NSSME | THE NATIONAL SURVEY OF SCIENCE & MATHEMATICS EDUCATION

The 2018 NSSME+: Implications for Science Education Leaders

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Eric R. Banilower

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Session Overview

- About the 2018 NSSME+
- Current Status of Science Instruction
- Resources for Instruction
- The Science Teaching Force
- Professional Development Experiences
- Implications for Teacher Preparation and Support

About the 2018 NSSME+

- The 2018 NSSME+ is the sixth in a series of surveys dating back to 1977.

- It is the only survey specific to STEM education that provides nationally representative results.

The 2018 NSSME+, and this presentation, is based upon work supported by the National Science Foundation under Grant No. DGE-1642413. Any opinions, findings, and conclusions or recommendations expressed are those of the authors and do not necessarily reflect the views of the National Science Foundation.

Topics Addressed

Six different survey instruments

- Characteristics of the science/mathematics/ computer science teaching force:
  - demographics
  - preparation for teaching
  - beliefs about teaching and learning
  - perceptions of preparedness
- Instructional practices
- Factors that shape teachers' decisions about content and pedagogy
- Use of instructional materials
- Opportunities teachers have for professional growth
- How instructional resources are distributed

Who's In the Sample

Two-stage random sample that targeted:

- 2,000 schools (public and private)
- Over 10,000 K–12 teachers

Very good response rate:

- 1,273 schools participated
- 86 percent of program representatives
- 78 percent of sampled teachers

Endorsing Organizations

- American Association of Chemistry Teachers
- American Association of Physics Teachers
- American Federation of Teachers
- Association of Mathematics Teacher Educators
- American Society for Engineering Education
- Association of State Supervisors of Mathematics
- Association for Science Teacher Education
- Council of State Science Supervisors
- Computer Science Teachers Association
- National Association of Biology Teachers
- National Association of Elementary School Principals
- National Association of Secondary School Principals
- National Council of Supervisors of Mathematics
- National Council of Teachers of Mathematics
- National Earth Science Teachers Association
- National Education Association
- National Science Education Leadership Association
- National Science Teachers Association

Equity

We also disaggregate data by factors historically associated with differences in students' educational opportunities:

- **School-level Factors**
  - Percentage of students in the school eligible for free or reduced-price lunch (FRL)
  - School size
  - School community type (rural, urban, suburban)
- **Class-level Factors**
  - Percentage students in the class from race/ethnicity groups historically underrepresented in STEM (HU)
  - Prior achievement level of students in the class

Science Instruction*

What science learning opportunities do students have in schools?

The 2018 NSSME+ collected data on:

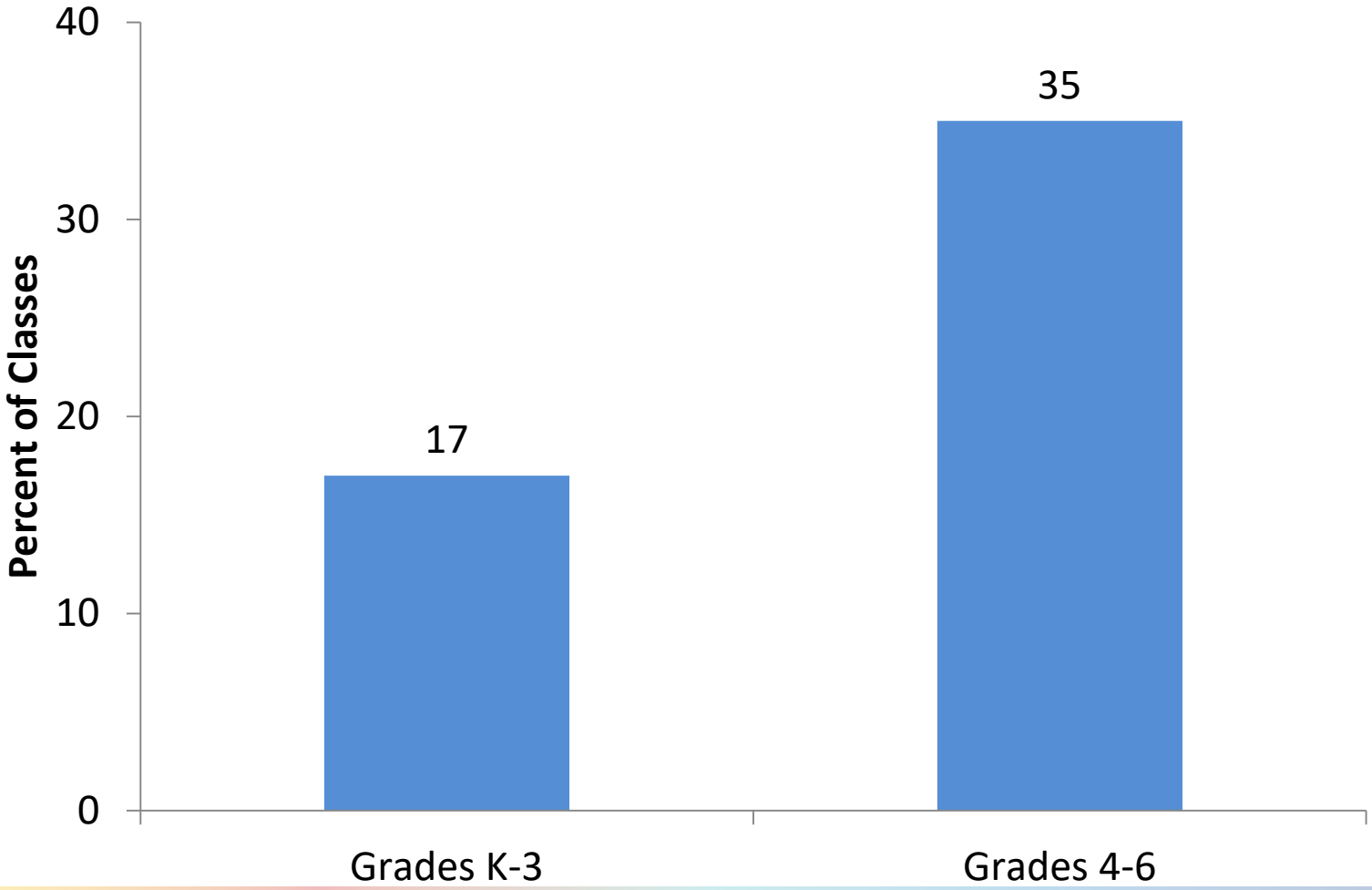
- Time on science in elementary grades
- Course offerings in secondary schools
- Instructional objectives
- Classroom practices
- Engagement of students with science practices

Instructional Time: Elementary

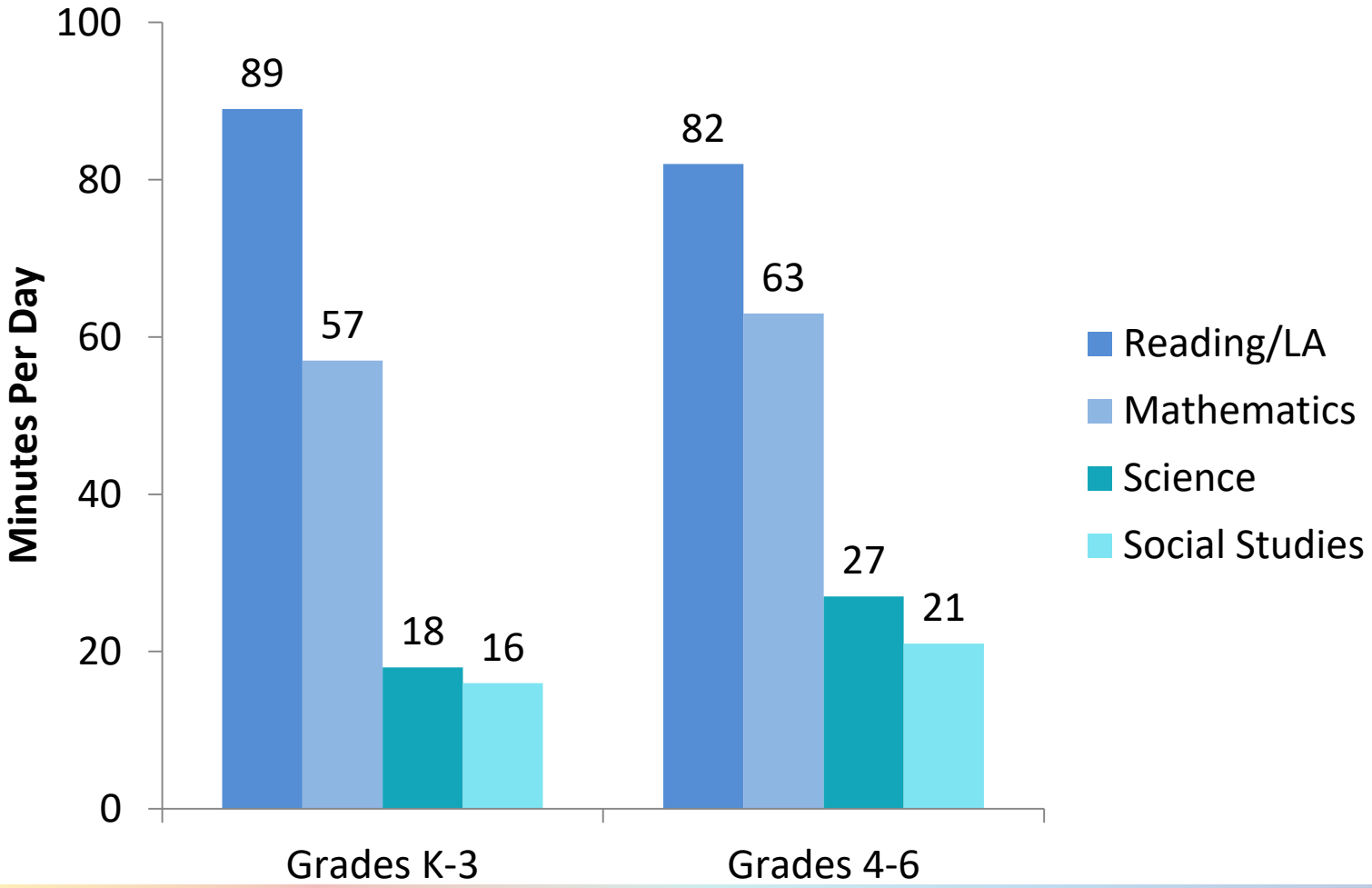
About what percentage of elementary classes receive science instruction all or most days every week of the school year?

A. 20%
B. 40%
C. 60%
D. 80%

Elementary Classes Receiving Science Instruction All/Most Days



Instructional Time: Elementary



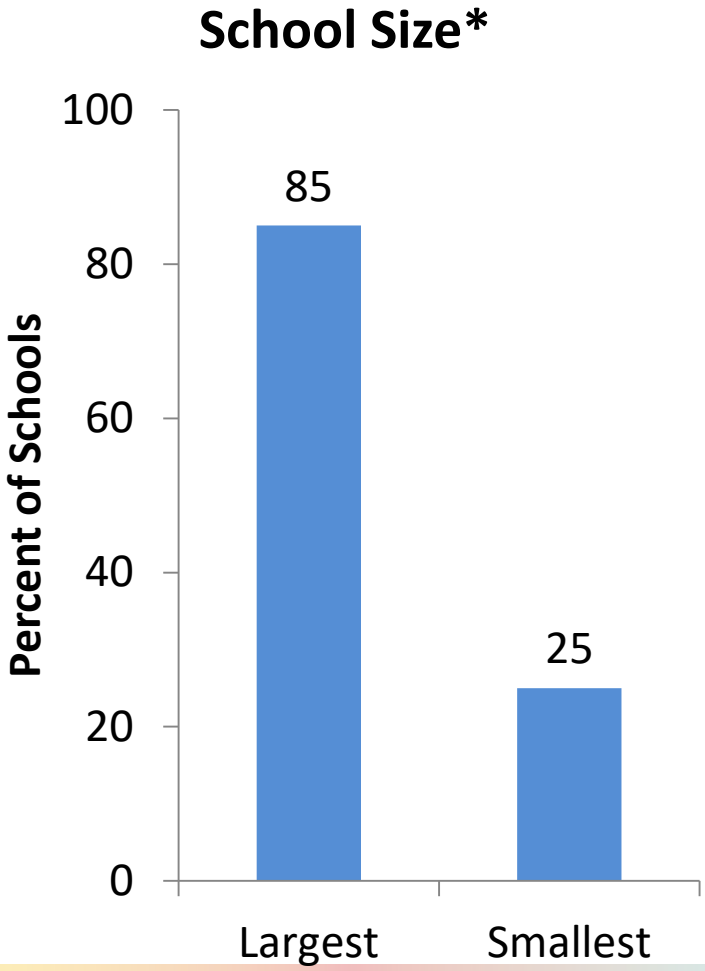
Courses Offered: High School

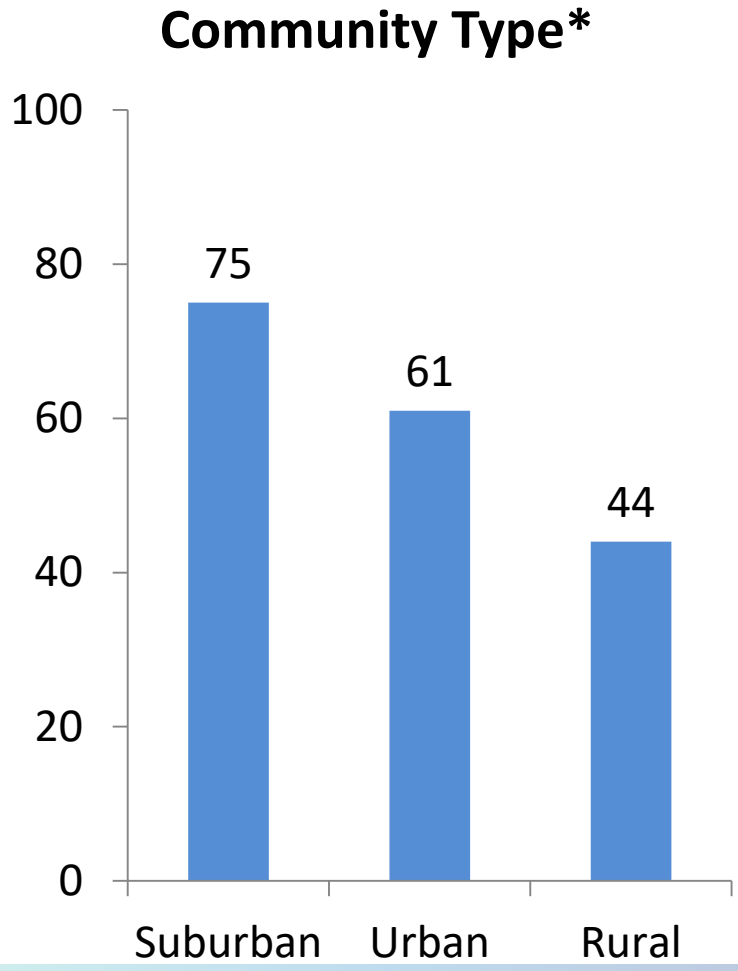
The vast majority of high schools offer introductory courses in biology, chemistry, and physics

About two-thirds offer introductory courses in Earth science and environmental science

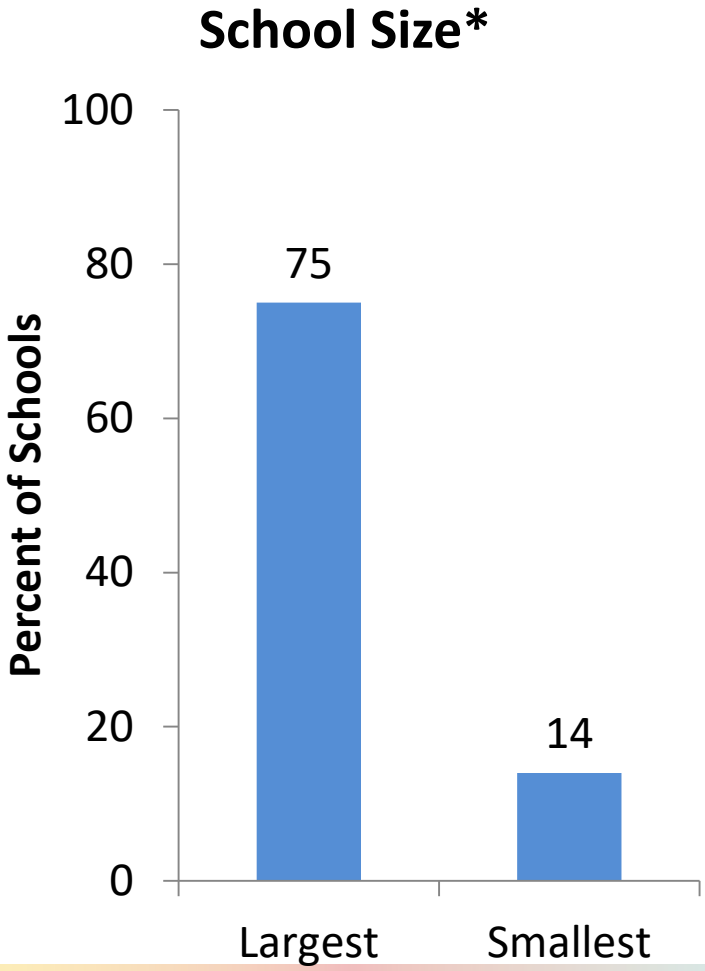
2nd year/advanced courses are less commonly offered

