NSSME | THE NATIONAL SURVEY OF SCIENCE & MATHEMATICS EDUCATION

The 2018 NSSME+

JANUARY 3, 2019

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horizon RESEARCH, INC.

Session Overview

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

Shameless Plug

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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

Interpreting Results

After data collection, design weights were computed, adjusted for nonresponse, and applied to the data.

Why should you care?

The sampling and weighting processes mean that the results are national estimates of schools, teachers, and classes—not characteristics of the respondents.

Science Instruction*

Are students experiencing the kind of science instruction we hope for?

Why might instruction look the way it does?

What are the implications for teacher preparation and support?

Instructional Objectives

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

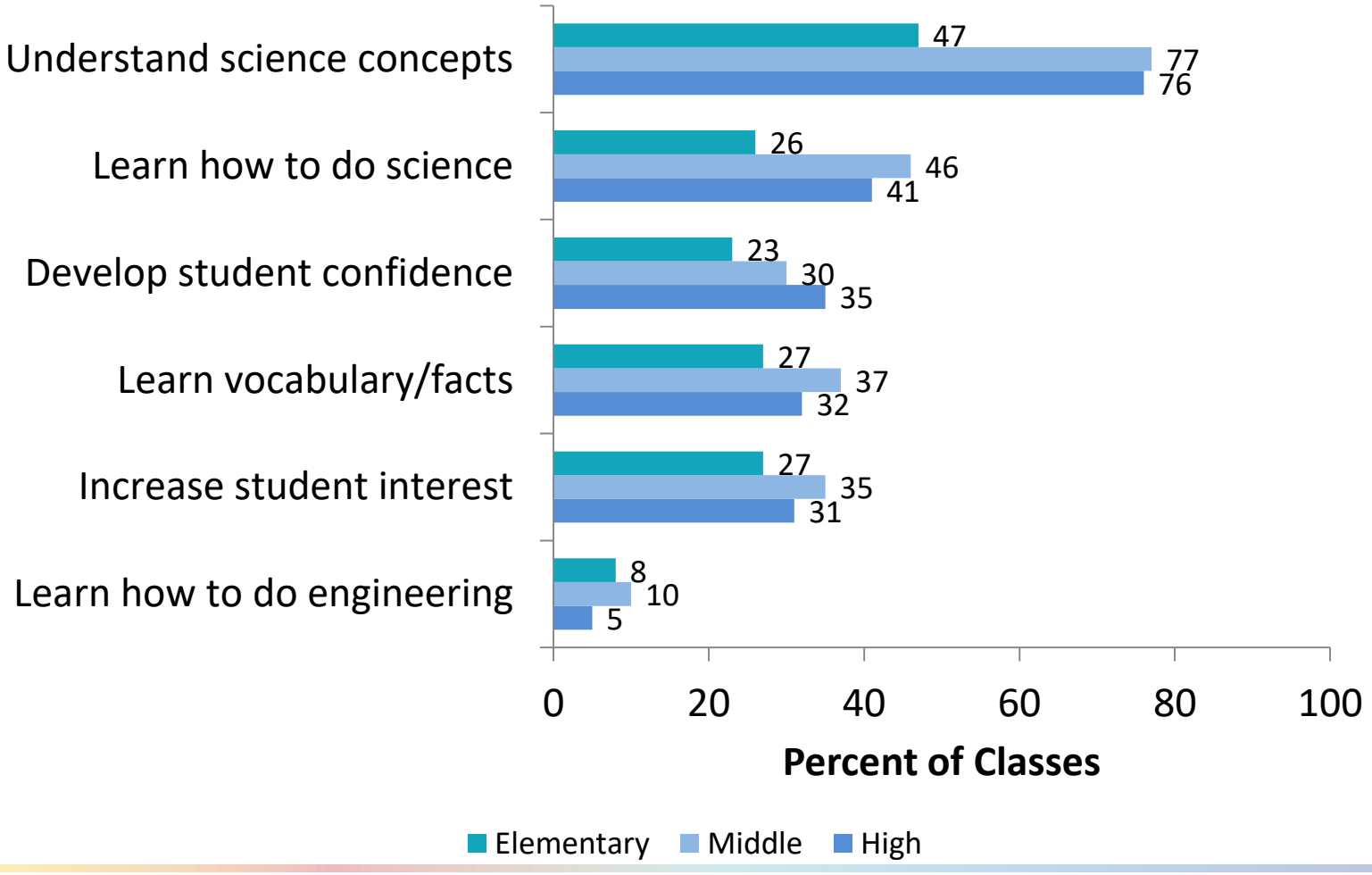
A. 0-25%

B. 26-50%

C. 51-75%

D. 76-100%

Objectives Receiving a Heavy Emphasis

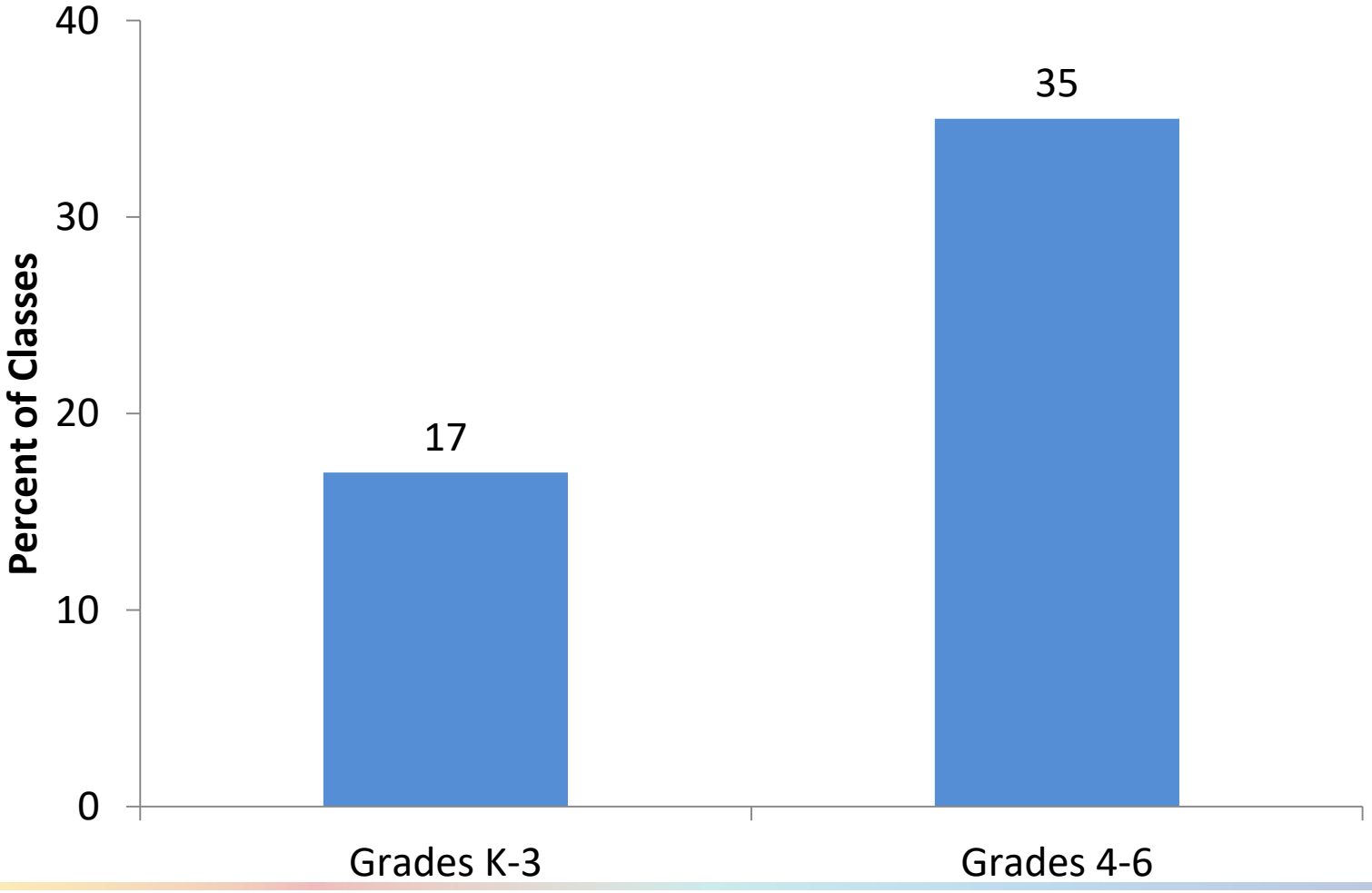


Instructional Time: Elementary

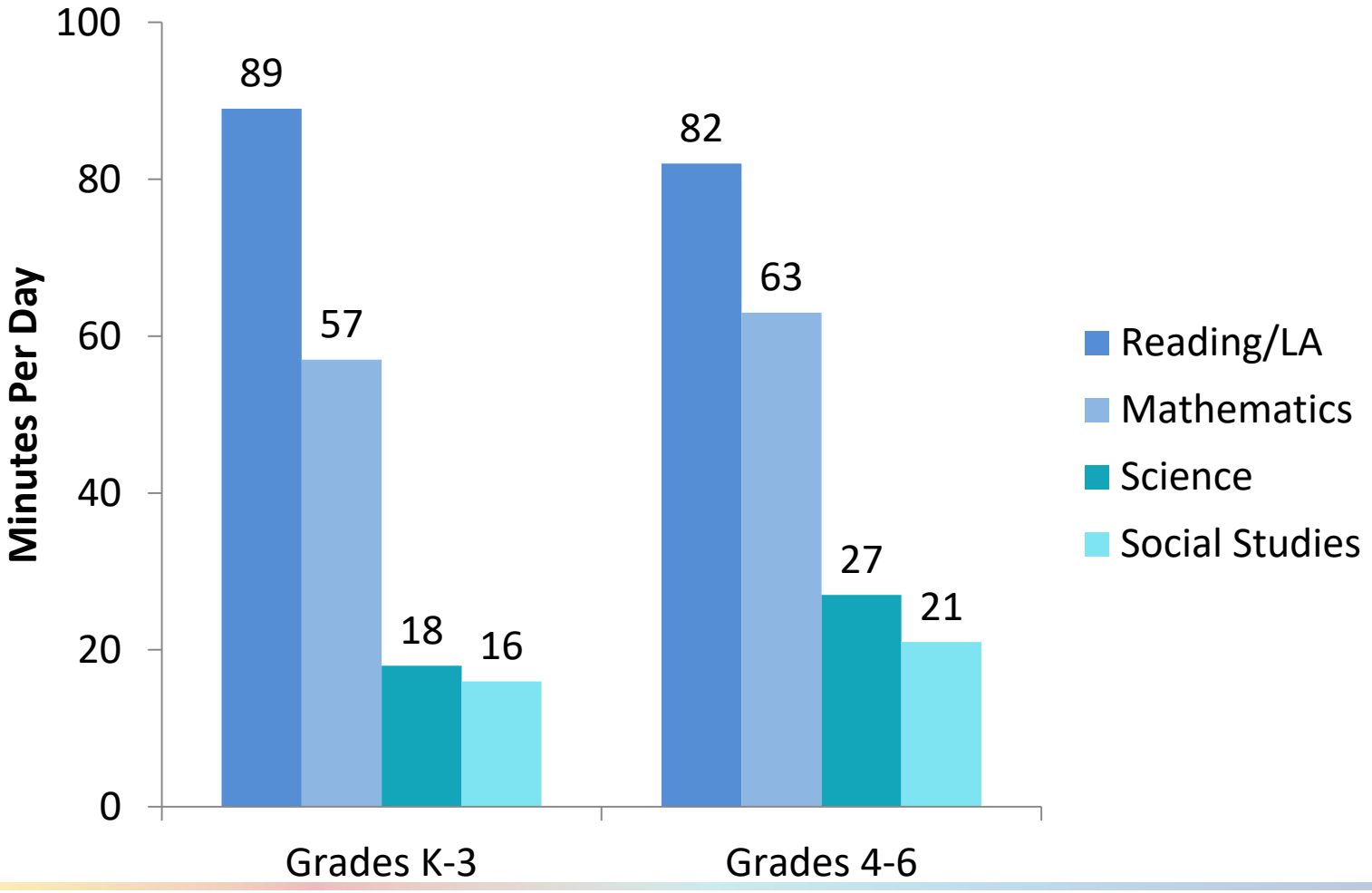
About what percentage of elementary classes receive science instruction all or most days every week of the school year?

