NSSME | THE NATIONAL SURVEY OF SCIENCE & MATHEMATICS EDUCATION

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

AUGUST 20, 2019

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Horizon RESEARCH, INC.

Session Overview

- Brief Intro to the 2018 NSSME+
- Equity in access to CS
- The Computer Science Teaching Force
- Professional Development Experiences
- Questions, Feedback, etc.

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

Today's Data

Two Instruments focused on CS:

- School Coordinator Questionnaire
- High School Computer Science Teacher Questionnaire

Both are available on our website

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

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

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

Access to Computer Science

Does your school offer each of the following types of computer science courses that might qualify for college credit? Include both courses that are offered every year and those offered in alternating years. *Select one on each row.*

		YES	NO
a.	Advanced Placement (AP) computer science courses	○	○
b.	International Baccalaureate (IB) computer science courses	○	○
c.	Concurrent college and high school credit/dual enrollment computer science courses *[If no, skip to Question 25]*	○	○

Is your school offering any computer science courses in the following categories this school year for students in any grades 9–12? *Select one on each row.*

	GRADES 9–12 COURSE TYPE	EXAMPLE COURSES	YES	NO
a.	**Computer technology courses that do not include programming**	Computer literacy, Keyboarding, Media technology (digital video/audio, multimedia presentations, digital arts), Desktop publishing, Computer applications (word processing, spreadsheets, slide presentations), Computer repair and computer networking, Web design, Computer-aided design (architectural drawing, fashion design), Other technology courses that do not teach or require programming	○	○
b.	**Introductory high school computer science courses that include programming but do not qualify for college credit**	Computer Science Discoveries on code.org, Exploring computer science, PLTW's Computer Science Essentials, introductory programming course, IB Computer Science–Standard Level, Computer science elective that includes introductory programming	○	○
c.	**Specialized/elective computer science courses with programming as a prerequisite that do not qualify for college credit**	Advanced Computer science electives such as Robotics, Game or mobile app development, or other advanced computer science elective with programming as a prerequisite	○	○

Access to Computer Science

About what percentage of high schools offer computer science courses that teach programming or have programming as a prerequisite?