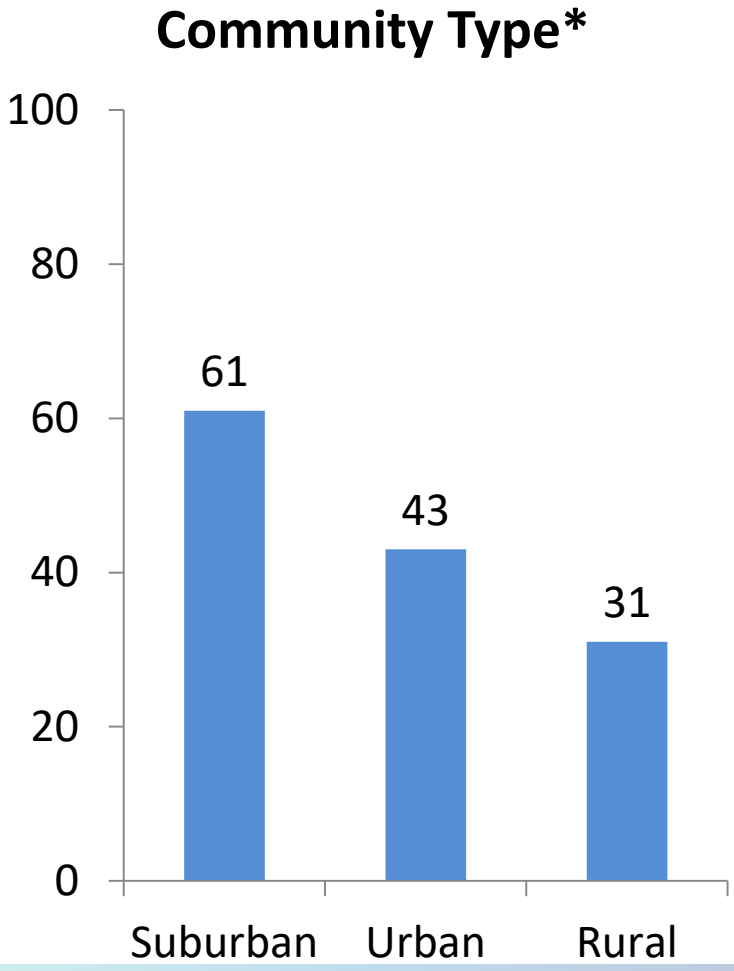
Schools Offering 2nd Year Biology



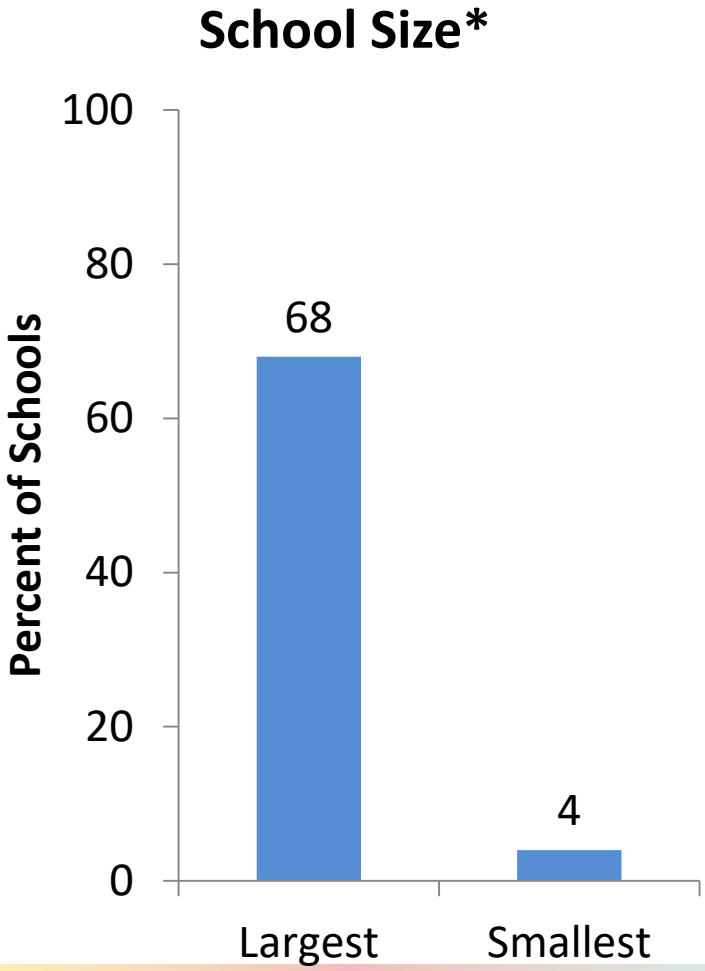


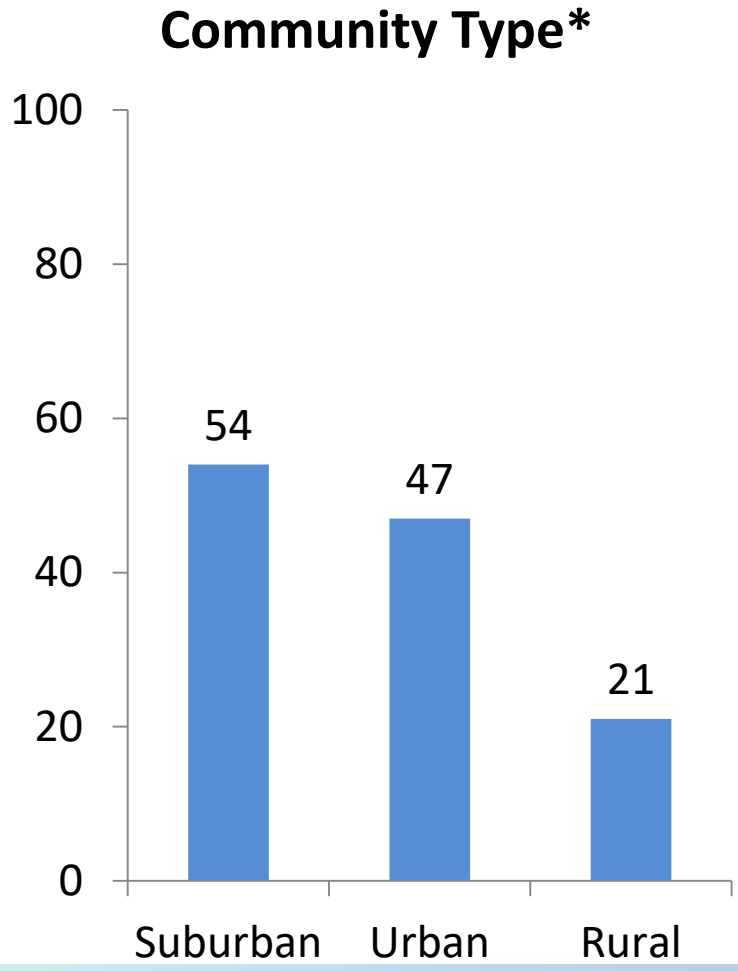
Schools Offering 2nd Year Chemistry





Schools Offering 2nd Year Physics





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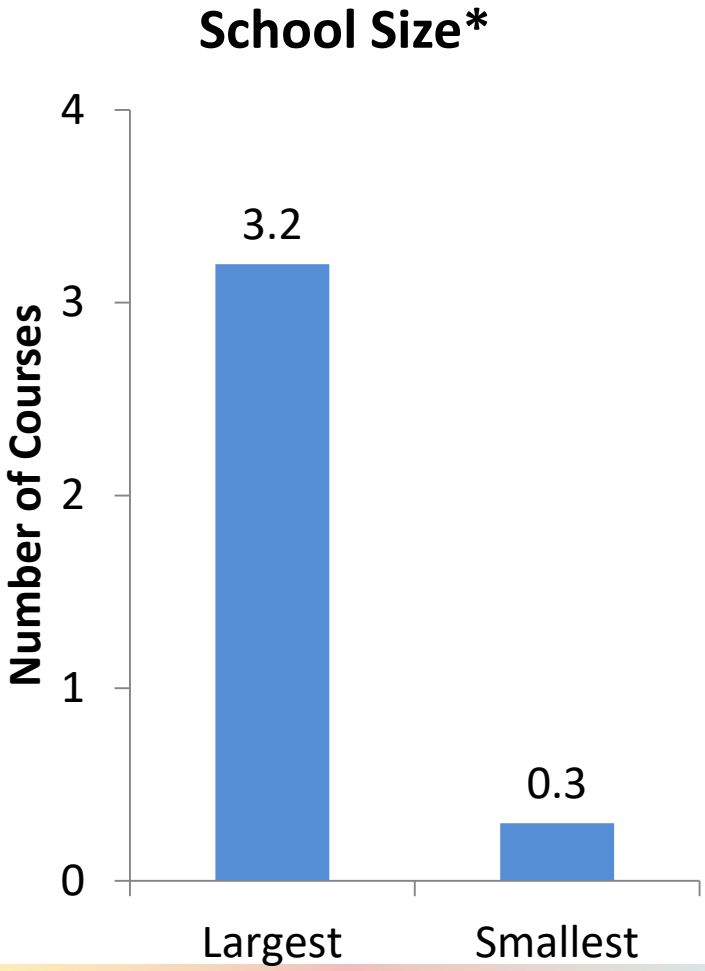
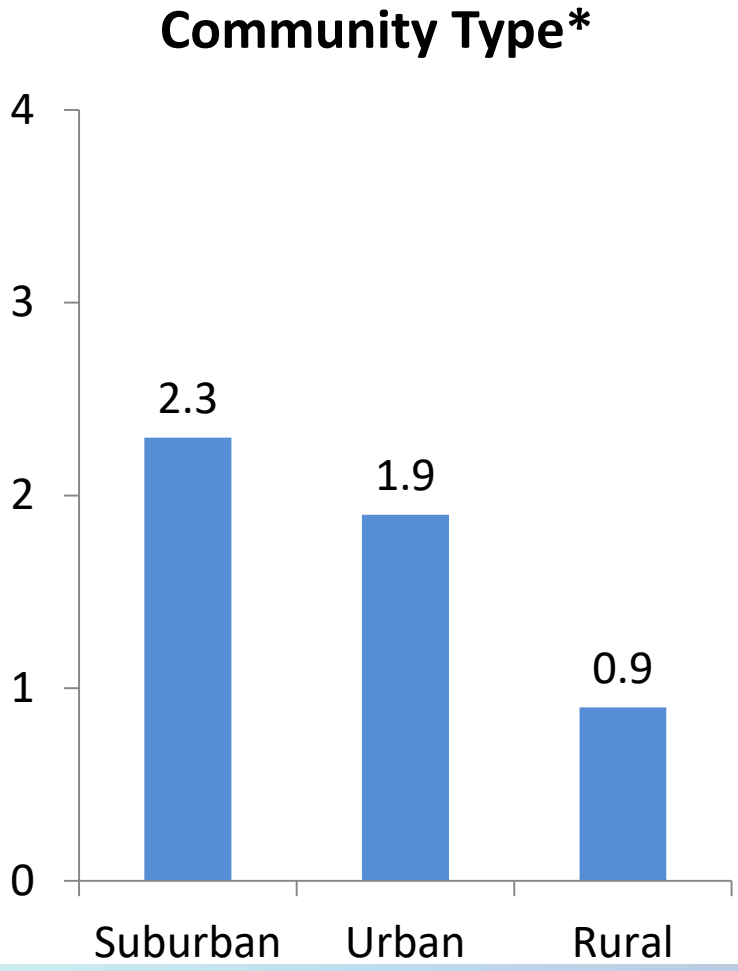
AP Course Access (out of 7)





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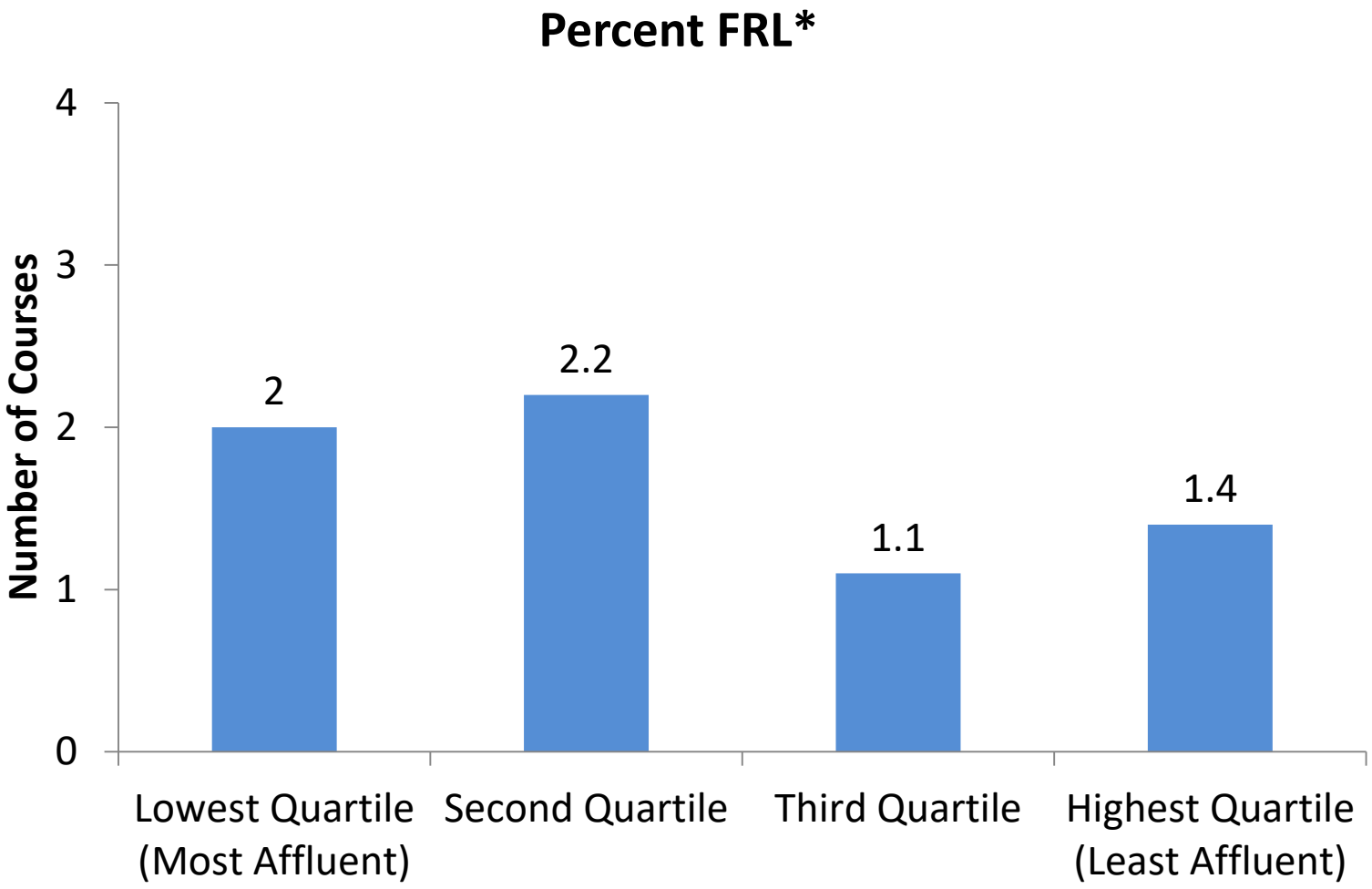
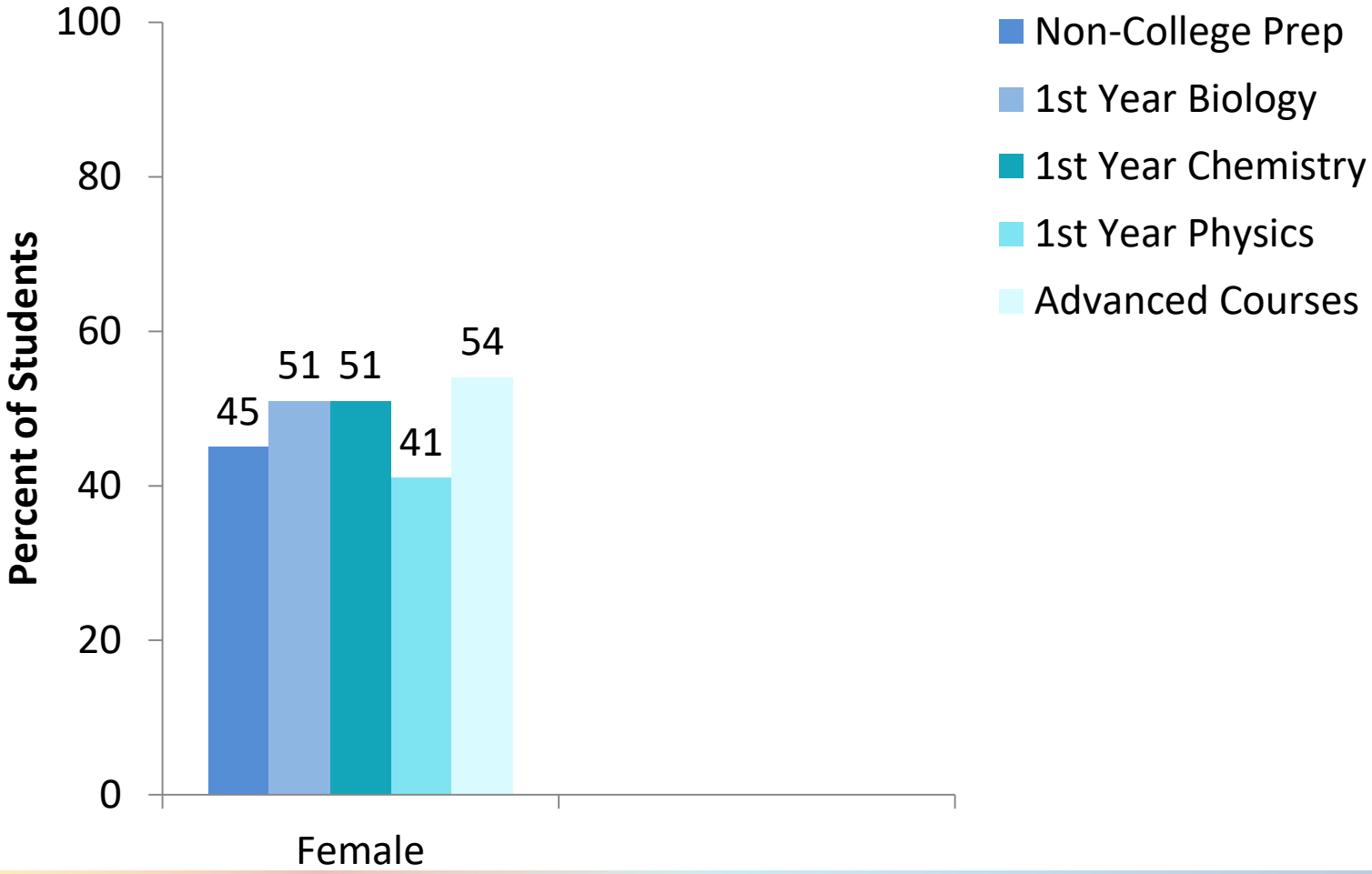


