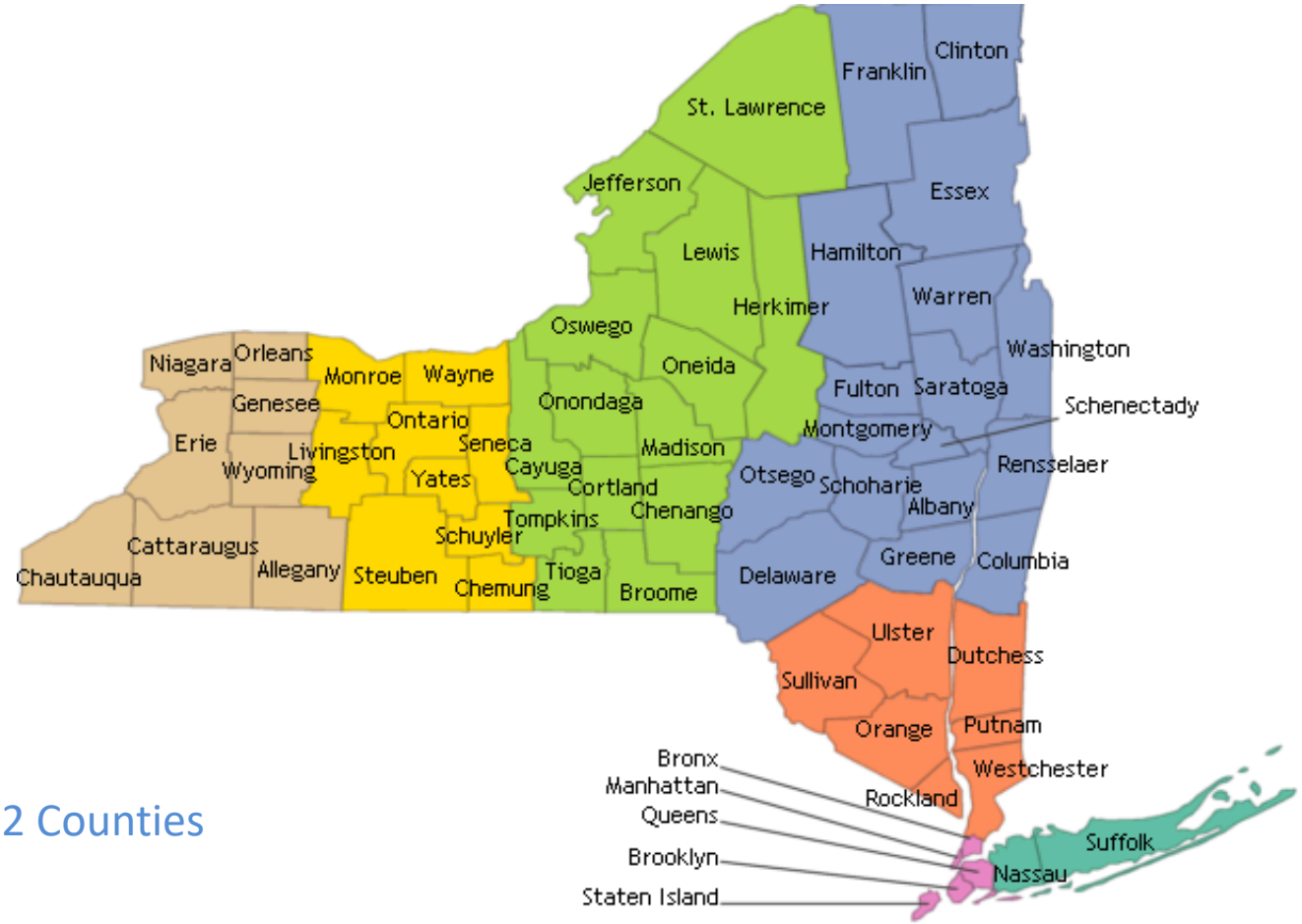
Physics Education in New York State

Keith Sheppard

Institute for STEM Education

STONY BROOK UNIVERSITY

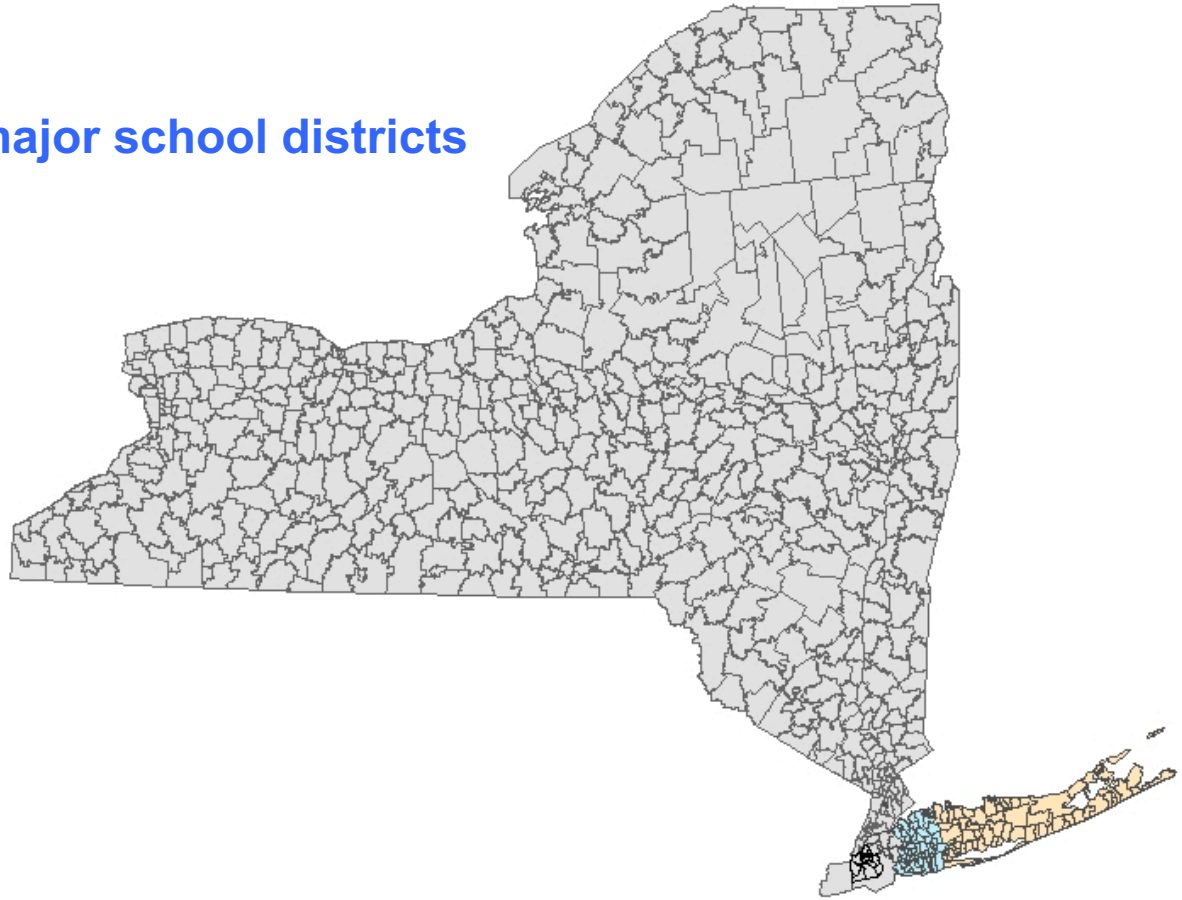
New York State



62 Counties

