NSSME | THE NATIONAL SURVEY OF SCIENCE & MATHEMATICS EDUCATION

The Status of K-12 Computer Science Education: Results from the 2018 NSSME+

JULY 31, 2019

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Horizon RESEARCH, INC.

Session Overview

- About the 2018 NSSME+
- Current Status of Computer Science Instruction
  - Resources for Instruction
- The Computer Science Teaching Force
- Professional Development Experiences

About the 2018 NSSME+

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

- The 2018 NSSME+ included a new focus on computer science education.

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

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.

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

Equity

I'm also sharing some data disaggregated 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

Computer Science Instruction*

The 2018 NSSME+ collected data about:

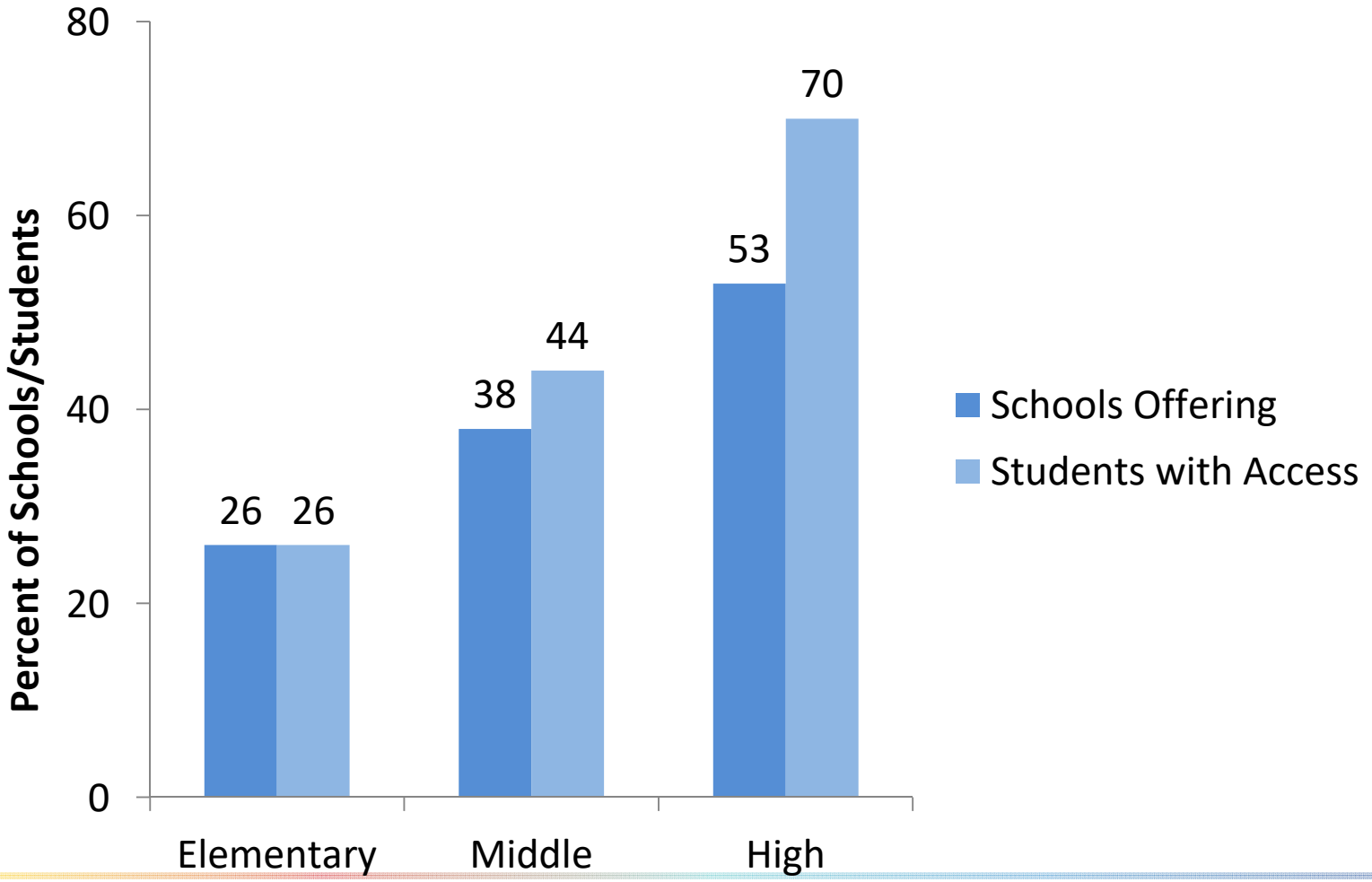
- Course offerings
- Integration of CS into science and mathematics
- Instructional objectives
- Pedagogies used
- Engagement in the practices of the discipline
- Homework and assessment practices
- Instructional materials used
- Other instructional resources

Computer Science Instruction

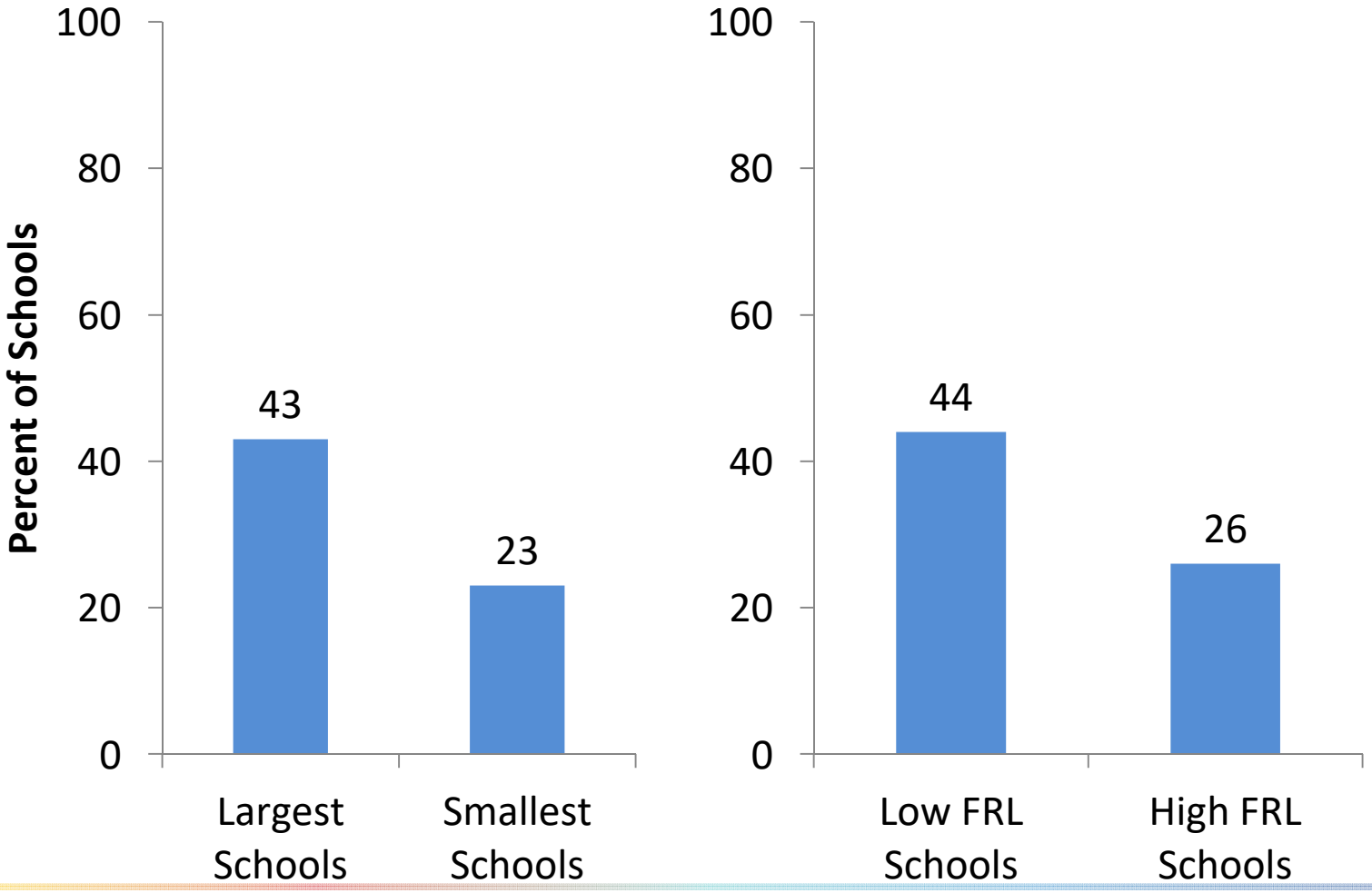
About what percentage of high schools offer computer science courses?

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

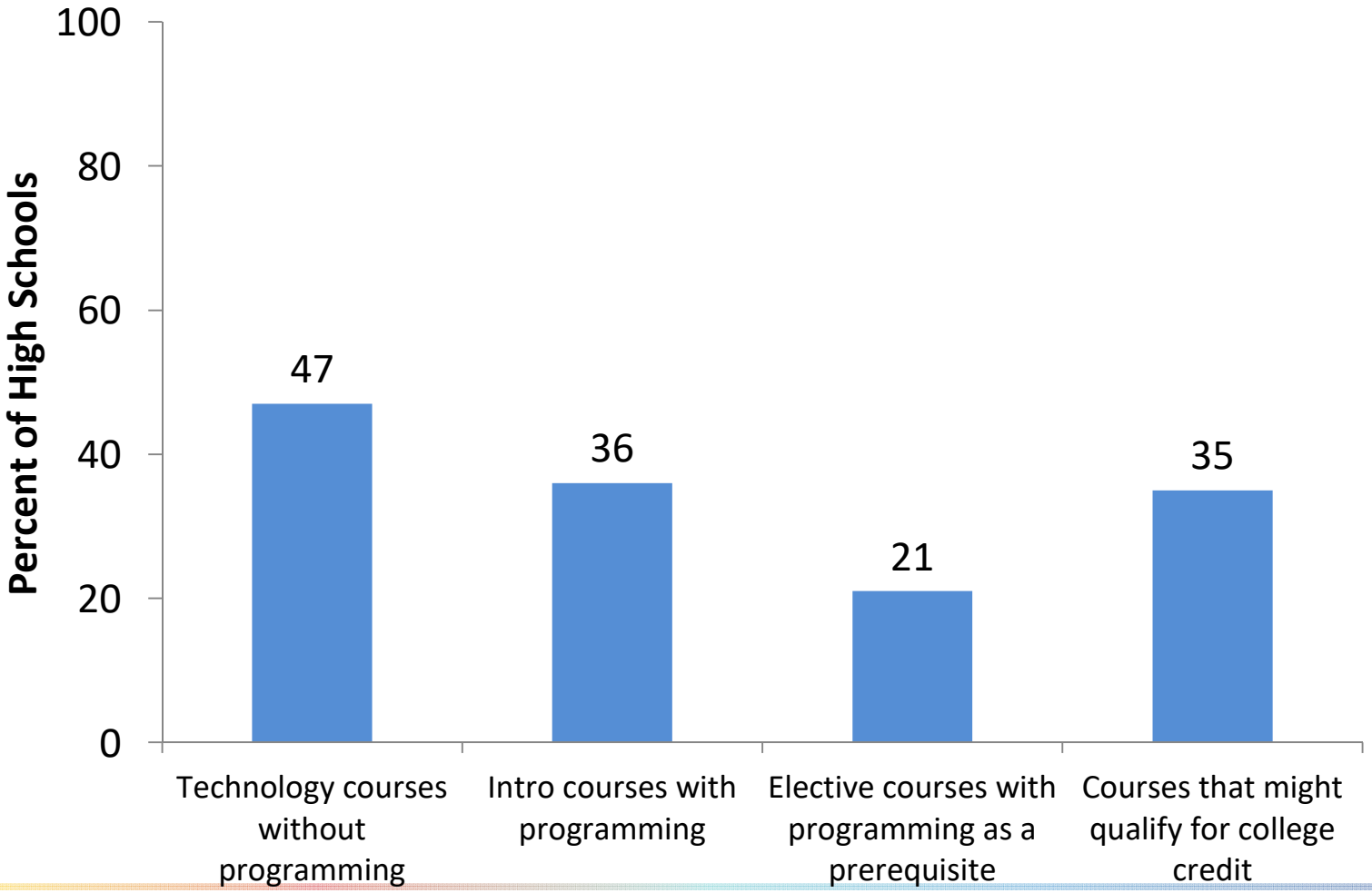
Schools Offering Computer Science Instruction