Course Enrollment



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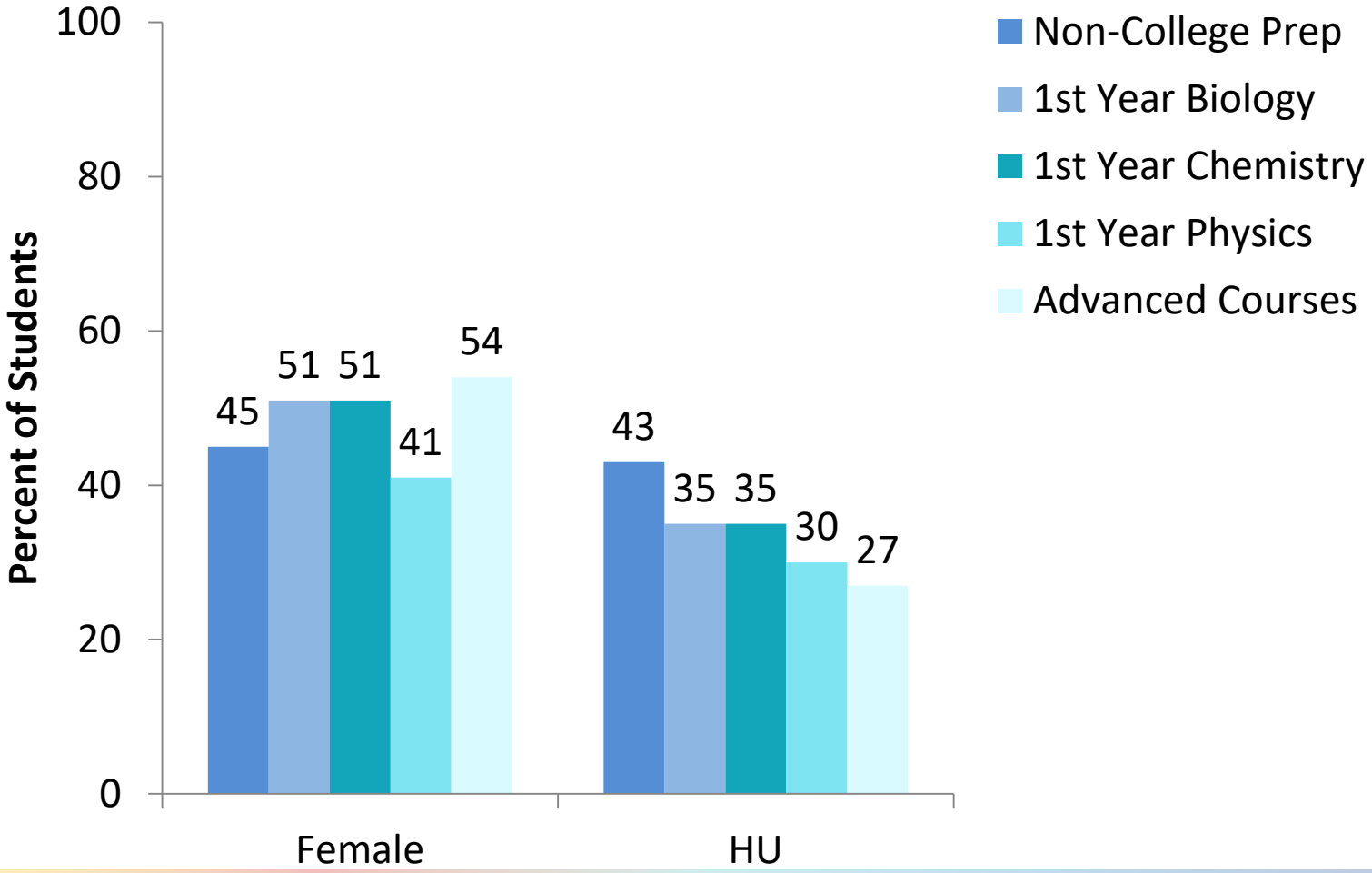


Instructional Objectives

In the ideal, what percentage of science classes would have a heavy emphasis on students learning how to "do" science?

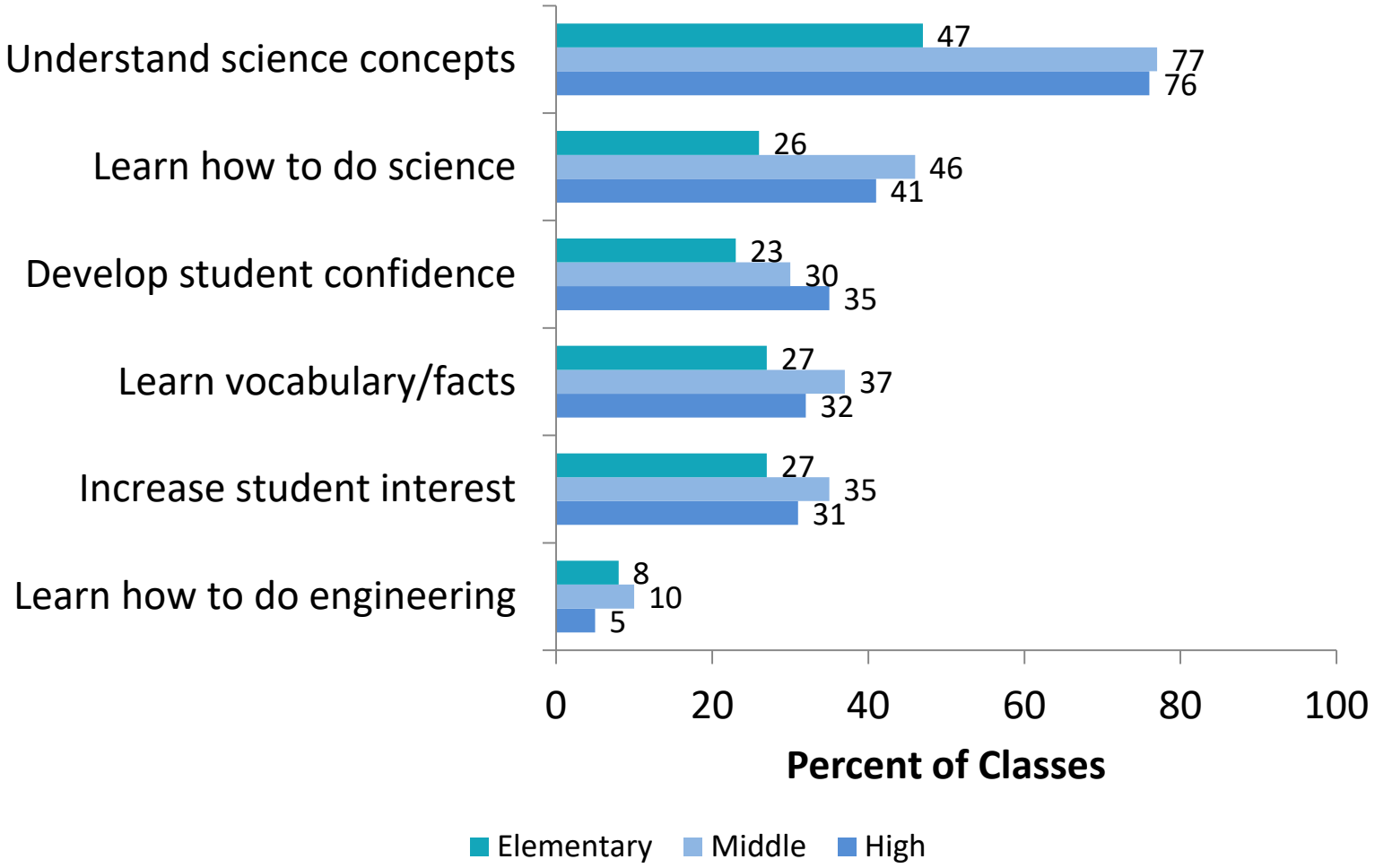
A. 0-25%

B. 26-50%

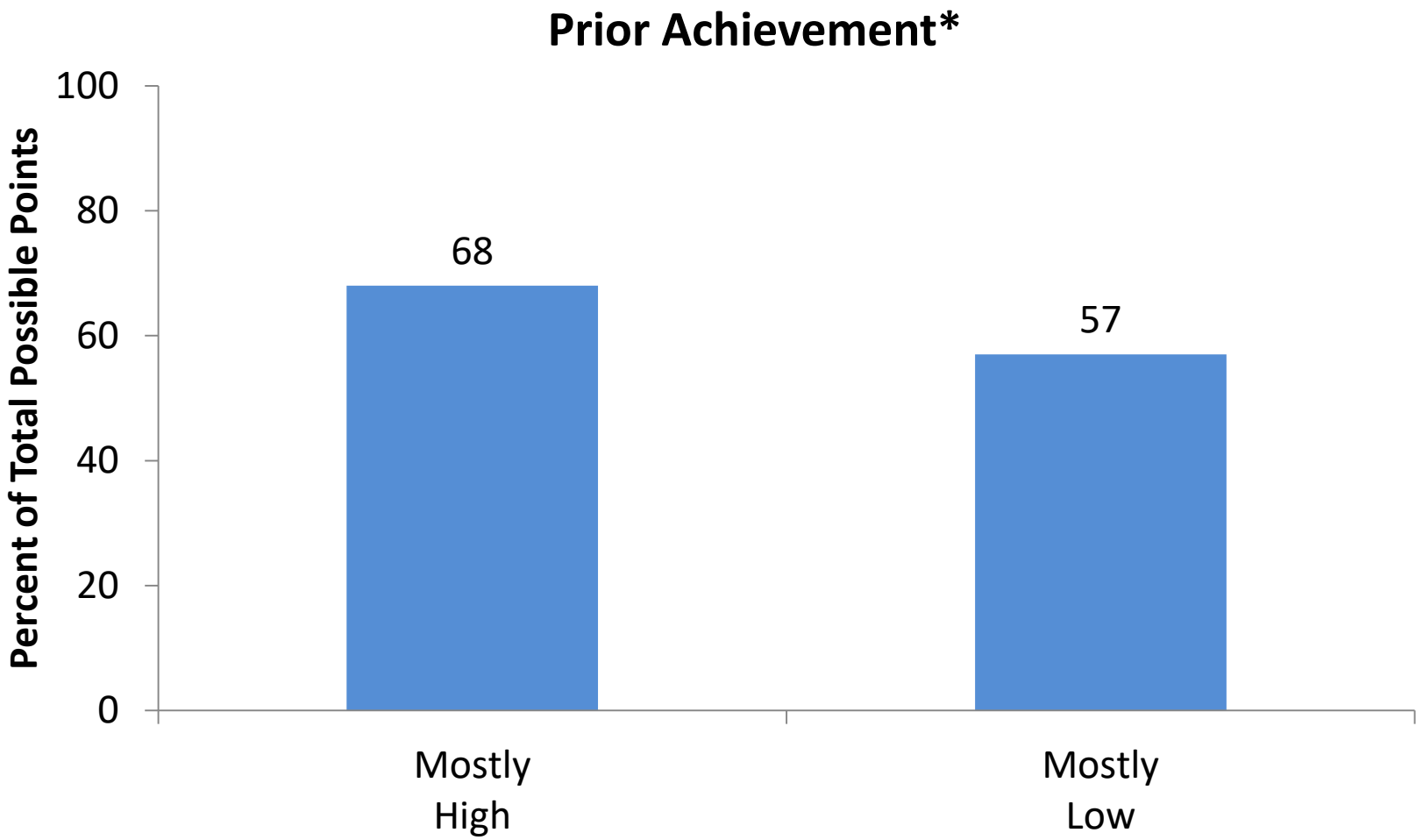
C. 51-75%

D. 76-100%

Objectives Receiving a Heavy Emphasis



Equity Analysis: Reform-Oriented Objectives

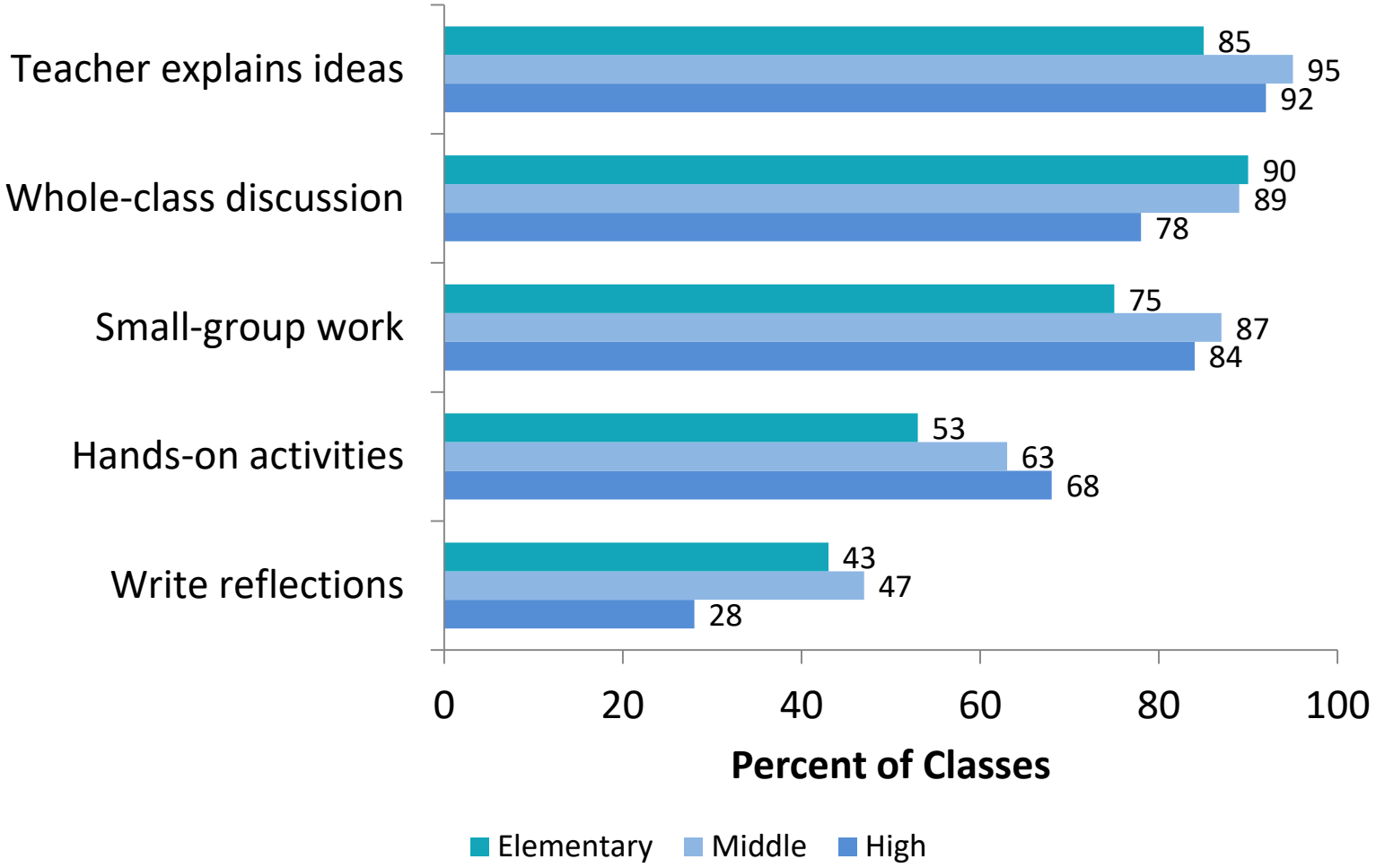


Instructional Activities

In the ideal, how often should students be engaged in hands-on/laboratory activities?