New York State School Districts

676 major school districts



Some Facts about New York State

Some Facts about New York State

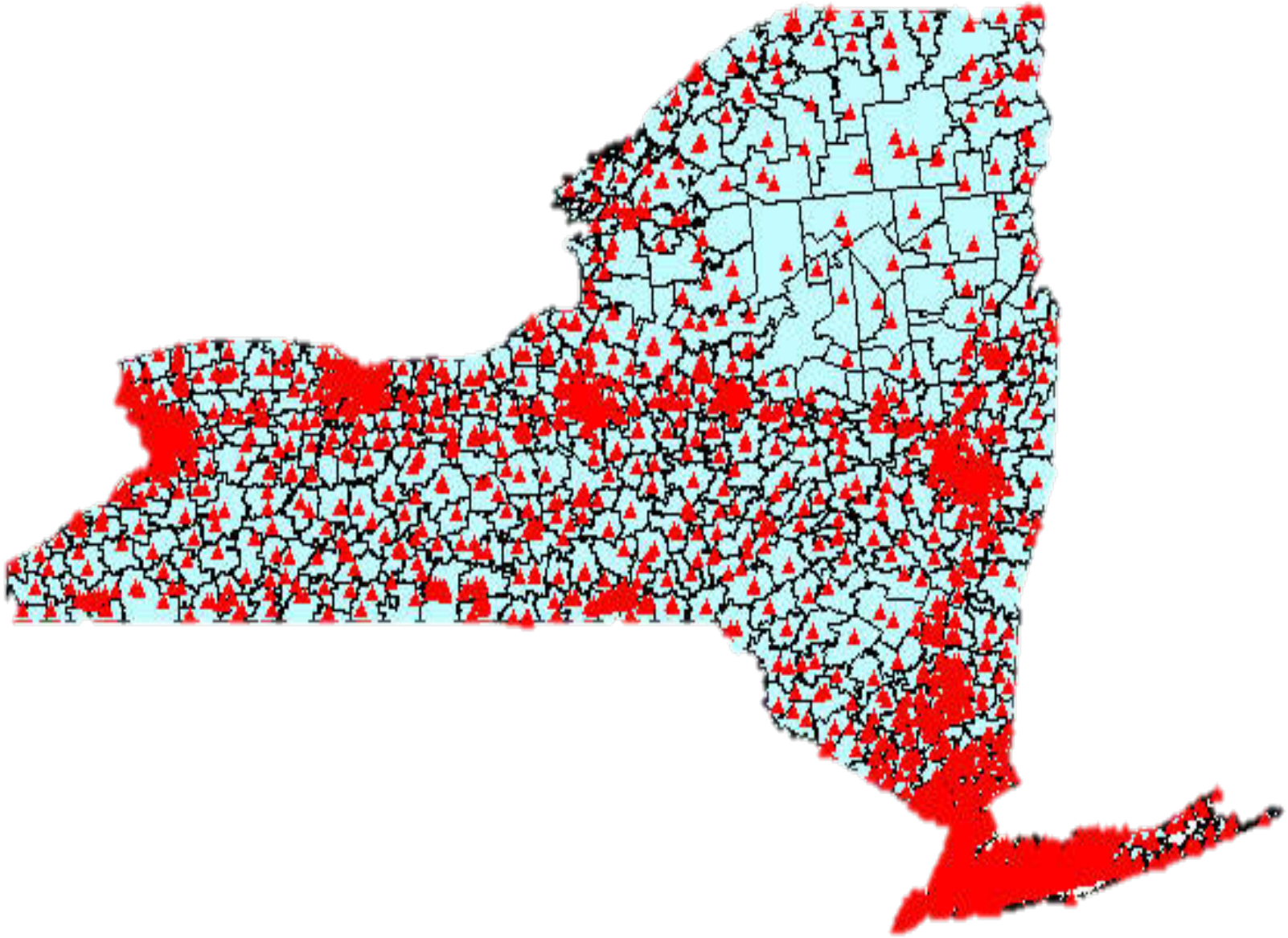
- 4th Most populous state (19.5 M)
  - {56% white, 16% Black,7% Asian, 18% Hispanic}

Some Facts about New York State

- 4th Most populous state (19.5 M)
  - {56% white, 16% Black,7% Asian, 18% Hispanic}
- Contains New York City (8.2 M)
  - 42% of whole state (38% of school population)