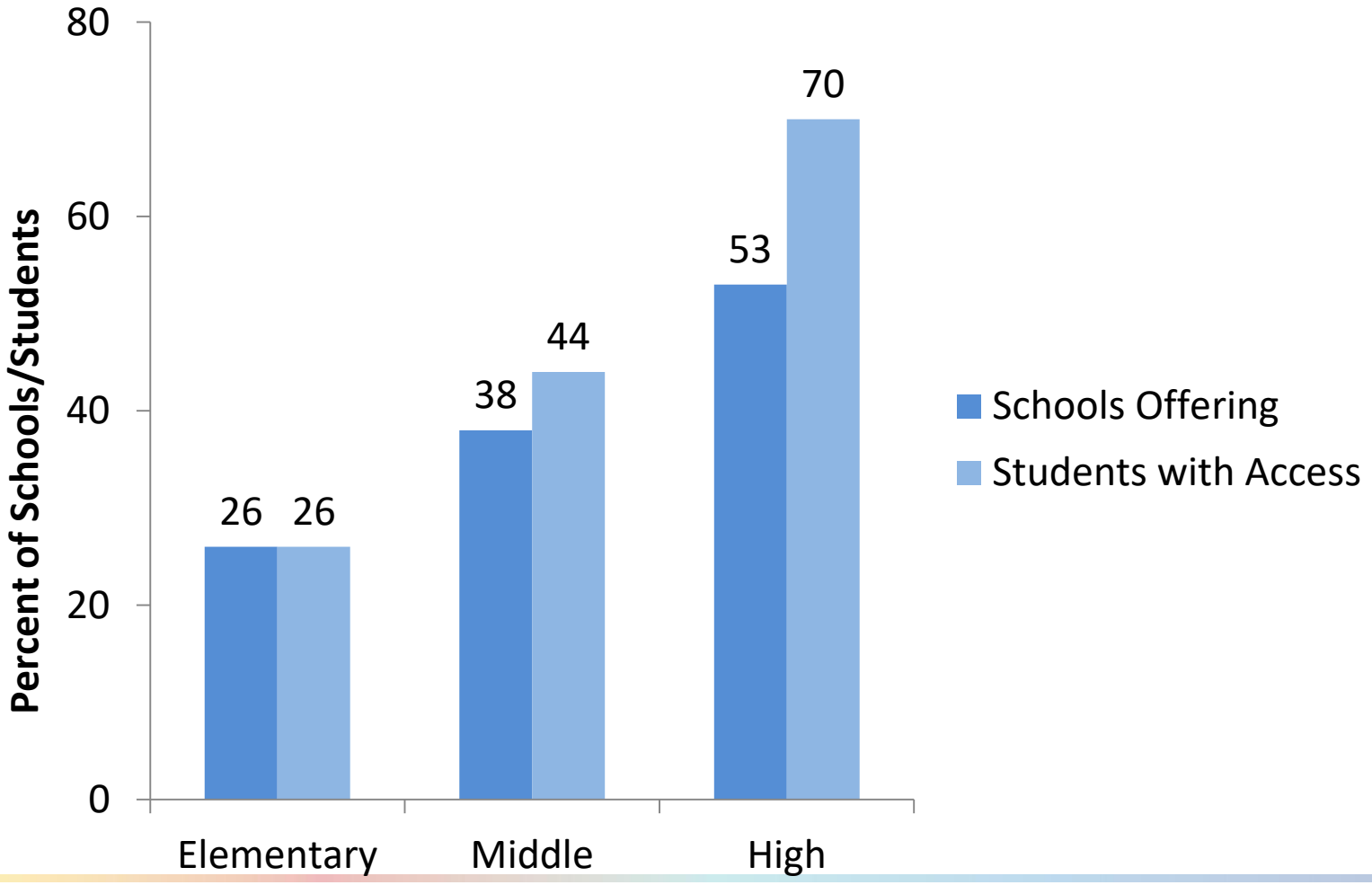
A. 25%

B. 50%

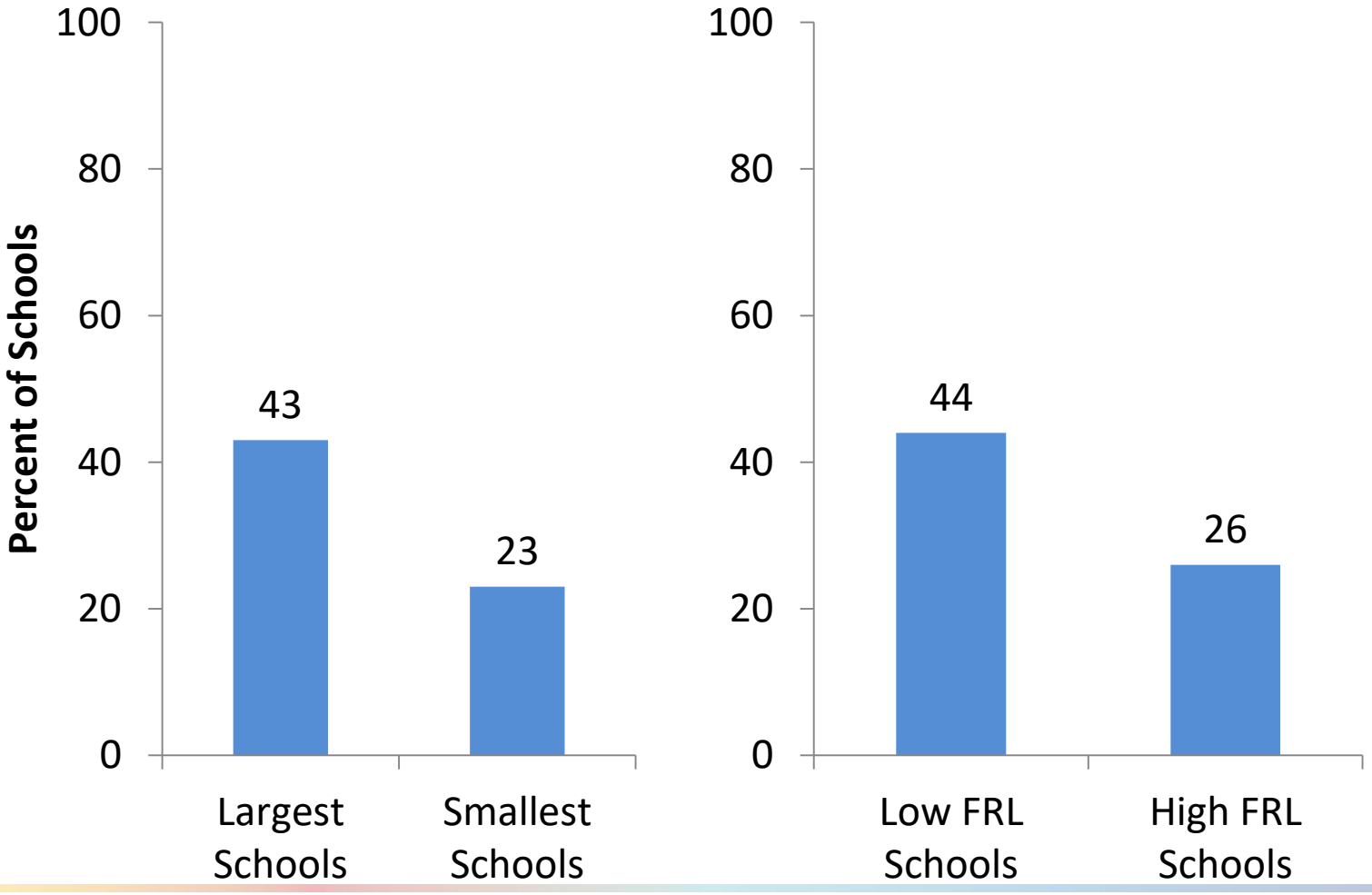
C. 75%

D. 100%

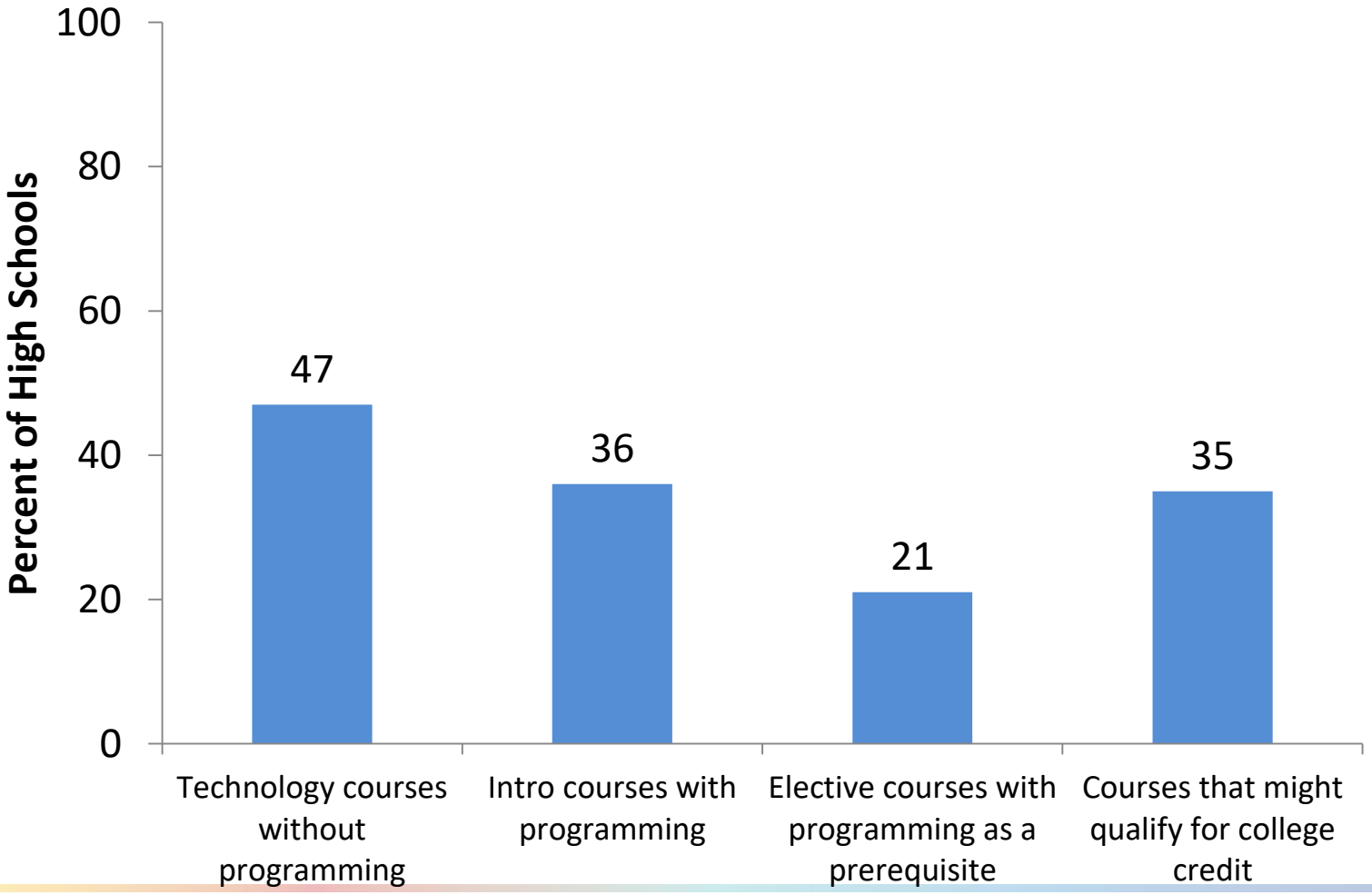
Schools Offering Computer Science Instruction



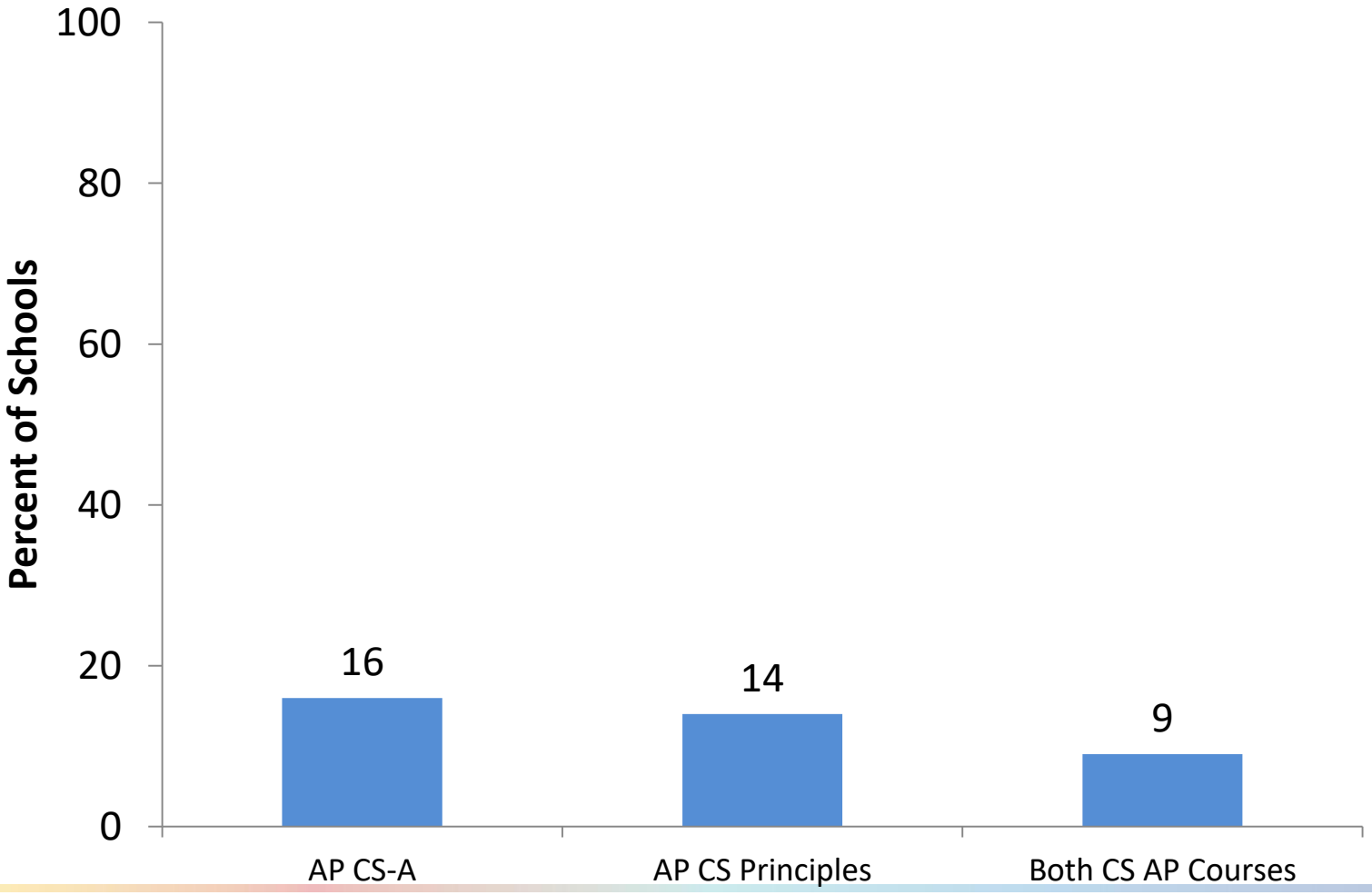
Equity Analysis: Schools Offering Computer Science Instruction



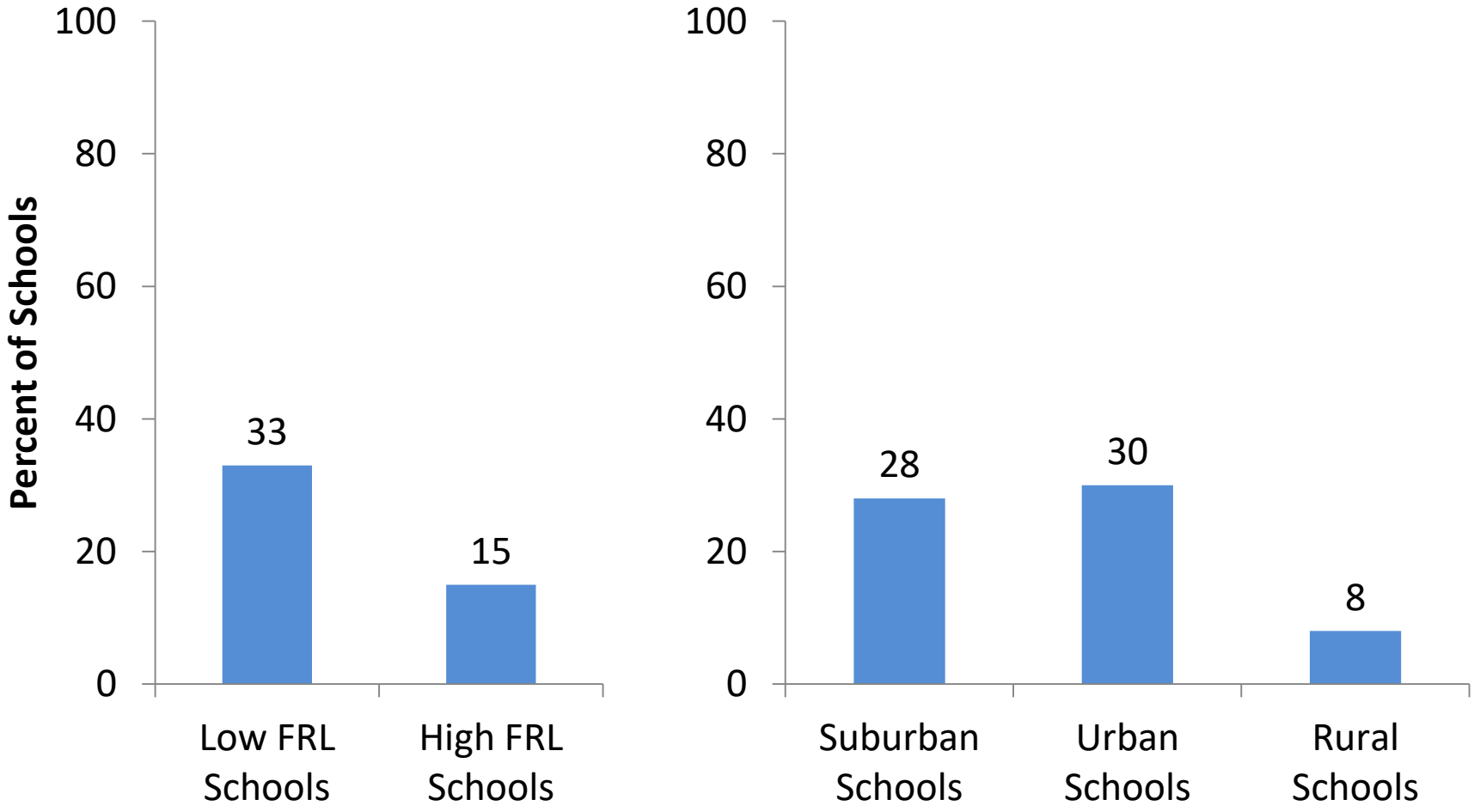
High Schools Offering Computer Science and Technology Courses