A. Daily
B. Once or twice a week
C. Once or twice a month
D. A few times a year

Instructional Activities: Weekly



Equity Analysis: Instructional Activities

Lecture

- No differences by equity factors

Small group work

- More likely in classes of high prior achieving students

Hands-on/laboratory activities

- More likely in class of high prior achieving students and classes with low %HU, and in most affluent schools

Read from textbook, write reflections, focus on literacy skills, and practice for standardized tests

- More likely in least affluent schools and in classes with high %HU

Engagement in Science Practices

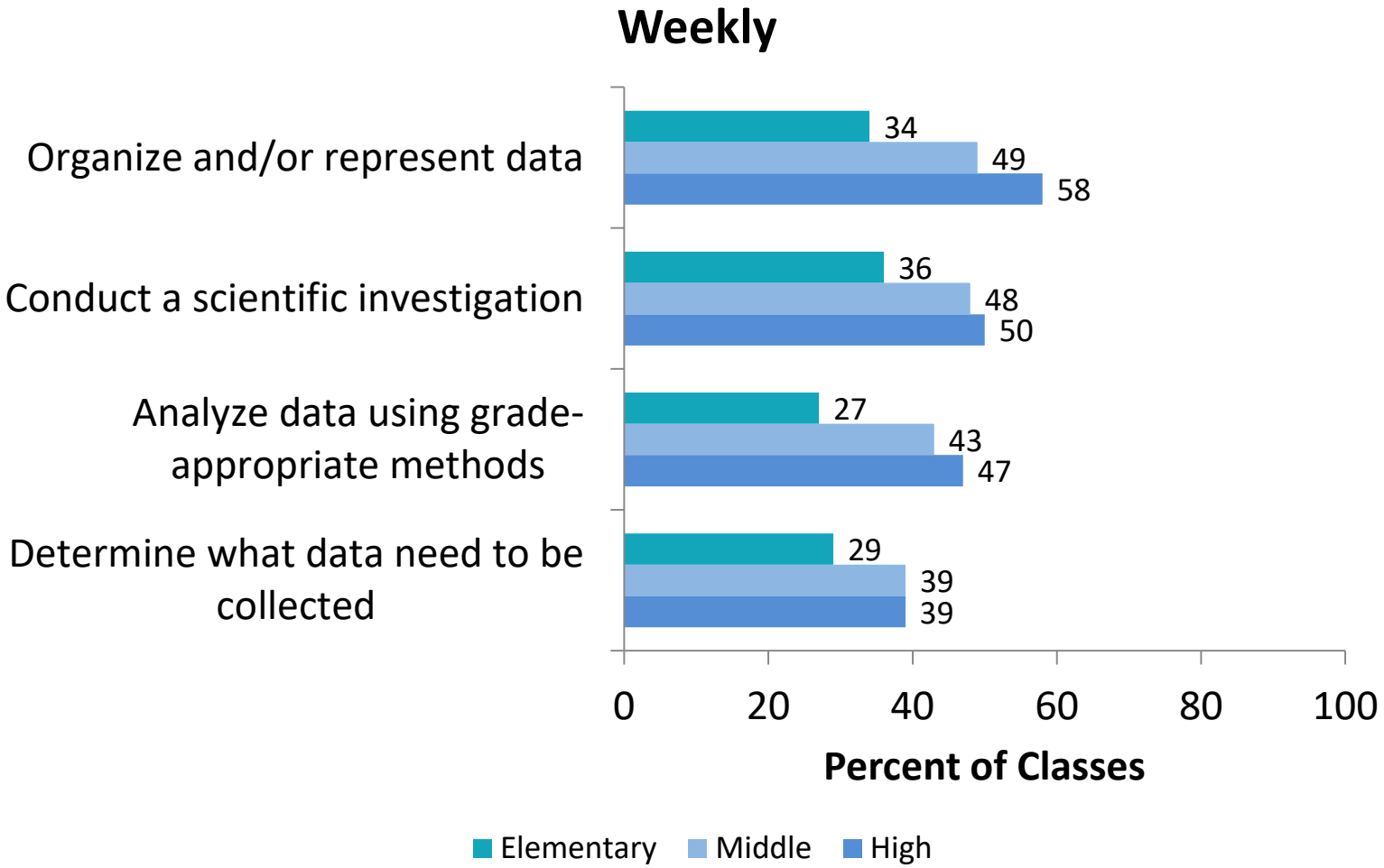
The 2018 NSSME+ included a series of items asking how often students were engaged in aspects of the science practices:

1. Asking questions/defining problems
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations/designing solutions
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

Engagement in Science Practices

Students are often engaged in aspects of science related to conducting investigations and analyzing data

Conducting Investigations and Analyzing Data

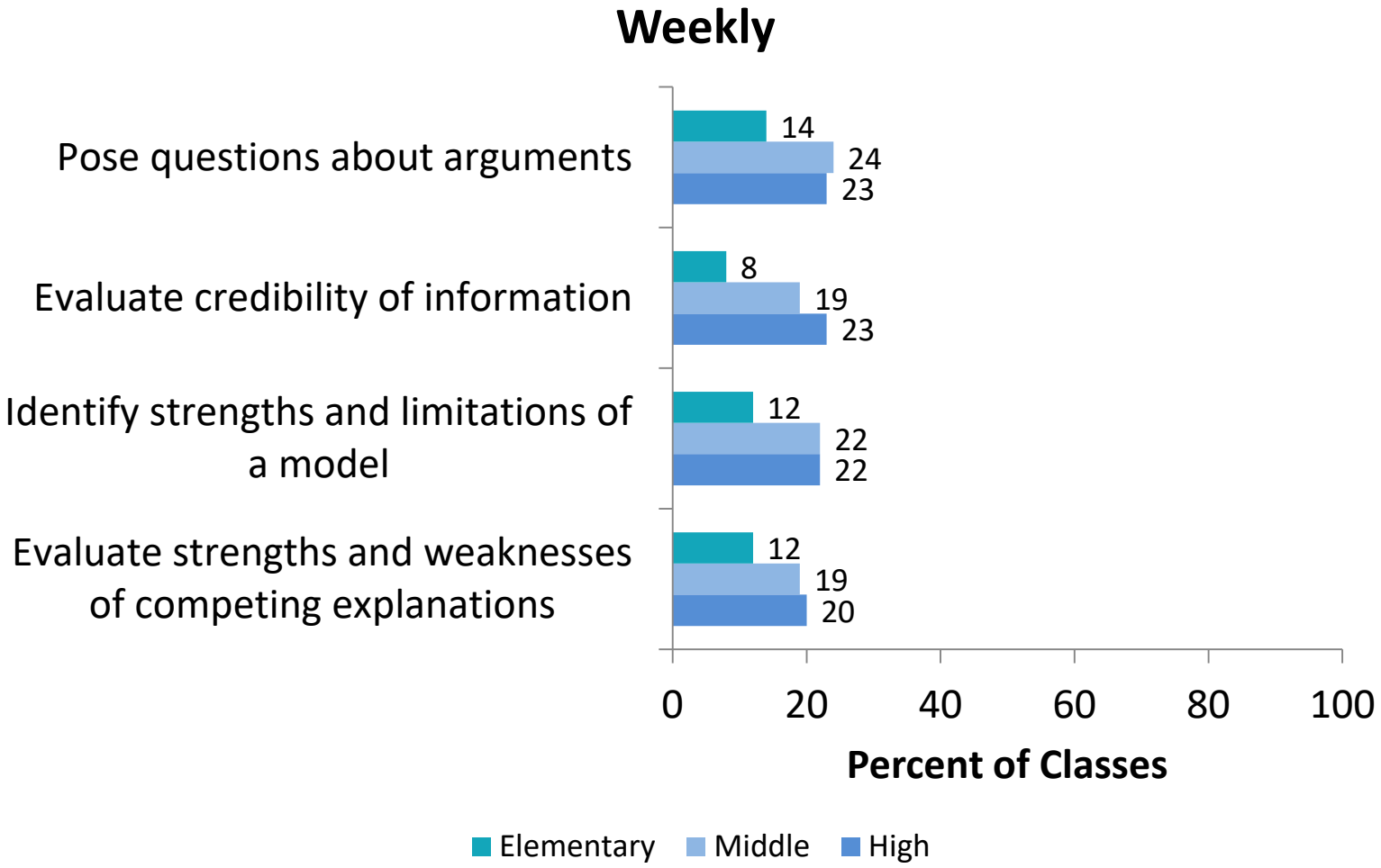


Engagement in Science Practices

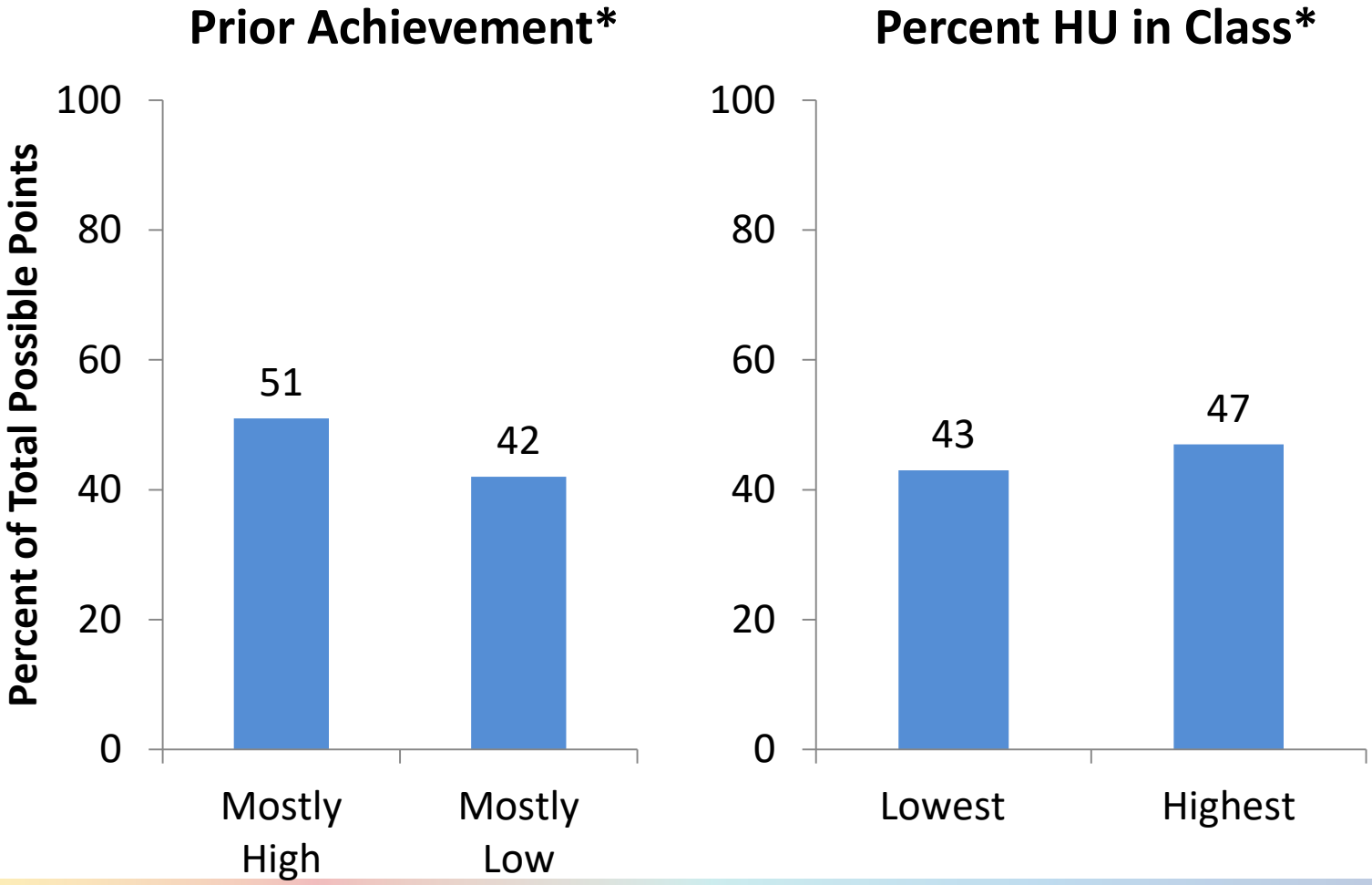
Students are often engaged in aspects of science related to conducting investigations and analyzing data

Students tend to not be engaged very often in aspects of science related to evaluating the strengths/limitations of evidence and the practice of argumentation

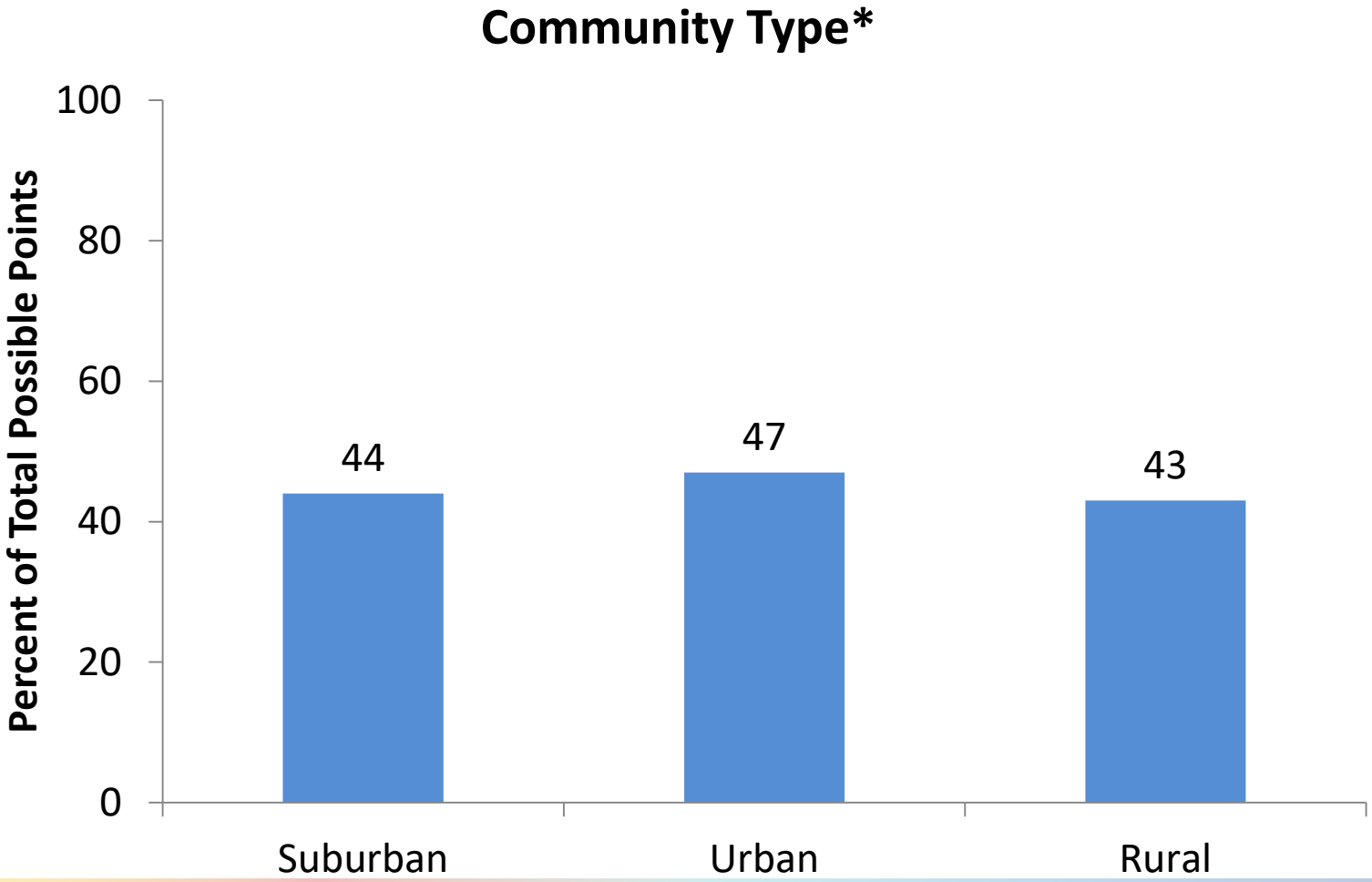
Evaluating Evidence and Arguing



Engagement in Science Practices



Engagement in Science Practices



Instruction Takeaways

Instructional time for science at the elementary is still relatively low; unequal access to upper level science classes

Heavy emphasis on developing conceptual understanding, but not on how science is done, or how knowledge is generated and revised