Some Facts about New York State

- 4th Most populous state (19.5 M)
  - {56% white, 16% Black,7% Asian, 18% Hispanic}
- Contains New York City (8.2 M)
- Population not evenly distributed



Some Facts about New York State

- 4th Most populous state (19.5 M)
  - {56% white, 16% Black,7% Asian, 18% Hispanic}
- Contains New York City (8.2 M)
- Population not evenly distributed
  - ~70% in downstate (lower 11 counties)

Some Facts about New York State

- 4th Most populous state (19.5 M)
  - {56% white, 16% Black,7% Asian, 18% Hispanic}
- Contains New York City (8.2 M)
- Population not evenly distributed
  - ~70% in downstate
- School Population (2.7 M) + (0.4 M Private)
  - {49% White, 19% Black, 8% Asian, 22% Hispanic}

Some Facts about New York State

- 4th Most populous state (19.5 M)
  - {56% white, 16% Black,7% Asian, 18% Hispanic}
- Contains New York City (8.2 M)
- Population not evenly distributed
  - ~70% in downstate
- School Population (2.7 M) + (0.4 M Private)
  - {49% White, 19% Black, 8% Asian, 22% Hispanic}
- Suburban 45%, Urban 42%, Rural 13%

New York State

- Identifying Feature(s) of New York State High School STEM Education?

New York State

- Identifying Features of New York State High School Science?
  - Regents Exams
  - Earth Science
  - Intel (now Regeneron)

University of the State of New York.

28th Advanced Academic Examination.

PHYSICS (Elementary).

June, 1887—Time two and one-half hours only.

---

40 *credits*, *necessary to pass*, 30.

1. Define mass, molecule, and atom. State a form of attraction peculiar to each..... 6

2. Name two general properties of matter and two specific properties 2

3. Name and define the three forms of matter, and explain how one form may be changed to another..... 3

4. State Pascal's law governing the transmission of pressure by liquids..... 1

*5. A body at the earth's surface weighs 1,200 lbs.: what would be its weight 1,800 miles below the surface? What, 1,800 miles above the surface? (Assume the earth's diameter to be 8,000 miles.) 2

*5. Upon what does the velocity of a jet of water depend? State the formula for calculating the velocity of a jet..... 2

University of the State of New York.

28th Advanced Academic Examination.

ADVANCED PHYSICS.

June, 1887—Time two and one-half hours only.

---

44 *credits, necessary to pass,* 33.

1. Distinguish between the weight of a body and its mass. One being given, how may the other be found? 3

2. On one arm of a false balance, a body weighs 11 lbs., on the other, 17 lbs. 3 oz.; what is the true weight? 1

3. A mass of granite contains 5,949 cu. ft. The specific gravity of a fragment of it is found to be 2.6; what is the weight of the mass? 1

4. Show how the pendulum is used in obtaining the form of the earth 1

*5. Make a drawing of Atwood's machine; explain how it is used; show what difficulties are overcome by its use; and state the laws that it verifies 4

*5. Give as complete an explanation as possible of the generally accepted theory of polarized light, illustrating it with the necessary diagrams 4

Physics Nobel Laureates
Who Took the NY Regents Physics Exam

Year of Award	Nobel Laureate		School Attended
1944	Isidor	Rabi	John Jay HS
1961	Robert	Hofstadter	Dewitt Clinton HS
1965	Richard	Feynman	Far Rockaway HS
1965	Julian	Schwinger	Townsend Harris HS
1967	George	Brooklyn	Brooklyn Tech HS
1972	John	Schrieffer	Manhasset HS*
1972	Leon	Cooper	Bronx HS of Science
1976	Burton	Richter	Far Rockaway HS
1978	Arno	Penzias	Brooklyn Tech HS
1979	Seldon	Glashow	Bronx HS of Science
1979	Steven	Weinberg	Bronx HS of Science
1988	Melvin	Schwartz	Bronx HS of Science
1988	Leon	Lederman	James Monroe HS
1993	Russell	Hulse	Bronx HS of Science
1995	Martin	Perl	James Madison HS
1996	David	Lee	Rye HS
2004	H Davis	Politzer	Bronx HS of Science
2004	Frank	Wilczek	Martin Van Buren HS
2005	Roy	Glauber	Bronx HS of Science
2017	Rainer	Weiss	Columbia Grammar & Prep**
2018	Arthur	Ashkin	James Madison HS