Equity Analysis: Schools Offering Computer Science Instruction

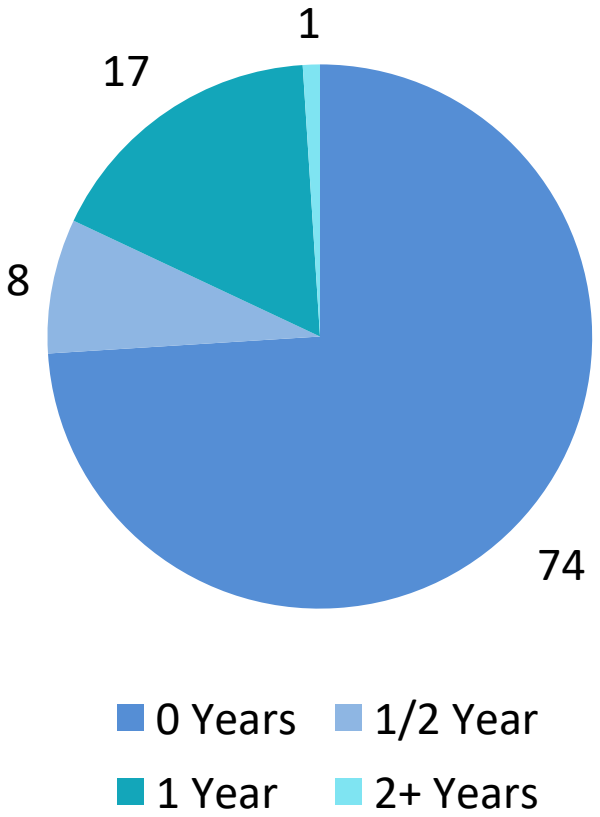


High Schools Offering Computer Science and Technology Courses

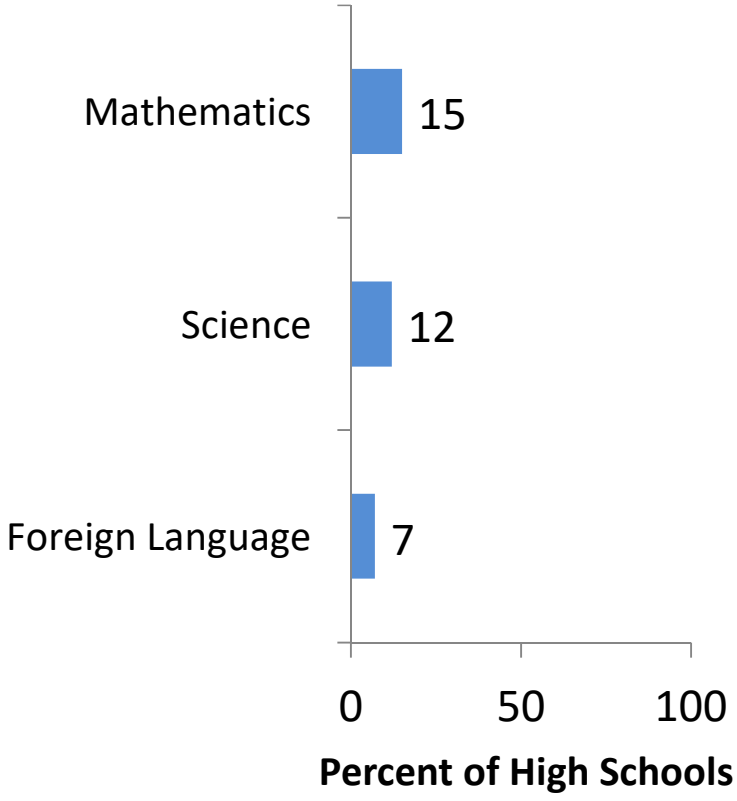


High School CS Graduation Credit

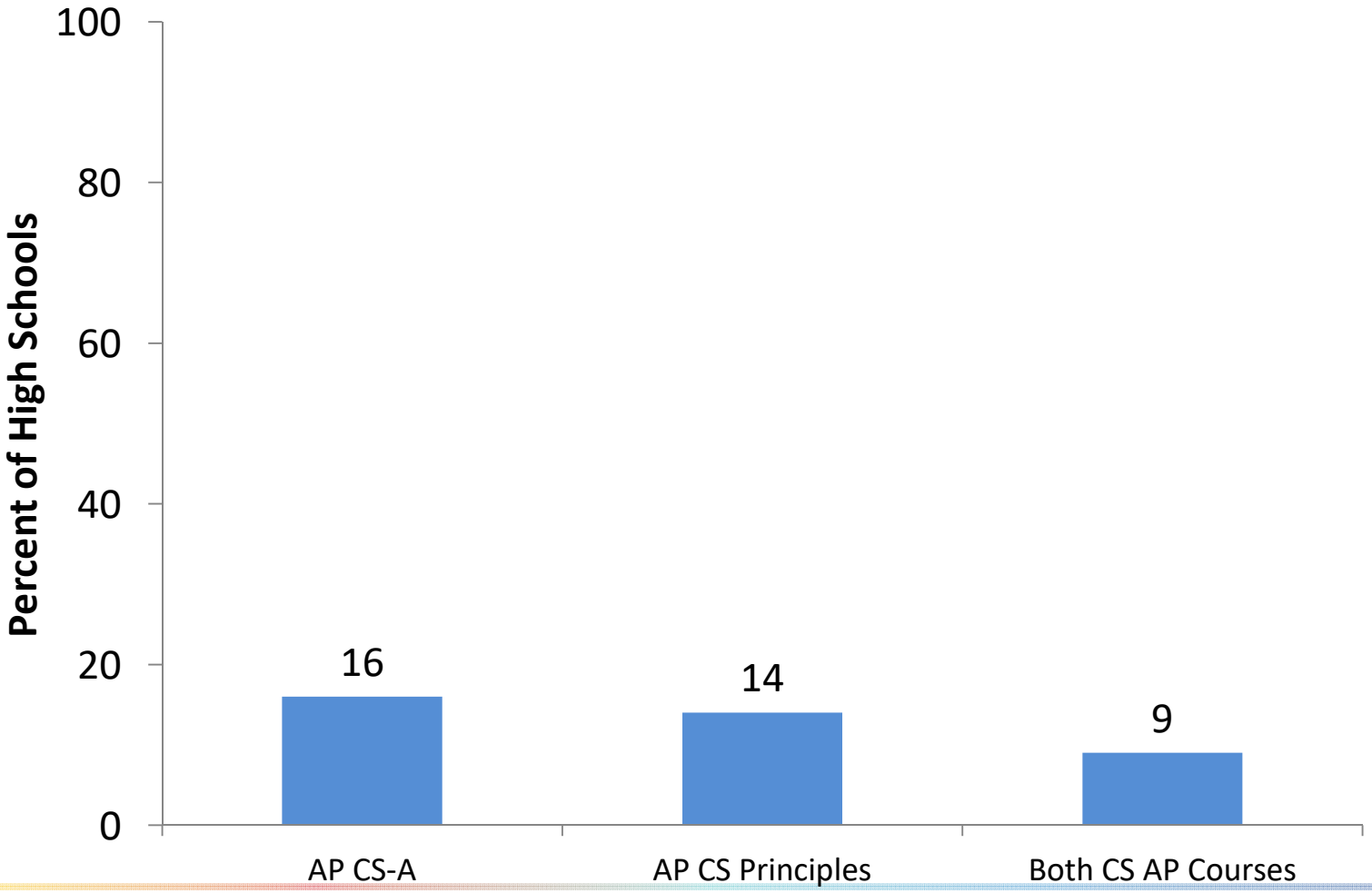
Percent of High Schools Requiring…



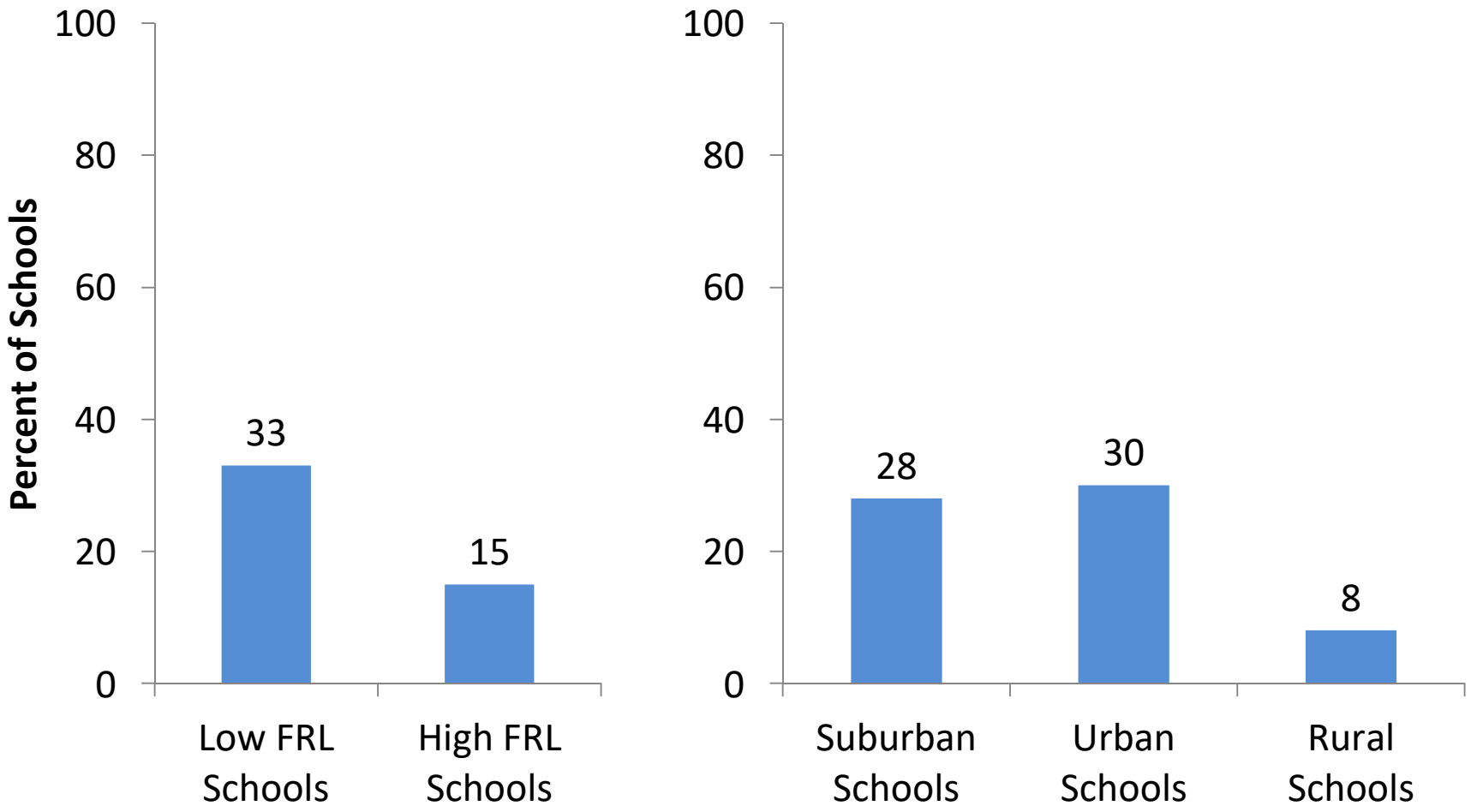
Meets Graduation Requirement In…



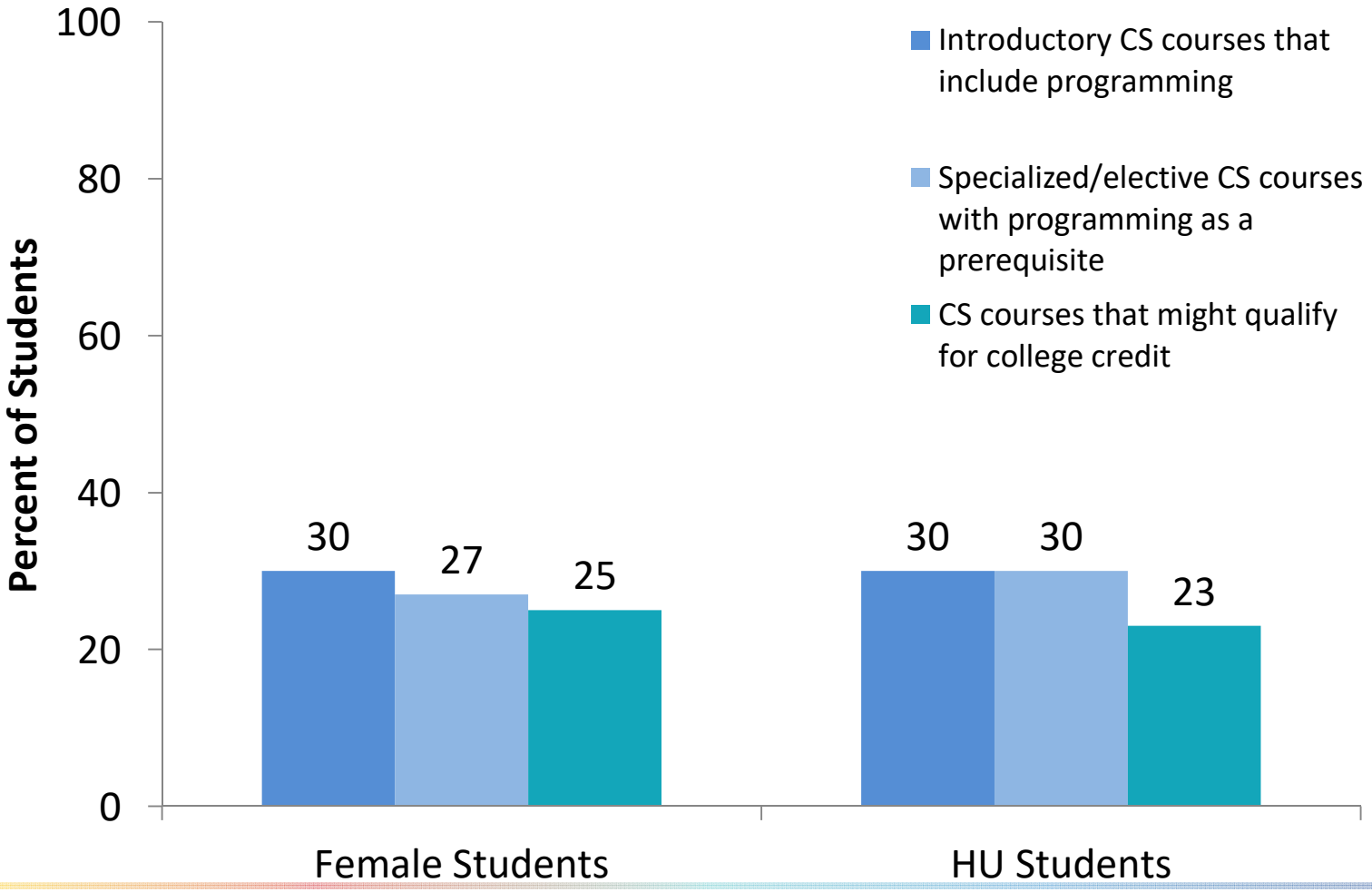
High Schools Offering AP Computer Science Courses