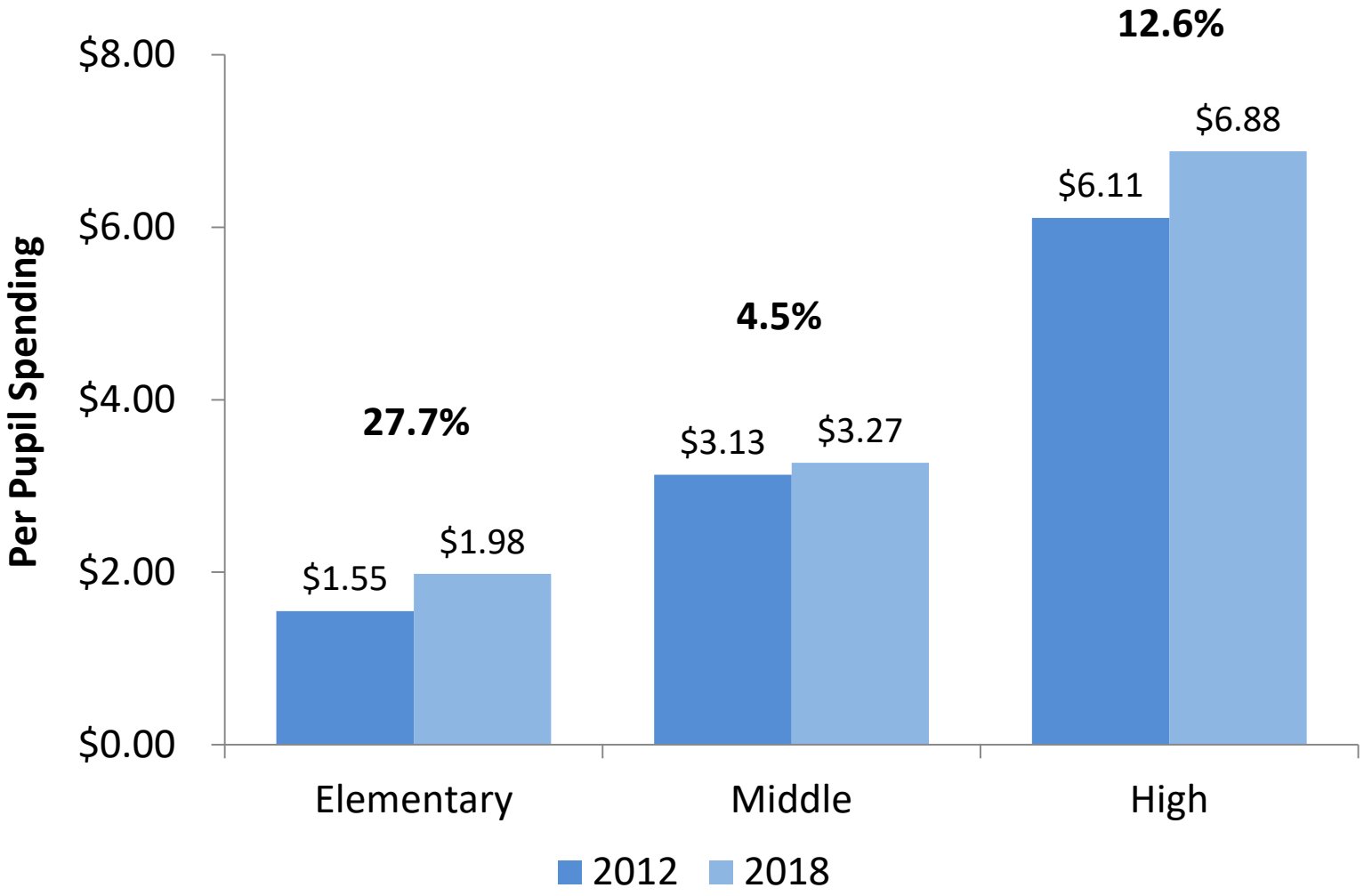
Students conduct investigations and analyze data fairly often, but not asked to think critically nearly as often

There continue to be a number of challenges to providing high-quality science learning opportunities to ALL students

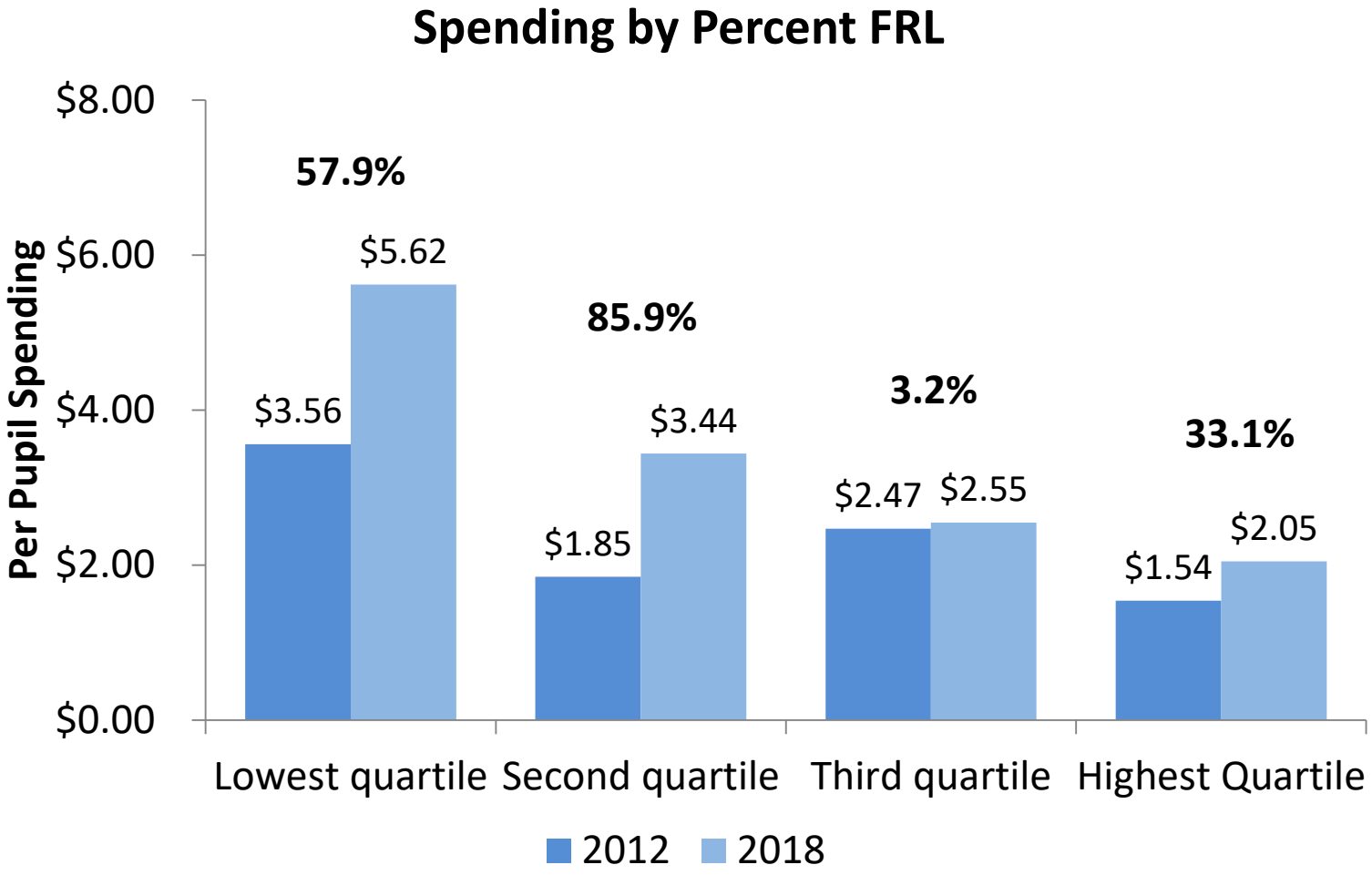
Why Might Instruction Look This Way?

- **State, district, school policies**
- **Availability of resources, including instructional materials**
- **Teacher beliefs, preparation, and support**

Median School Spending Per Pupil for Science



Equity Analysis



Science Instructional Materials

Pre-packaged units or curricula

- Commercially published textbooks
- Commercially published kits/modules
- State, county, or district-developed units or lessons

Activities/resources teachers pull together on own

- Teacher-developed units or lessons
- Units or lessons from other sources (e.g., conferences, colleagues)
- Lessons or resources from websites that are free
- Lessons or resources from websites that have a subscription fee or cost (e.g., BrainPop, TpT)

Science Instructional Materials Used (Weekly)

	Percent of Classes		
	Elementary	**Middle**	**High**
Teacher-developed units or lessons	**47**	**76**	**86**
Commercially published textbooks	38	45	50
Units or lessons from other sources	**28**	**43**	**49**
Lessons or resources from websites that are free	**23**	**31**	**31**
Commercially published kits/modules	29	21	21
Lessons or resources from websites that have a subscription fee or cost	**49**	**34**	**16**
State, county, or district-developed units or lessons	32	21	14

Resources Takeaways

Spending on resources for science instruction has outpaced inflation at the elementary and high school levels, but fallen behind in middle schools

Schools with high percentages of FRL-eligible students spend substantially less per pupil than schools with fewer FRL-eligible students

Teachers use a hodgepodge of instructional materials raising questions about quality and coherence

The Science Teaching Force

The 2018 NSSME+ collected data about:

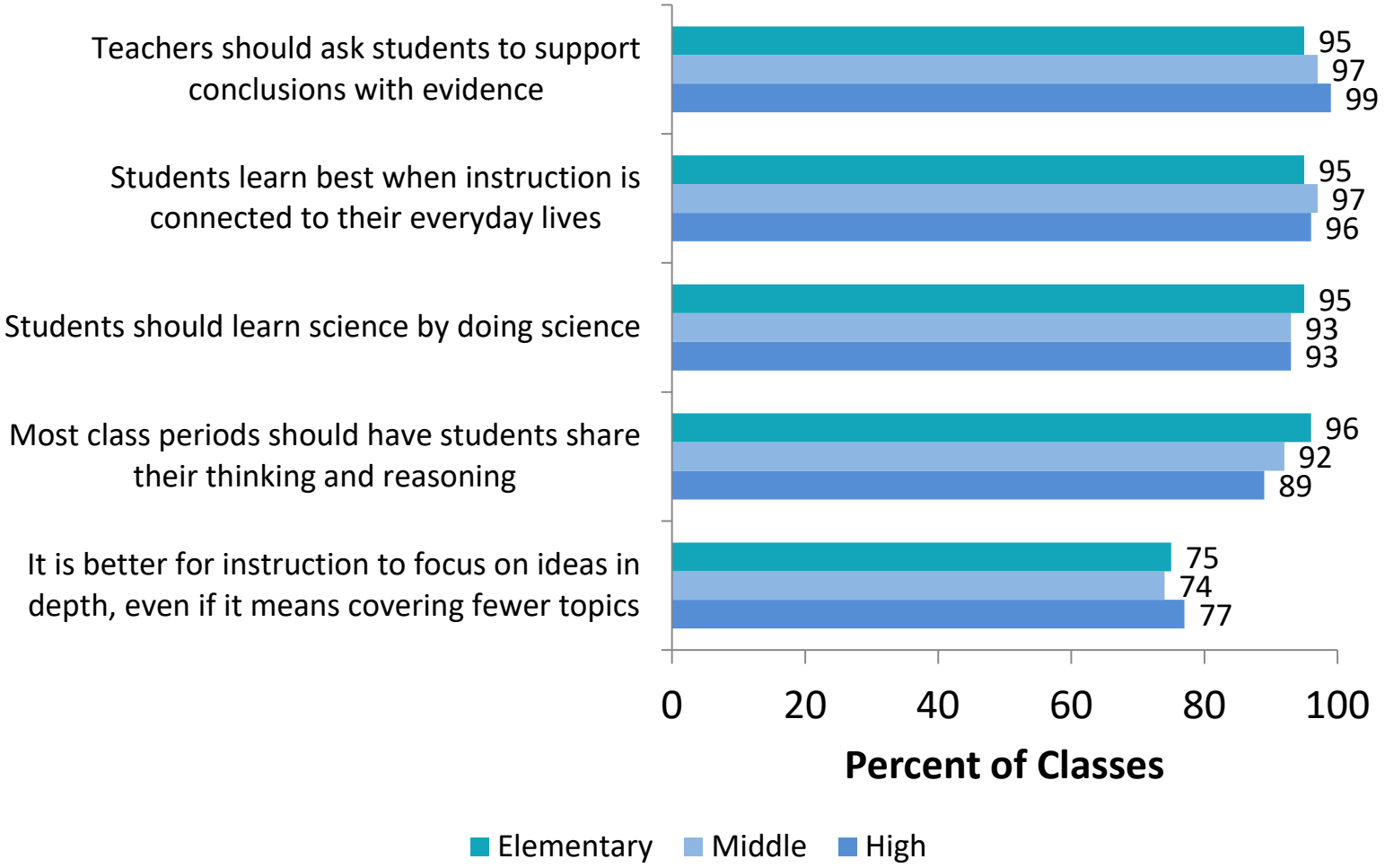
- Demographics of teachers
- Beliefs about teaching and learning
- Feelings of preparedness
- Path to certification
- College coursework

Teacher Beliefs

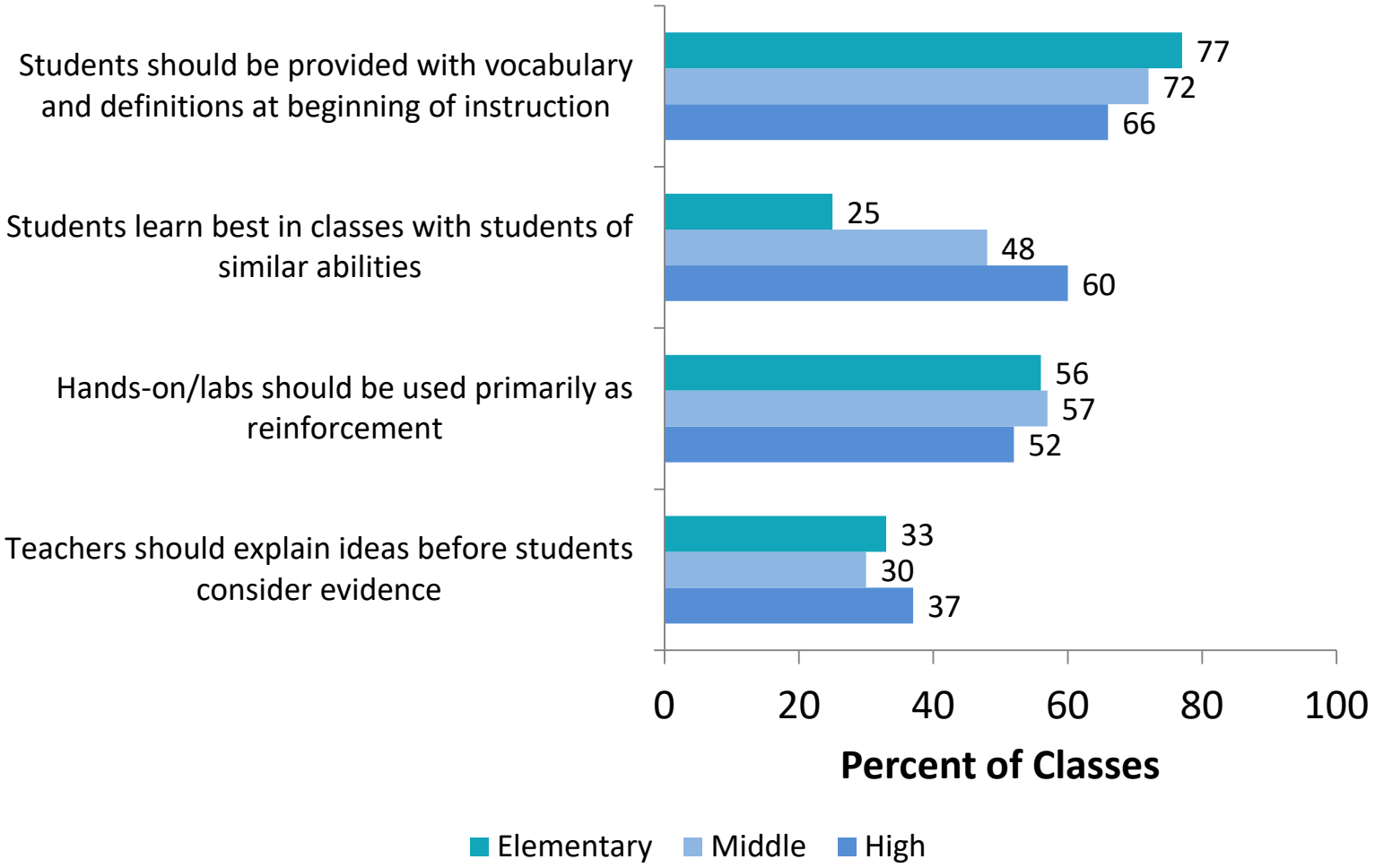
What percentage of teachers believe that students should be asked to support their conclusions with evidence?