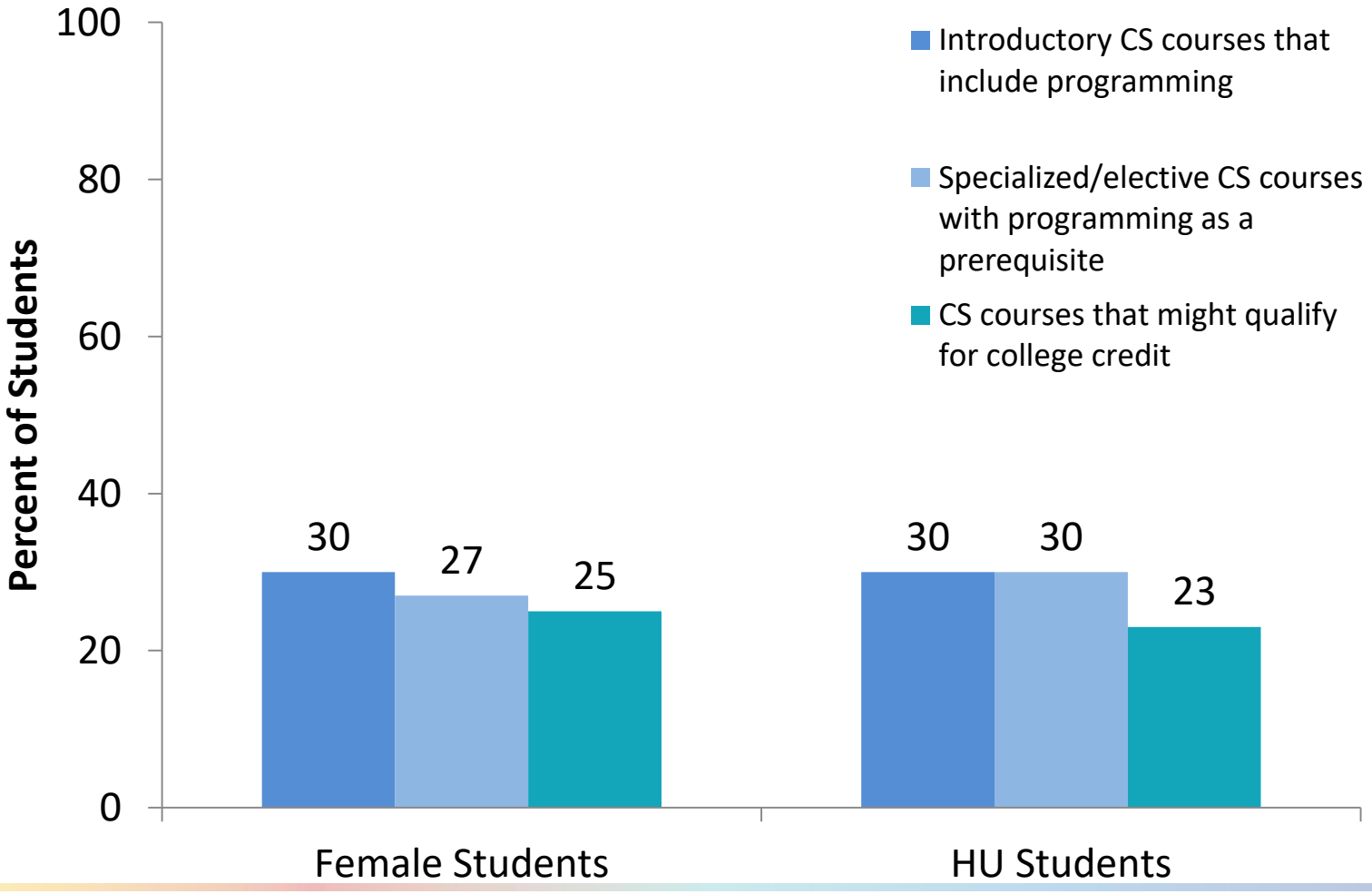
High Schools Offering AP Computer Science Courses



Equity Analysis: High Schools Offering AP CS



Equity Analysis: High School Students Taking CS Courses

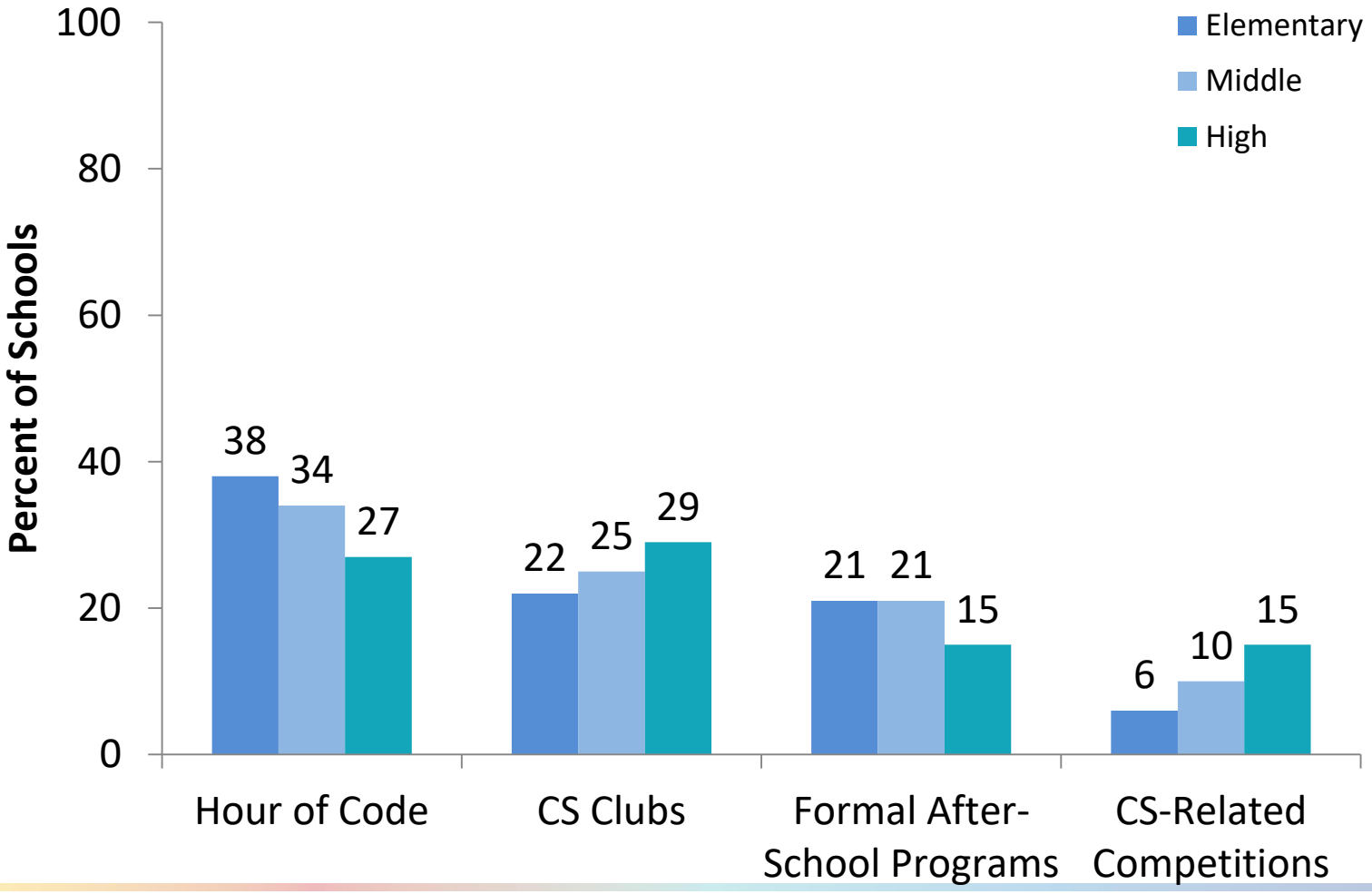


School Enrichment Programs

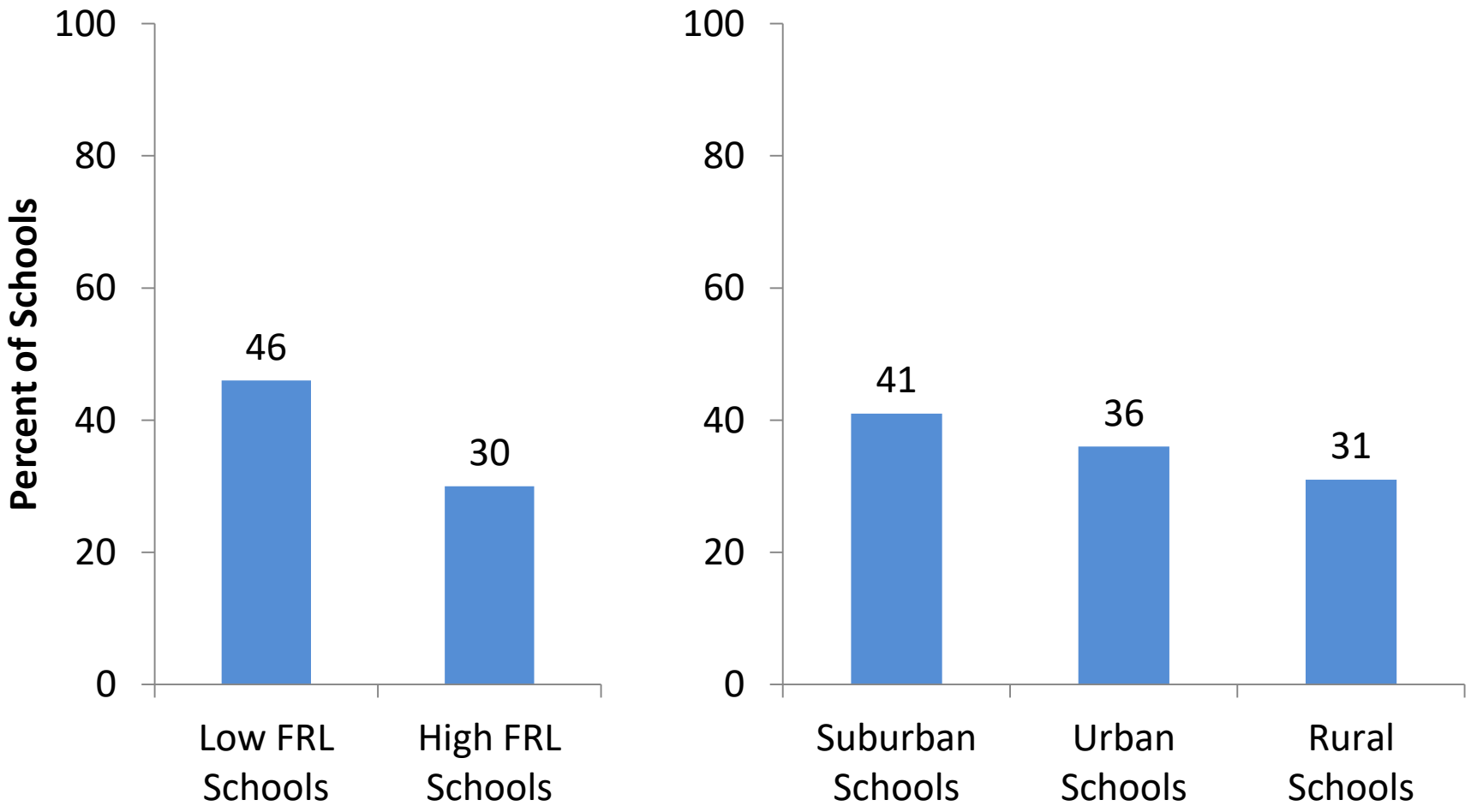
Indicate whether your school does each of the following to enhance students' interest and/or achievement in computer science. *Select one on each row.*

		YES	NO
a.	Holds family computer science nights	○	○
b.	Offers after-school help in computer science (for example: tutoring)	○	○
c.	Offers formal after-school programs for enrichment in computer science	○	○
d.	Offers one or more computer science clubs	○	○
e.	Participates in Hour of Code	○	○
f.	Participates in a local or regional computer science fair	○	○
g.	Has one or more teams participating in computer science competitions (for example: USA Computer Science Olympiad)	○	○
h.	Encourages students to participate in computer science summer programs or camps offered by community colleges, universities, museums or computer science centers	○	○
i.	Coordinates visits to business, industry, and/or research sites related to computer science	○	○
j.	Coordinates meetings with adult mentors who work in computer science fields	○	○
k.	*[High schools only]* Coordinates internships in computer science fields	○	○