How the Regents Sciences Compare

Subject	# Registered	# Taking Exam	% Passing (65%+)	% Mastery (85%+)	% 9-12 Population Taking Exam
Living Environment	253,818	241,638	78	32	28.9
Earth Science	179,173	154,178	72	33	18.5
Chemistry	134,173	104,603	73	21	12.4
Physics	60,512	51,288	81	37	6.1

What do you notice?

Source: New York State Report Card, 2014

Where is Physics being taught In NY ?

Locale	Total Number of Schools[1]	Number Schools Offering Physics (%)	Teachers of Physics (%)
Urban (42%)	516	249 (48)	367 (26)
Rural (13%)	282	257 (91)	291 (21)
Suburban. (45%)	386	366 (95)	729 (53)
Total	1184	872 (74%)	1387

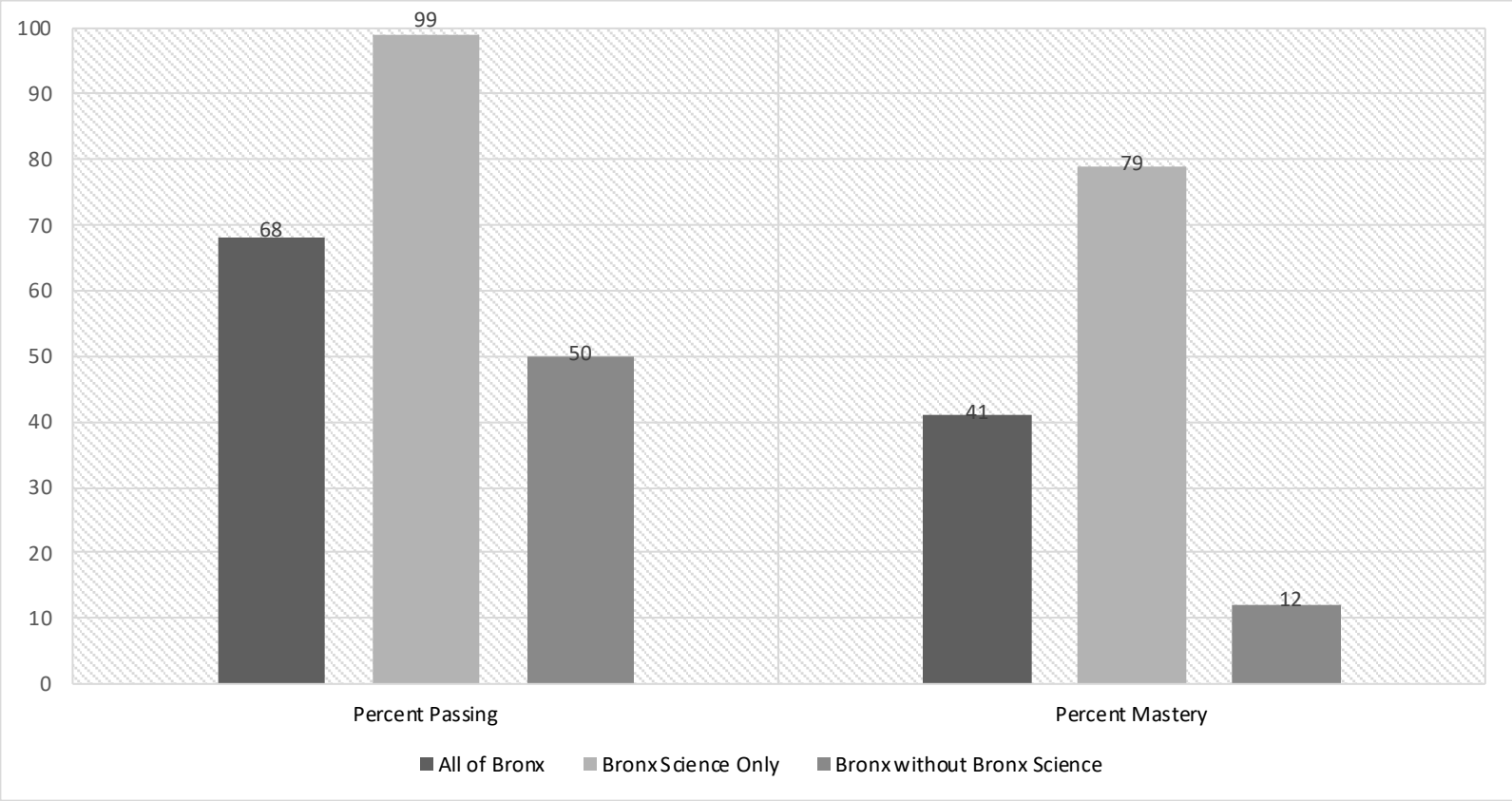
Sheppard et al. (2020). Out-of-field teaching in chemistry and physics: An empirical census study. *Journal of Science Teacher Education, 31*(7), 746-767. https://doi.org/10.1080/1046560X.2019.1702268