A. 25%
B. 50%
C. 75%
D. 100%

Teacher Beliefs



Teacher Beliefs

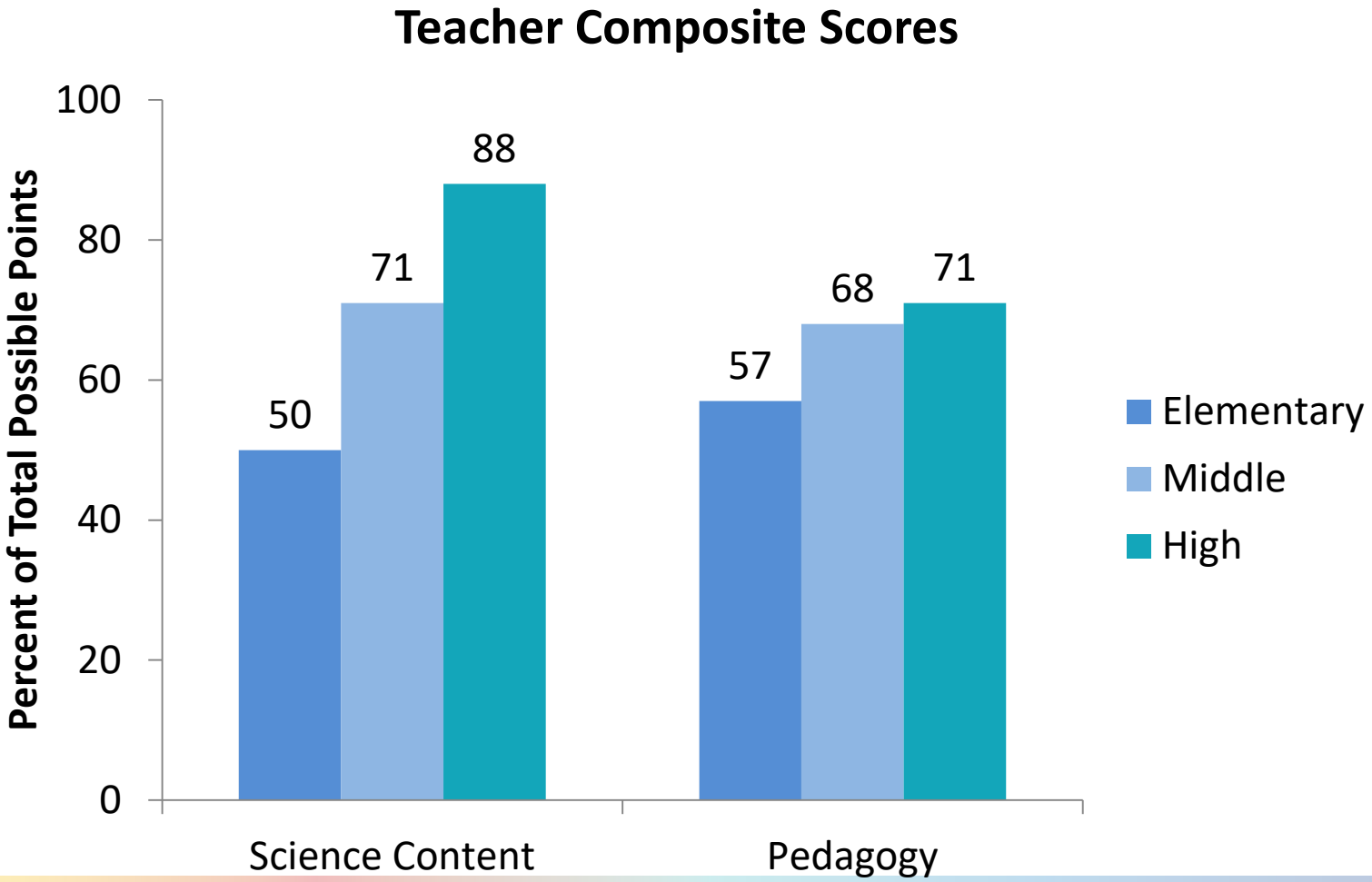


Perceptions of Preparedness

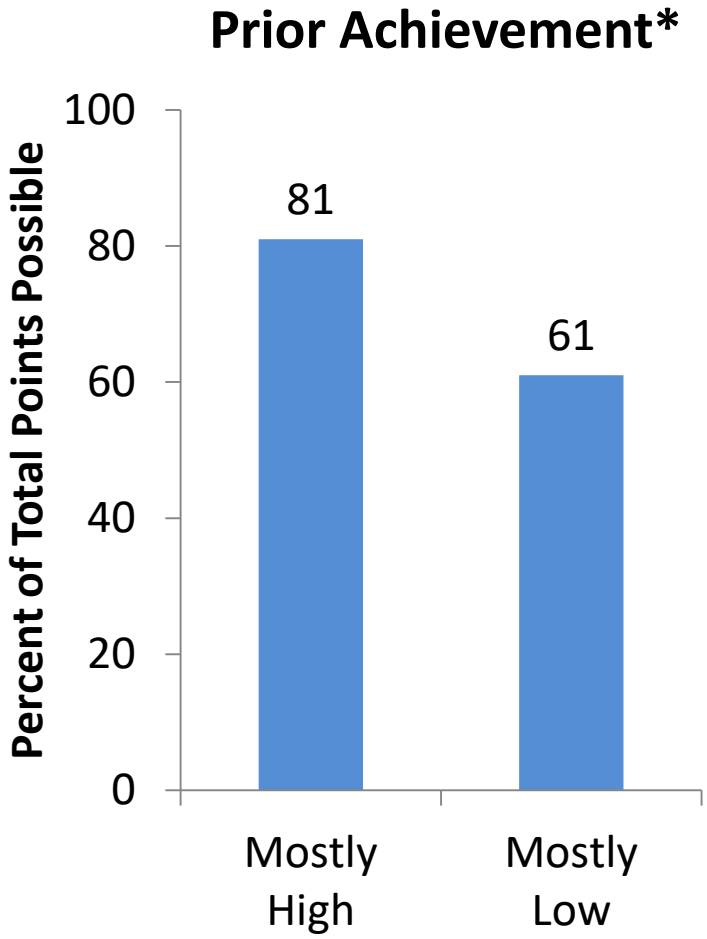
The 2018 NSSME+ included items about teachers' feelings of preparedness to:

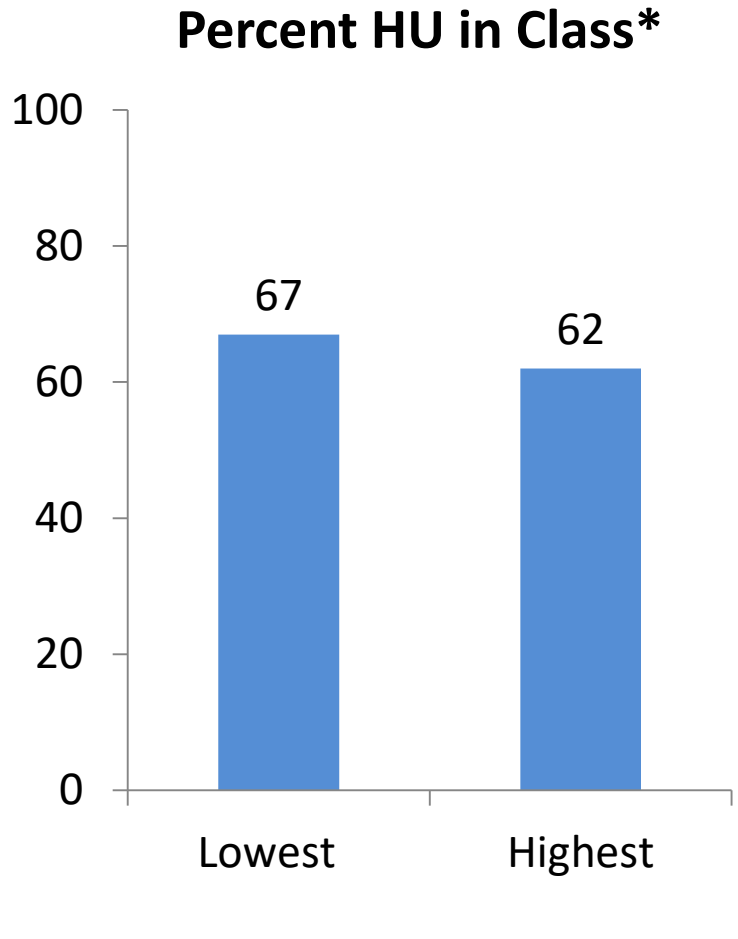
- Teach the science content of their class
- Use student-centered pedagogies, e.g.:
  - Use formative assessment
  - Develop student abilities to do science
  - Encourage student interest in science
  - Differentiate instruction
  - Incorporate students' cultural backgrounds into instruction

Perceptions of Preparedness

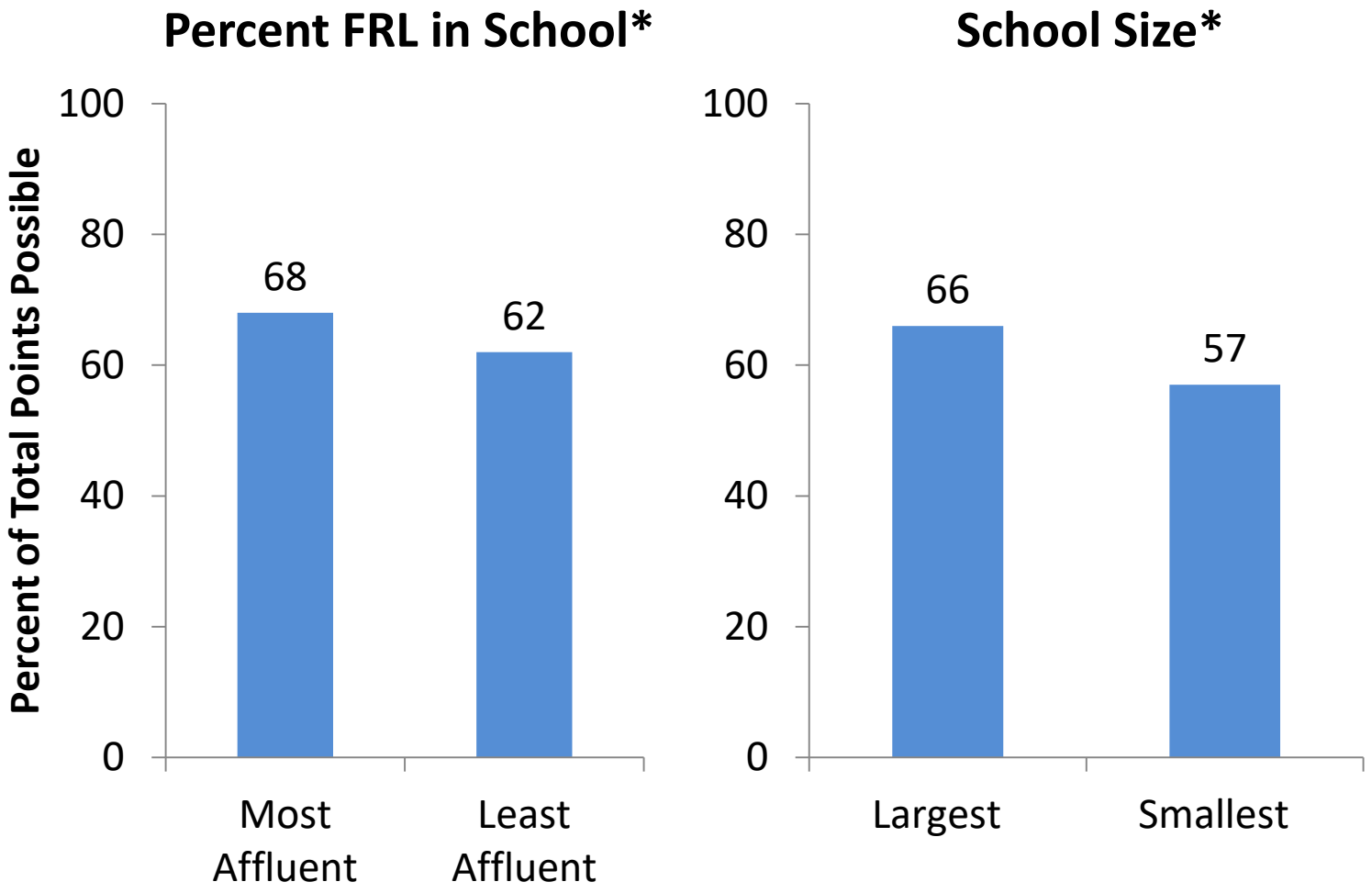


Preparedness to Teach Science Content Composite

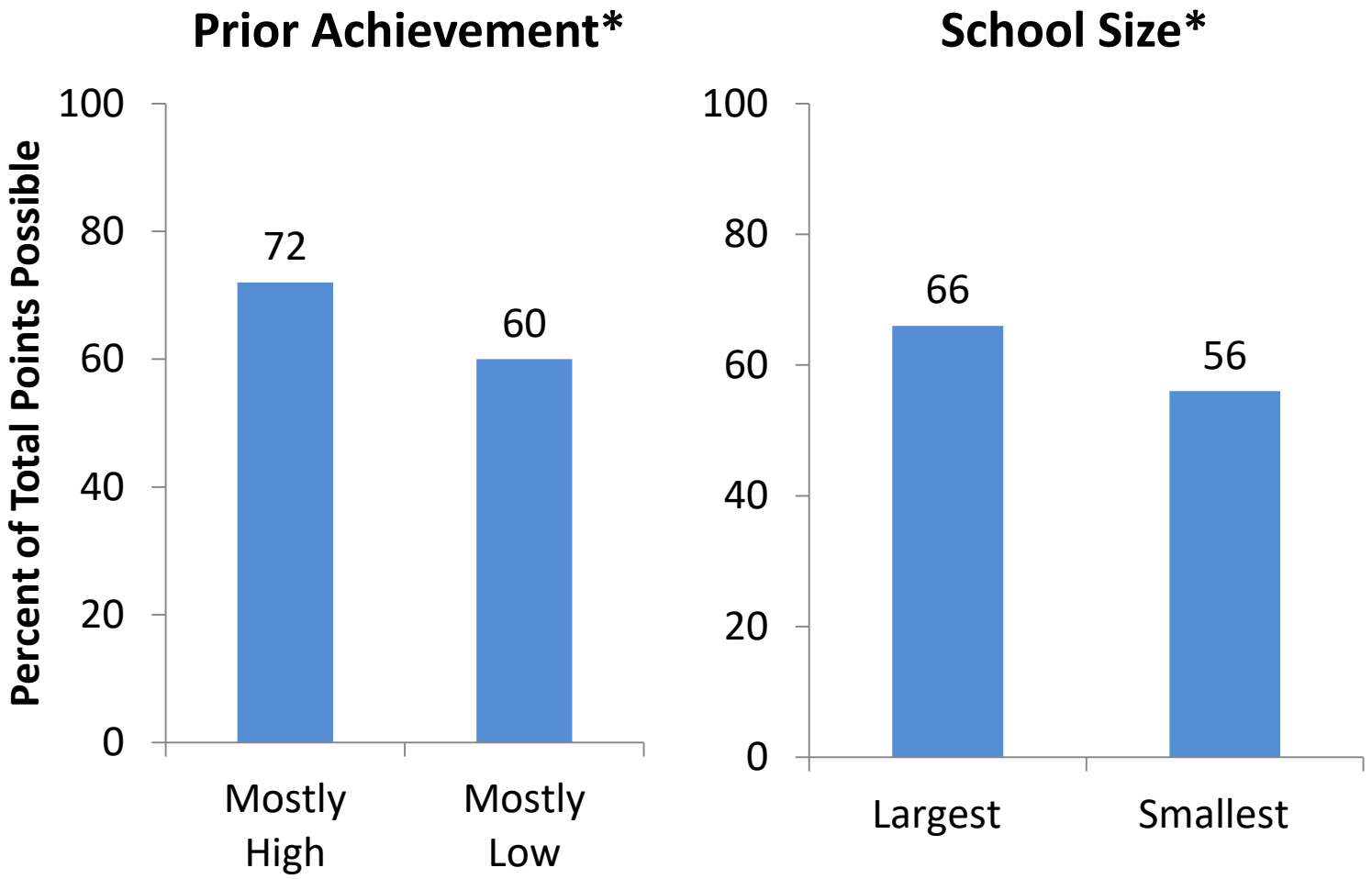




Preparedness to Teach Science Content Composite



Pedagogical Preparedness Composite



College Degrees

About what percentage of middle school science teachers have a degree in science, engineering, or science education?