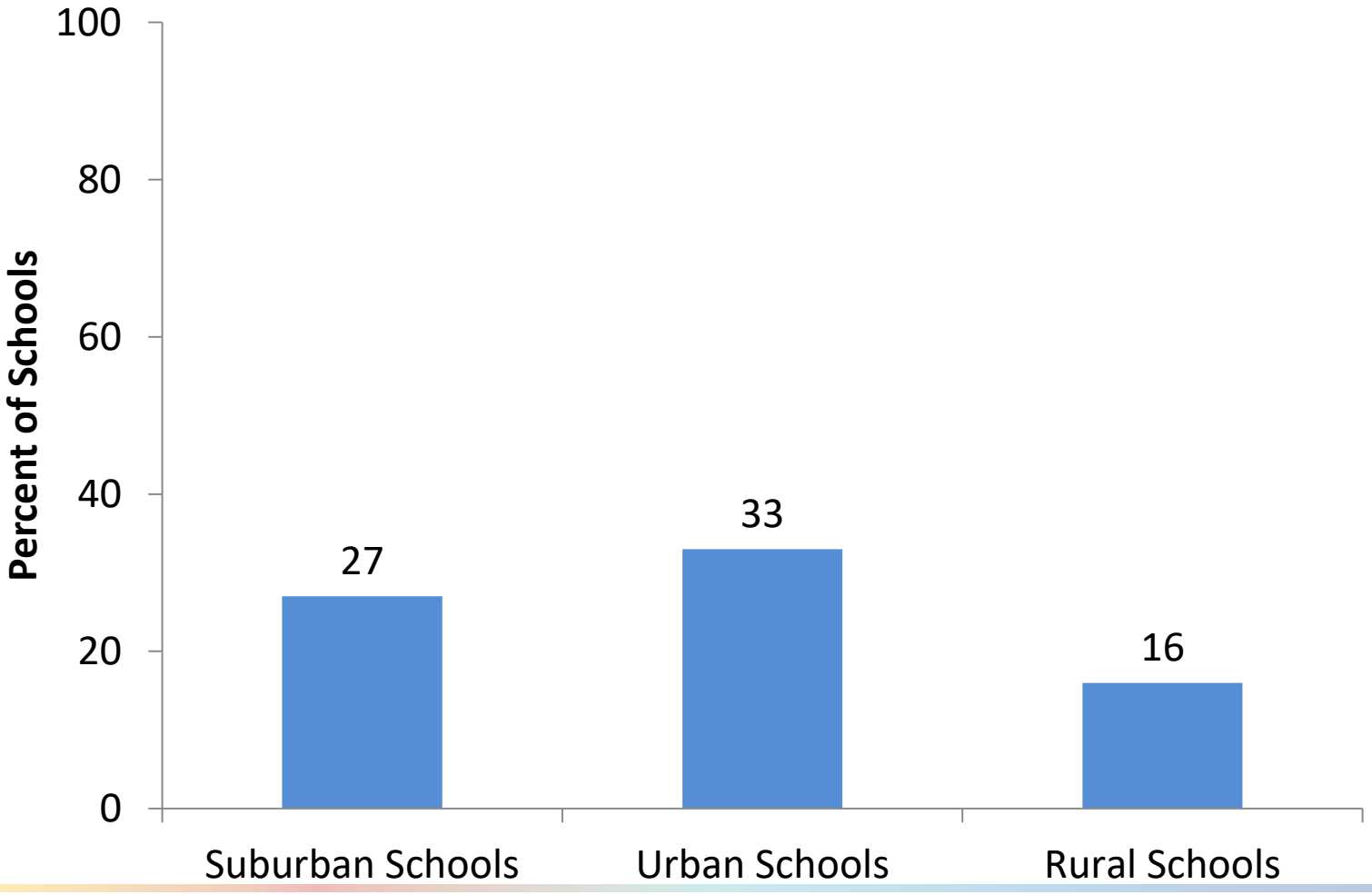
School Enrichment Programs



Equity Analysis: Hour of Code



Equity Analysis: CS Clubs



Equitable Access Takeaways

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

Rural schools are less likely to have CS-related enrichment opportunities

Reflection

What are the implications of these data for your work?

How might you work in your state, or as a collective, to provide more equitable access to CS?

The Computer Science Teaching Force

The 2018 NSSME+ collected data about:

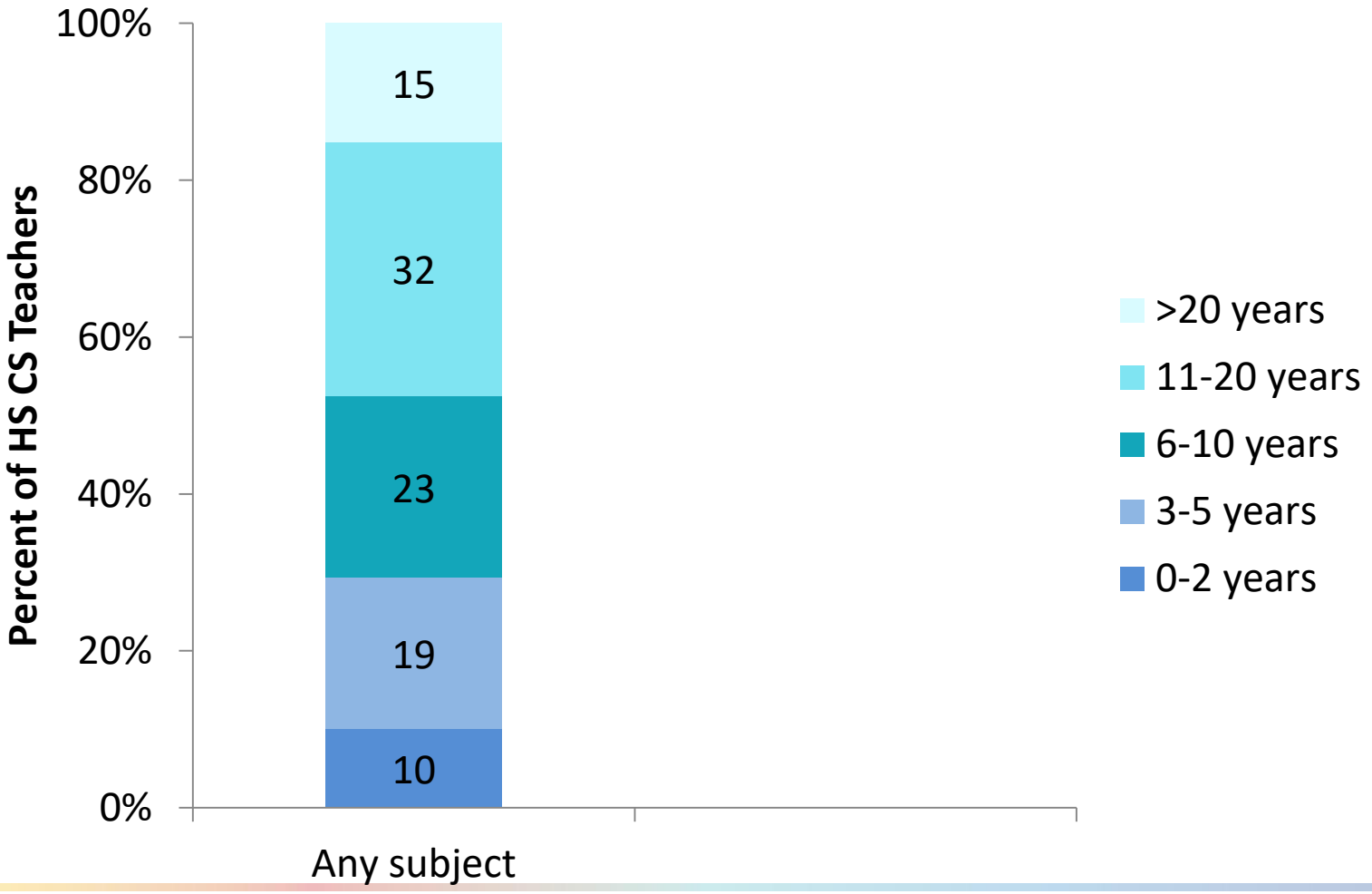
- Demographics of teachers
- College degrees and coursework
- Path to certification
- Feelings of preparedness
- Beliefs about teaching and learning

Teaching Experience

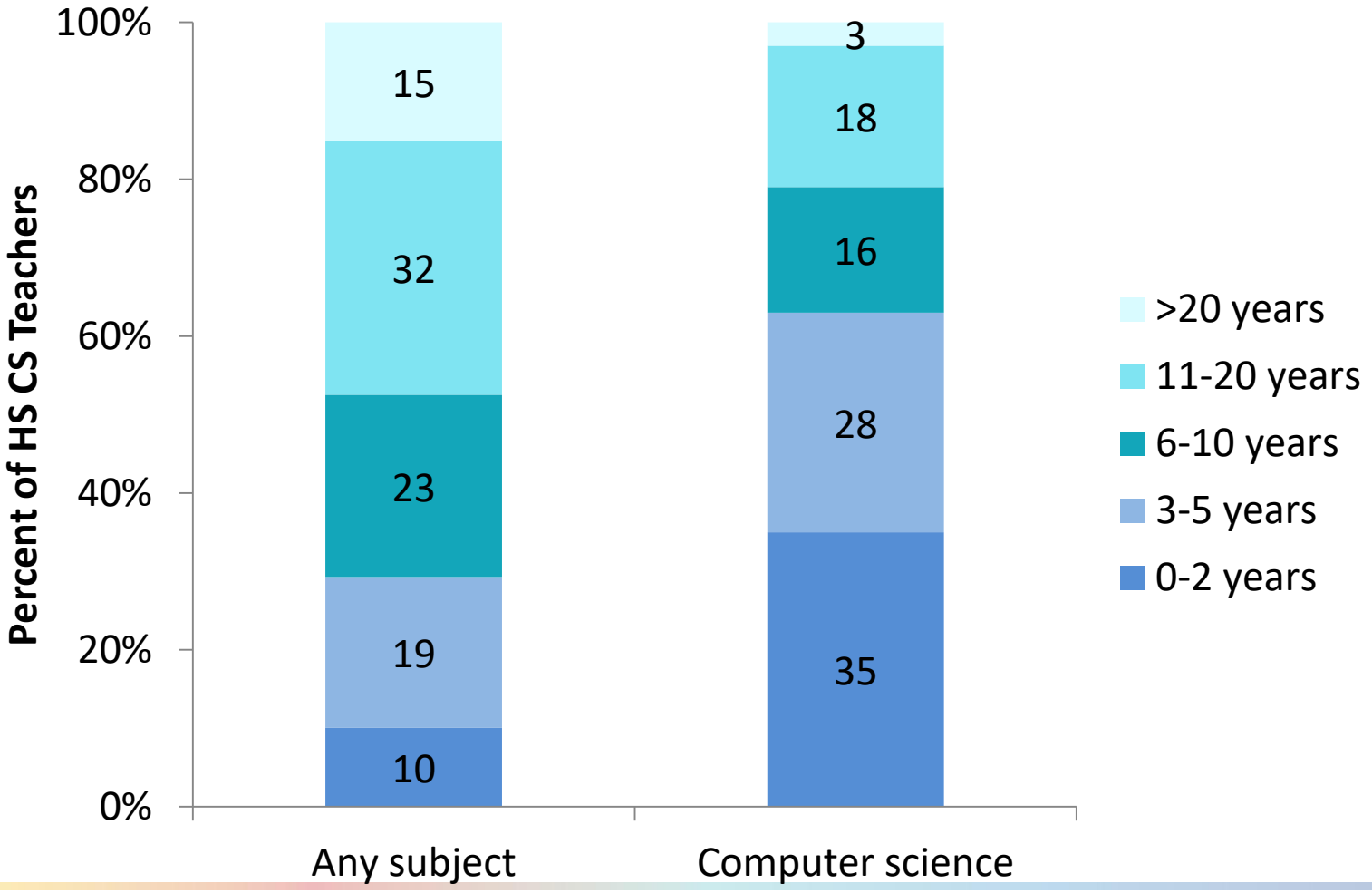
About what percentage of high school computer science teachers have 5 or fewer years teaching experience?