A Tale of Two Counties

	Nassau	Bronx
9-12 Population	65000	60,000
# Teachers teaching Physics Regents	125	38
	Certifications	
Permanent	83	9
Professional	21	5
Initial & Prov	14	10
Trans-B and Supp	2	1
Biology	2	7
ES & Chem	2	3
Out of field	1	3

Sources: New York State Report Card, 2013, NY Teacher Certificate Database

How are students performing in Regents Physics in the Bronx?



Physics Regents Exam Performance in the Bronx

Kelly, A.M. & Sheppard,K. (2019). Access to elite urban science schools in the U.S.: Opportunity, disparate impact, and equal protection. *Teachers College Record.* https://www.tcrecord.org/Content.asp?ContentID=22951

Who is Teaching Physics?

	Physics n (%)
Teachers with state certification in their subject	1137 (82)
Teachers without state certification in their subject	250 (18)
Teachers holding no science certification	49 (4)
Teachers with mathematics certification	44 (3)

Are Qualified Physics Teachers Equitably Distributed?

		Physics Teachers *n* (%)
Teachers Out-of-Field by Locale (% in category)	Rural	78 (27)
	Suburban/Town	73 (10)
	Urban	99 (27)
Teachers Out-of-Field by Socioeconomic Status	High need	155 (29)
	Average need	75 (14)
	Low need	18 (6)
Teachers Out-of-Field by Course	Regents	173 (15)
	AP & College	8 (2)
	Other	73 (18)

Sheppard, K. et al. (2020). Out-of-field teaching in chemistry and physics: An empirical census study. *Journal of Science Teacher Education, 31*(7), 746-767. https://doi.org/10.1080/1046560X.2019.1702268

What Are the Primary Certifications of Physics Teachers?

Primary Certification of Physics Teachers	Number Certified	% of All Physics Teachers
Physics	821	59
Biology	180	13
Chemistry	169	12
Earth Science	91	7
Mathematics	76	5
Non-Science/Mathematics	43	3

Sources: New York State Report Card, 2017, NY Teacher Certificate Database; Sheppard et al. (2020).

Distribution of Physics Teachers By School

- 297 NY High schools have nobody teaching physics
- 641 schools have an “isolated” physics teacher