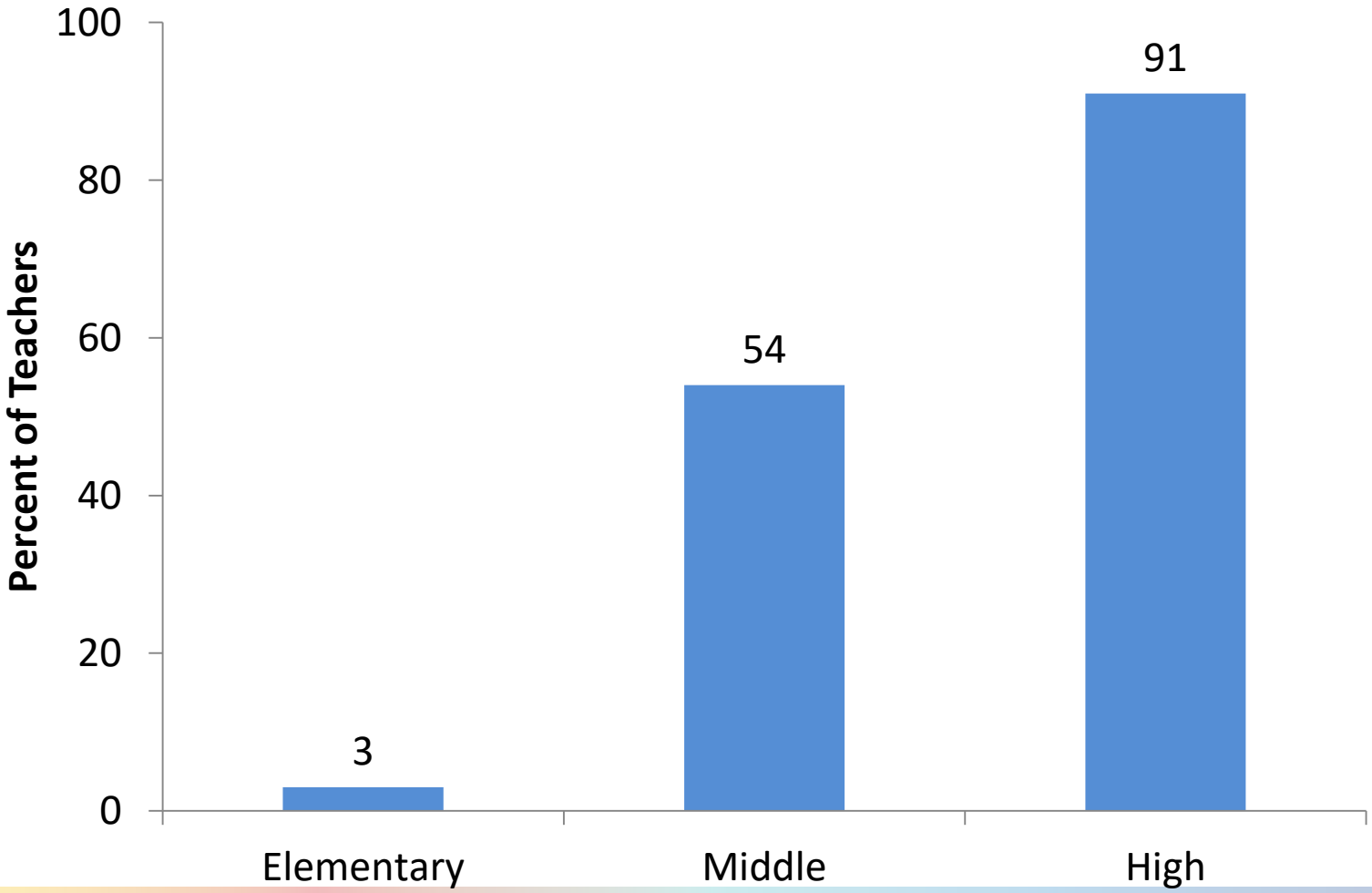
A. 25%

B. 50%

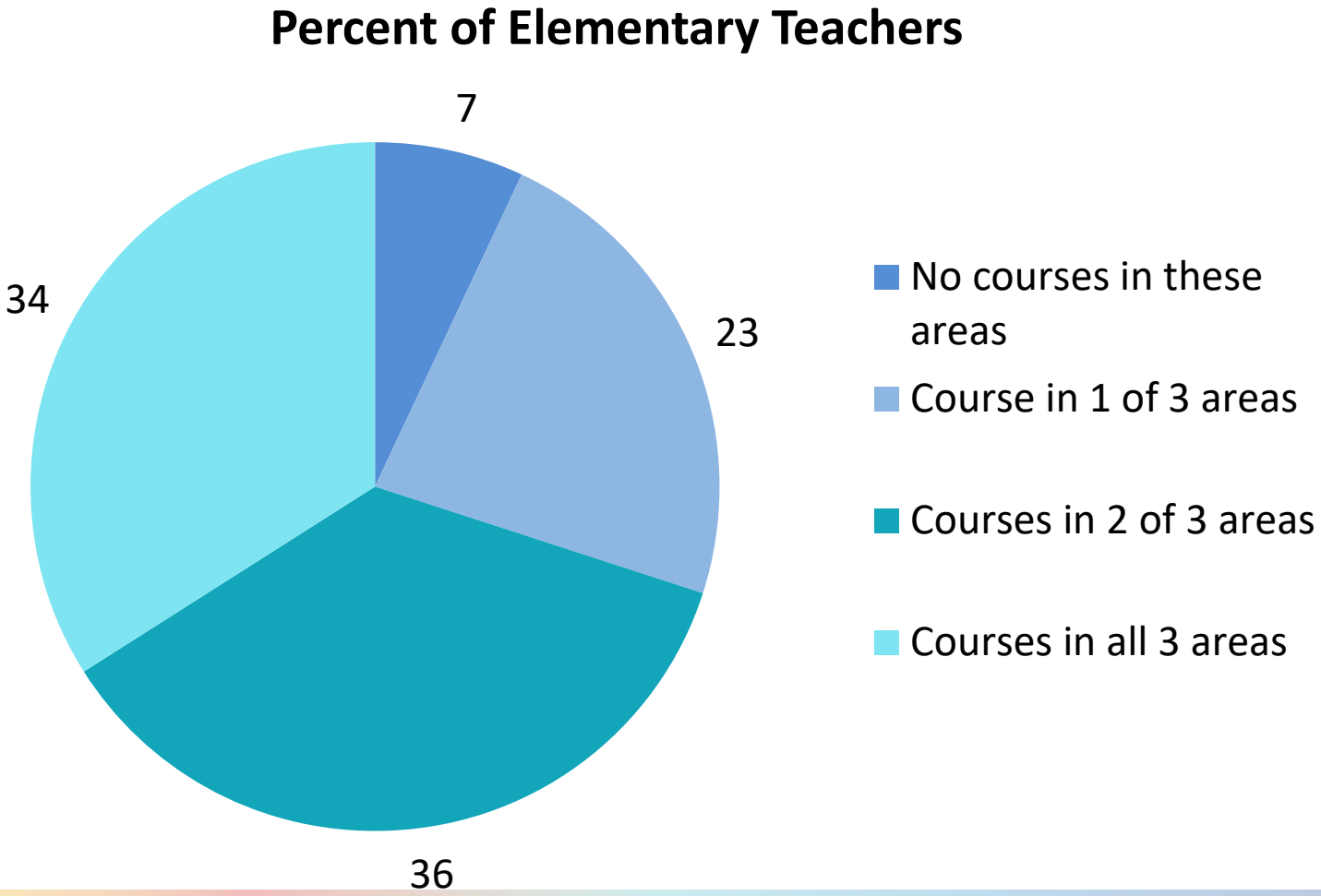
C. 75%

D. 100%

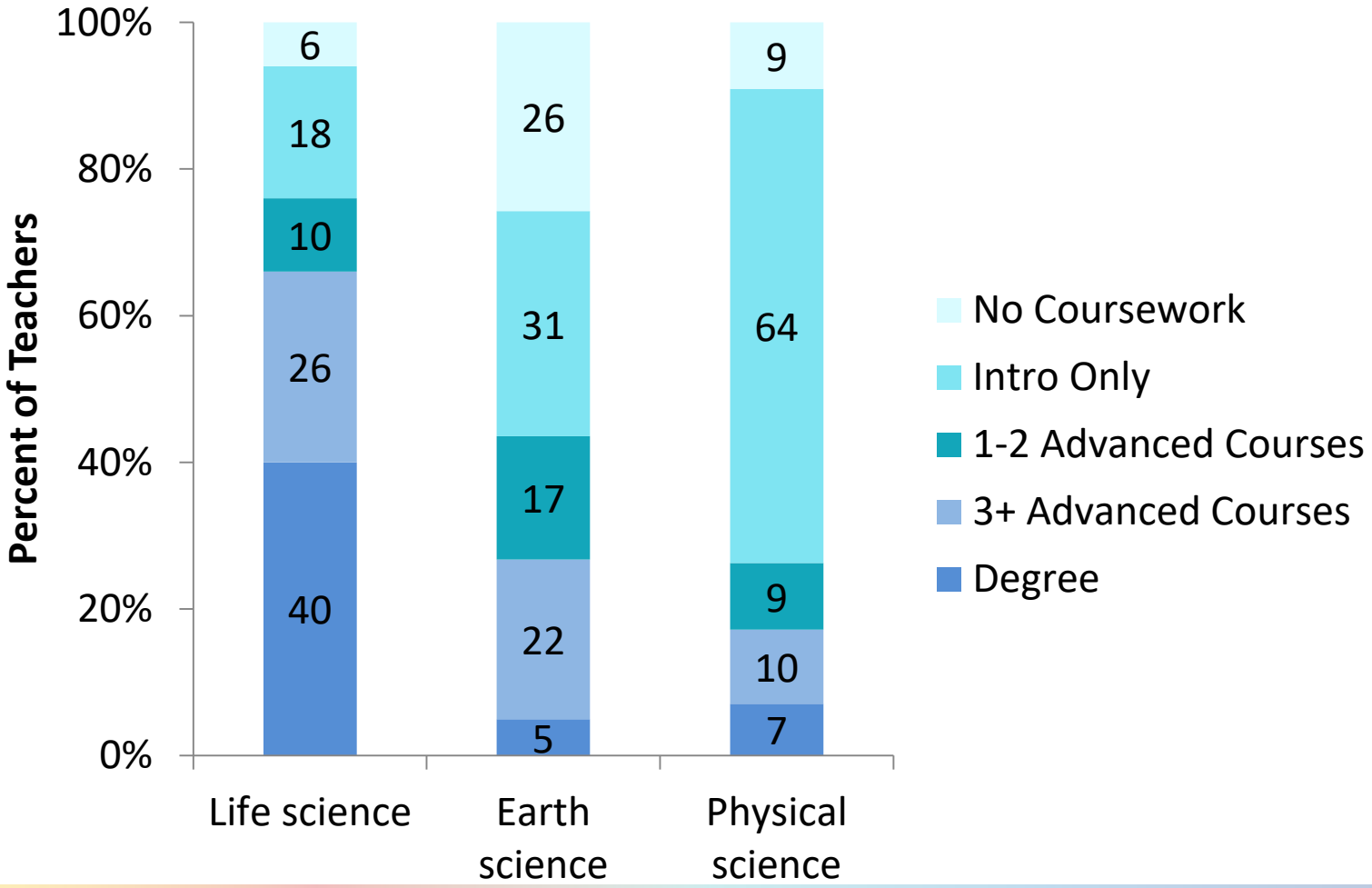
Degree in Science/Engineering/ Science Education



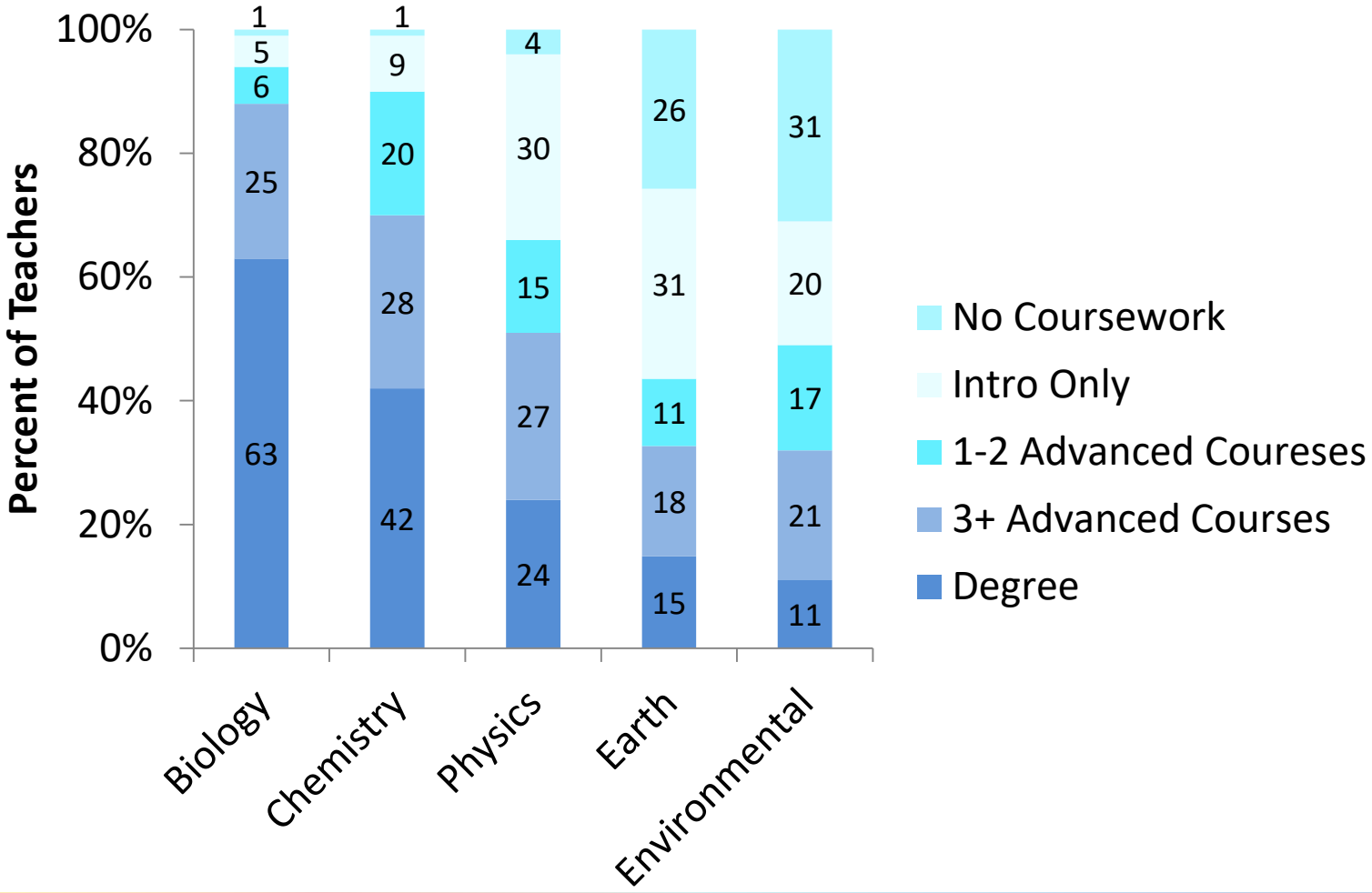
Elementary Teachers' College Coursework: Earth, Life, Physical Sciences



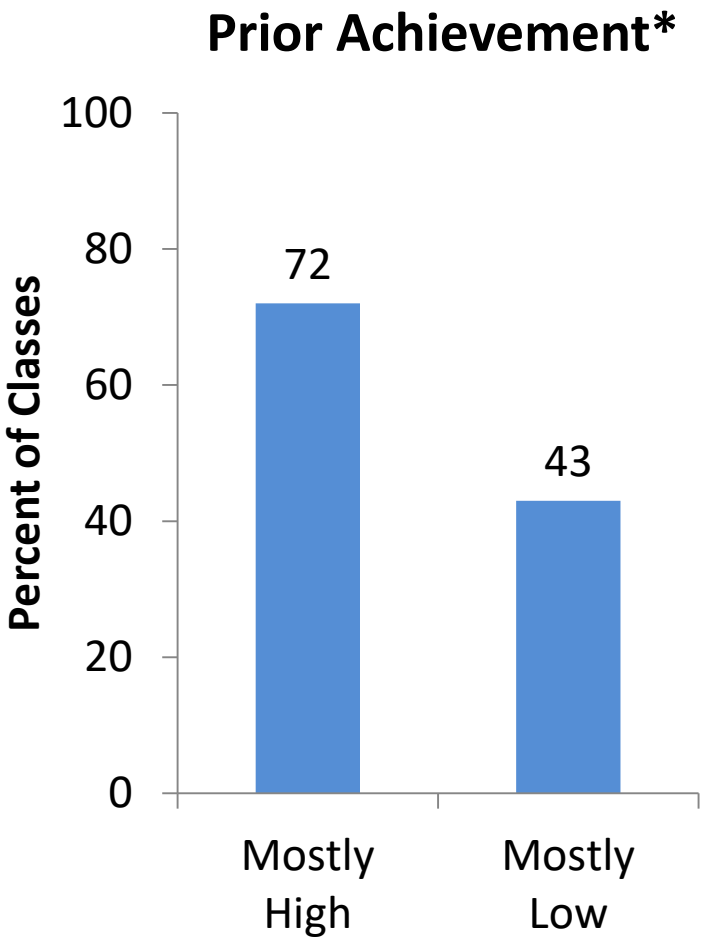
Middle School Teachers' College Coursework, by Course Taught