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

Teaching Experience



Teaching Experience



Certification

In which of the following areas are you certified (have a credential or endorsement) to teach at the high school level? [Select all that apply.]

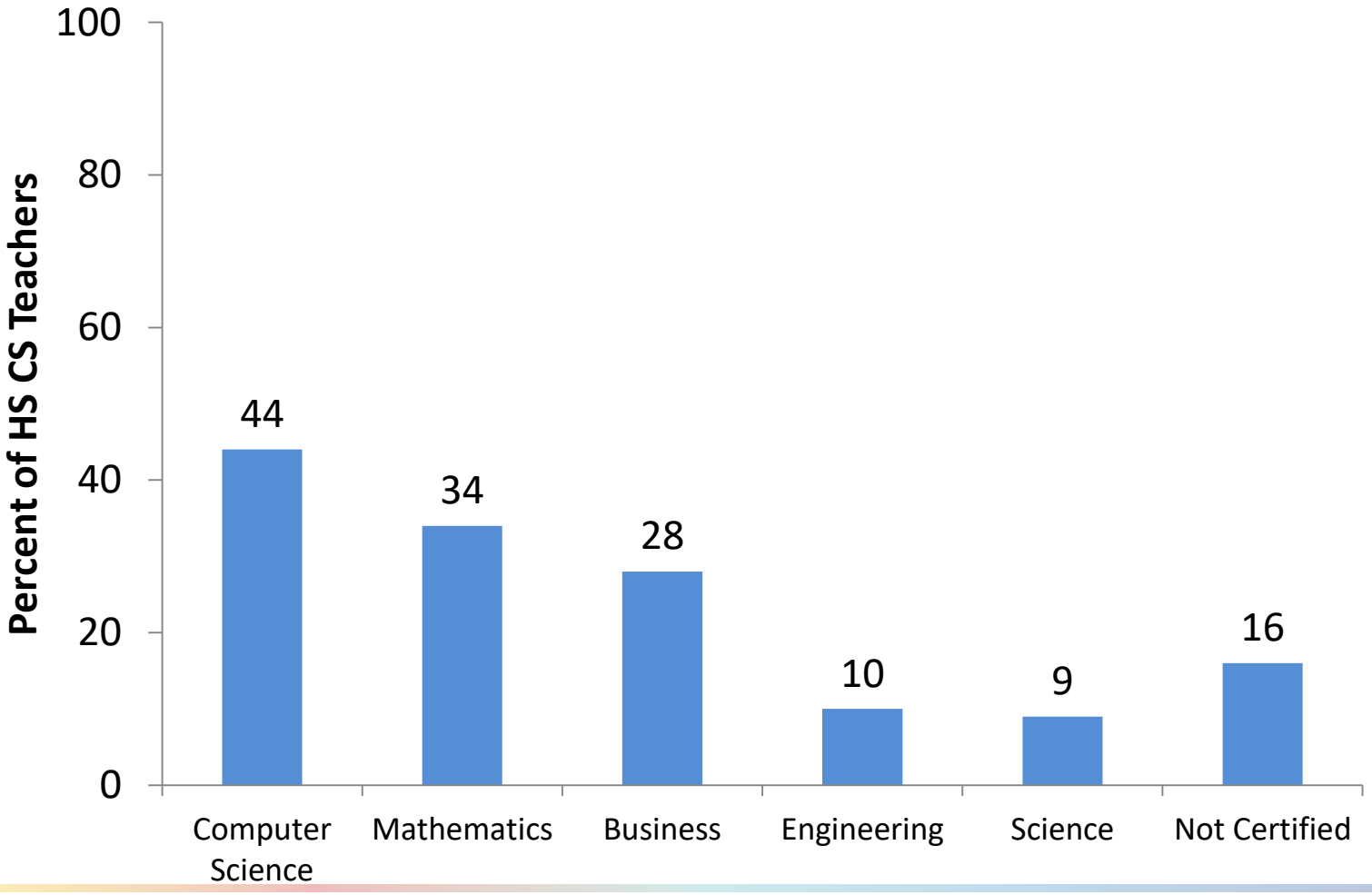
☐	Business
☐	Computer science
☐	Engineering
☐	Mathematics
☐	Science (any area)
☐	Other

Certification

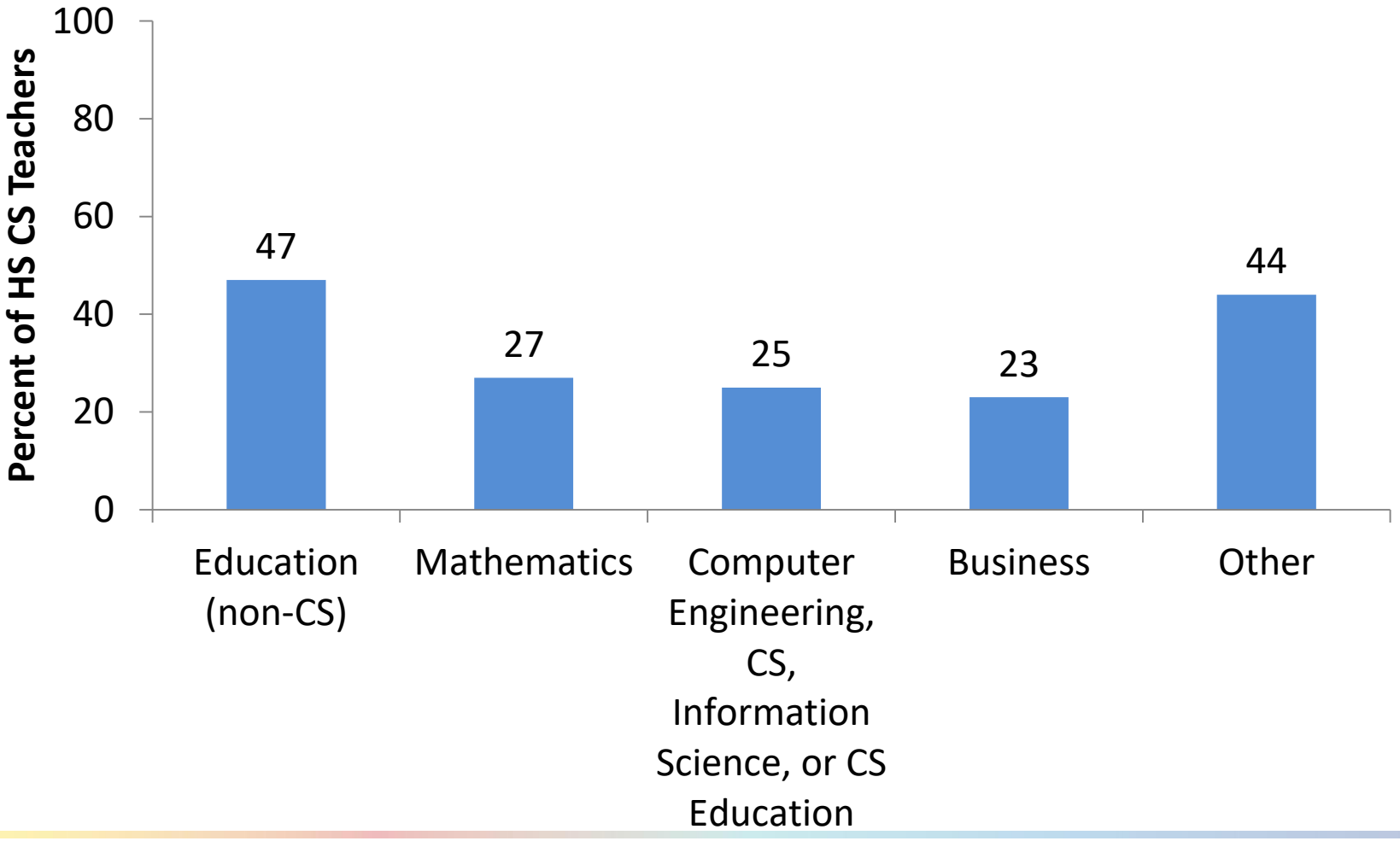
About what percentage of high school computer science teachers are certified to teach computer science?

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

Areas of Certification



Computer Science Teacher Degrees



CSTA/ISTE CS Teacher Preparation Recommendations

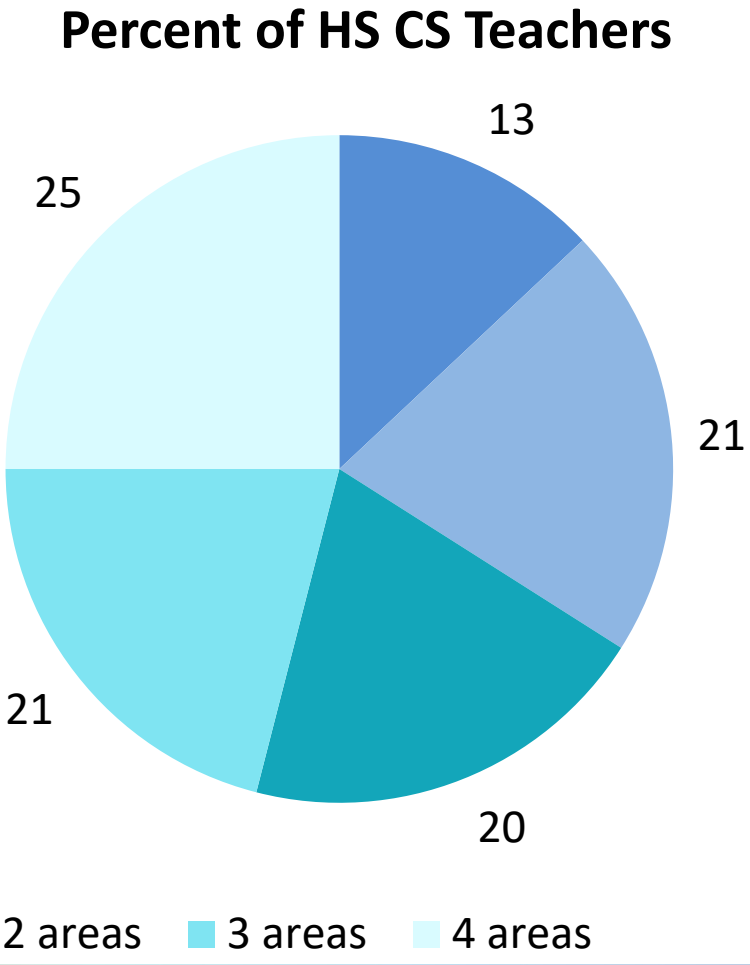
Similar recommended content knowledge for CS educators from CSTA and ISTE

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:

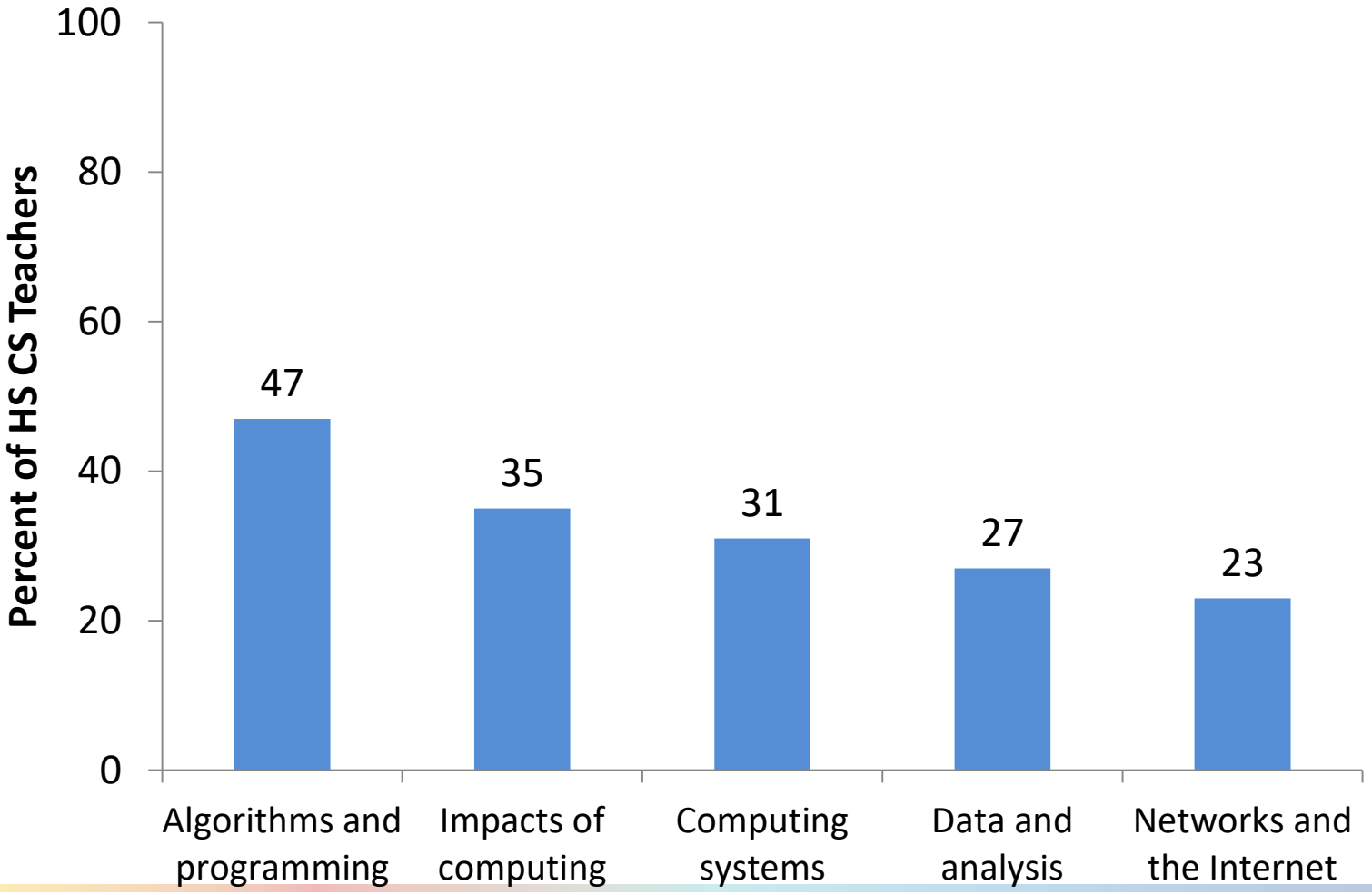
- Teach core computer science ideas
- Use student-centered pedagogies, e.g.:
  - Use formative assessment
  - Develop student abilities to do computer science
  - Encourage student interest in computer science
  - Differentiate instruction
  - Incorporate students' cultural backgrounds into instruction

Perceptions of Preparedness: Very Well Prepared to Teach CS Topics

Within computer science, many teachers feel better prepared to teach some topics than others. How prepared do you feel to teach each of the following topics **at the grade level(s) you teach,** whether or not they are currently included in your teaching responsibilities? [Select one on each row.]

		NOT ADEQUATELY PREPARED	SOMEWHAT PREPARED	FAIRLY WELL PREPARED	VERY WELL PREPARED
a.	Computing systems	①	②	③	④
b.	Networks and the Internet	①	②	③	④
c.	Data and analysis	①	②	③	④
d.	Algorithms and programming	①	②	③	④
e.	Impacts of computing	①	②	③	④

Perceptions of Preparedness: Very Well Prepared to Teach CS Topics

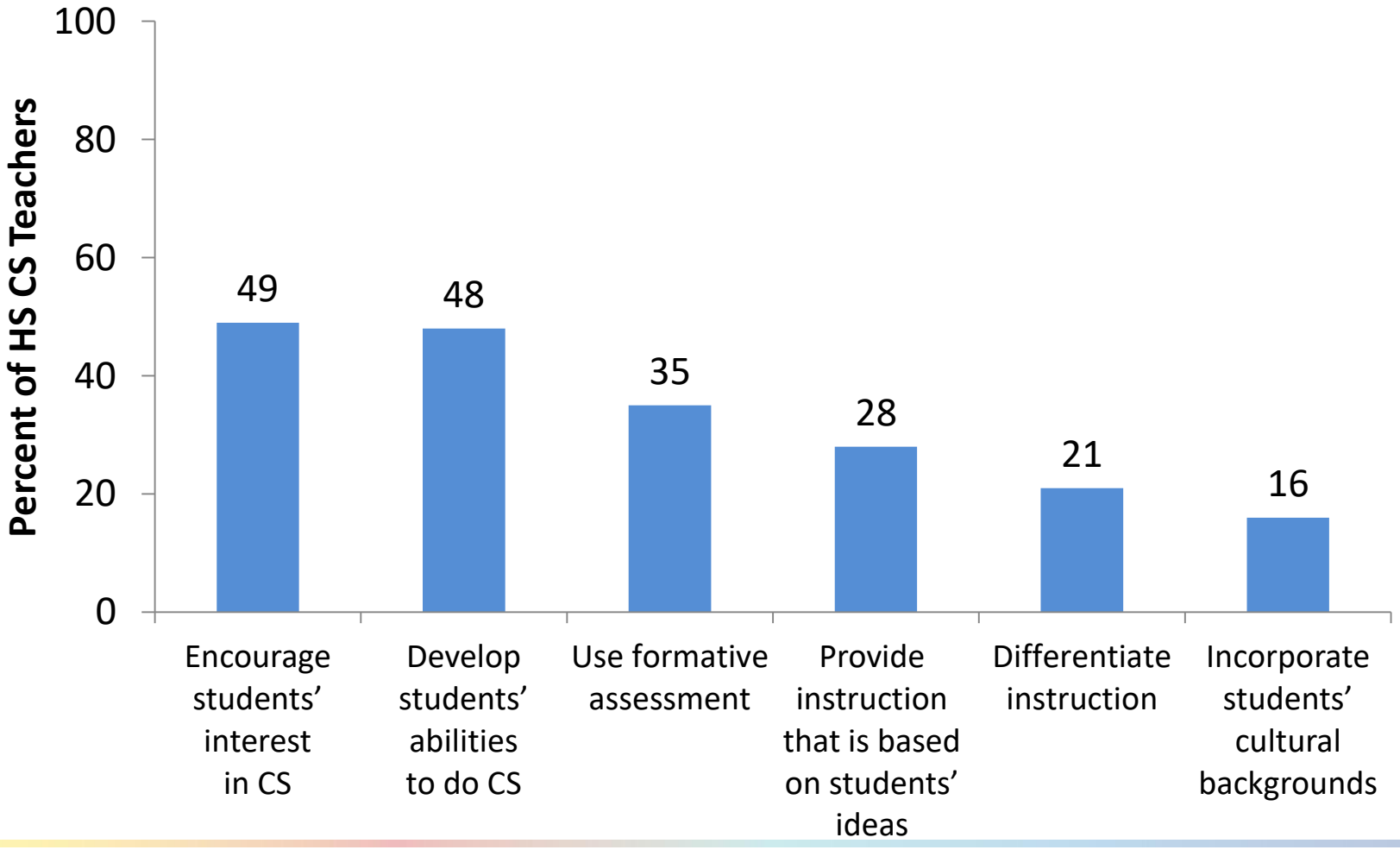


Perceptions of Preparedness: Very Well Prepared to Use Student-Centered Pedagogies

How well prepared do you feel to do each of the following in your computer science instruction? [Select one on each row.]

		NOT ADEQUATELY PREPARED	SOMEWHAT PREPARED	FAIRLY WELL PREPARED	VERY WELL PREPARED
a.	Develop students' conceptual understanding of the computer science ideas you teach	①	②	③	④
b.	Develop students' abilities to do computer science (for example: breaking problems into smaller parts, considering the needs of a user, creating computational artifacts)	①	②	③	④
c.	Develop students' awareness of STEM careers	①	②	③	④
d.	Provide computer science instruction that is based on students' ideas (whether completely correct or not) about the topics you teach	①	②	③	④
e.	Use formative assessment to monitor student learning	①	②	③	④
f.	Differentiate computer science instruction to meet the needs of diverse learners	①	②	③	④
g.	Incorporate students' cultural backgrounds into computer science instruction	①	②	③	④
h.	Encourage students' interest in computer science	①	②	③	④
i.	Encourage participation of all students in computer science	①	②	③	④