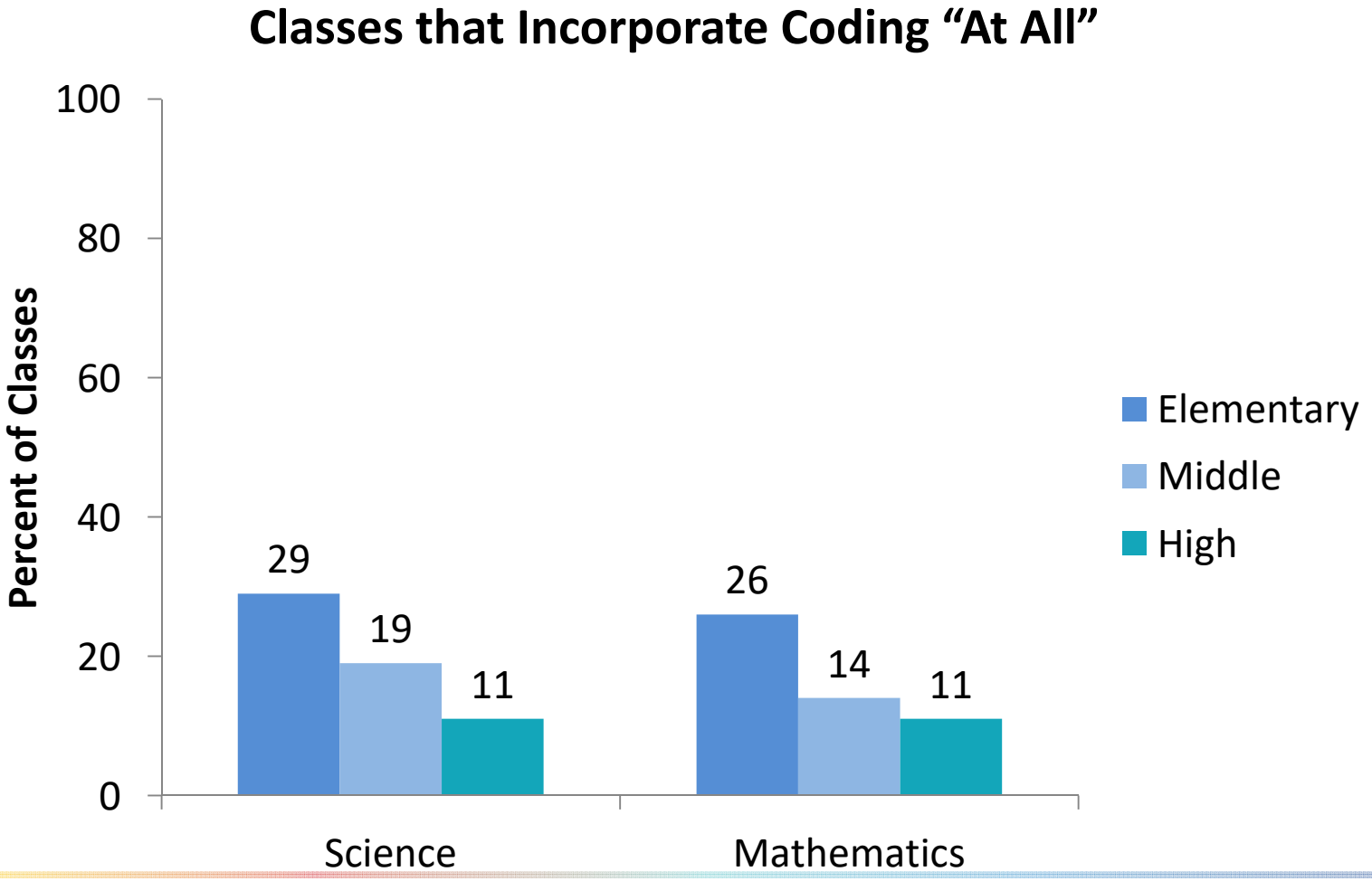
Equity Analysis: High Schools Offering AP CS



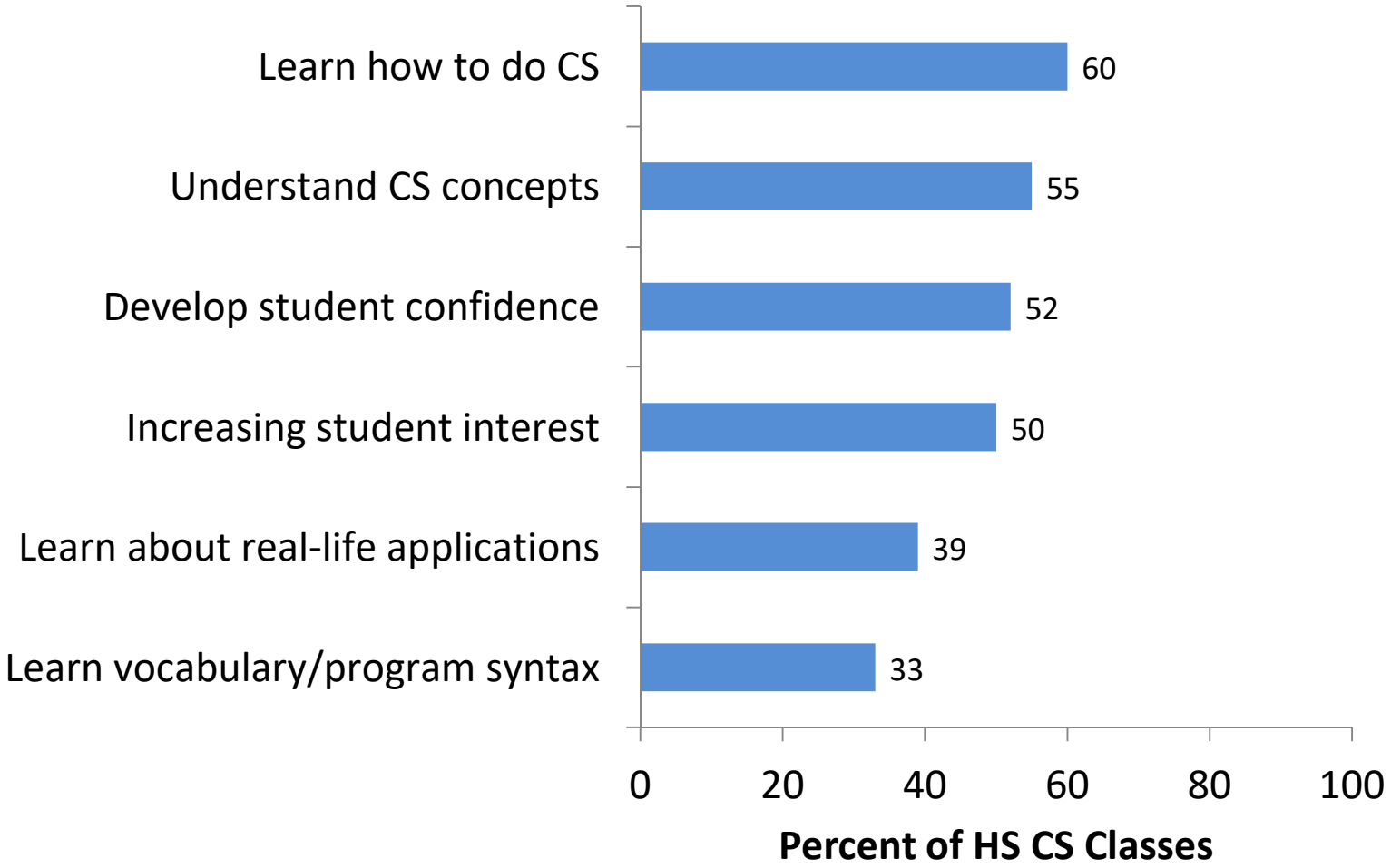
Equity Analysis: High School Students Taking CS Courses



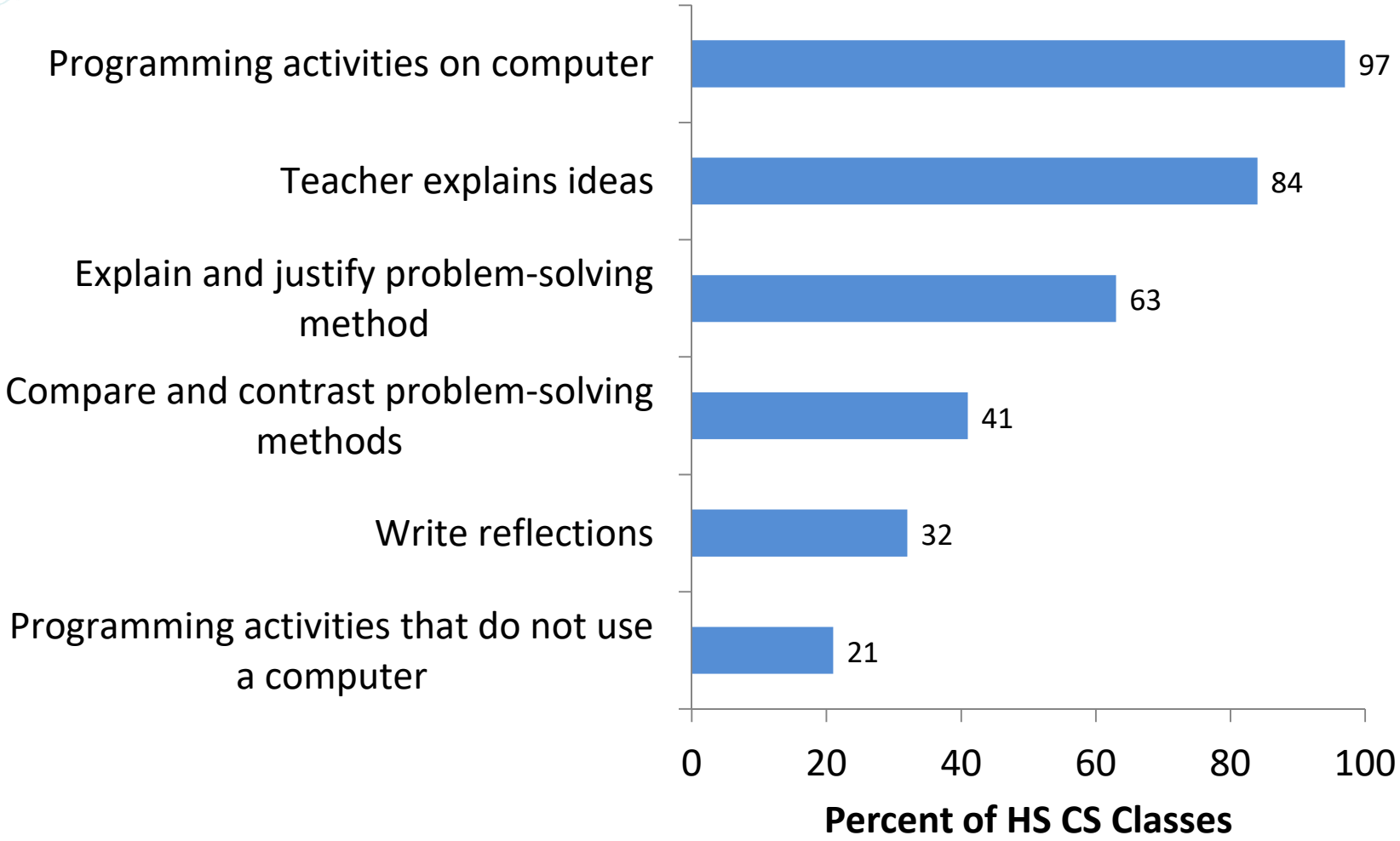
CS in Science and Mathematics Instruction