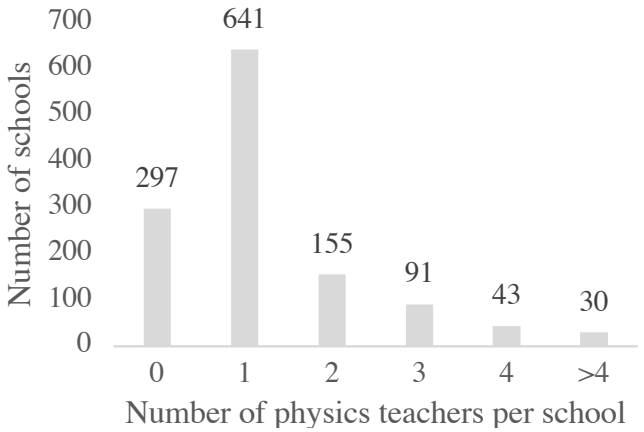
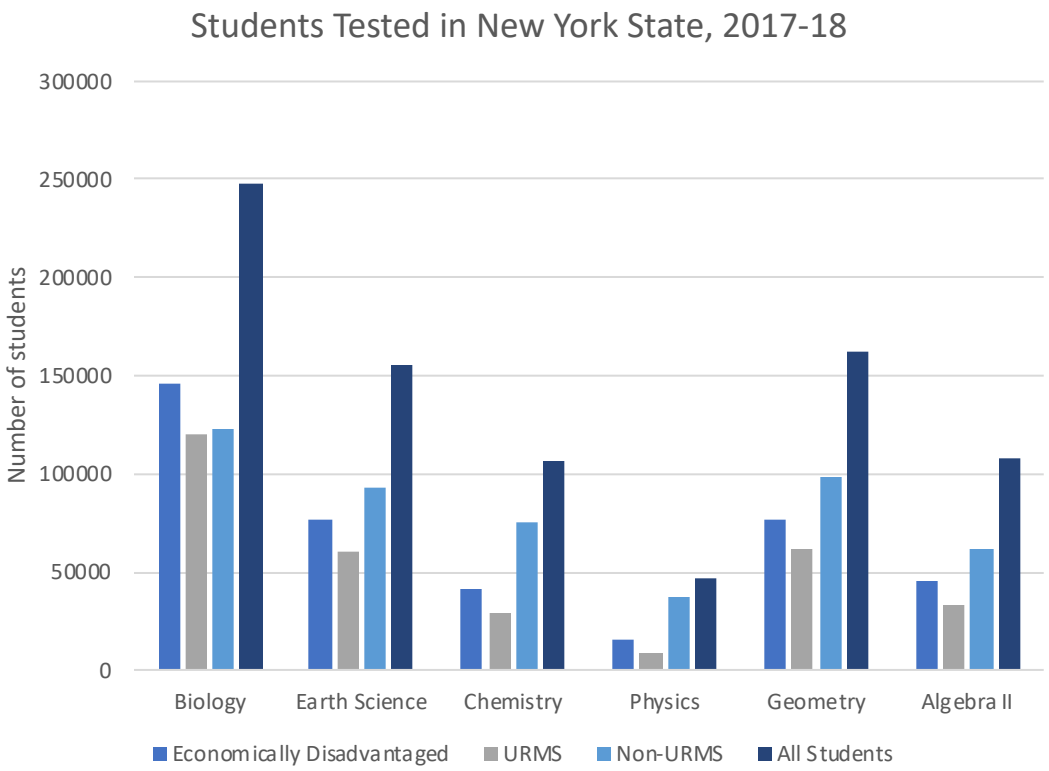