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

Elementary Classes Receiving Science Instruction All/Most Days



Instructional Time: Elementary

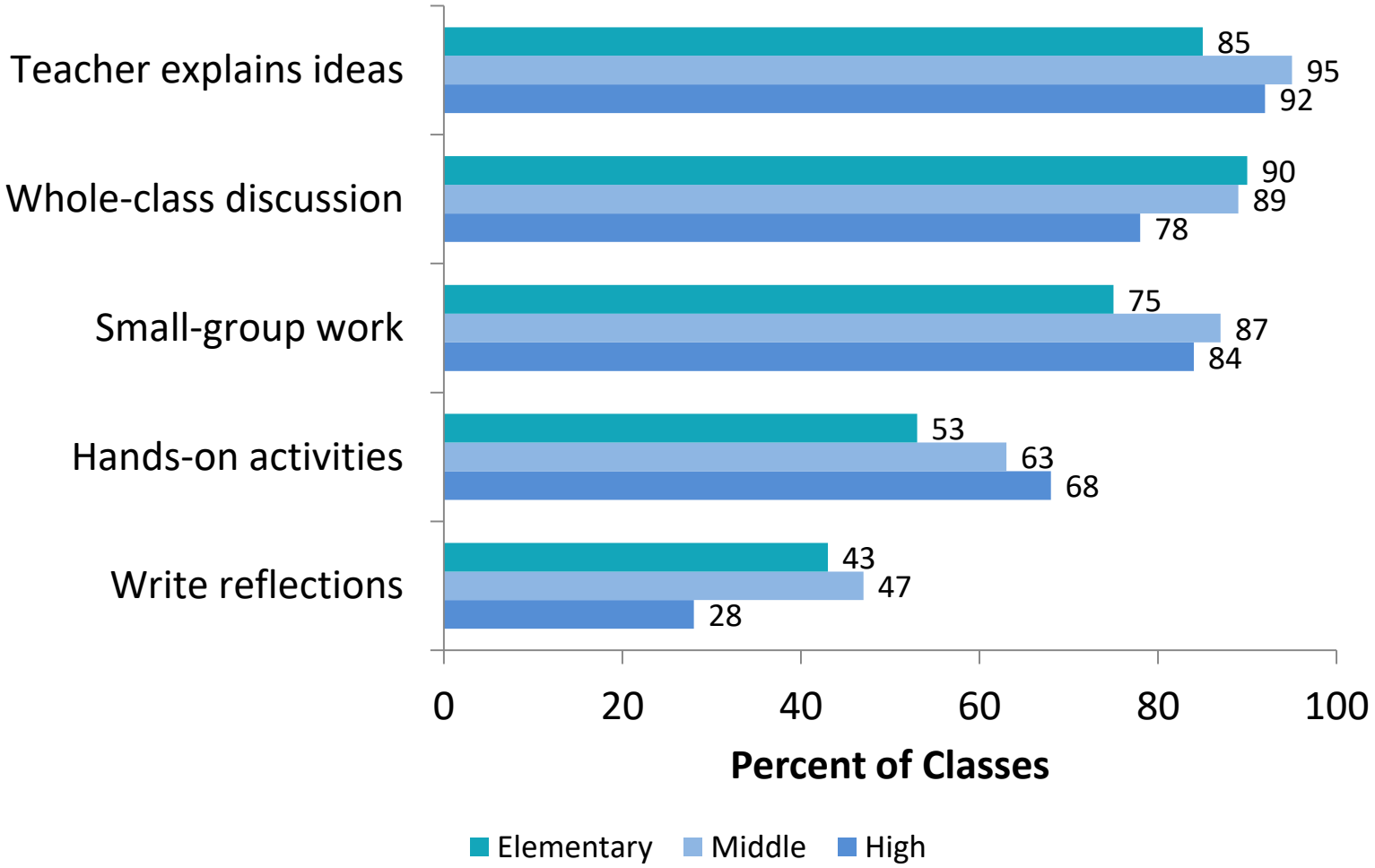


Instructional Activities

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



Engagement in Science Practices

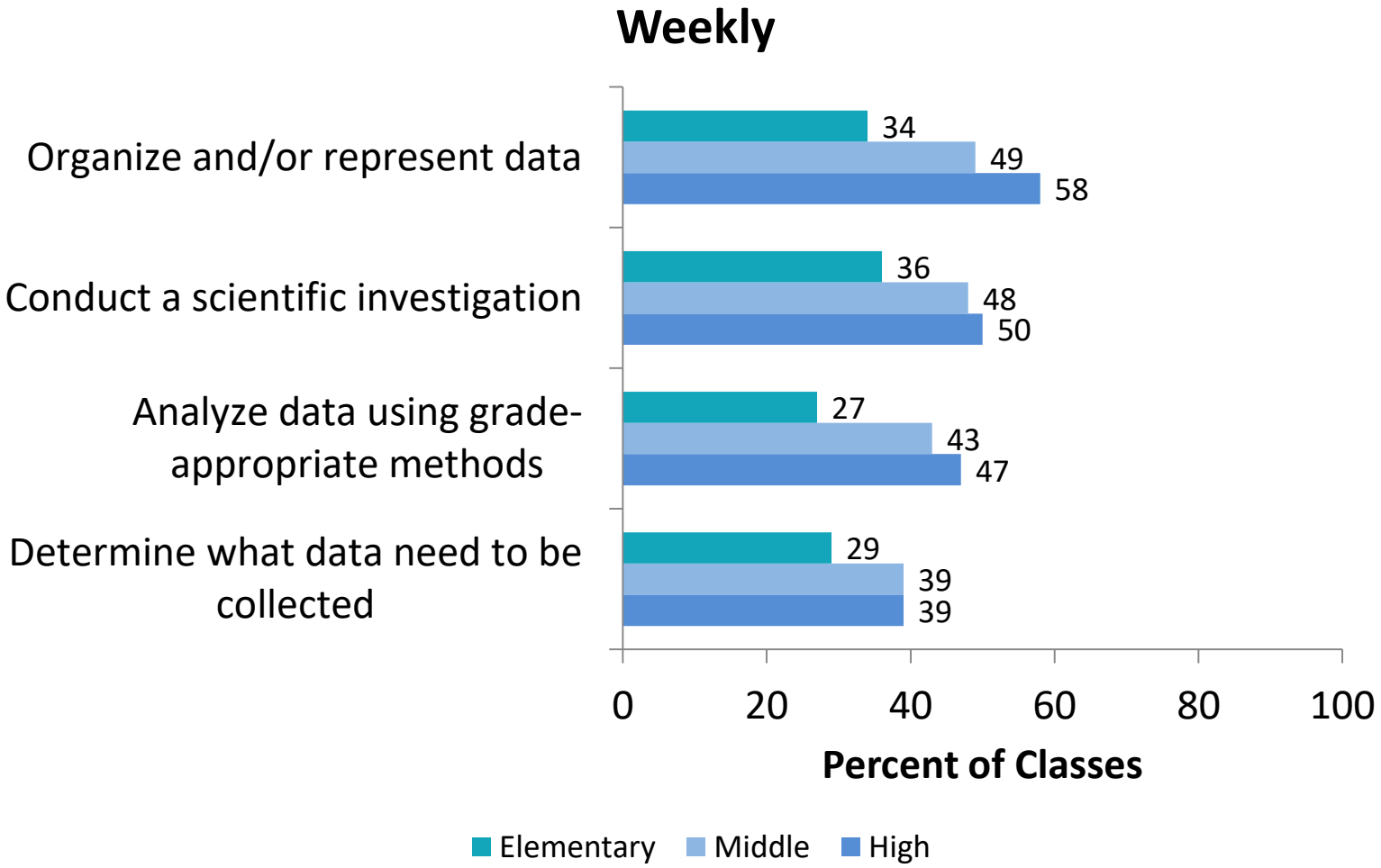
The 2018 NSSME+ included a series of items asking how often students were engaged in aspects of the science practices:

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

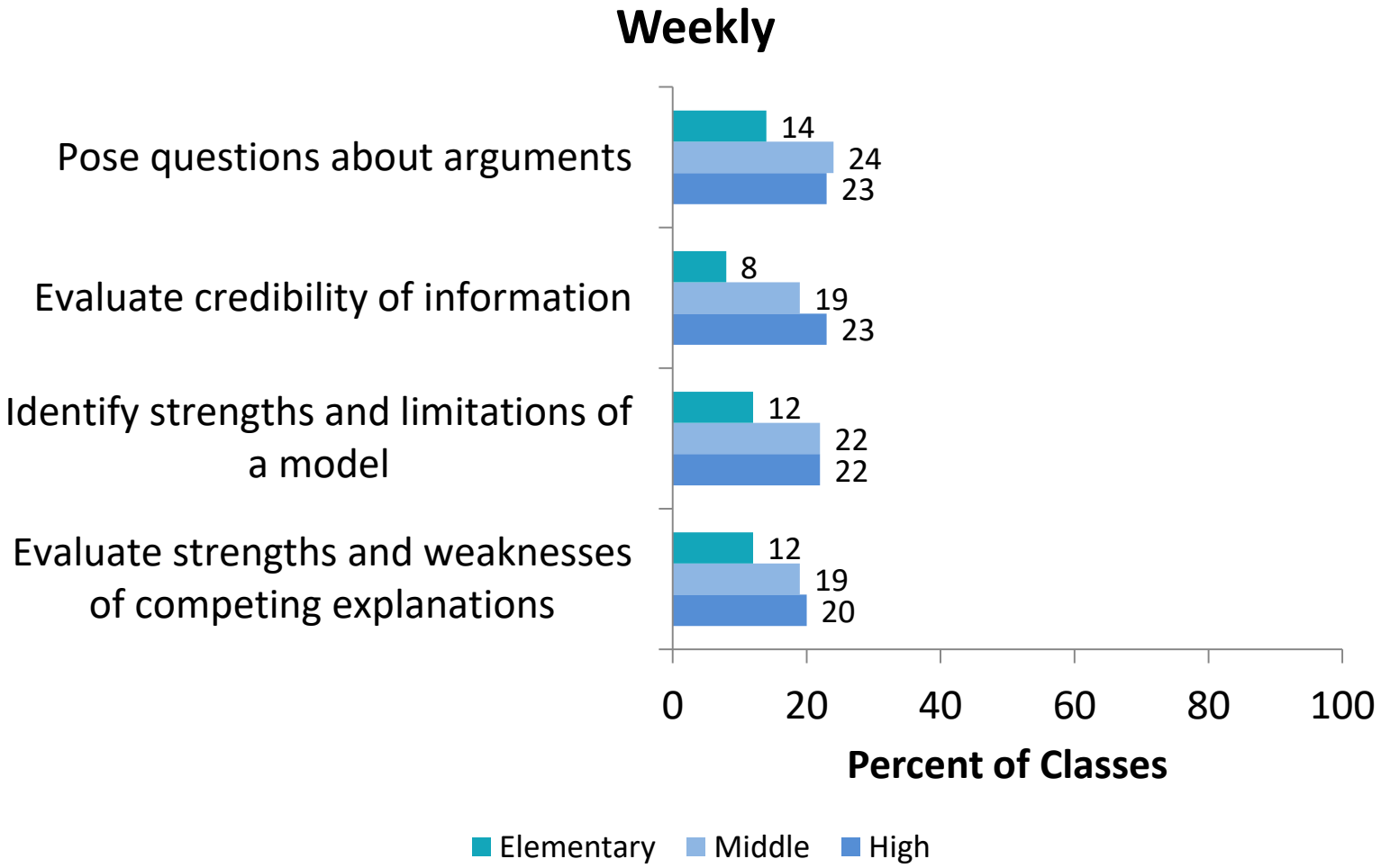


Engagement in Science Practices

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



Instruction Take-Aways

Instructional time for science at the elementary is still relatively low

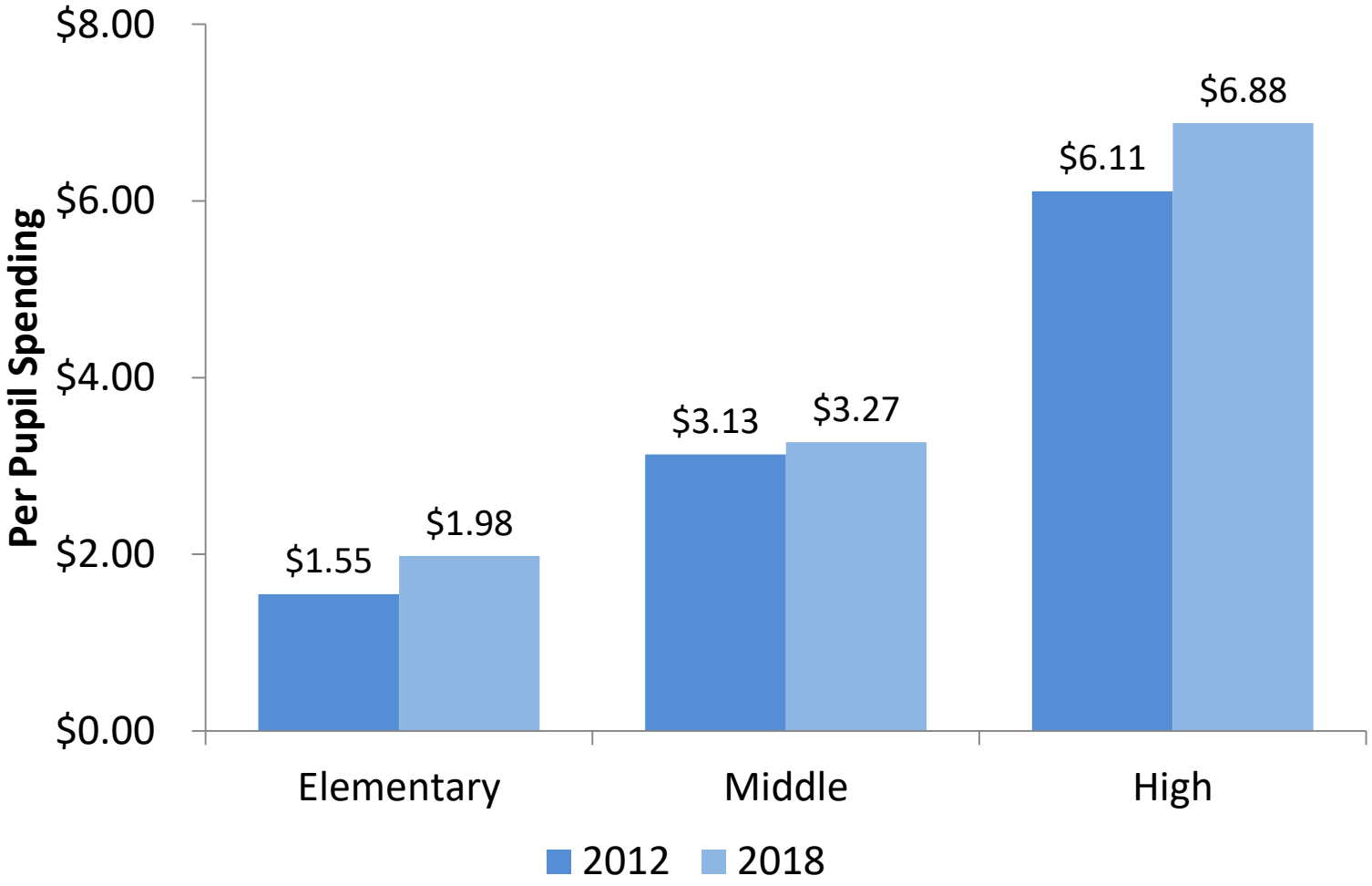
Heavy emphasis on developing conceptual understanding, but not on how science is done, or how knowledge is generated and revised