Objectives Receiving a Heavy Emphasis



Instructional Activities: Weekly



Engagement in Computer Science Practices

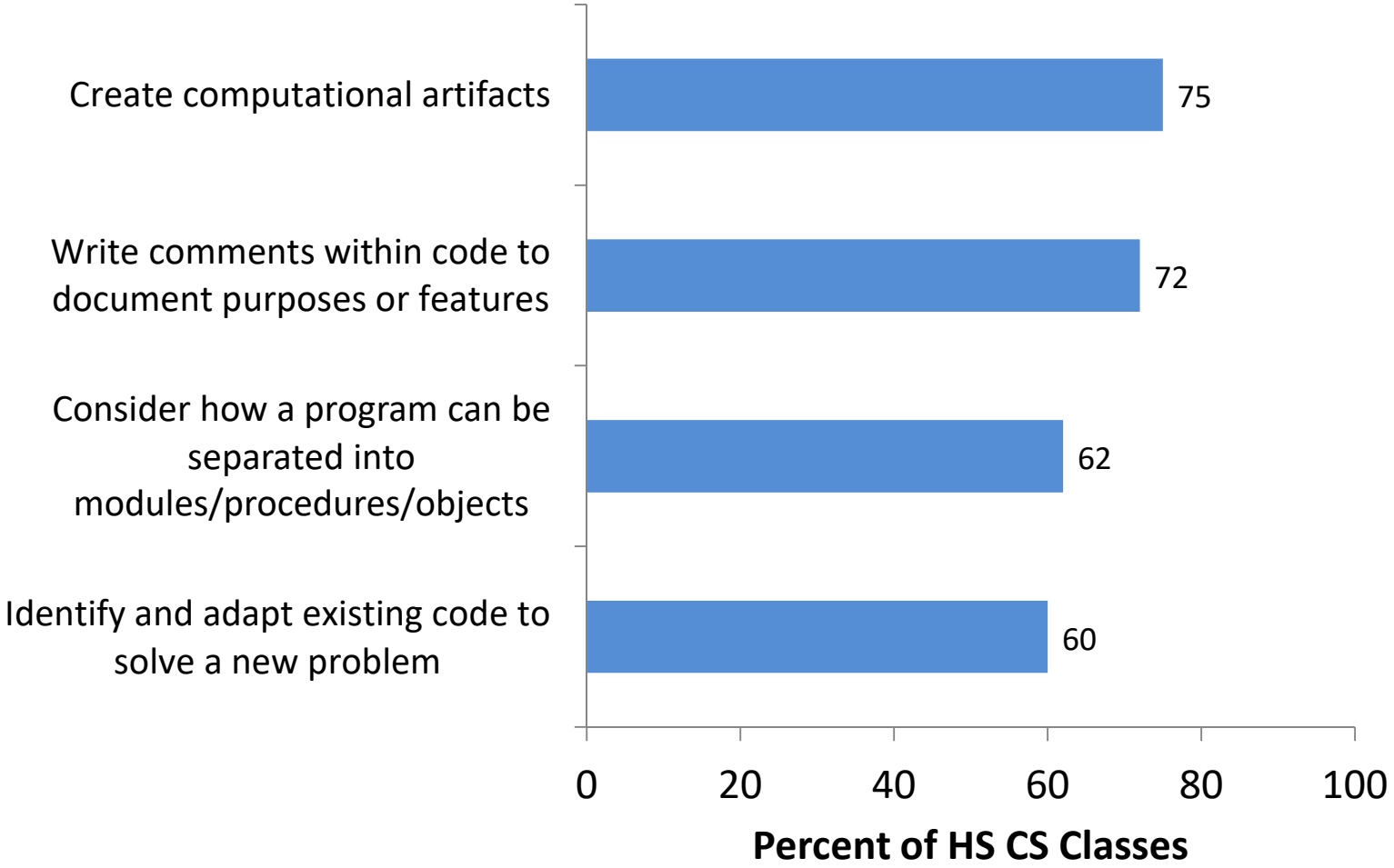
The 2018 NSSME+ included a series of items asking how often students were engaged in aspects of the computer science practices:

1. Fostering an inclusive computing culture
2. Collaborating around computing
3. Recognizing and defining computational problems
4. Developing and using abstractions
5. Creating computational artifacts
6. Testing and refining computational artifacts
7. Communicating about computing

Engagement in Computer Science Practices

Students are often engaged in aspects of computer science related to developing computational artifacts

Developing Computational Artifacts: Weekly

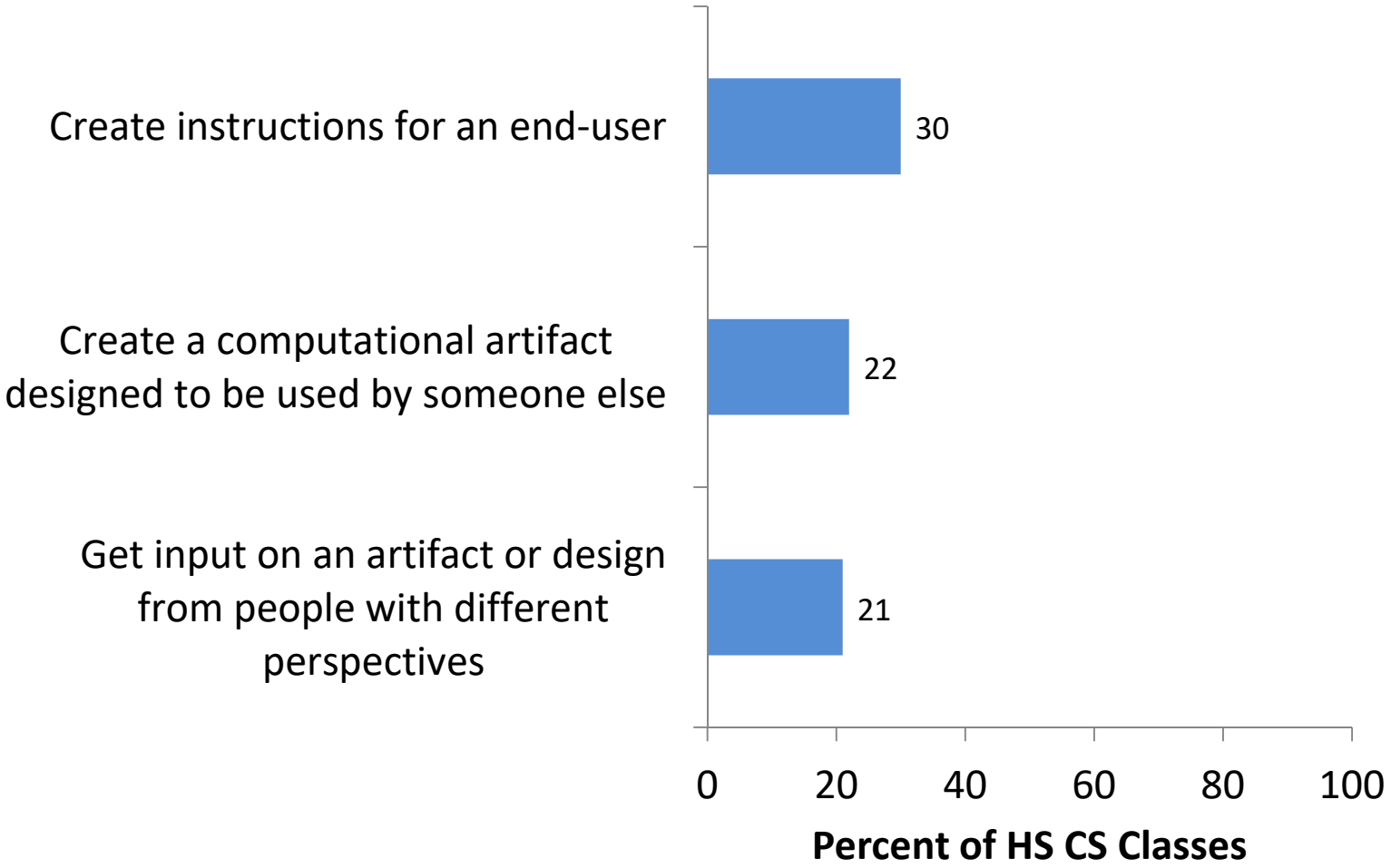


Engagement in Computer Science Practices

Students are often engaged in aspects of computer science related to developing computational artifacts

Students tend not to be engaged very often in aspects of computer science related to communicating with end-users or considering diverse needs

Considering End Users: Weekly



Instructional Materials

About what percentage of high school computer science classes base instruction on commercially published textbooks at least once a week?

A. 25%

B. 50%

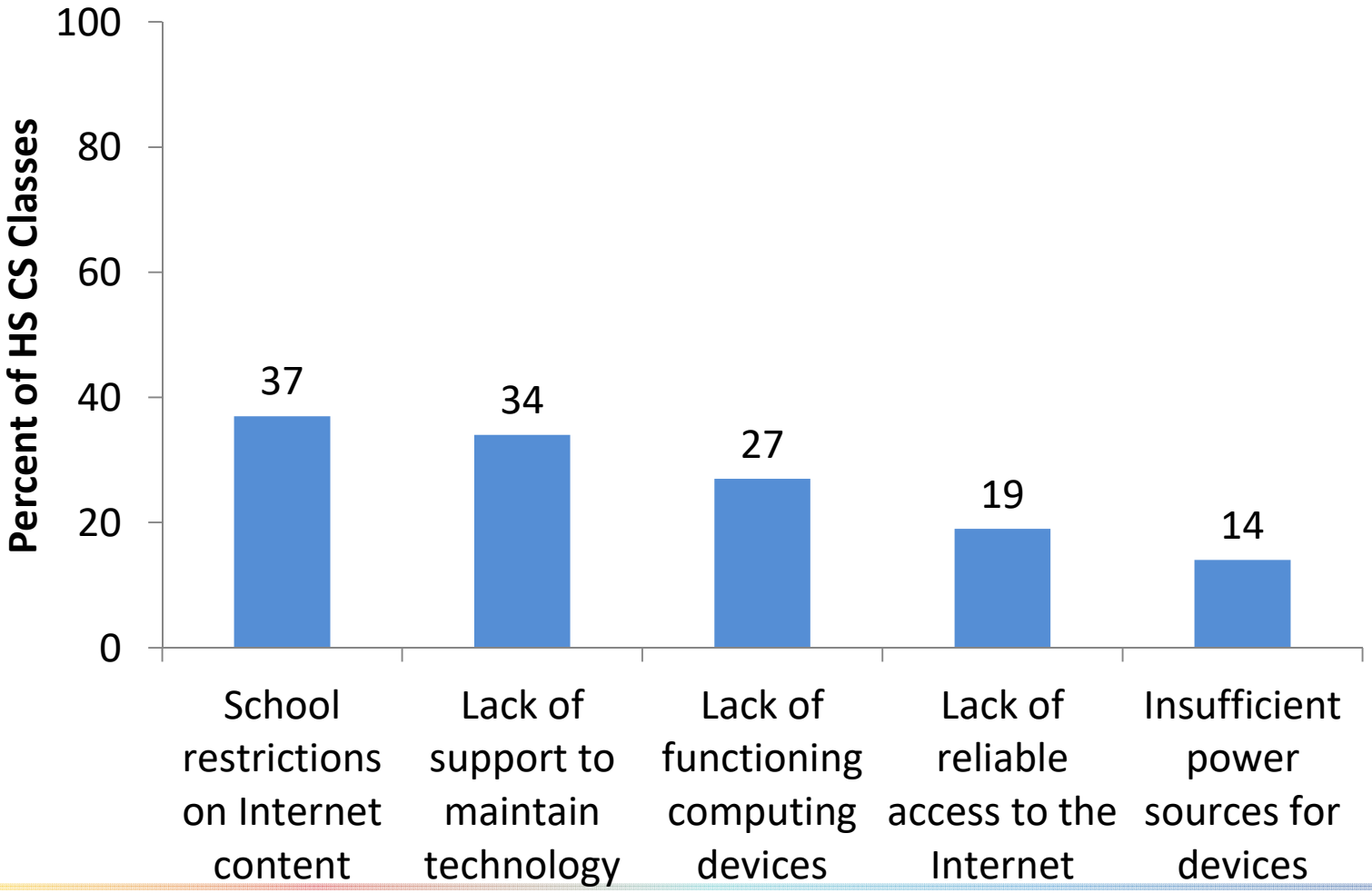
C. 75%

D. 100%

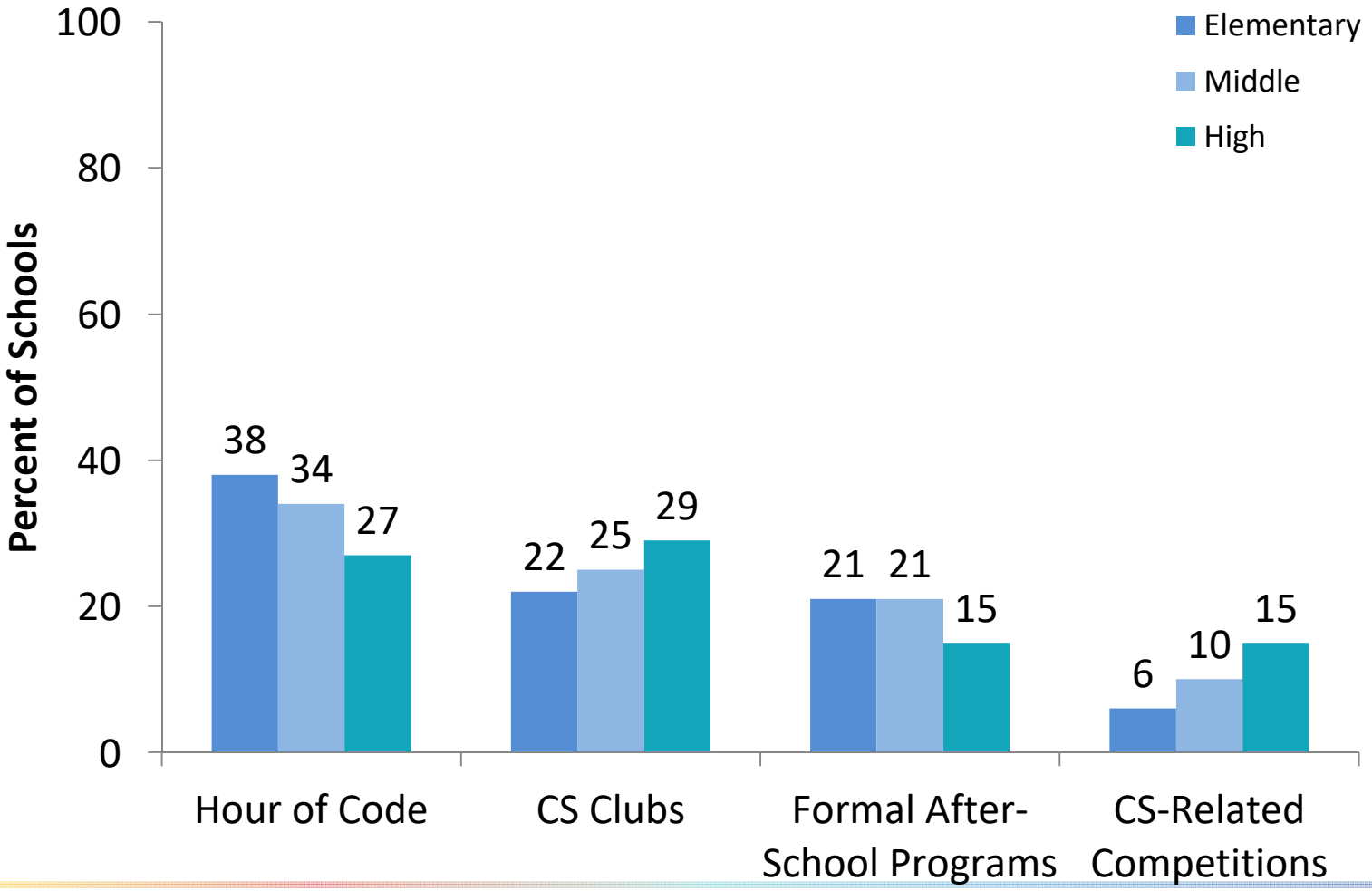
Instructional Materials Used (Weekly)