Figure 1. Physics teacher distribution in New York State. 2016-17

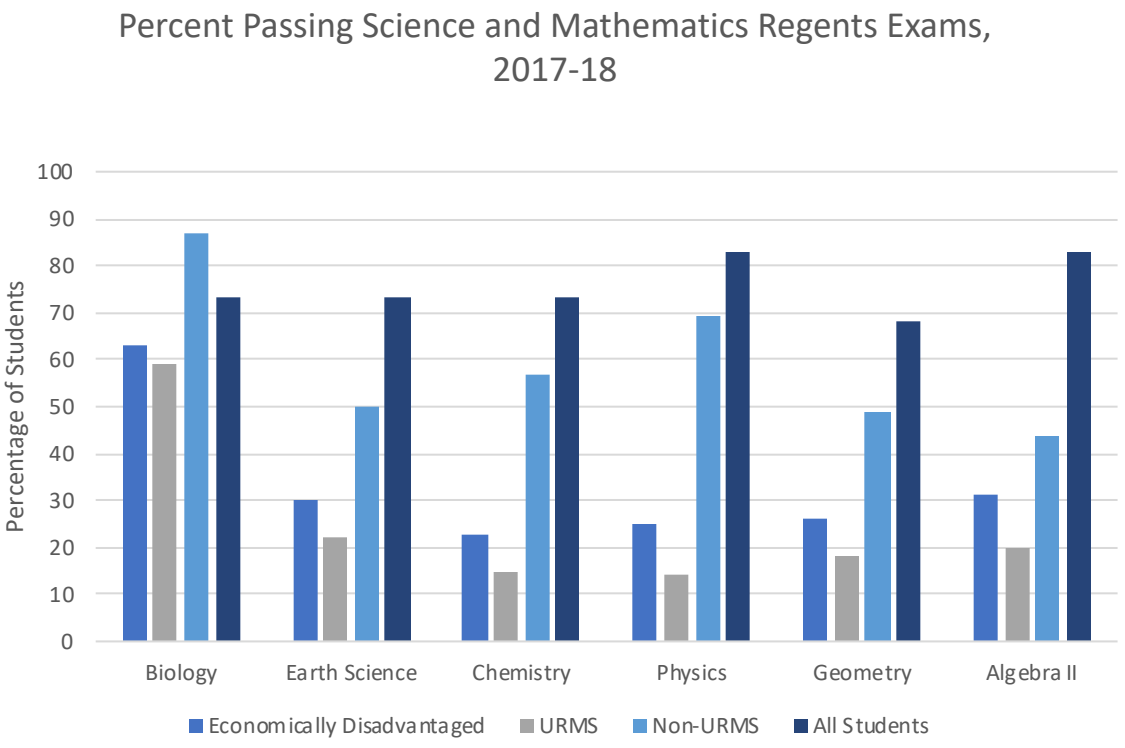
Krakehl, R., Kelly, A. M., Sheppard, K., & Palermo, M. (2020). Physics teacher isolation, contextual characteristics, and student performance. *Physical Review: Physics Education Research. 16, 020117.*

How does physics coursetaking compare to other sciences?



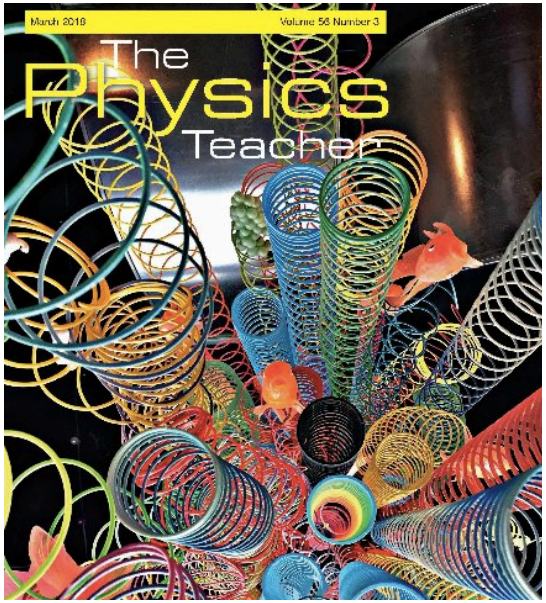
Krakehl & Kelly. (2020).

How does physics performance compare to other sciences?



Krakehl & Kelly. (2020).

PhysTEC NY NEXT STEPS



- Future Meetings
  - Second Tuesdays, 7:00-8:00pm, Jan 12, Feb 9, Mar 9, Apr 13.
  - In-Person Network Meeting/Dinner: May, 2021 (tentative), at SBU Manhattan, 535 8th Ave, between 36th/37th St.
- Network Speaker Series
  - Please contact angela.kelly@stonybrook.edu to volunteer to share initiatives, successes, and/or challenges at future meetings.
- Website Development
  - PhysTEC NY Website
  - Share your news, events, and publications related to physics teacher education.
- Potential Network Initiatives
  - Inter-University Master's Consortium
  - Grant Collaborations