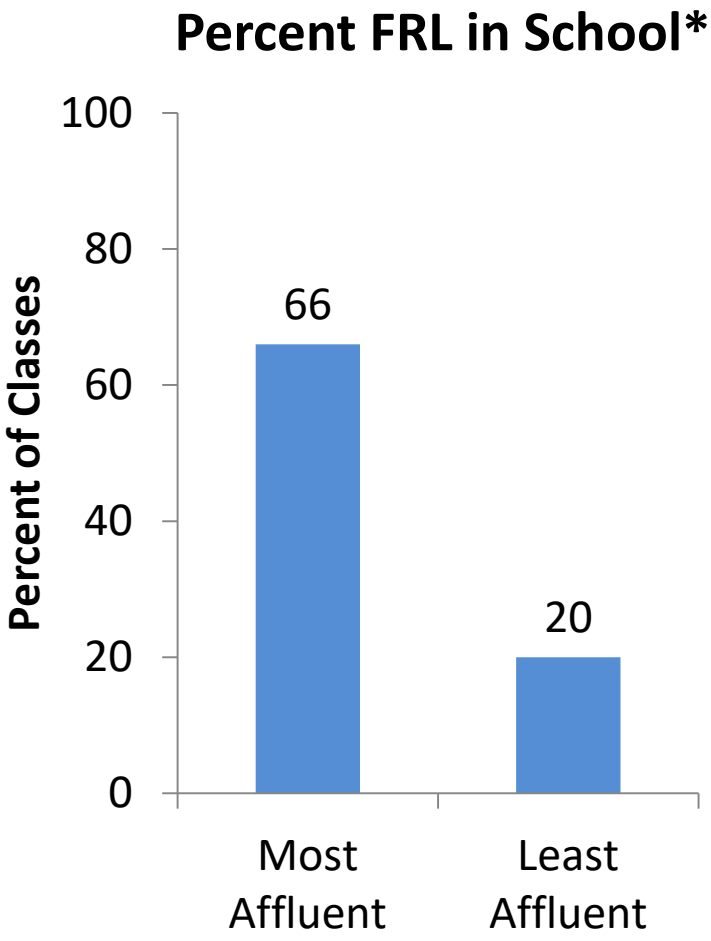


High School Teachers' College Coursework, by Course Taught



Classes Taught by Teachers with a Substantial Science Content Background





Science Teachers Takeaways

Teachers' beliefs about teaching and learning indicate only partial alignment with what is known about how students learn science

Elementary teachers do not feel nearly as well prepared to teach science as do secondary teachers, which is not surprising given they have taken relatively few college courses in science

Low prior achieving students, and those in schools with large proportions of FRL-eligible students are less likely to have a well-prepared teacher

Inservice Support

The 2018 NSSME+ asked about:

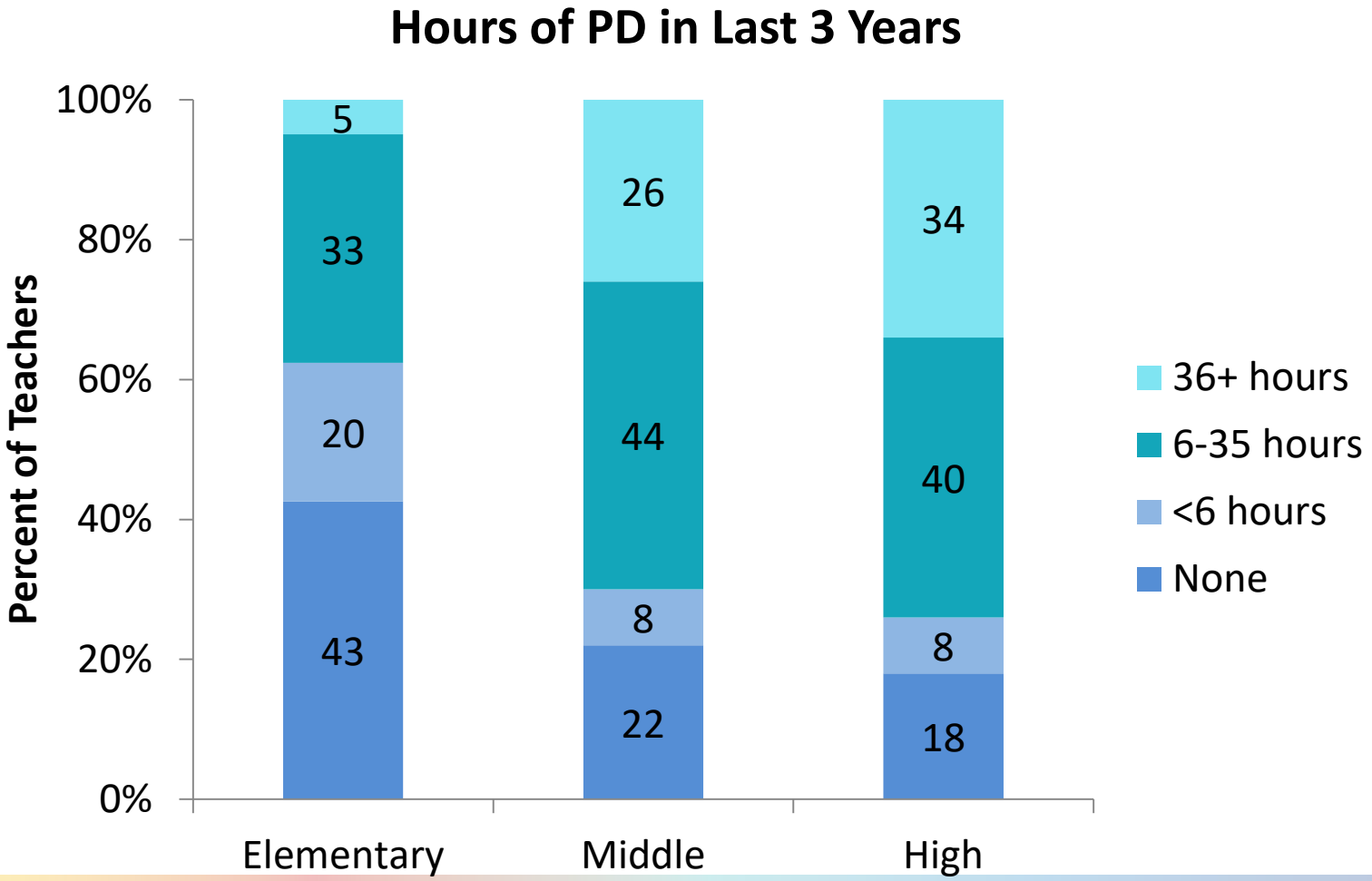
- School/district-offered induction programs
- School/district-offered professional development (workshops, study groups/PLCs, coaching)
- Teacher PD experiences

Professional Development

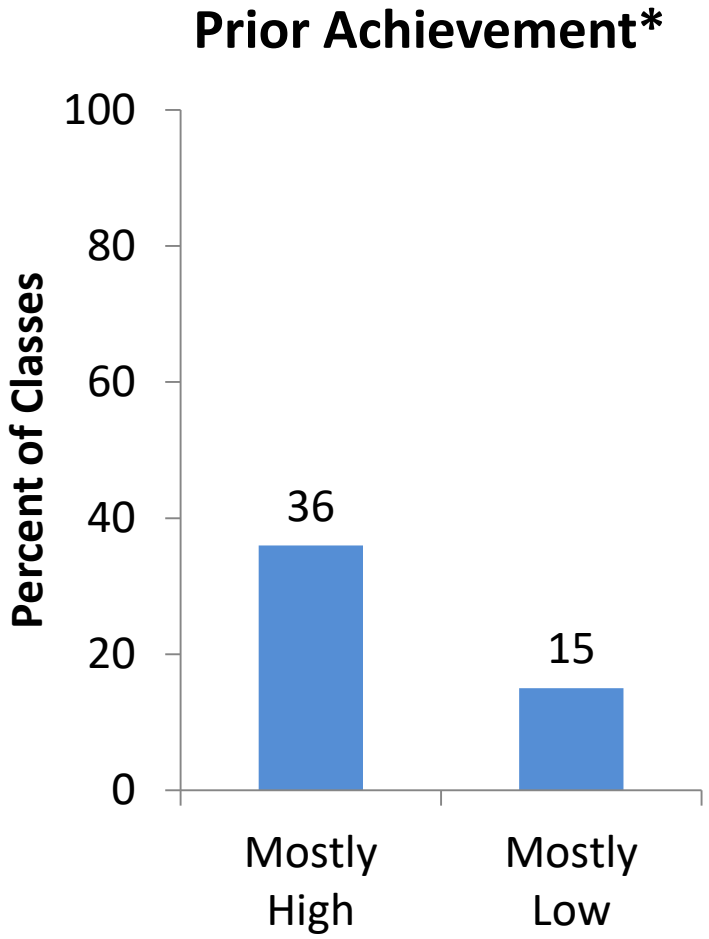
About what percentage of elementary teachers have had <u>any</u> science-related PD in the last three years?

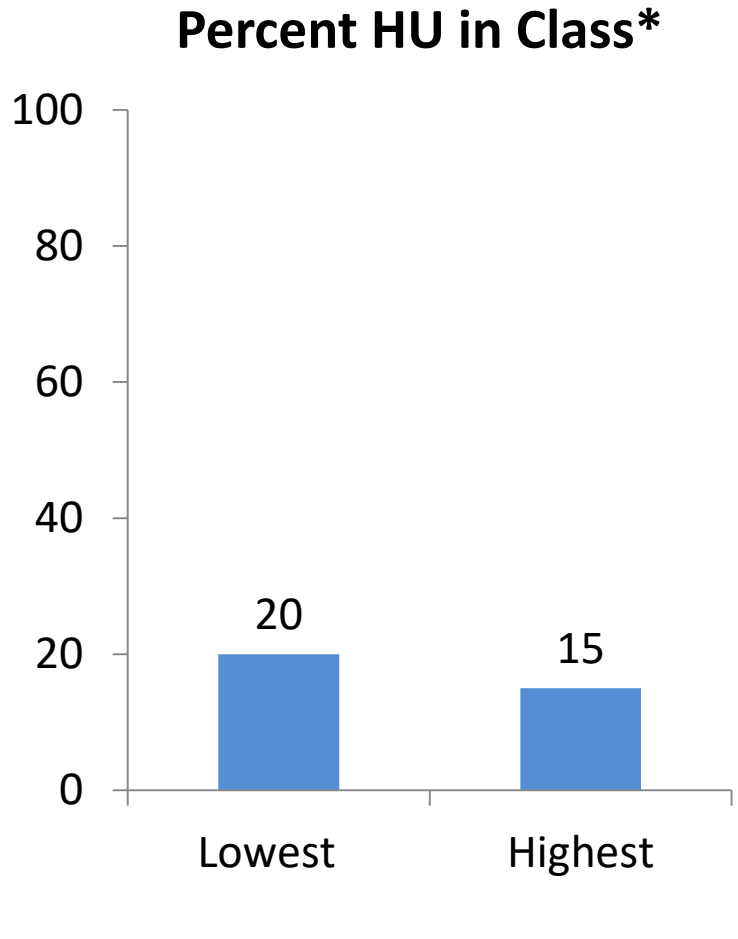
A. 25%
B. 50%
C. 75%
D. 100%

Professional Development



Classes Taught by Teachers With More Than 35 Hours of Science PD in the Last Three Years





Characteristics of PD

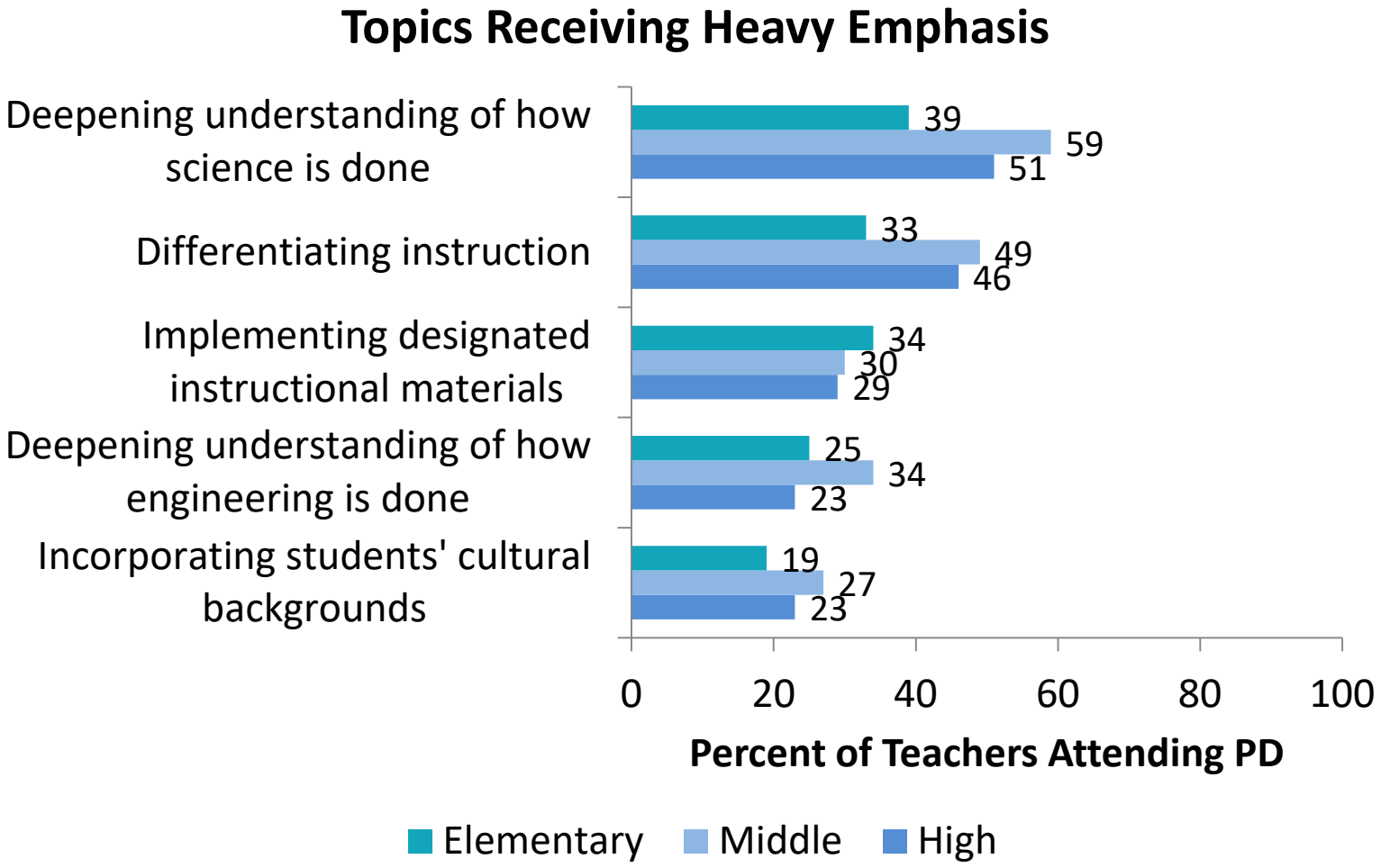
	Percent of Teachers Attending PD		
	Elementary	**Middle**	**High**
Work closely with other teachers in school	57	62	55
Work with those teaching same subject or grade level	47	53	54
Engage in science investigations or engineering design challenges	38	46	45
Experience lessons as students	43	40	45
Apply what they learn in classroom and come back to discuss	30	40	43
Examine classroom artifacts	31	38	39
Rehearse instructional practices	23	27	35

Emphasis of PD

Given what you know, what areas do you think PD for science teachers should emphasize?

1. Implementing instructional materials
2. Deepening understanding of how science is done
3. Deepening understanding of how engineering is done
4. Differentiating instruction
5. Making instruction culturally relevant

Emphasis of PD



Inservice Support Takeaways

Very few elementary teachers participate in substantive amounts of science-focused PD

PD often has characteristics identified as high quality

PD tends to focus on understanding how science is done (practices?), infrequently on cultural relevancy

Reflection

What are the implications of these data for your work?

What do you see as the implications for NSELA?

What partnerships might you or NSELA pursue to tackle the thorny problems?

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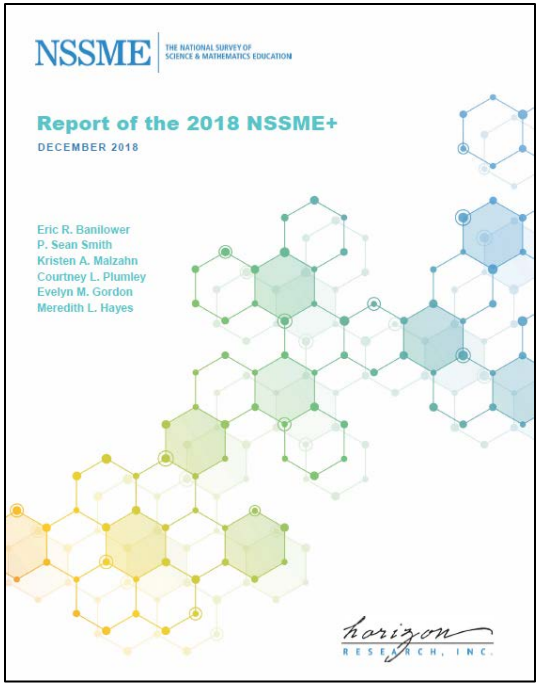
Current reports:

- Technical report
- Highlights report
- Compendium of Tables
- Subject/Grade-level reports and compendia



Coming Soon:

- Equity reports
- Trend reports
- NGSS report
- Novice Teacher reports

nssme@horizon-research.com

@NSSMEatHRI

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