	Percent of Classes
Teacher-developed units or lessons	64
Units or lessons from websites that are free	43
Self-paced online courses or units	32
Units or lessons from other sources (e.g., conferences or colleagues)	28
Commercially published textbooks (printed or online)	26
Lessons or resources from websites that have a subscription fee or cost	9
State, county, district, or diocese-developed unit or lessons	7

Factors Perceived as Problems



School Enrichment Programs



Computer Science Instruction Takeaways

Only about half of high schools offer computer science; it is less common in smaller schools, high-poverty schools, and rural schools

Computer science instruction is relatively rare at elementary and middle schools

On average, female students and students from race/ethnicity groups historically underrepresented in STEM make up less than a third of students in high school computer science classes

Students work on creating computational artifacts often, but are not asked to attend to end-users' needs nearly as often

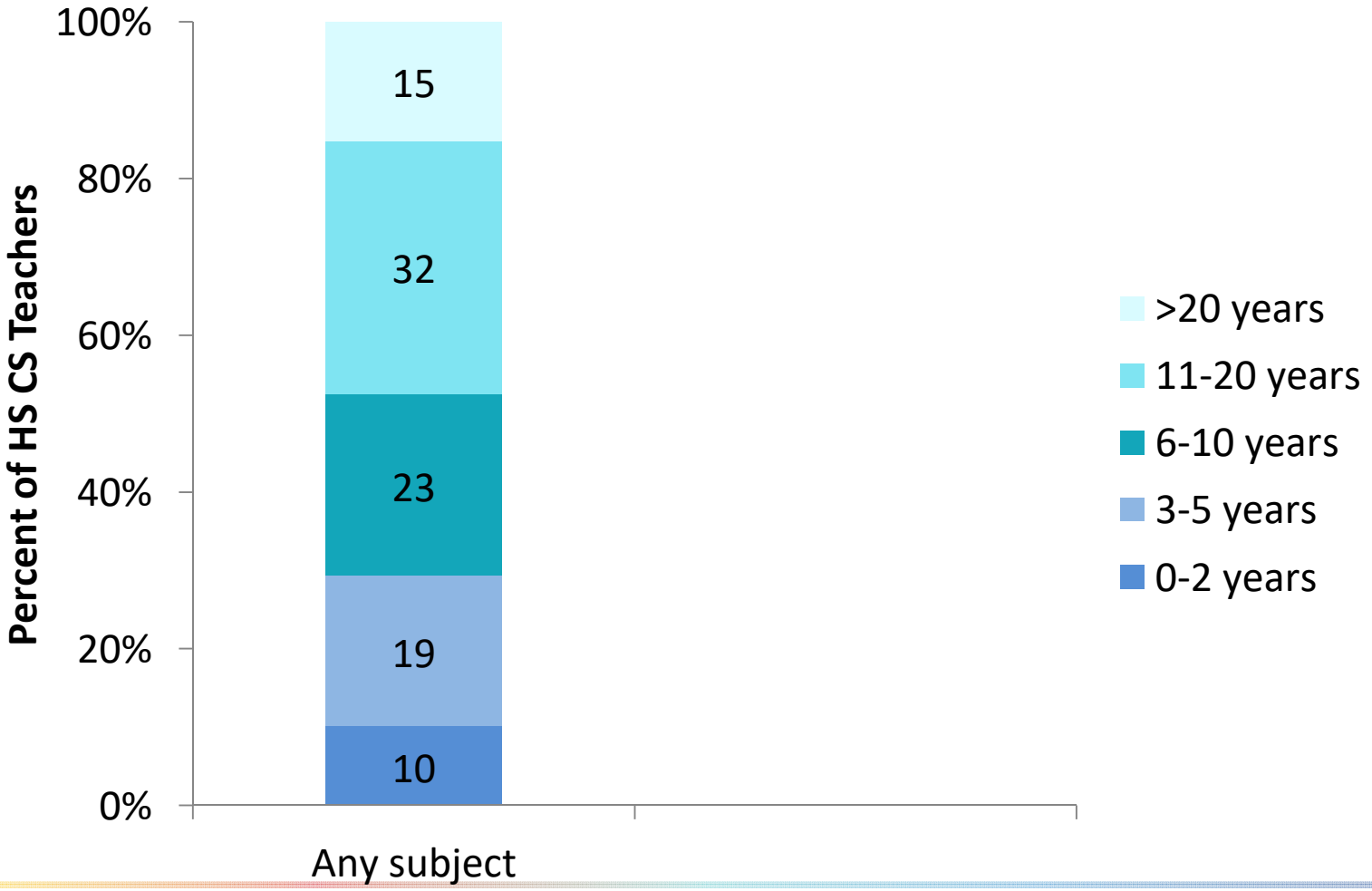
Teachers are often using self-developed units and lessons, and picking and choosing from other sources, raising questions about quality and coherence

The Computer Science Teaching Force

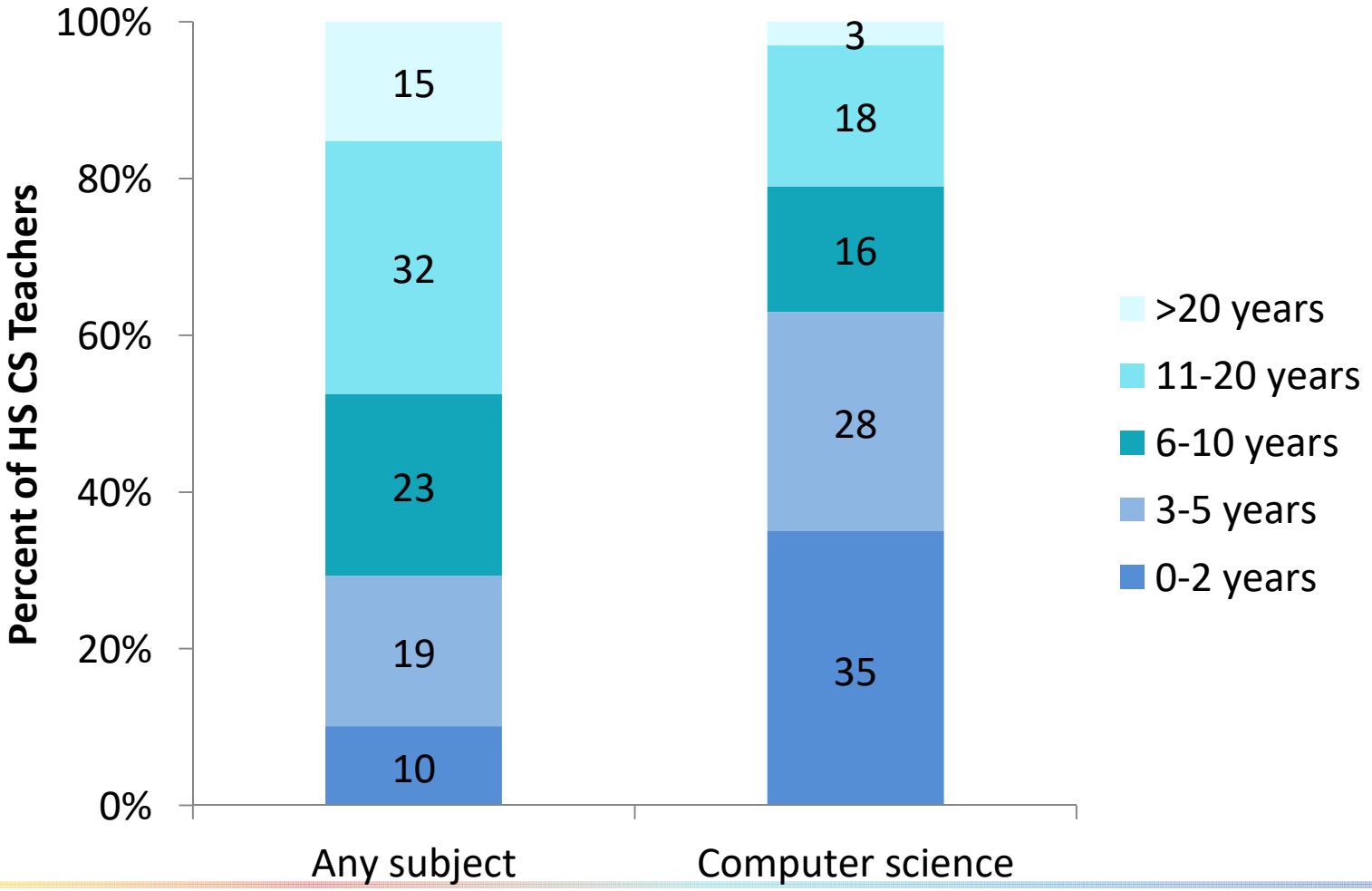
The 2018 NSSME+ collected data about:

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

Teaching Experience



Teaching Experience



Certification

About what percentage of high school computer science teachers are certified to teach computer science?