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

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



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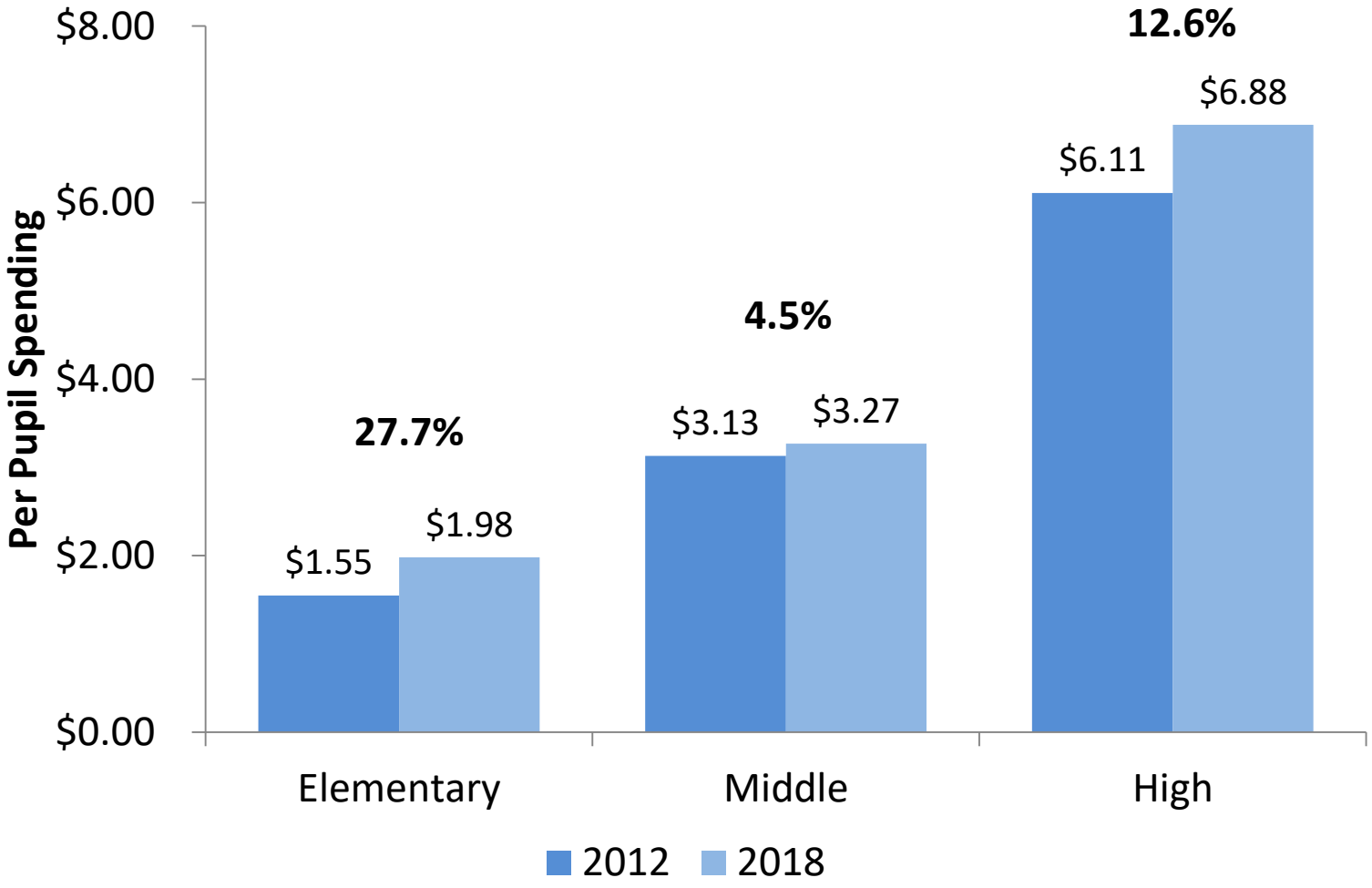
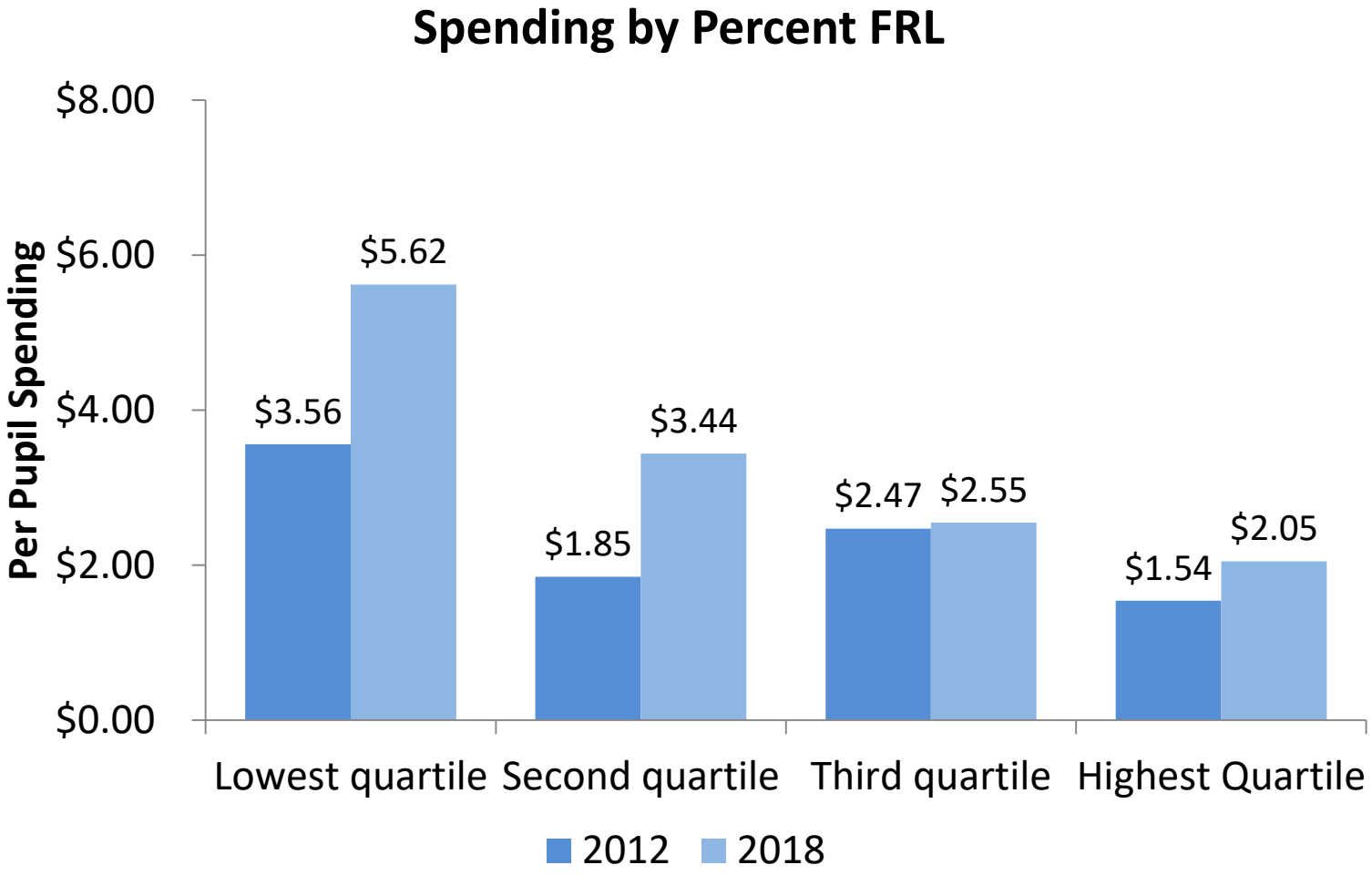