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

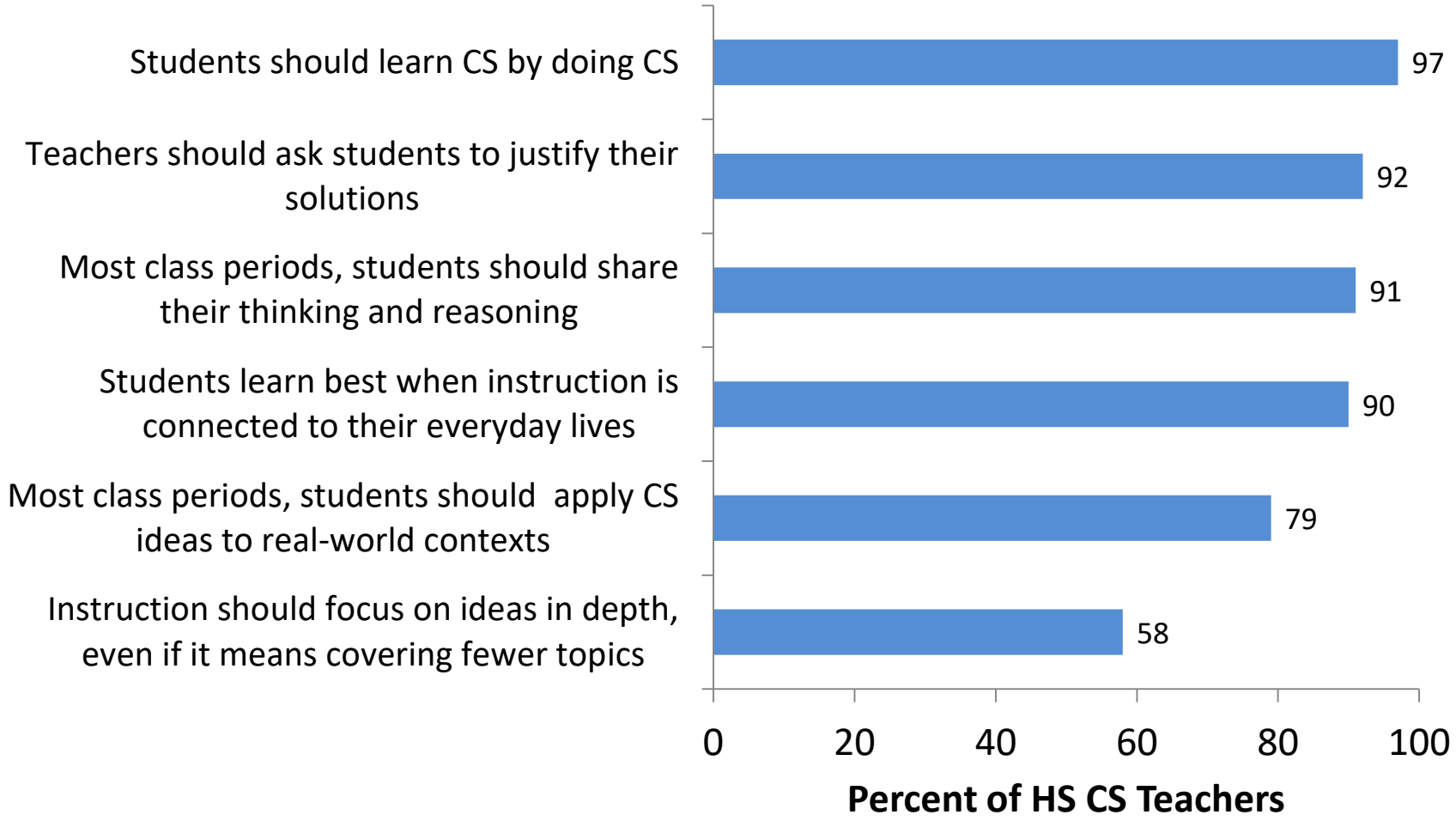


Teacher Beliefs

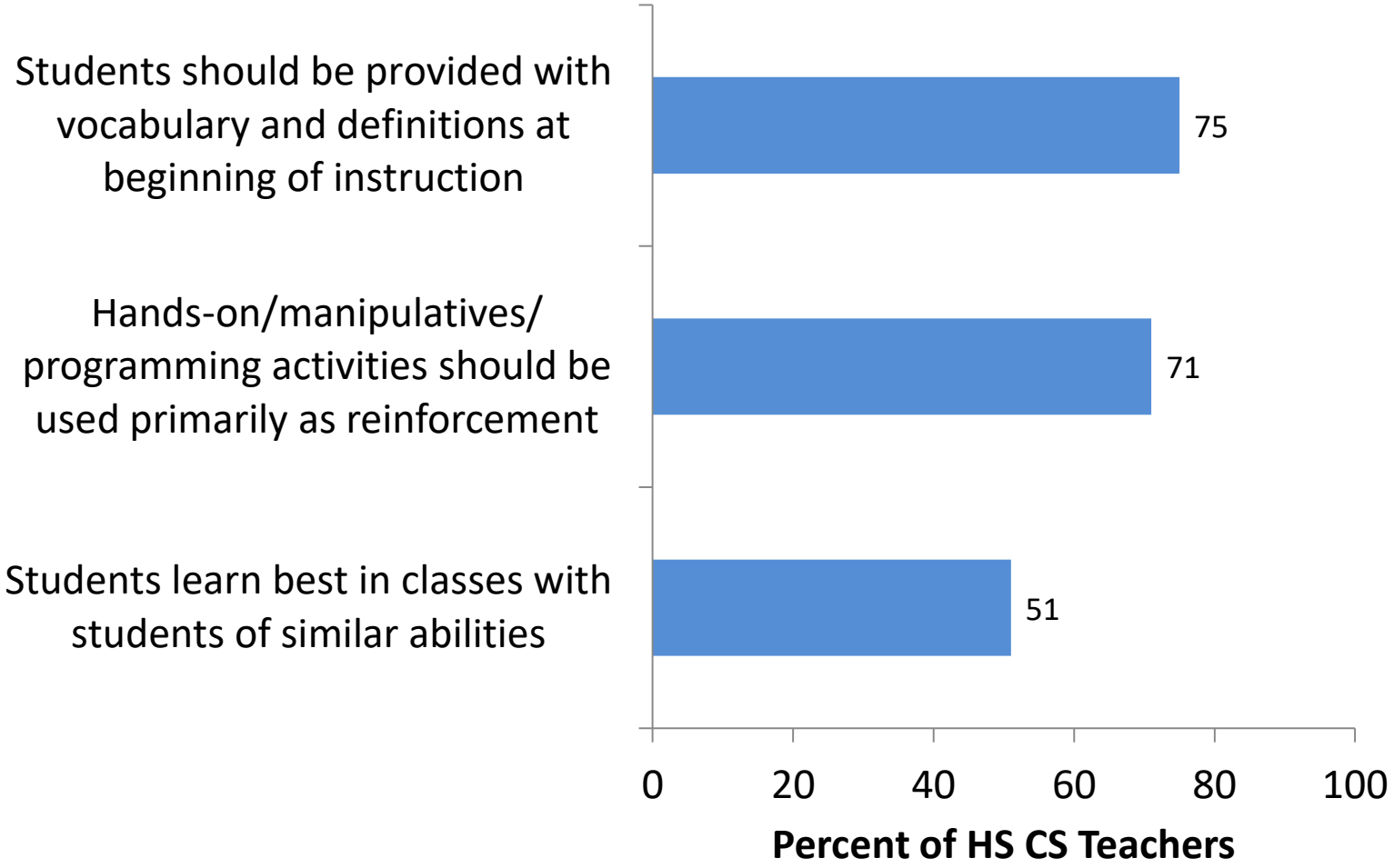
Please provide your opinion about each of the following statements. [Select one on each row.]

		STRONGLY DISAGREE	DISAGREE	NO OPINION	AGREE	STRONGLY AGREE
a.	Students learn computer science best in classes with students of similar abilities.	①	②	③	④	⑤
b.	It is better for computer science instruction to focus on ideas in depth, even if that means covering fewer topics.	①	②	③	④	⑤
c.	At the beginning of instruction on a computer science idea, students should be provided with definitions for new vocabulary that will be used.	①	②	③	④	⑤
d.	Most class periods should provide opportunities for students to share their thinking and reasoning.	①	②	③	④	⑤
e.	Hands-on/manipulatives/programming activities should be used primarily to reinforce a computer science idea that the students have already learned.	①	②	③	④	⑤
f.	Teachers should ask students to justify their solutions to a computational problem.	①	②	③	④	⑤
g.	Students learn best when instruction is connected to their everyday lives.	①	②	③	④	⑤
h.	Most class periods should provide opportunities for students to apply computer science ideas to real-world contexts.	①	②	③	④	⑤
i.	Students should learn computer science by doing computer science (for example: breaking problems into smaller parts, considering the needs of a user, creating computational artifacts).	①	②	③	④	⑤

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:

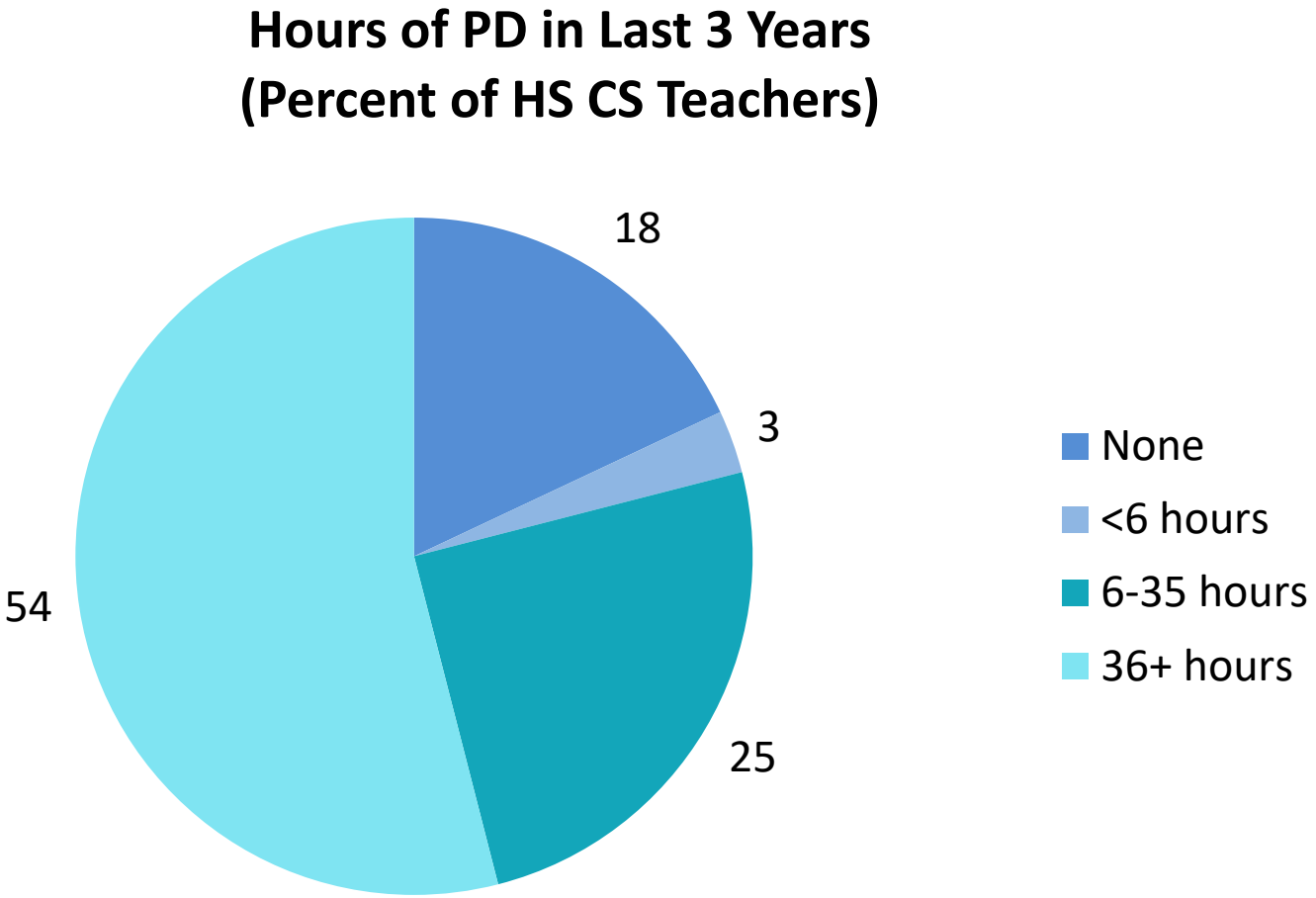
- School/district-offered induction programs
- School/district-offered professional development (workshops, study groups/PLCs, coaching)
- Teacher PD experiences