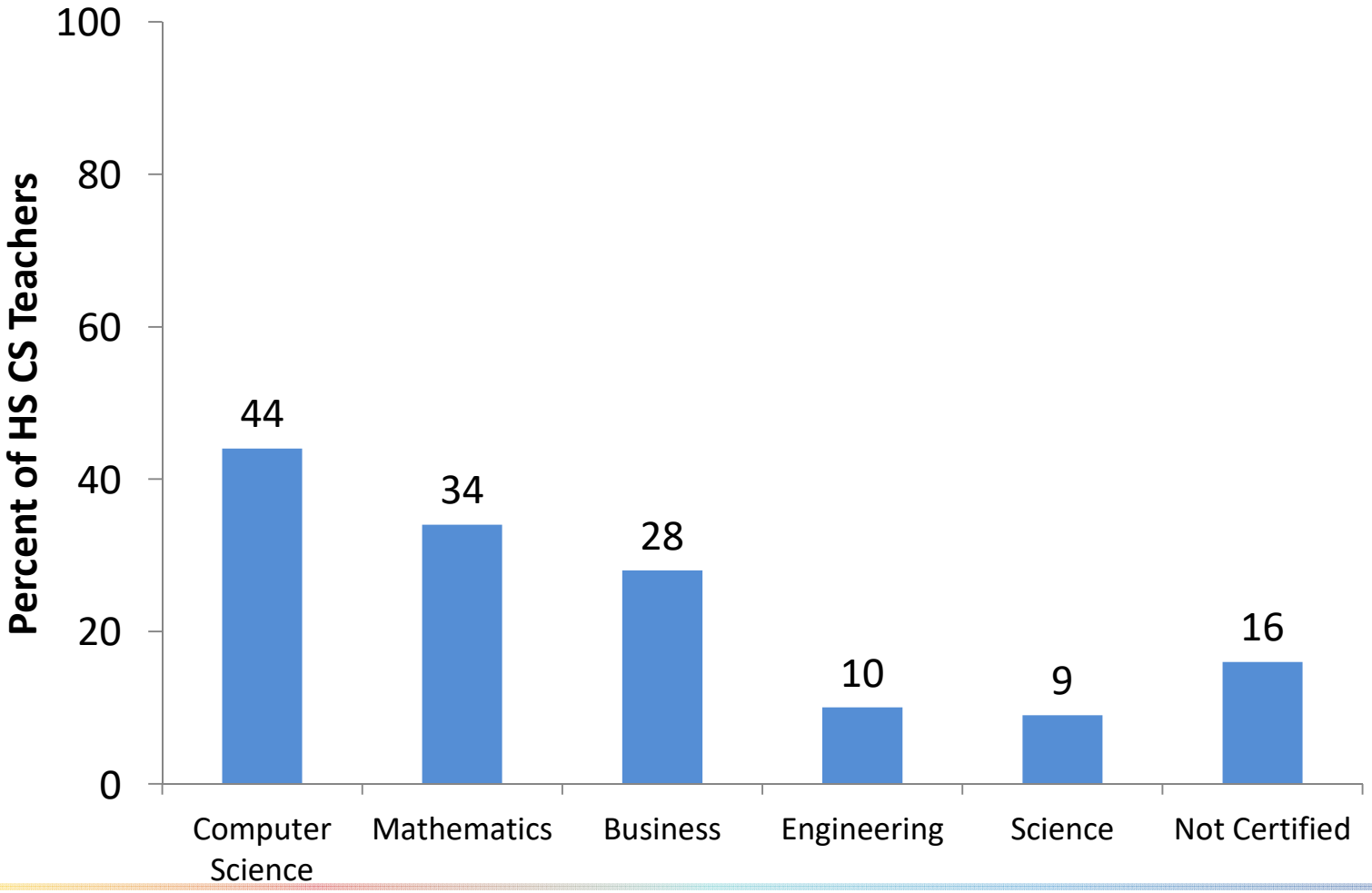
A. 25%

B. 50%

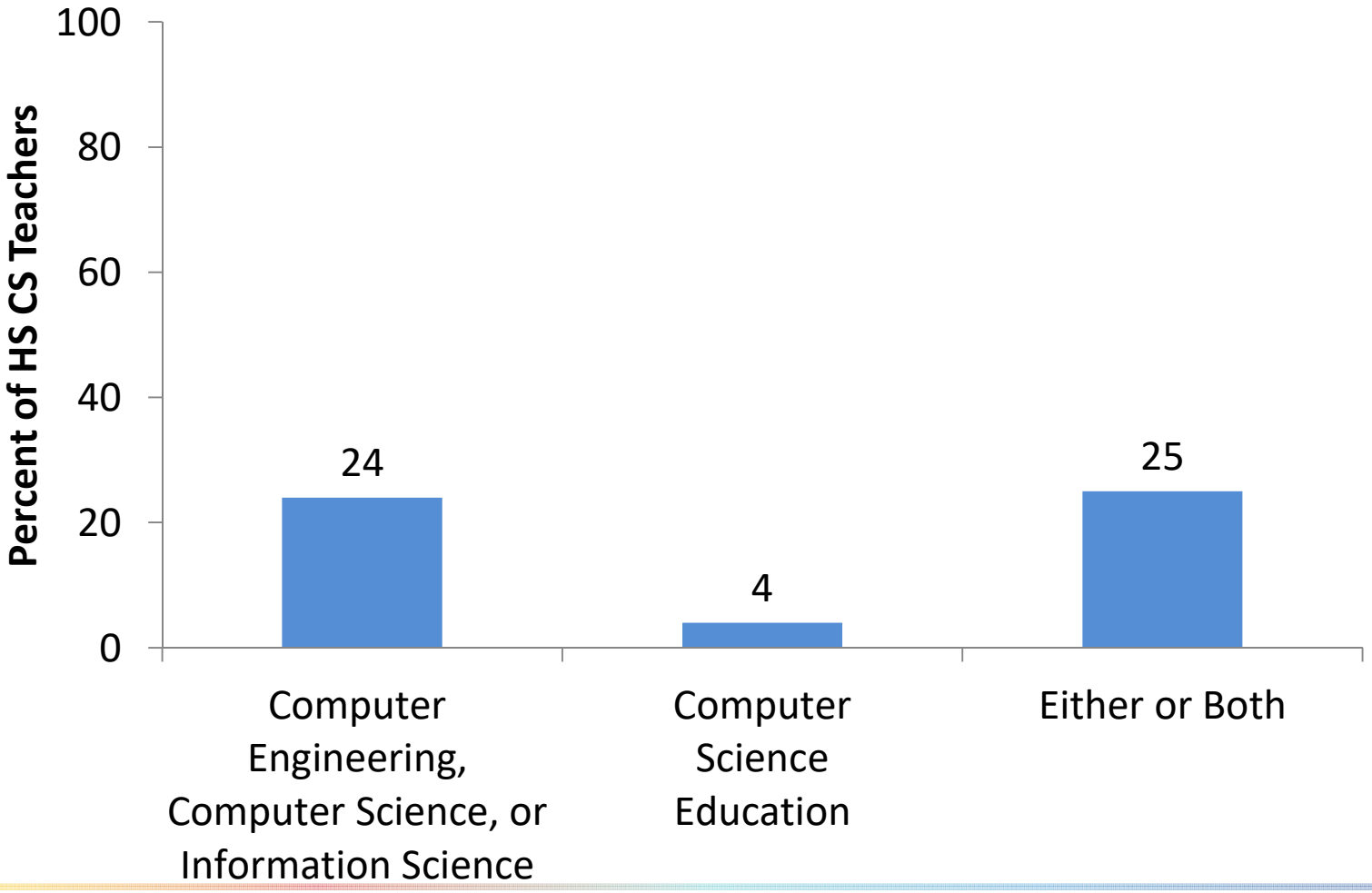
C. 75%

D. 100%

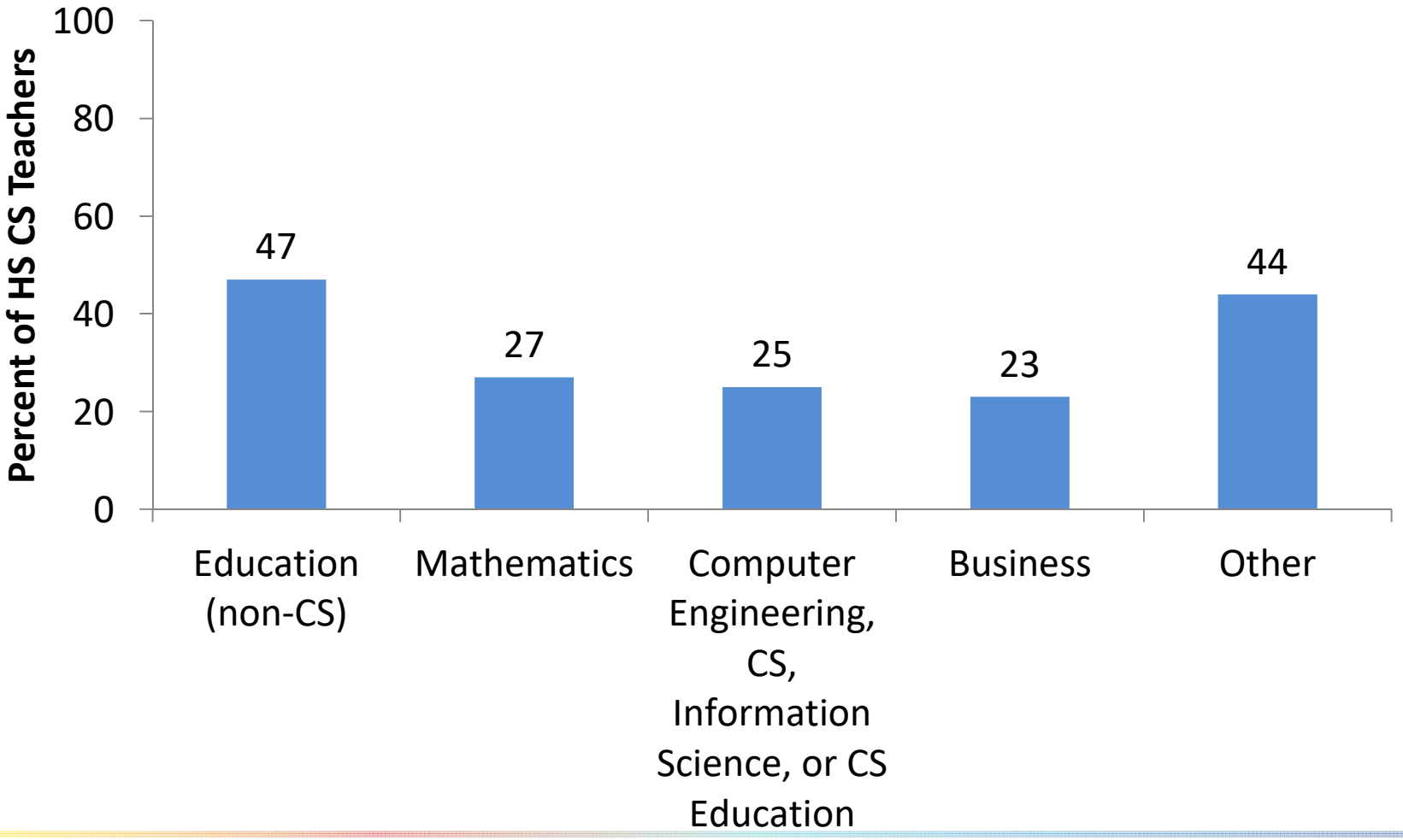
Areas of Certification



Degree in Computer Science/ Related Field/CS Education



Computer Science Teacher Degrees



CSTA/ISTE CS Teacher Preparation Recommendations

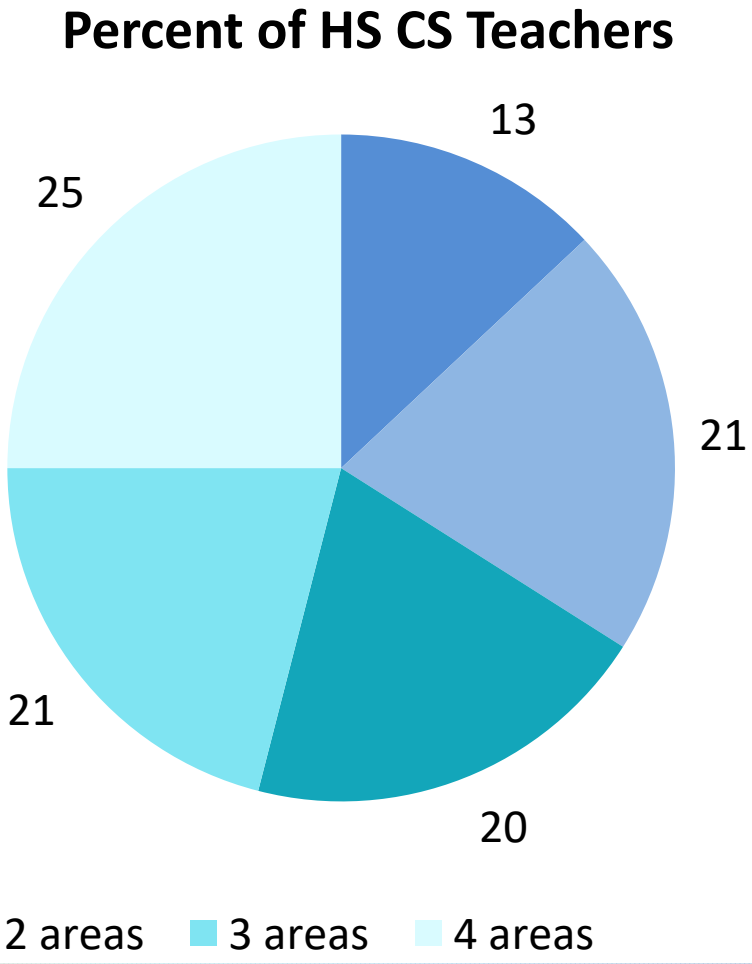
Similar recommended content knowledge for CS educators from CSTA and ISTE

Combined, they suggest teachers have coursework in four content areas:

- Programming
- Algorithms
- Data structures
- Computer systems or networks

Coursework Related to CSTA/ISTE Course-Background Standards

Programming
Algorithms
Data structures
Computer systems/networks

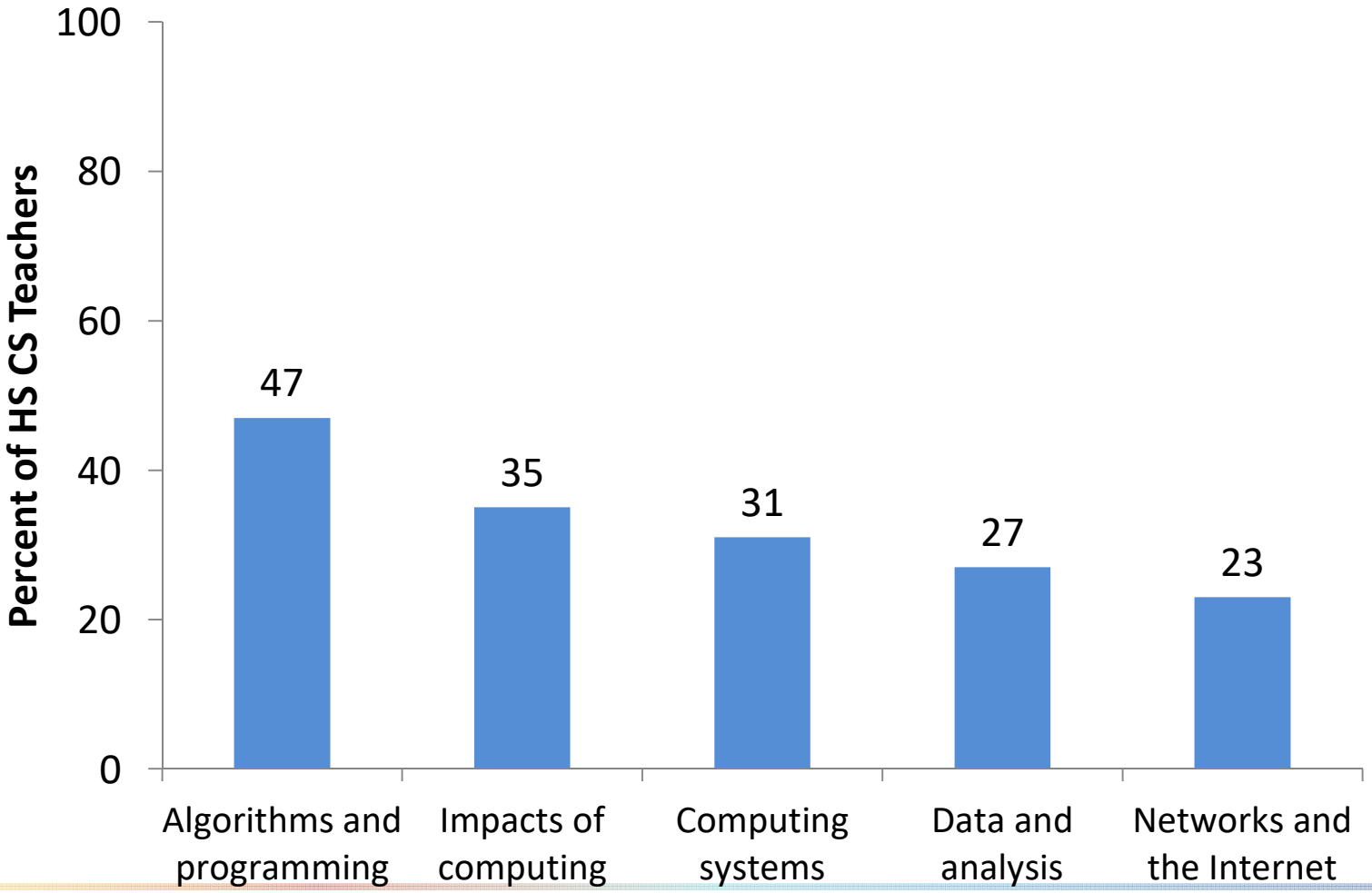


Perceptions of Preparedness

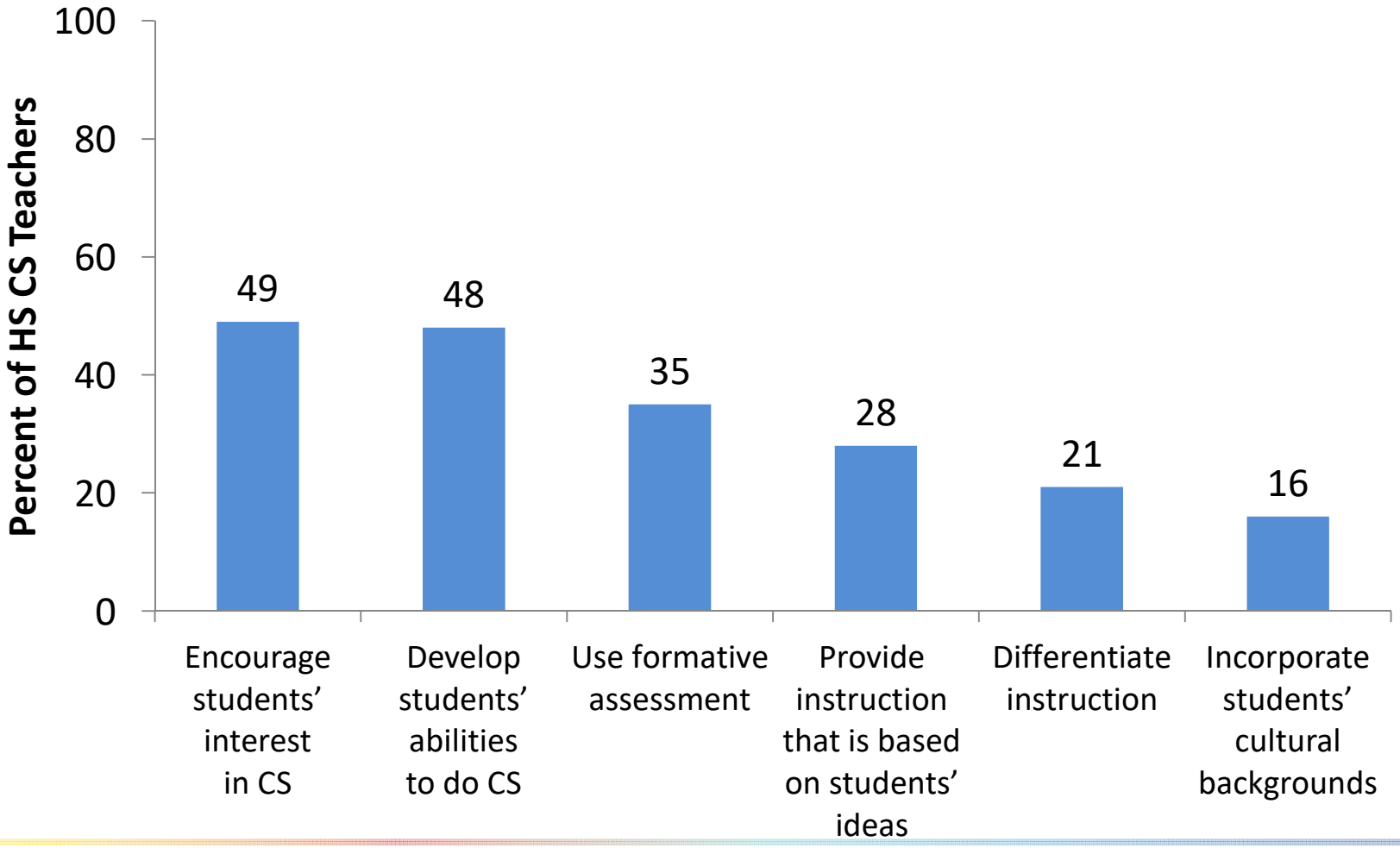
The 2018 NSSME+ included items about teachers' feelings of preparedness to:

- Teach core computer science ideas
- Use student-centered pedagogies, e.g.:
  - Use formative assessment
  - Develop student abilities to do computer science
  - Encourage student interest in computer science
  - Differentiate instruction
  - Incorporate students' cultural backgrounds into instruction

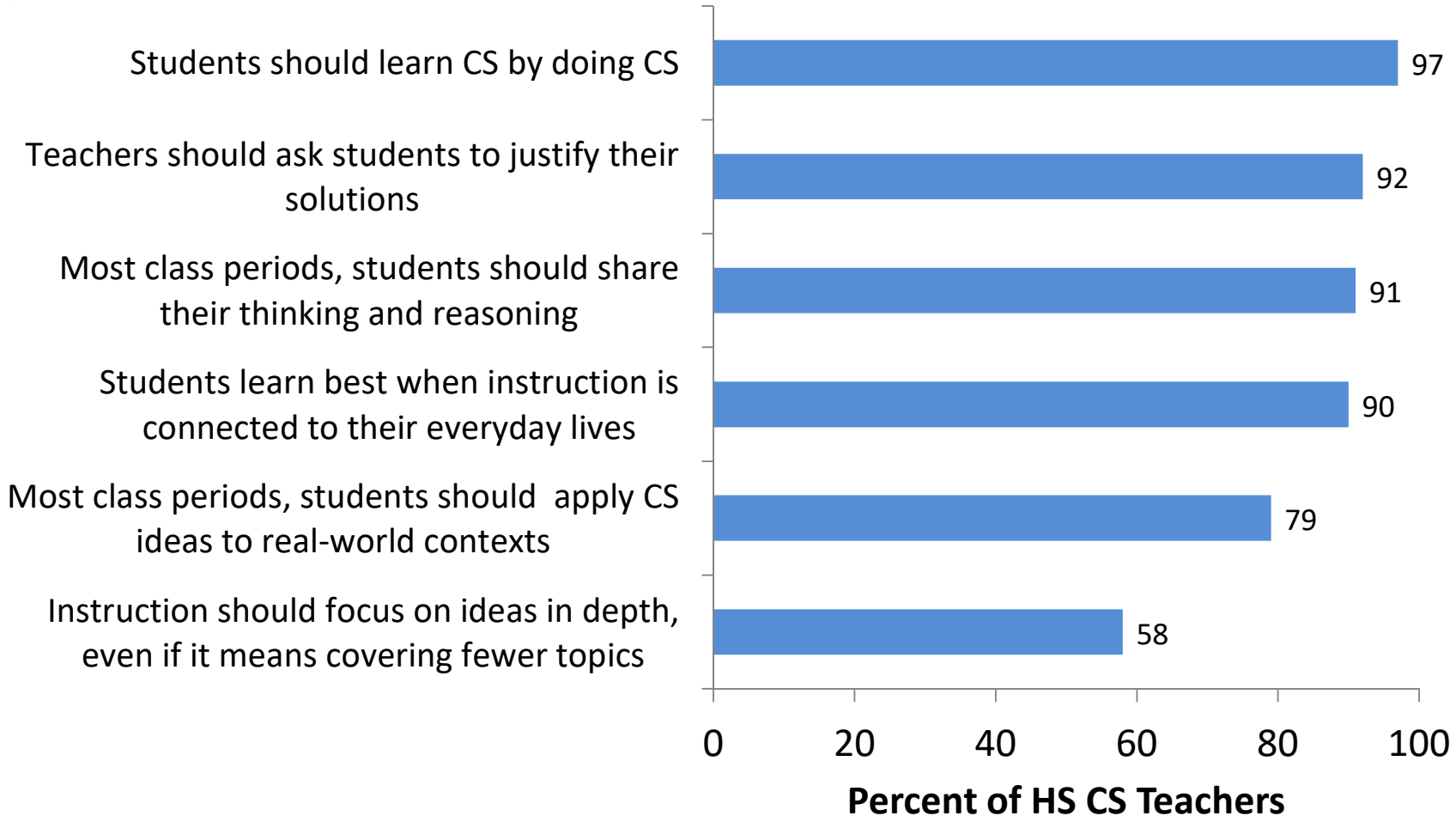
Perceptions of Preparedness: Very Well Prepared to Teach CS Topics



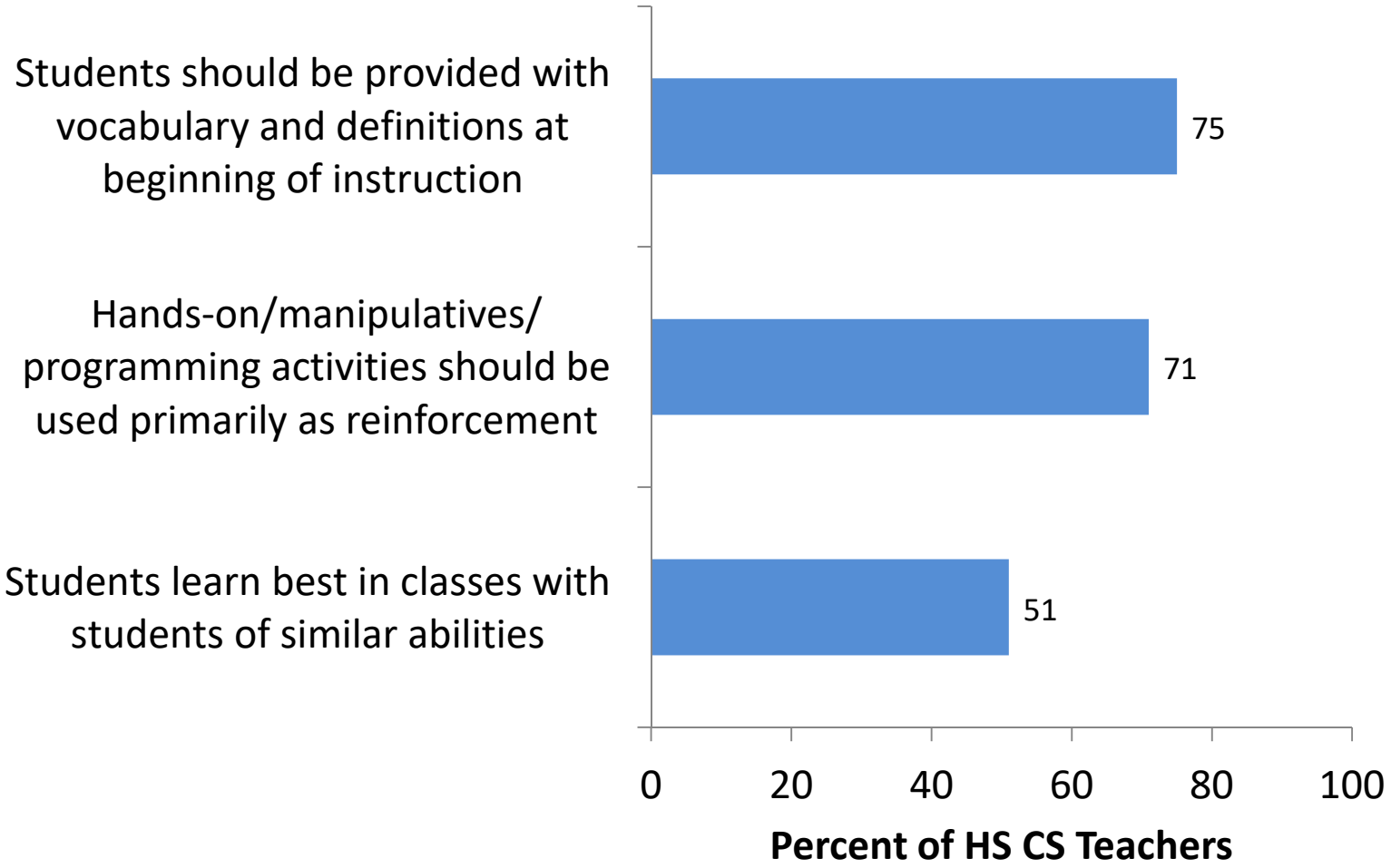
Perceptions of Preparedness: Very Well Prepared to Use Student-Centered Pedagogies



Teacher Beliefs



Teacher Beliefs



Computer Science Teachers Takeaways

Sizeable proportion of the computer science teacher workforce is newer, or new to teaching computer science, and likely still honing their craft

Many have limited preparation to teach computer science

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

Inservice Support

The 2018 NSSME+ asked about:

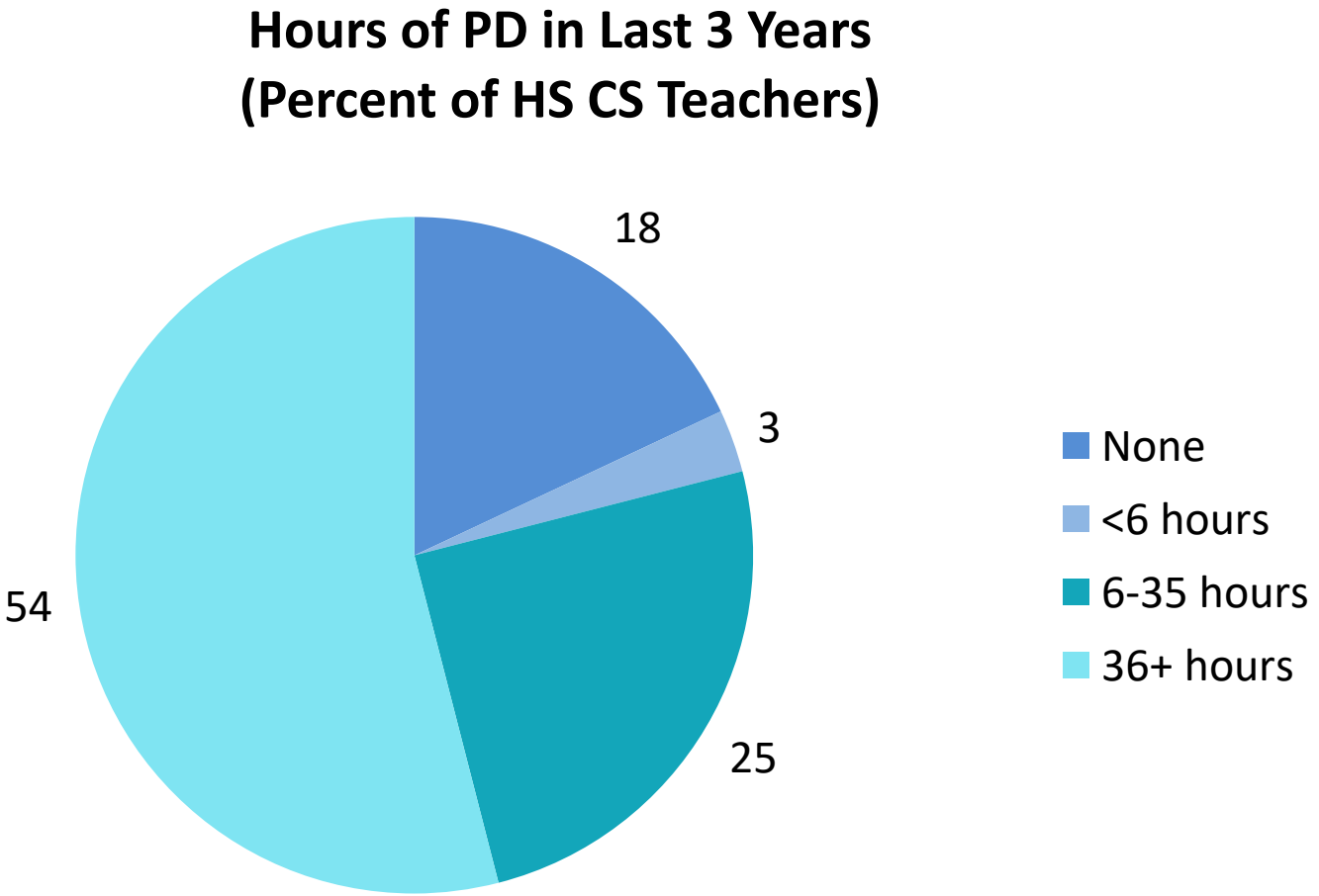
- School/district-offered induction programs
- School/district-offered professional development (workshops, study groups/PLCs, coaching)
- Teacher PD experiences

Professional Development

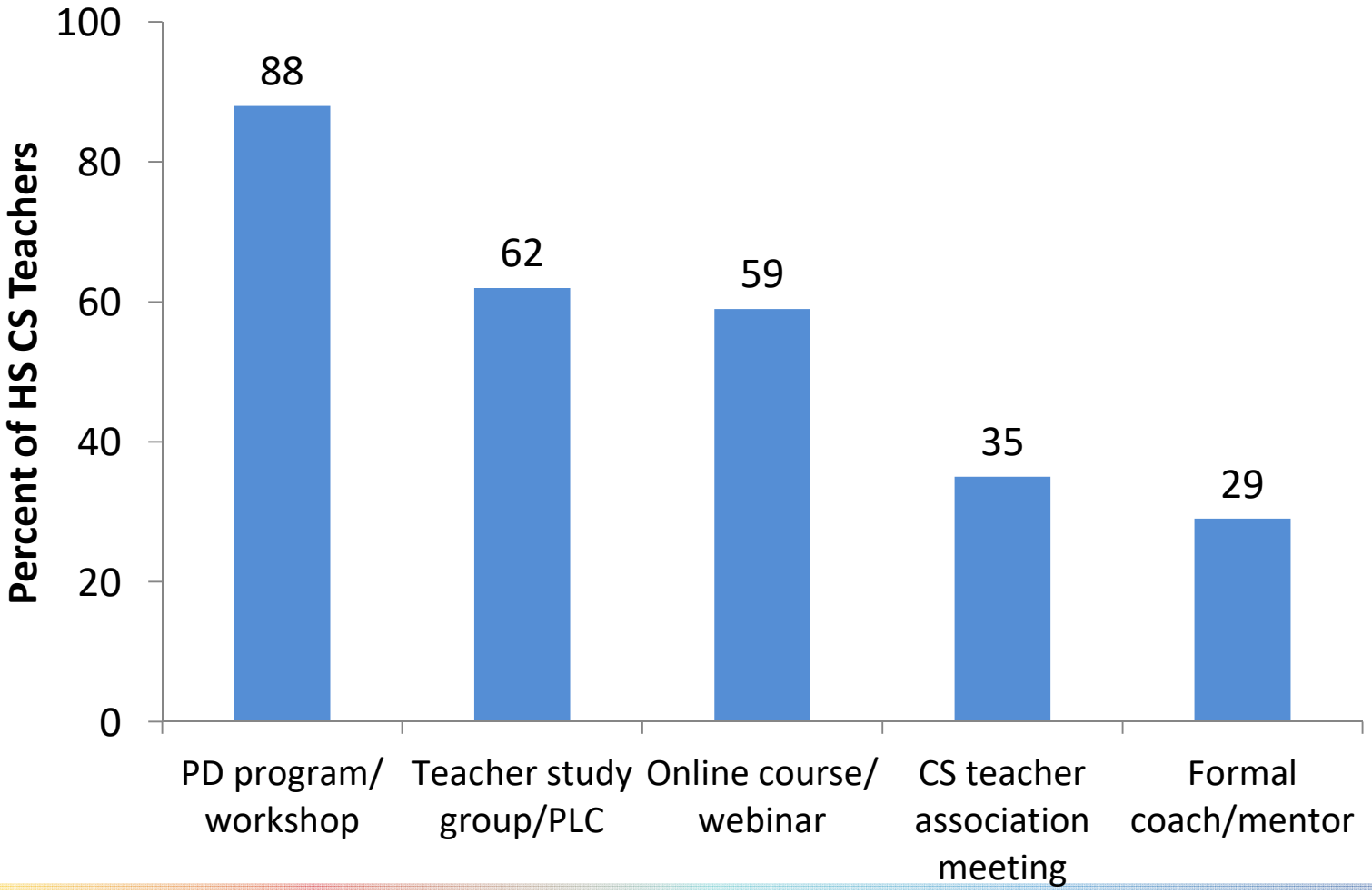
About what percentage of high school computer science teachers have had <u>any</u> computer science-related PD in the last three years?

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

Professional Development



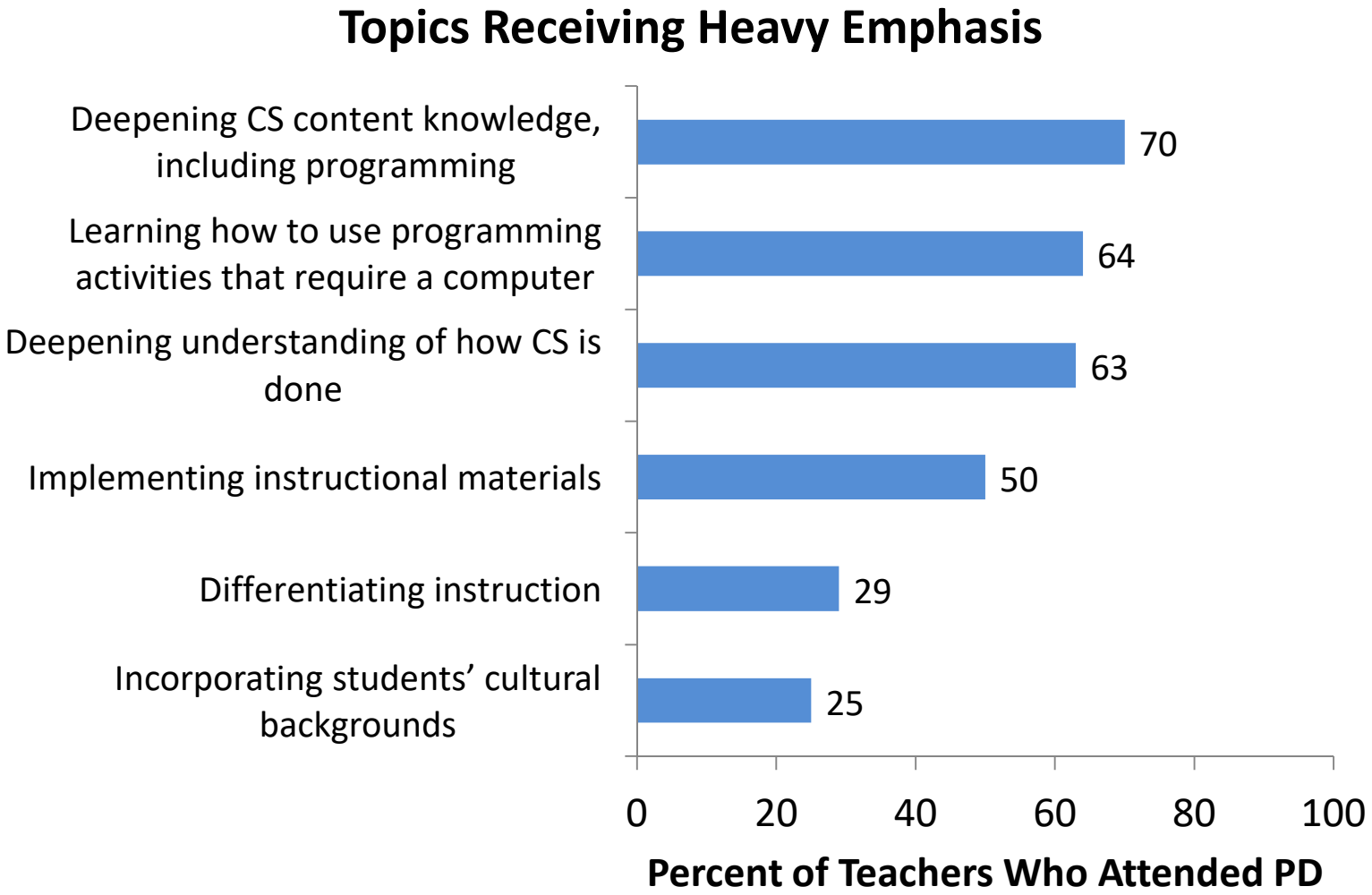
Types of Professional Development in the Past Three Years



Characteristics of PD

	Percent of HS CS Teachers Attending PD
Engage in activities to learn computer science content	76
Experience lessons as students	62
Work with those teaching the same subject/grade level	51
Examine classroom artifacts	46
Apply what they learn in classroom and come back to discuss	39
Rehearse instructional practices	31
Work closely with other teachers in school	26

Emphasis of PD



Inservice Support Takeaways

A relatively large proportion of HS CS Teachers have had substantial PD experiences in the last three years; still, many others have not

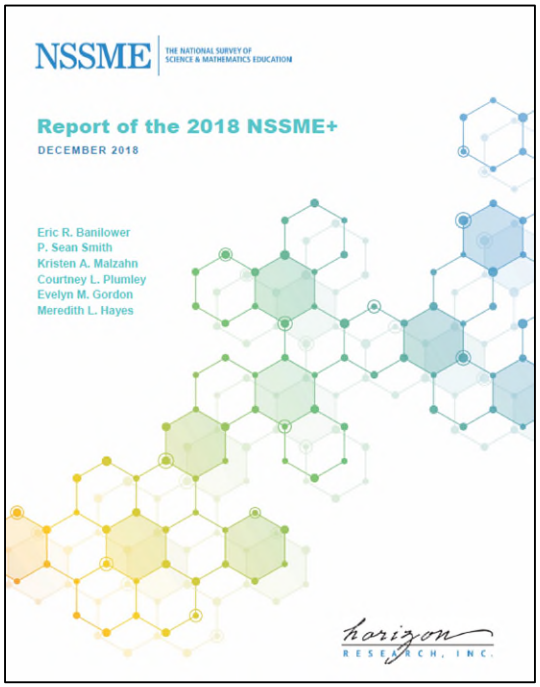
PD is mostly engaging teachers in CS activities, often with the goals of increasing their own content knowledge

Less emphasis on helping teachers improve their instructional practice or encourage and support students from diverse backgrounds

www.horizon-research.com/NSSME

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

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