Equity Analysis



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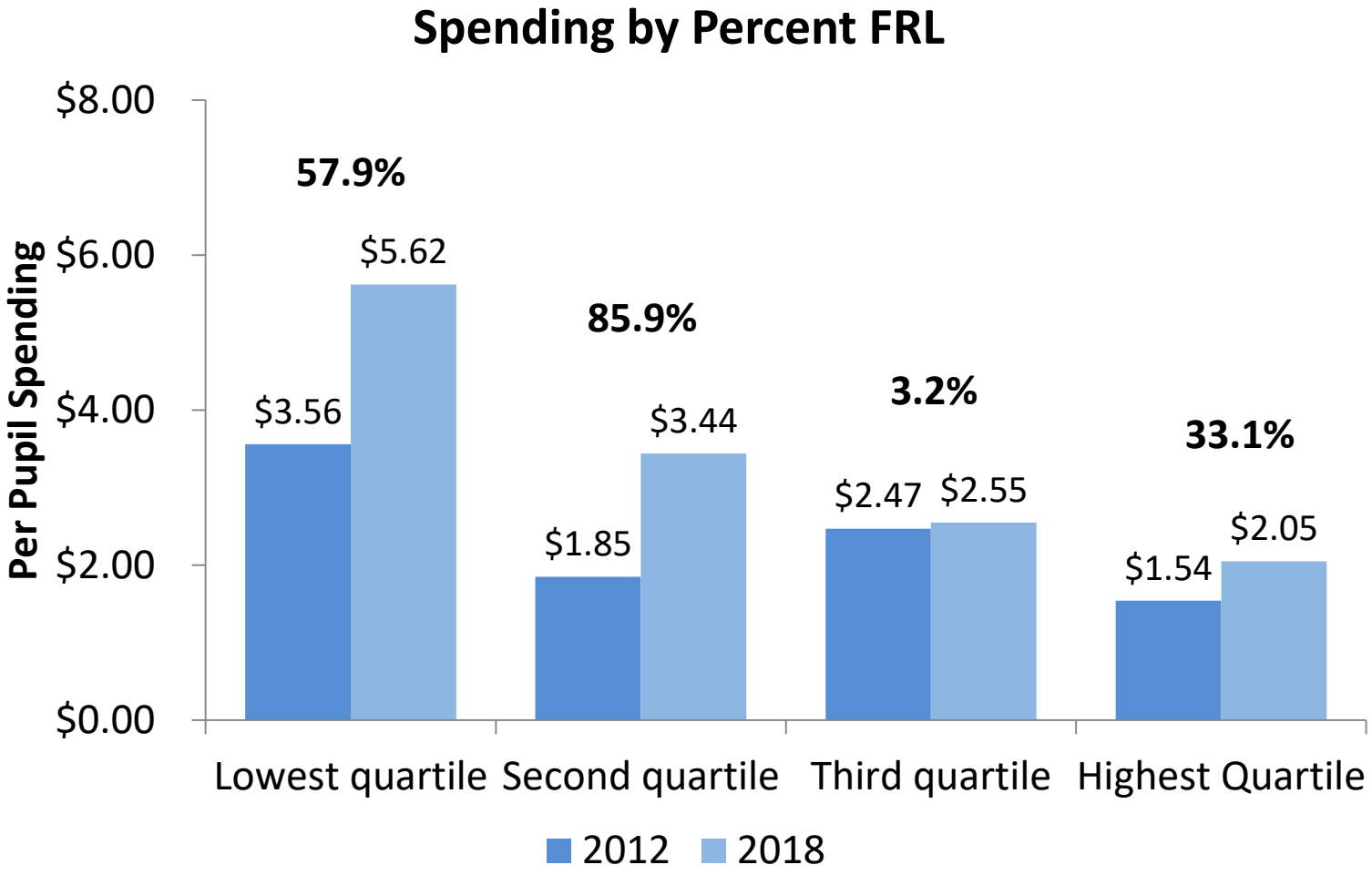
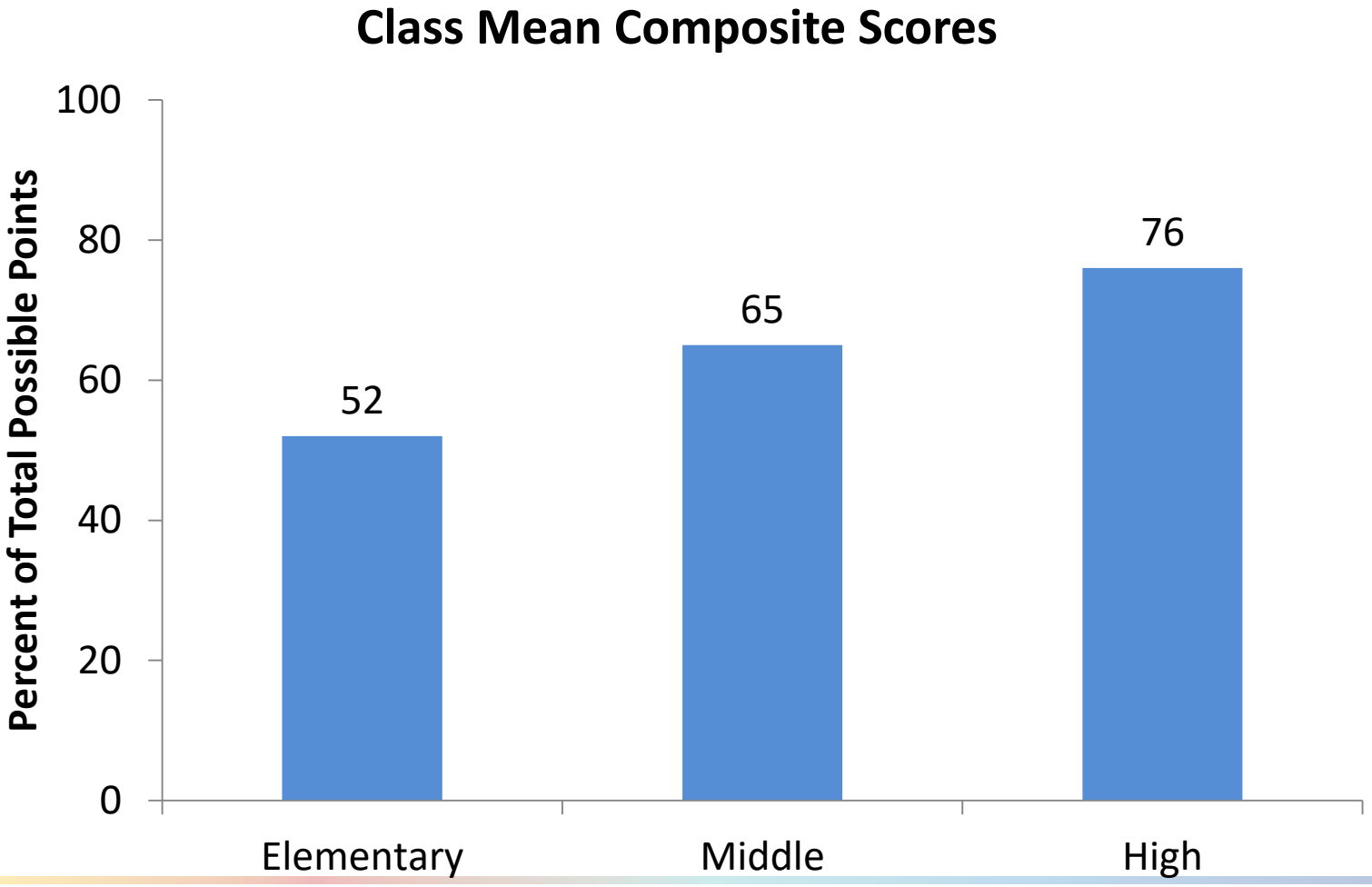
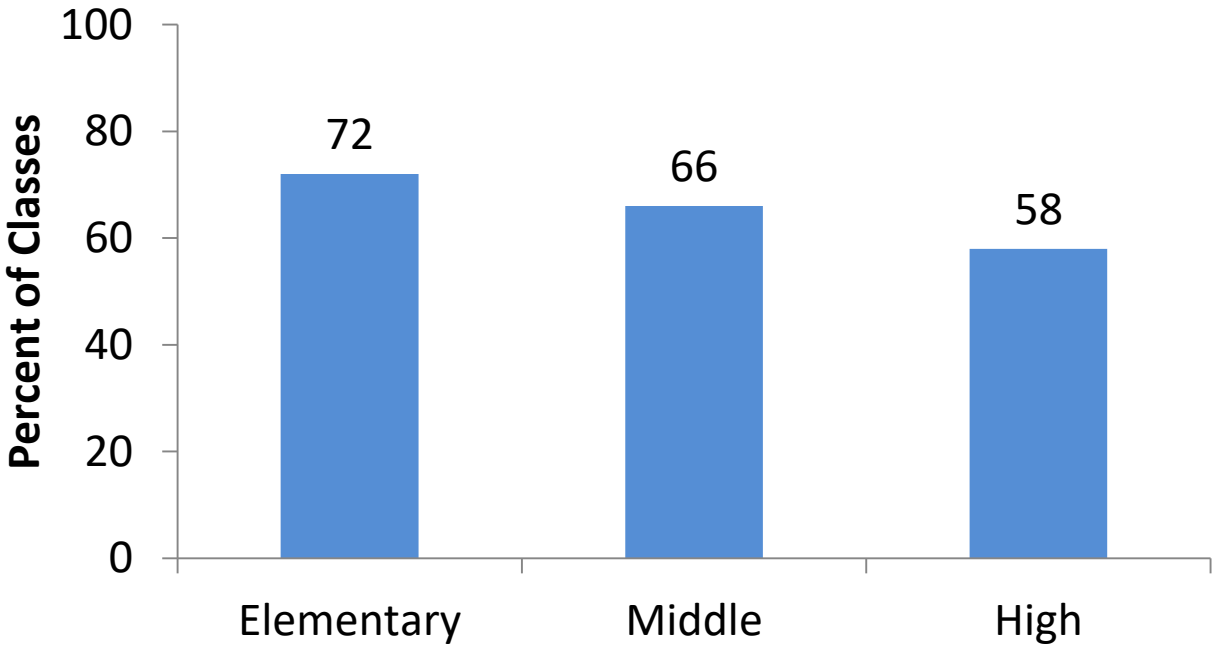


Teachers' Views of Adequacy of Resources



Instructional Materials

For most classes, districts designate instructional materials to be used:



What Is Designated

	Percent of Classes		
	Elementary	**Middle**	**High**
Commercially published textbooks	67	87	95
State, county, or district-developed units or lessons	43	32	27
Lessons or resources from websites that are free	20	26	25
Commercially published kits/modules	51	36	22
Lessons or resources from websites that have a subscription fee or cost	39	39	16
Self-paced online courses or units	9	15	11

What Teachers Use (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 (e.g., conferences, colleagues)	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
Self-paced online courses or units	7	9	9

Resources Take-Aways

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

Many teachers, particularly K-8 do not think they have adequate resources for science instruction

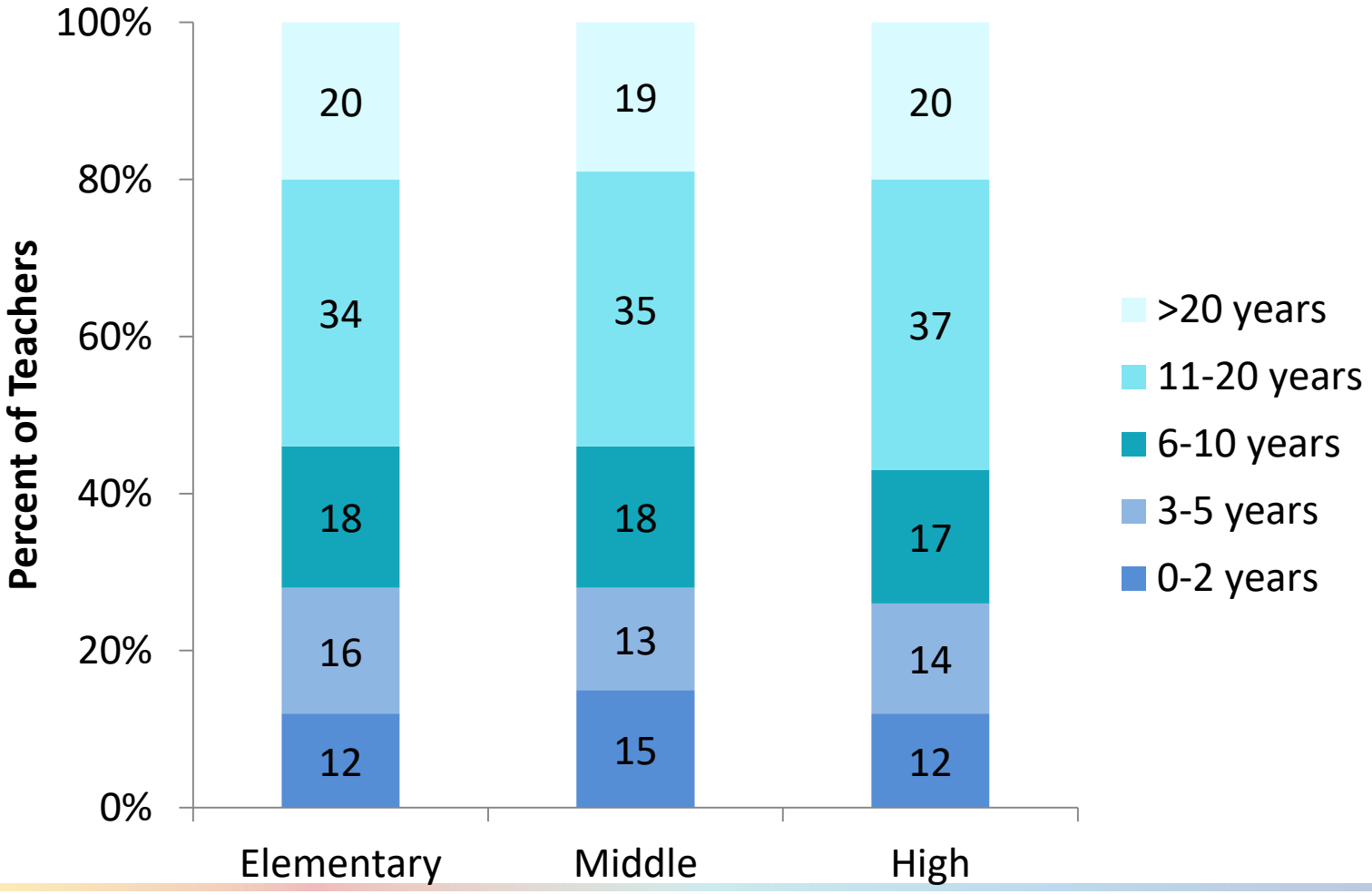
Teachers use a hodgepodge of instructional materials raising questions about quality and coherence