Professional Development

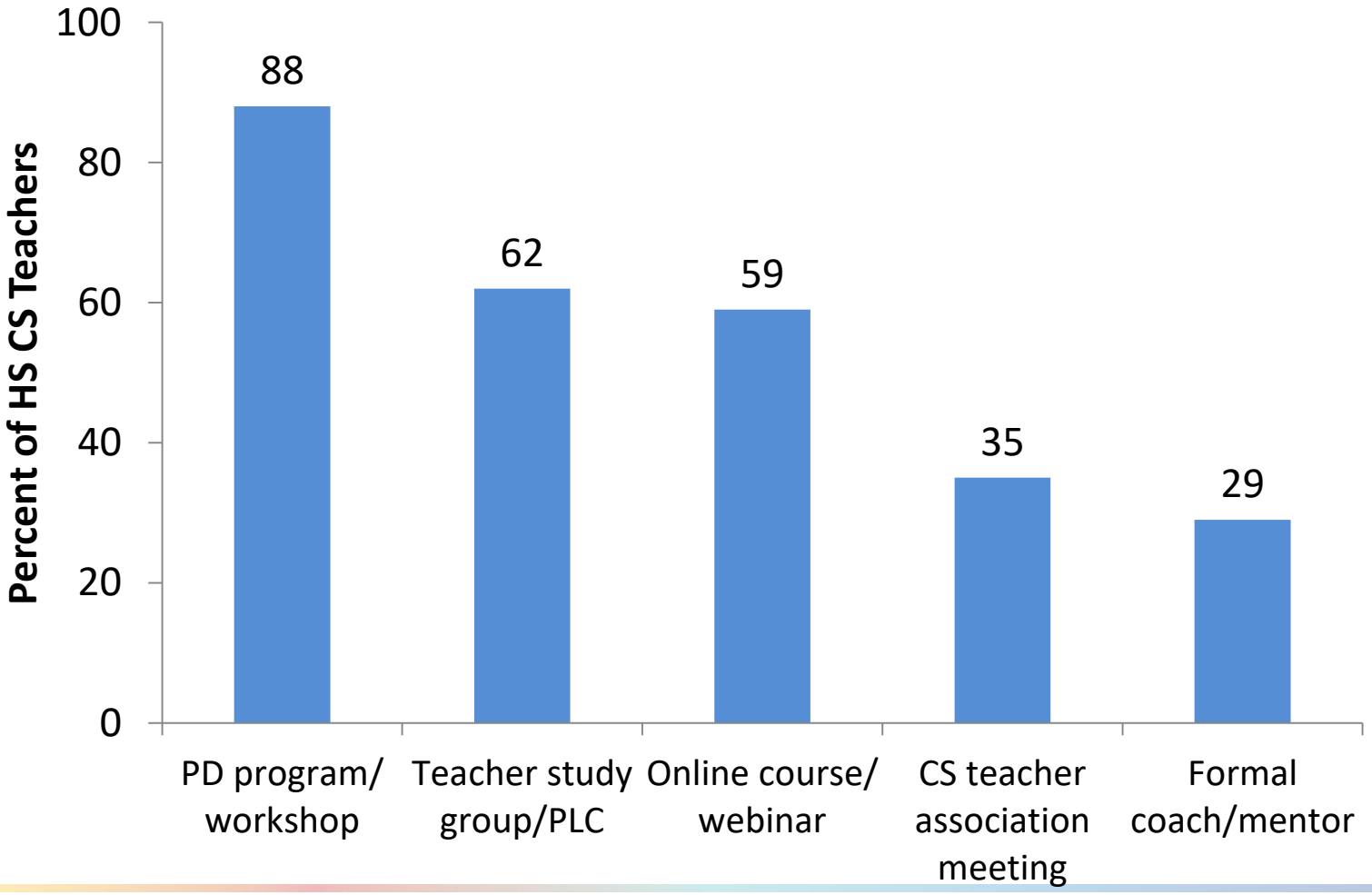
About what percentage of high school computer science teachers have had <u>any</u> computer science-related PD in the last three years?

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

Professional Development



Types of Professional Development in the Past Three Years



Characteristics of PD

Considering all of your computer science-related professional development **in the last 3 years**, to what extent does each of the following describe your experiences? [Select one on each row.]

	NOT AT ALL		SOMEWHAT		TO A GREAT EXTENT
a. I had opportunities to engage in activities to learn computer science content.	①	②	③	④	⑤
b. I had opportunities to experience lessons, as my students would, from the textbook/units I use in my classroom.	①	②	③	④	⑤
c. I had opportunities to examine classroom artifacts (for example: student work samples, e-portfolios, videos of classroom instruction).	①	②	③	④	⑤
d. I had opportunities to rehearse instructional practices during the professional development (meaning: try out, receive feedback, and reflect on those practices).	①	②	③	④	⑤
e. I had opportunities to apply what I learned to my classroom and then come back and talk about it as part of the professional development.	①	②	③	④	⑤
f. I worked closely with other teachers from my school.	①	②	③	④	⑤
g. I worked closely with other teachers who taught the same grade and/or subject whether or not they were from my school.	①	②	③	④	⑤

Characteristics of PD

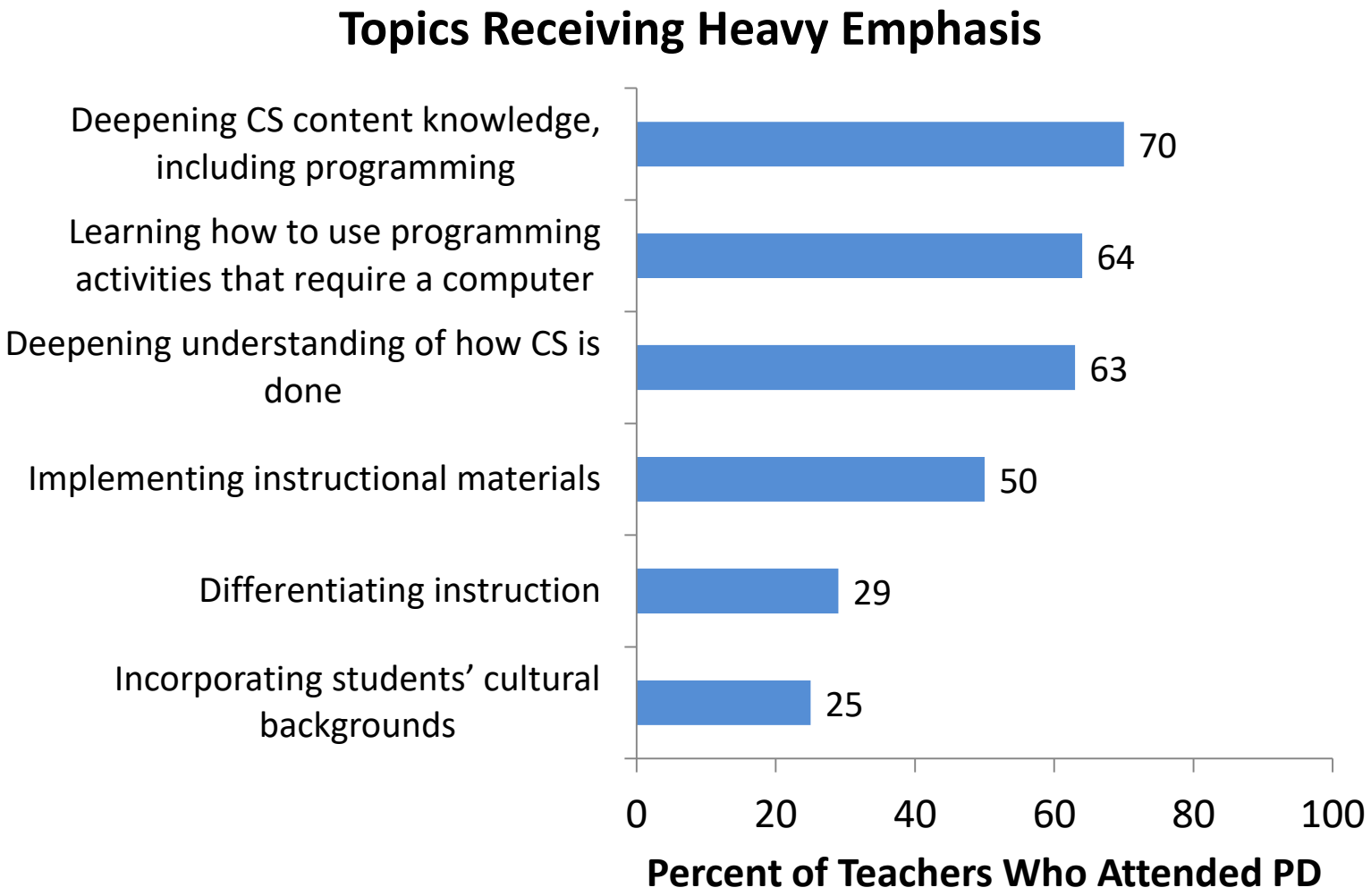
	Percent of HS CS Teachers Attending PD
Engage in activities to learn computer science content	76
Experience lessons as students	62
Work with those teaching the same subject/grade level	51
Examine classroom artifacts	46
Apply what they learn in classroom and come back to discuss	39
Rehearse instructional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

Emphasis of PD

Thinking about all of your computer science-related professional development **in the last 3 years**, to what extent was each of the following emphasized? [Select one on each row.]

		NOT AT ALL		SOMEWHAT		TO A GREAT EXTENT
a.	Deepening your own computer science content knowledge, including programming	①	②	③	④	⑤
b.	Deepening your understanding of how computer science is done (for example: breaking problems into smaller parts, considering the needs of a user, creating computational artifacts)	①	②	③	④	⑤
c.	Implementing the computer science textbook/online course to be used in your classroom	①	②	③	④	⑤
d.	Learning how to use programming activities that require a computer	①	②	③	④	⑤
e.	Learning about difficulties that students may have with particular computer science ideas and/or practices	①	②	③	④	⑤
f.	Monitoring student understanding during computer science instruction					
g.	Differentiating computer science instruction to meet the needs of diverse learners	①	②	③	④	⑤
h.	Incorporating students' cultural backgrounds into computer science instruction	①	②	③	④	⑤
i.	Learning how to provide computer science instruction that integrates engineering, mathematics, and/or science	①	②	③	④	⑤

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

Reflection

What are the implications of these data for your work?

How might you work in your state, or as a collective, to address issues related to teacher preparation and ongoing support?

Discussion

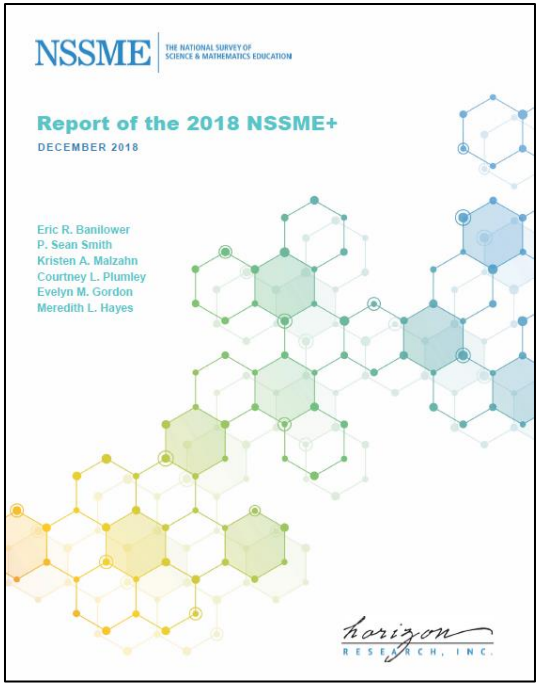
Questions/comments about the study or results?

Suggestions for future iterations of the study?

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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