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

Teaching Experience

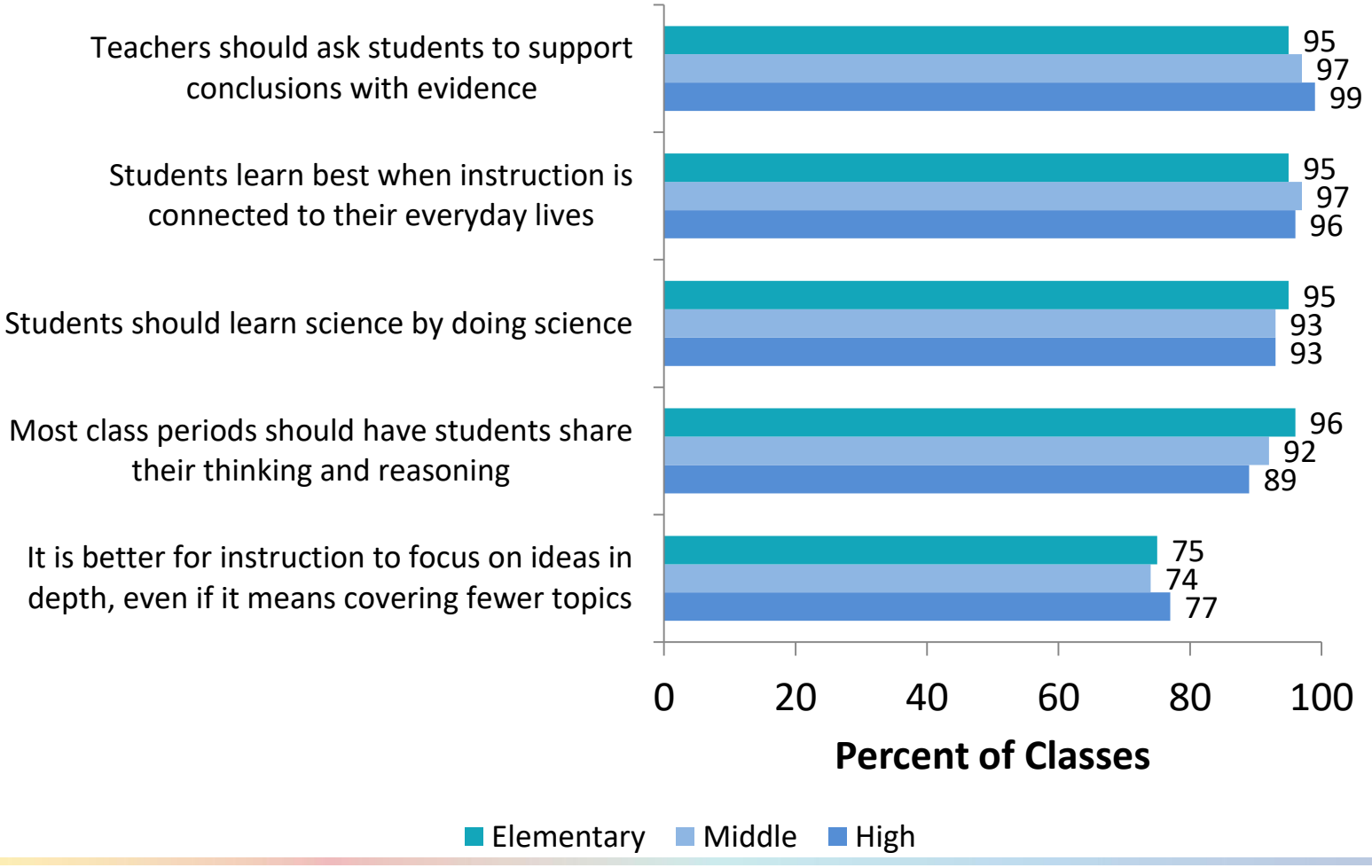


Teacher Beliefs

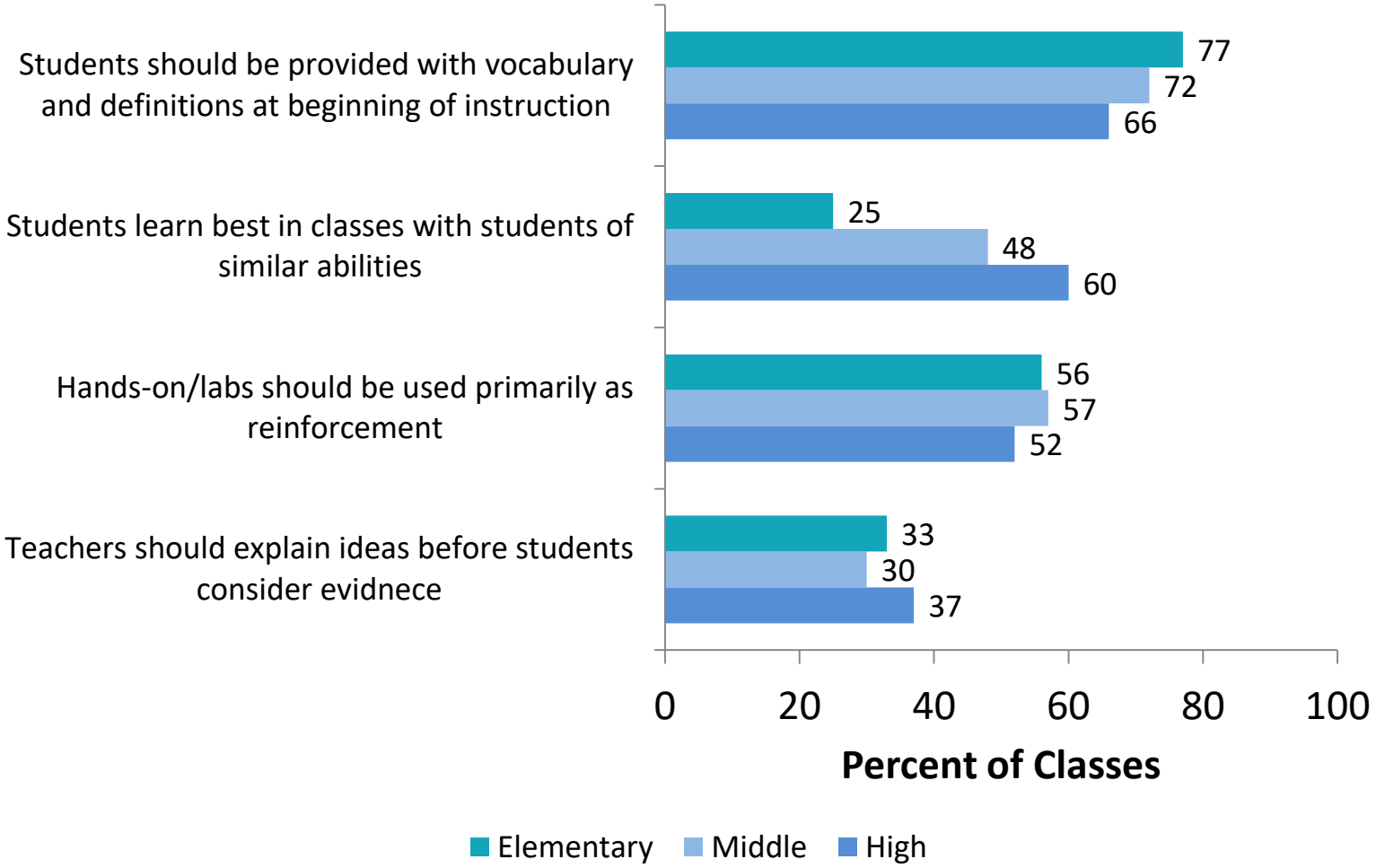
What percentage of teachers believe that students should be asked to support their conclusions with evidence?

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

Teacher Beliefs



Teacher Beliefs

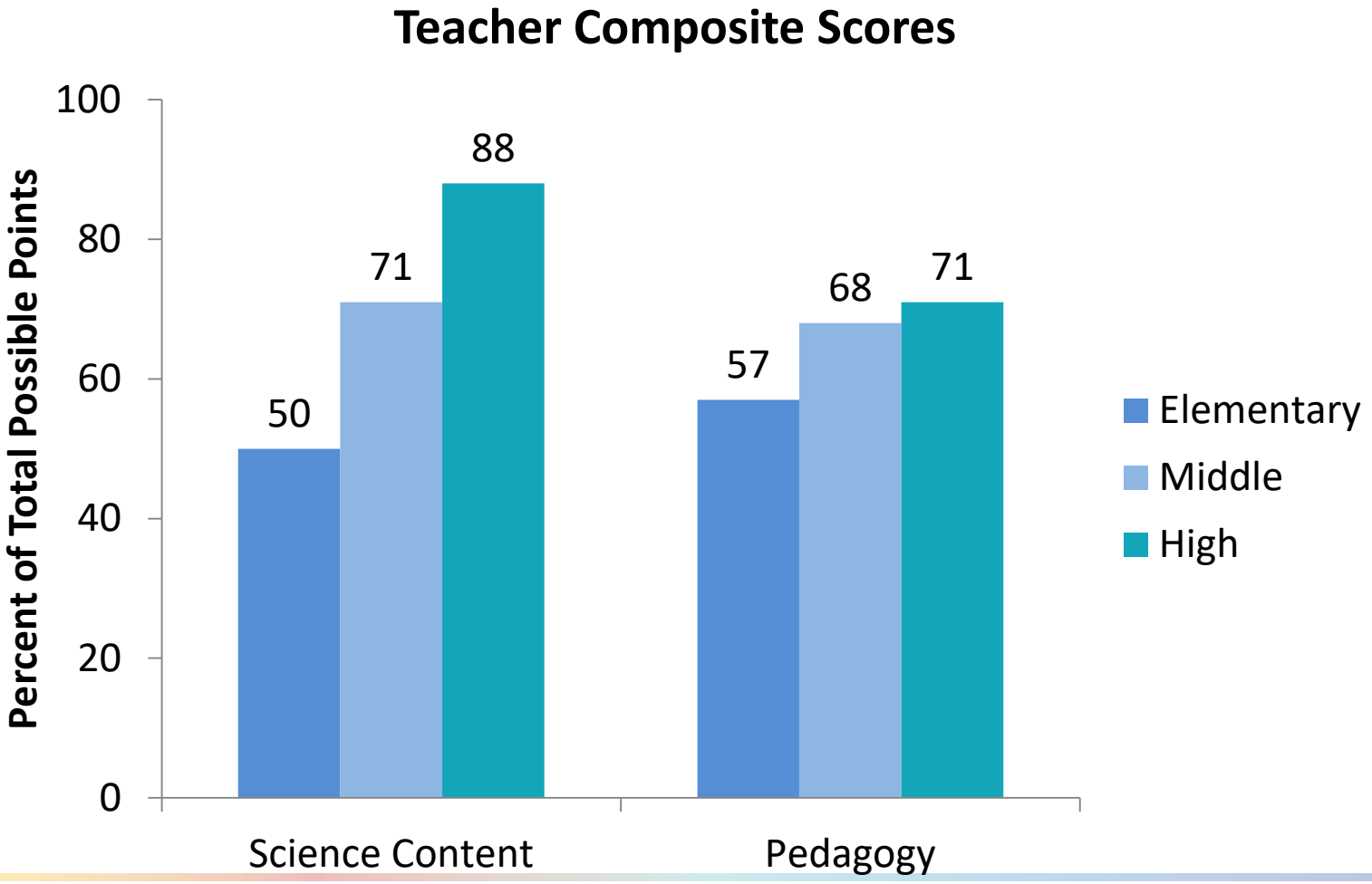


Perceptions of Preparedness

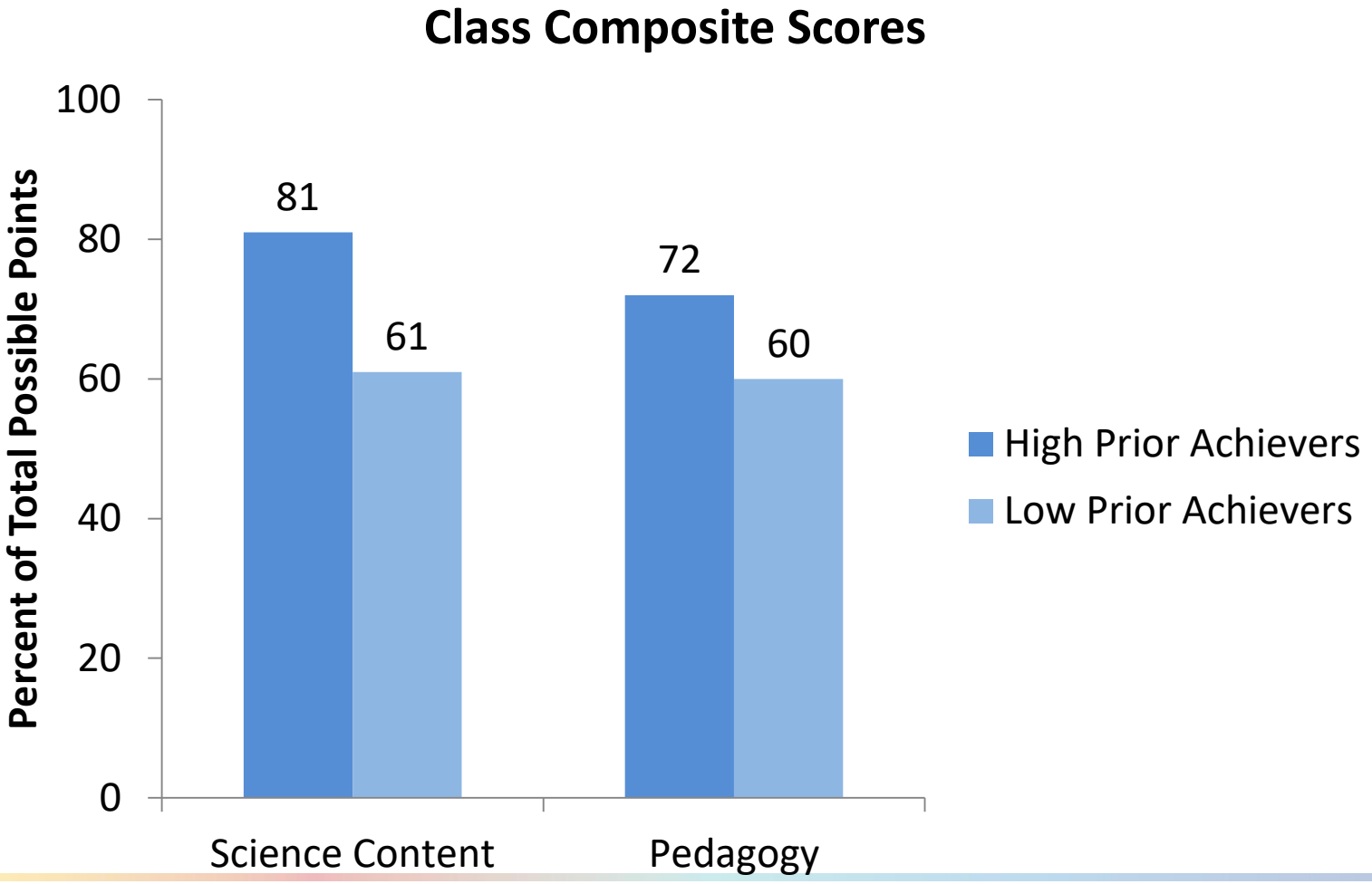
The 2018 NSSME+ included items about teachers' feelings of preparedness to:

- 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



Equity Analyses: Teacher Perceptions of Preparedness

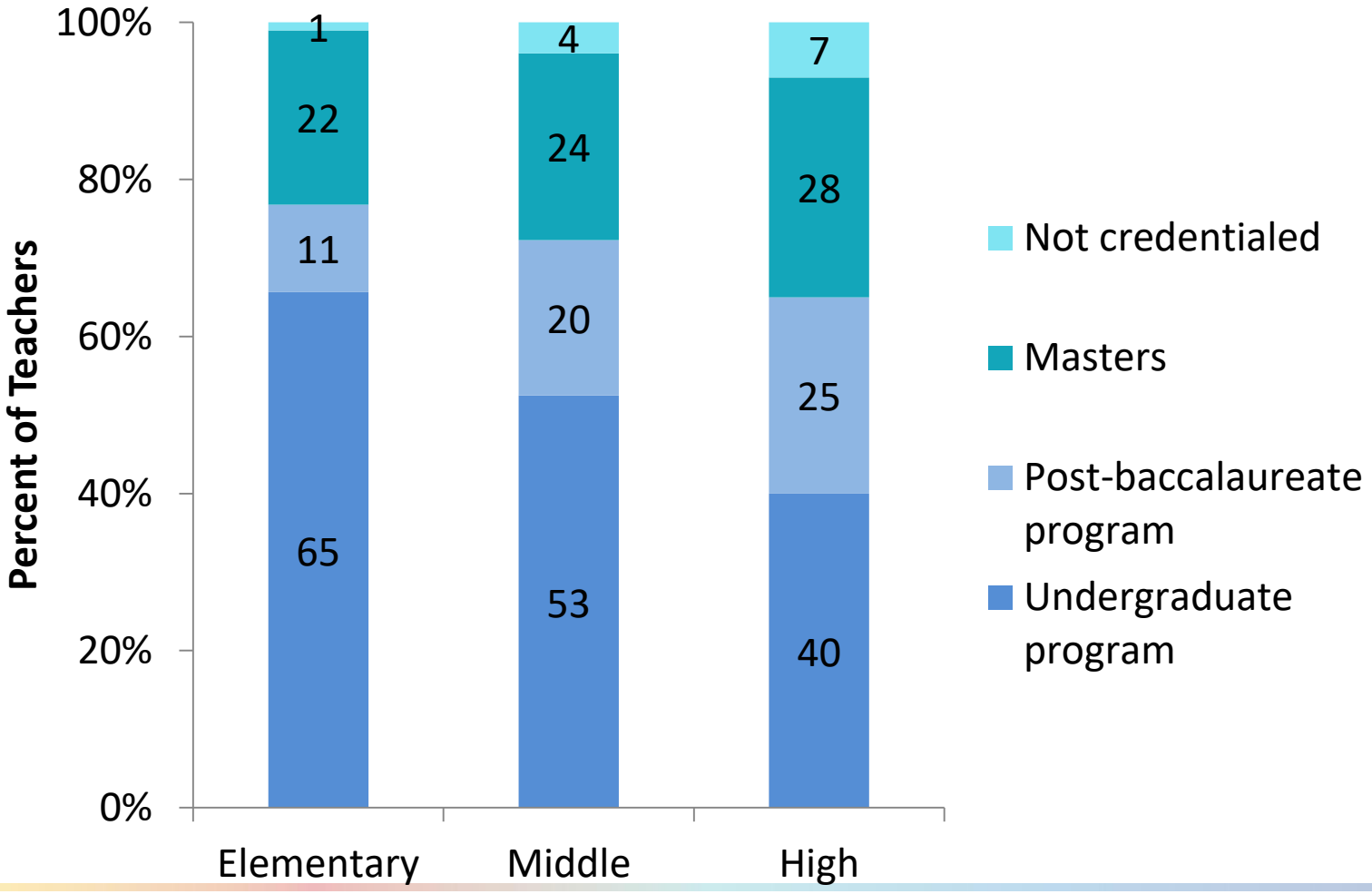


Paths to Certification

About what percentage of science teachers have earned a teaching credential?

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

Paths to Certification

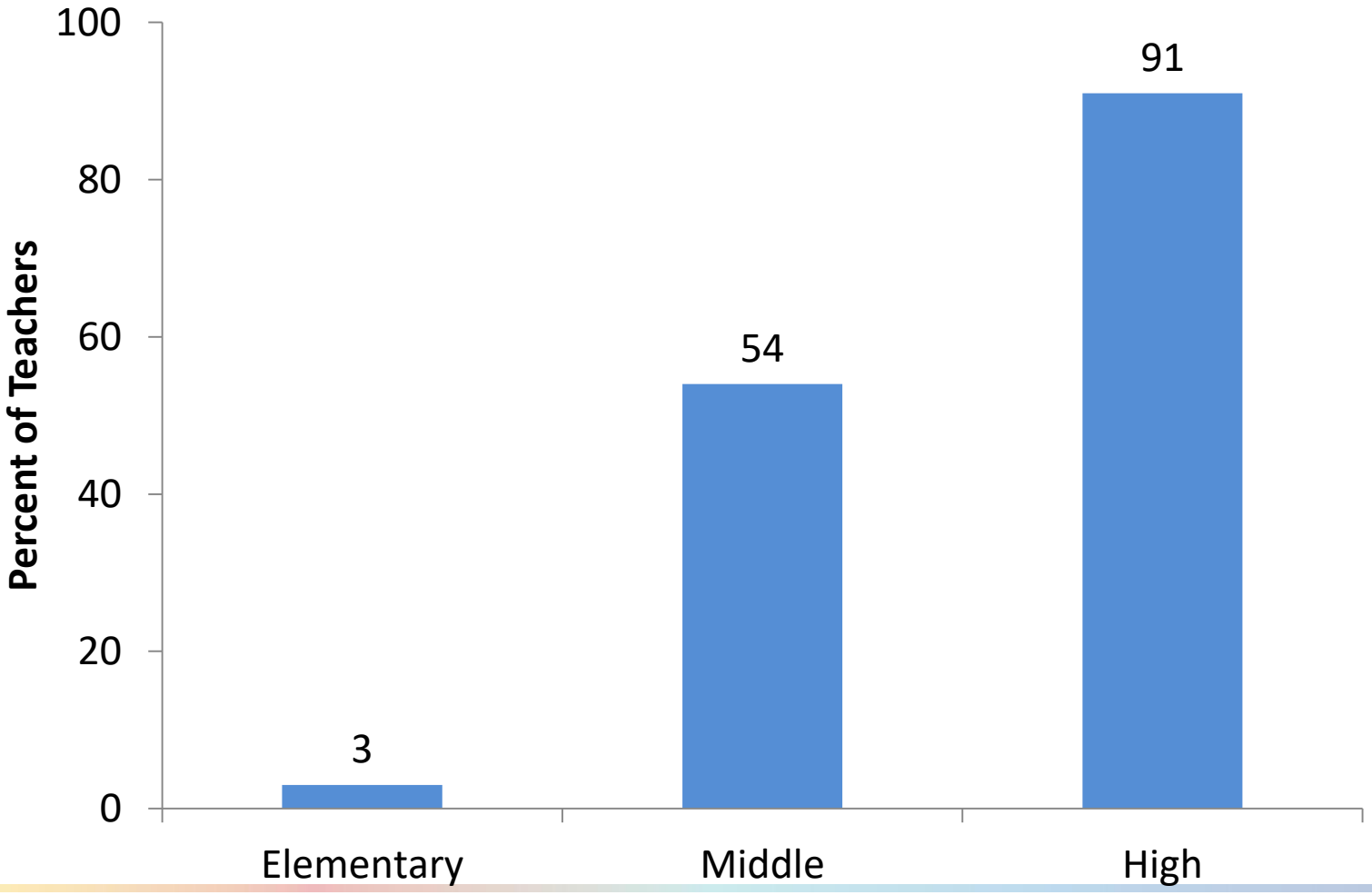


College Degrees

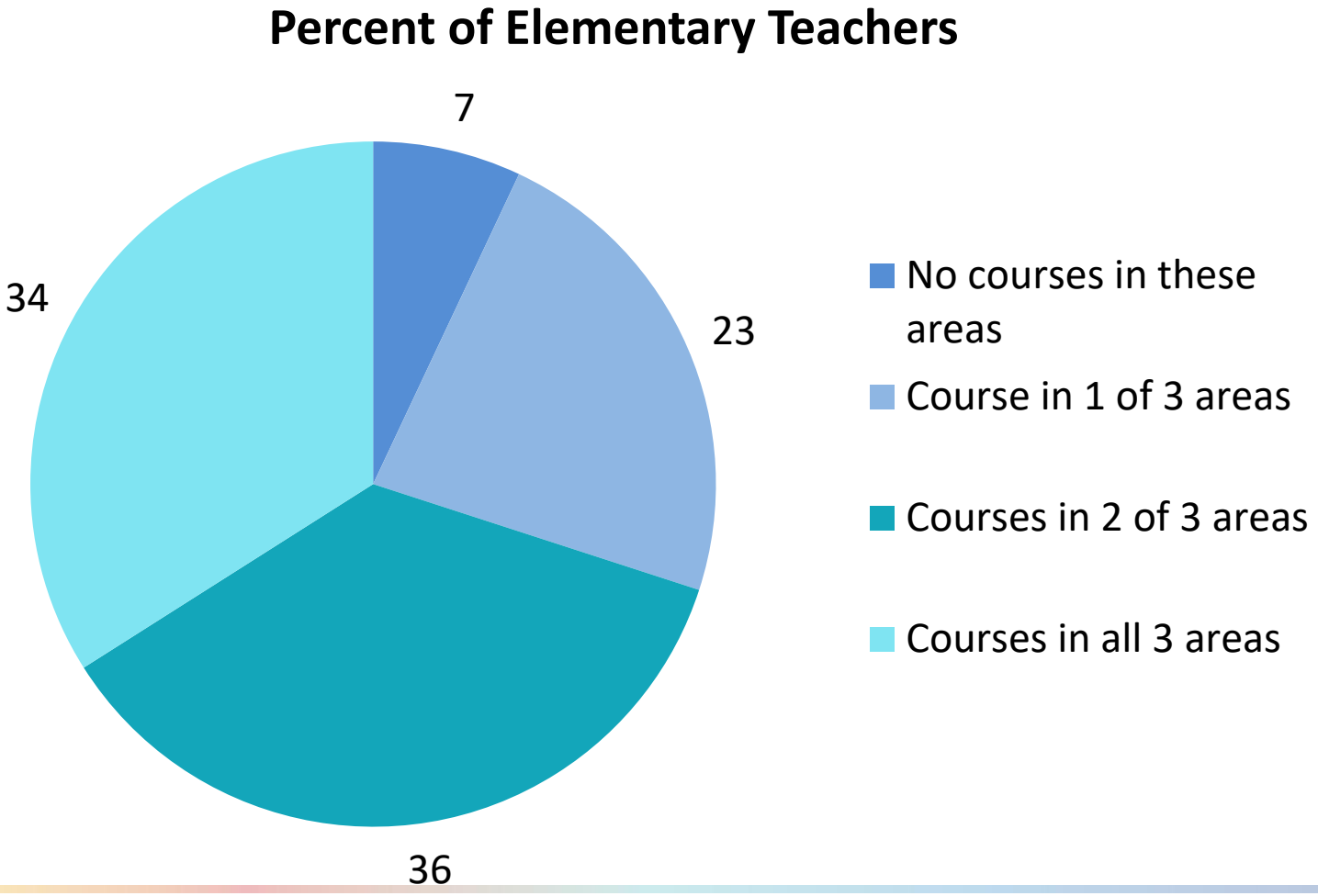
About what percentage of middle school science teachers have a degree in science, engineering, or science education?

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

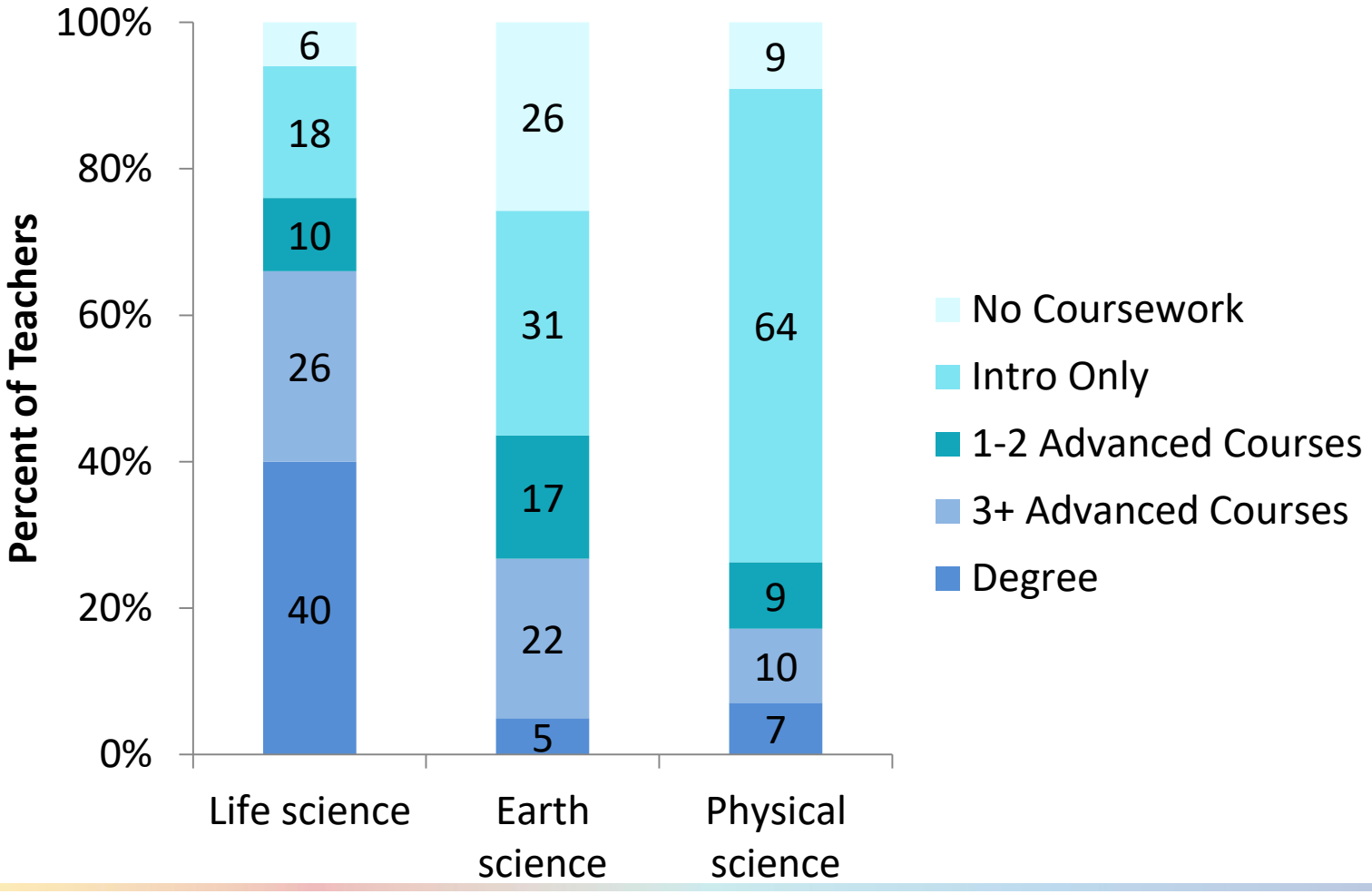
Degree in Science/Engineering/ Science Education



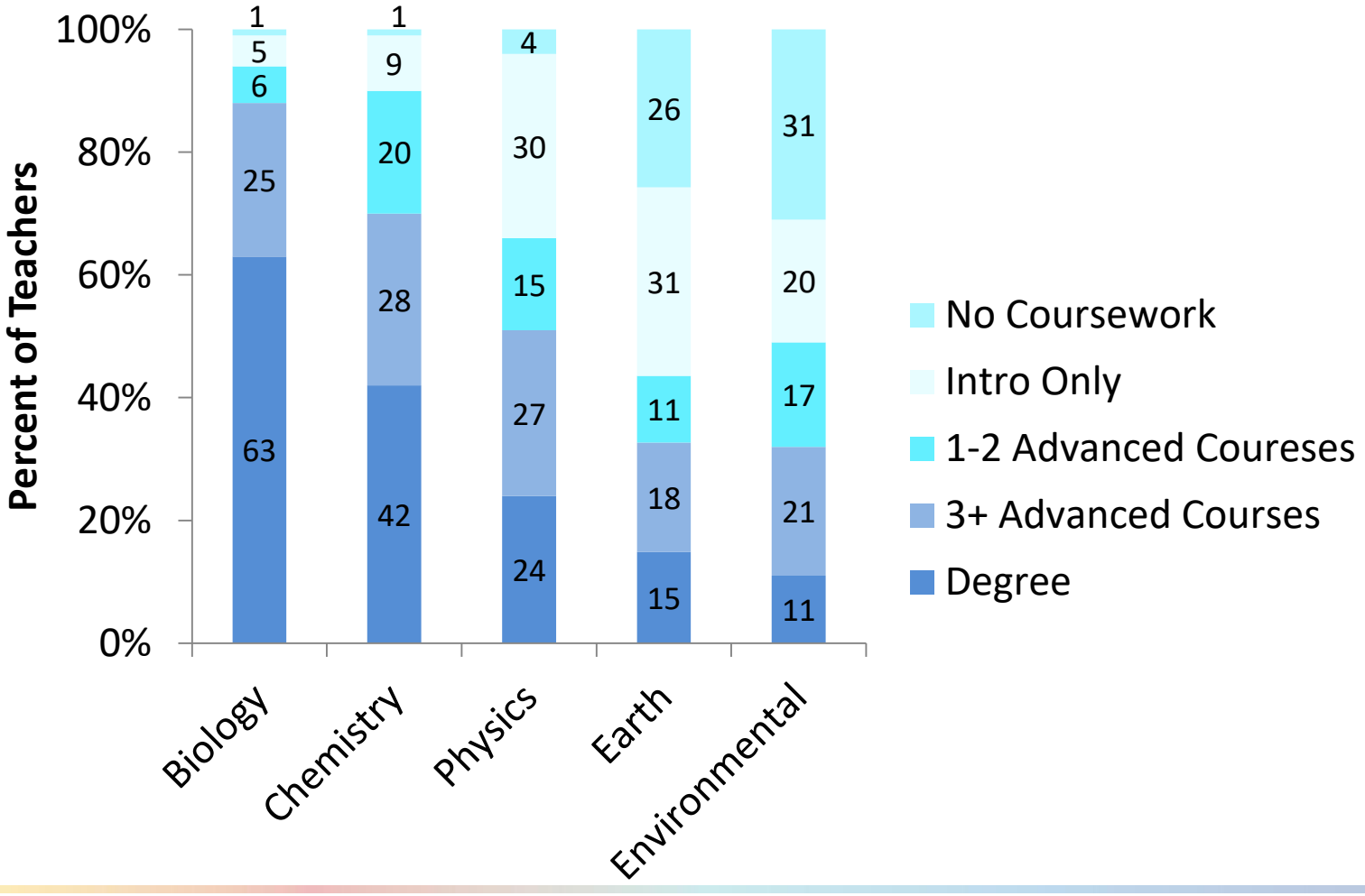
Elementary Teachers' College Coursework: Earth, Life, Physical Sciences



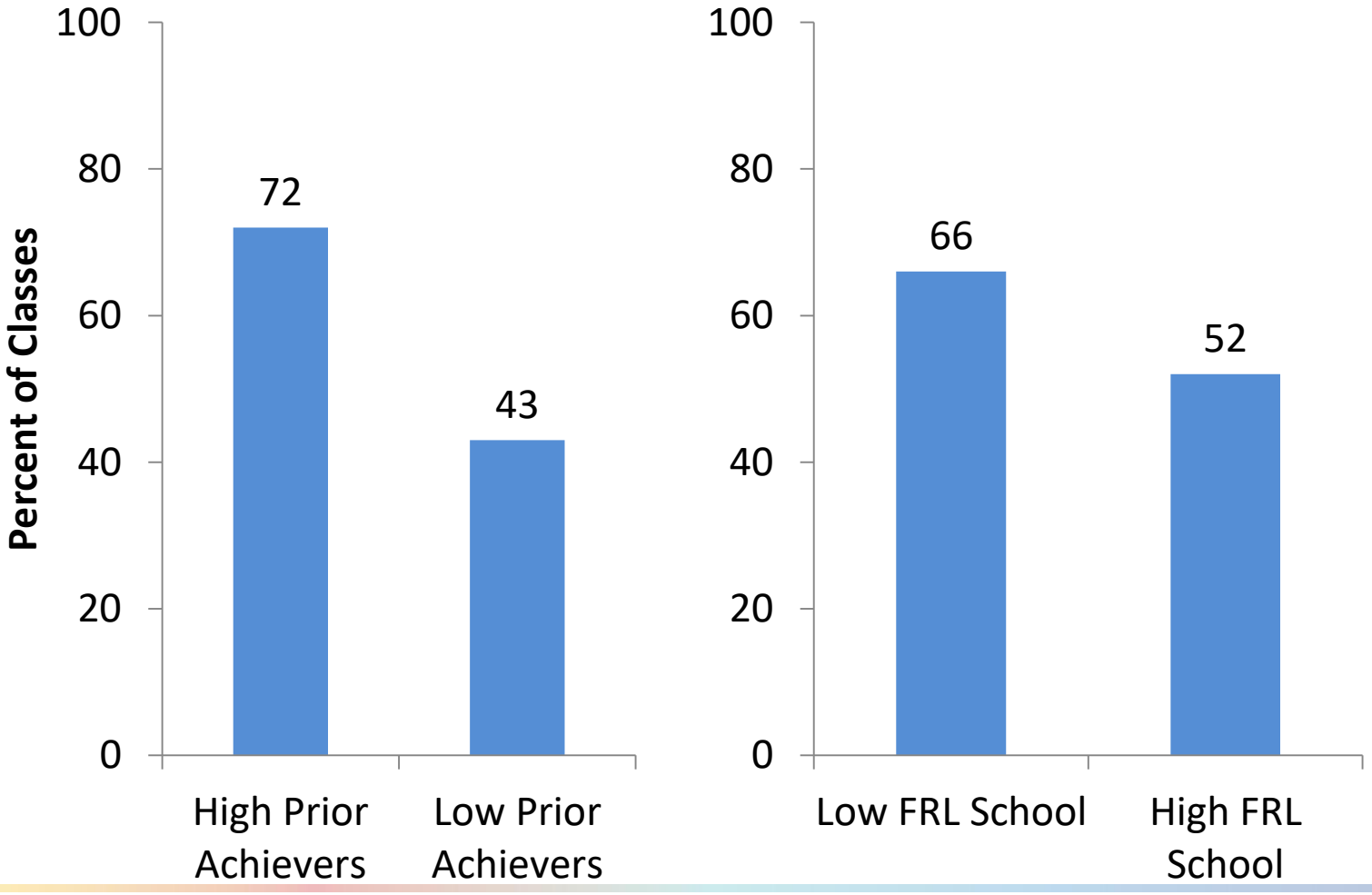
Middle School Teachers' College Coursework, by Course Taught



High School Teachers' College Coursework, by Course Taught



Equity Analyses: Secondary Classes Taught by Teacher With Degree/3+ Advanced Courses



Science Teachers Take-Aways

Sizeable proportion of the science teacher workforce is newer and likely still honing their craft

Sizeable proportion is nearing retirement, meaning new teachers will be taking their place

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

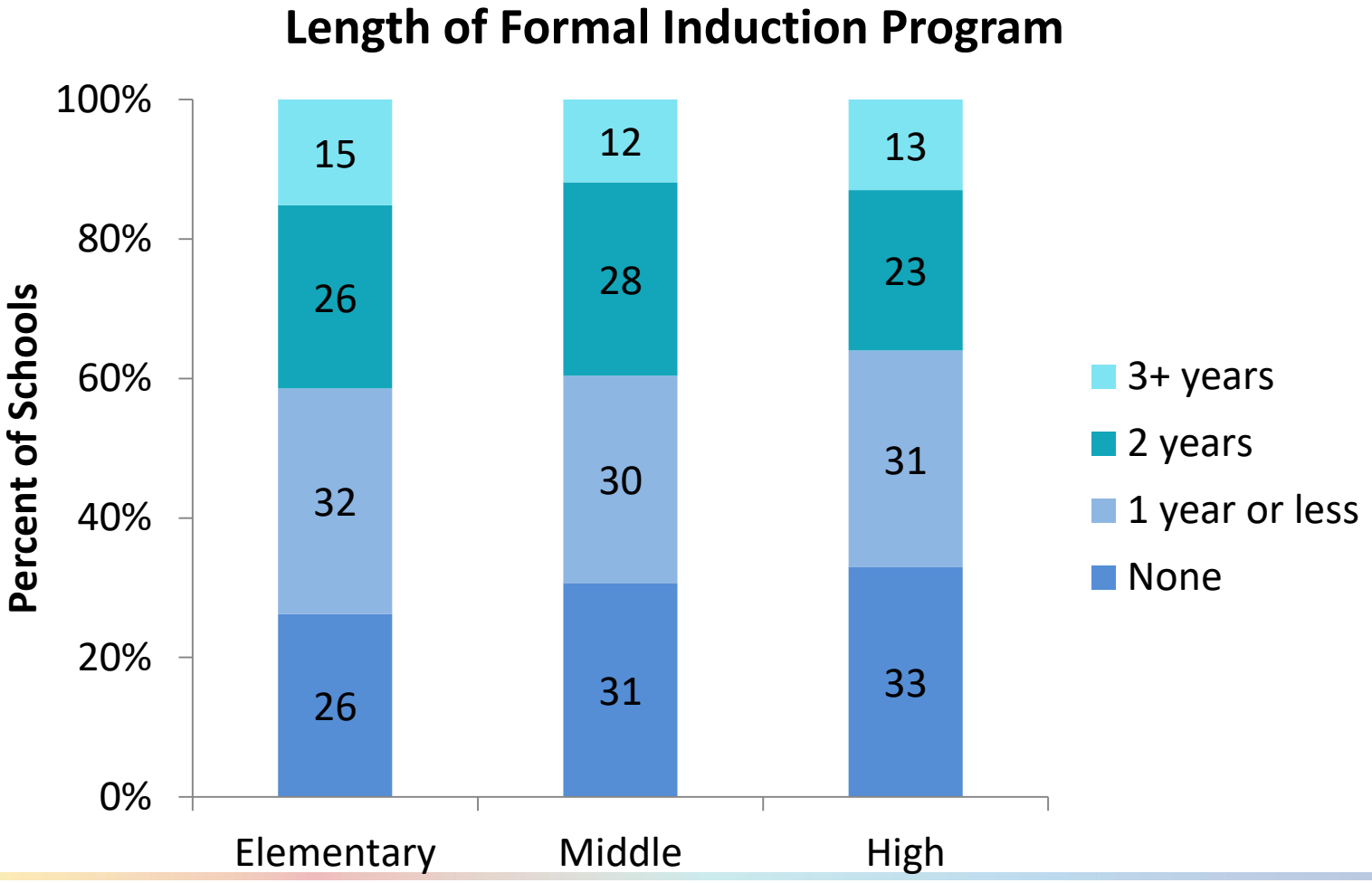
Induction Programs

Ideally, how long should induction programs last?

A. One year or less
B. Two years
C. Three or more years

Ideally, what supports should be provided?

Induction Programs



Induction Programs

Typical features

- An orientation meeting
- Formal school-based mentor
- Subject-specific PD opportunities
- Release time to observe other teachers
- Common planning time with experienced teachers

Uncommon features

- Classroom aide/teaching assistant
- Reduced number of preparations
- Reduced course load
- Reduced class size

Mentors

Of schools with formally assigned mentors:

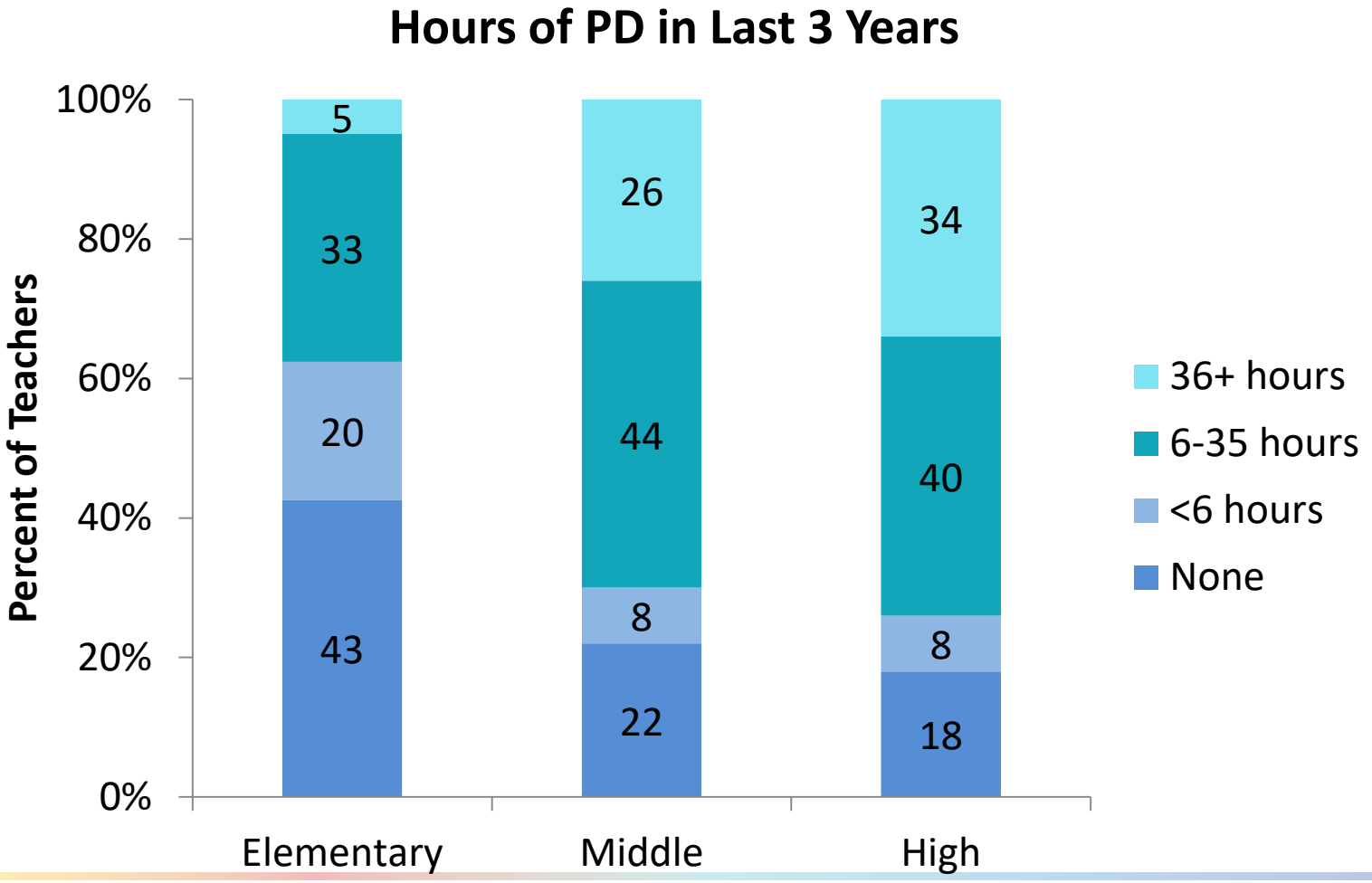
- 88% assign mentors who teach the same subject or grade level as mentee (when feasible)
- 70% intentionally give mentors common planning time with mentees
- 66% give training on effective mentoring practices
- 66% give mentors extra compensation
- 39% require mentors to attend workshops with mentees
- 25% give mentors release time or reduced course load

Professional Development

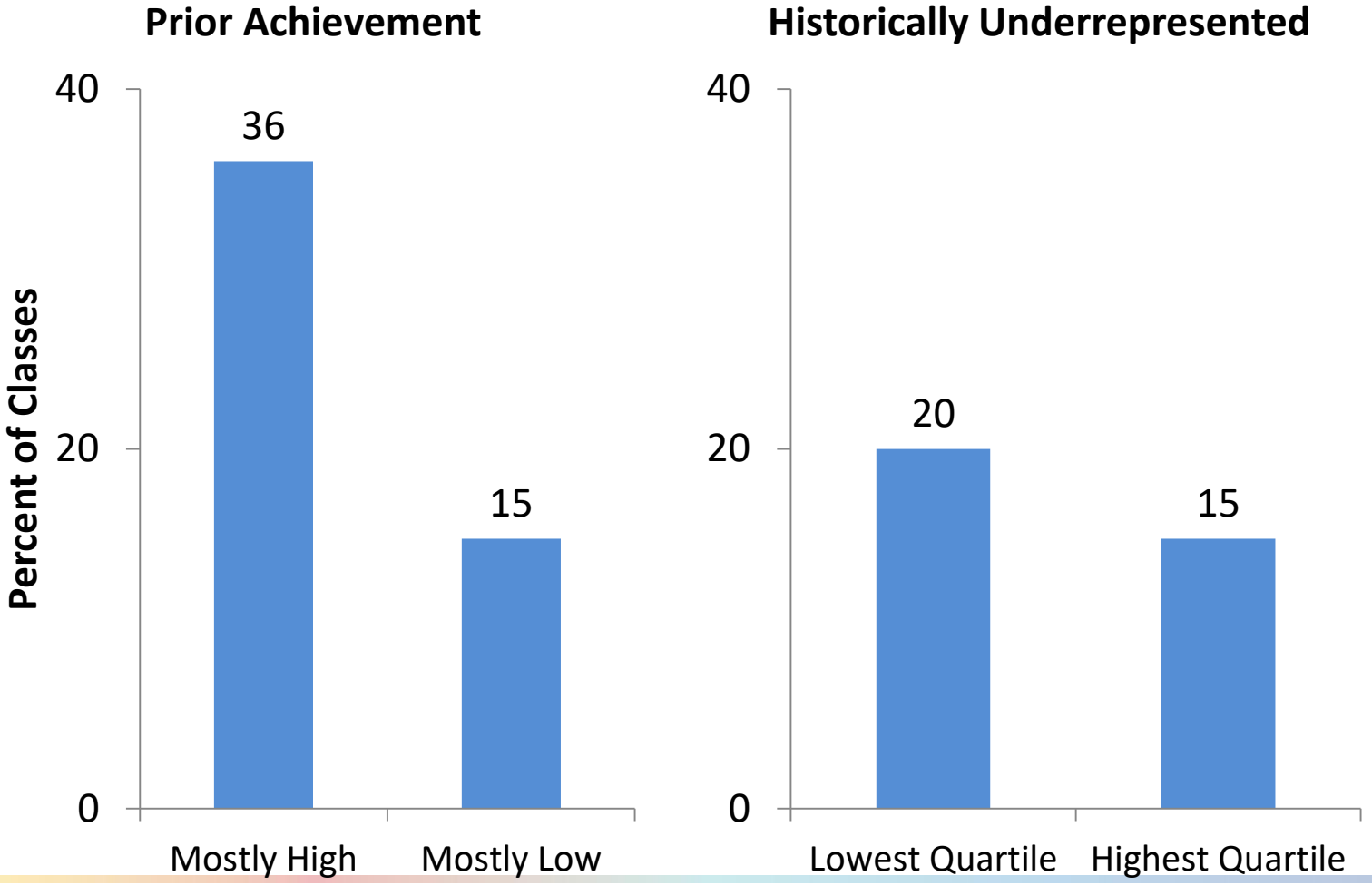
About what percentage of elementary teachers have had <u>any</u> science-related PD in the last three years?

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

Professional Development



Equity Analyses: Teachers with 36+ Hours of PD in Last 3 Years



Characteristics of PD

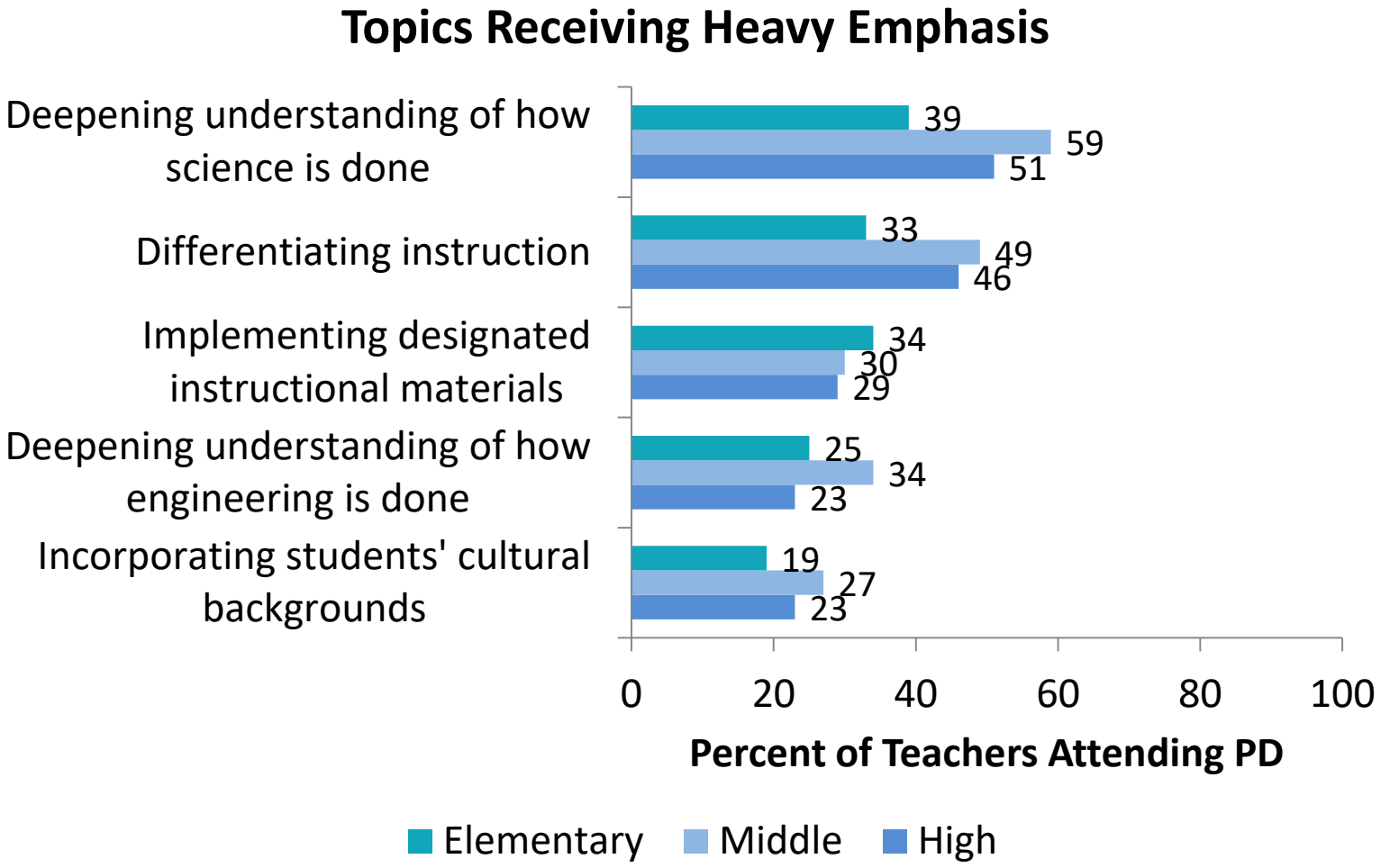
	Percent of Teachers Attending PD		
	Elementary	**Middle**	**High**
Work closely with other teachers in school	57	62	55
Work with those teaching same subject or grade level	47	53	54
Engage in science investigations or engineering design challenges	38	46	45
Experience lessons as students	43	40	45
Apply 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 Take-Aways

A large majority of schools have new teacher induction programs, though duration and nature vary

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

PD often has characteristics identified as high quality

Implications

The education system is perfectly designed to get the results it gets

Thus, achieving different outcomes requires changing the system

But that's hard and often has unintended consequences

My 2¢

I believe the vast majority of teachers are doing the very best for students that they are able

But the system seems stacked against them

We need to develop solutions that can be tailored to meet local needs, but that are scalable

Systemic inequities must be addressed

My ~~2¢~~ 4¢

Mentor teachers, both preservice and during induction, likely have a tremendous impact on new teachers—is this a feasible place to have a large impact?

It is unreasonable to expect elementary teachers to be experts in all subjects, even though they may be best positioned to the type of teaching envisioned in *A Framework for K-12 Science Education*

My ~~2¢~~ 4¢

Teachers should not be expected to develop their own instructional materials—most have neither the time nor the training to develop high-quality materials

Rather, they should be provided with high-quality tools (formative assessments, instructional materials, etc.) and trained on how to use and adapt them to serve diverse students

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