NSSME | THE NATIONAL SURVEY OF SCIENCE & MATHEMATICS EDUCATION

Factors Associated With High-Quality Computer Science Instruction

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Session Overview

- About the 2018 NSSME+
- Analytic approach
- Results
- Discussion

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+ 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.

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.

Analytic Approach

The 2018 NSSME+ collected data about the nature of instruction in high school CS classes

Study also collected tons of data about teachers, schools, and instructional resources

We used path modeling to identify school, class, and teacher characteristics that are associated with certain instructional practices

Outcomes

Composite variables measuring:

1. Reform-oriented instructional objectives
2. Extent instruction engages students with the practices of computer science

Reform-Oriented Instructional Objectives

How much emphasis each would receive over the entire course:

1. Learning how to do computer science (e.g., breaking problems into smaller parts, considering the needs of a user, creating computational artifacts)
2. Understanding computer science concepts
3. Developing students' confidence that they can successfully pursue careers in computer science
4. Increasing students' interest in computer science
5. Learning how to develop computational solutions
6. Learning about real-life applications of computer science

Engagement in Computer Science Practices

How often students are 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

Independent Variables

Schools

- School size
- Percent FRL
- Community type
- Public vs. private school
- Block scheduling

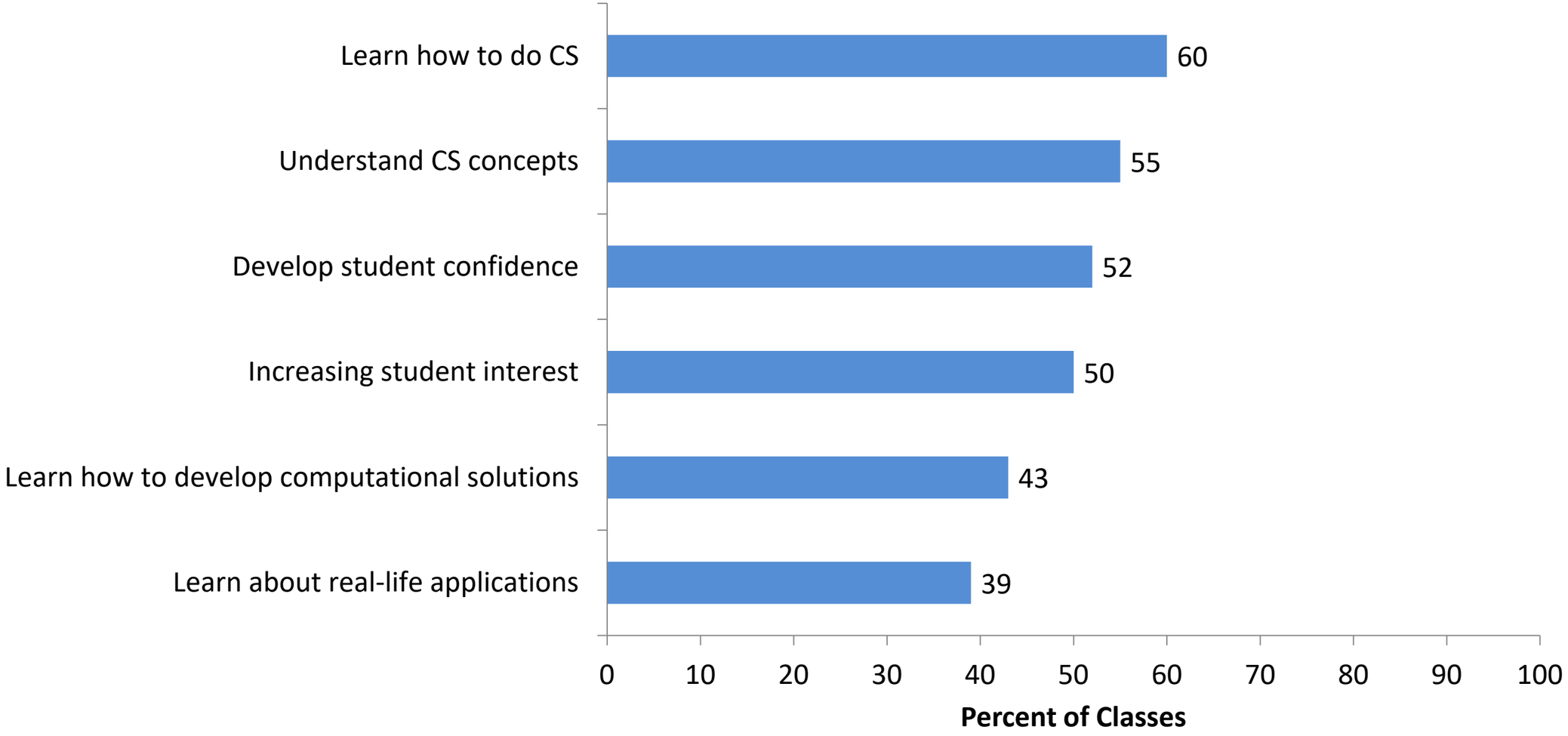
Teachers

- Years of CS teaching experience
- Perceptions of preparedness
- Teaching beliefs
- CS degree
- CS-related job before teaching
- Amount of CS PD

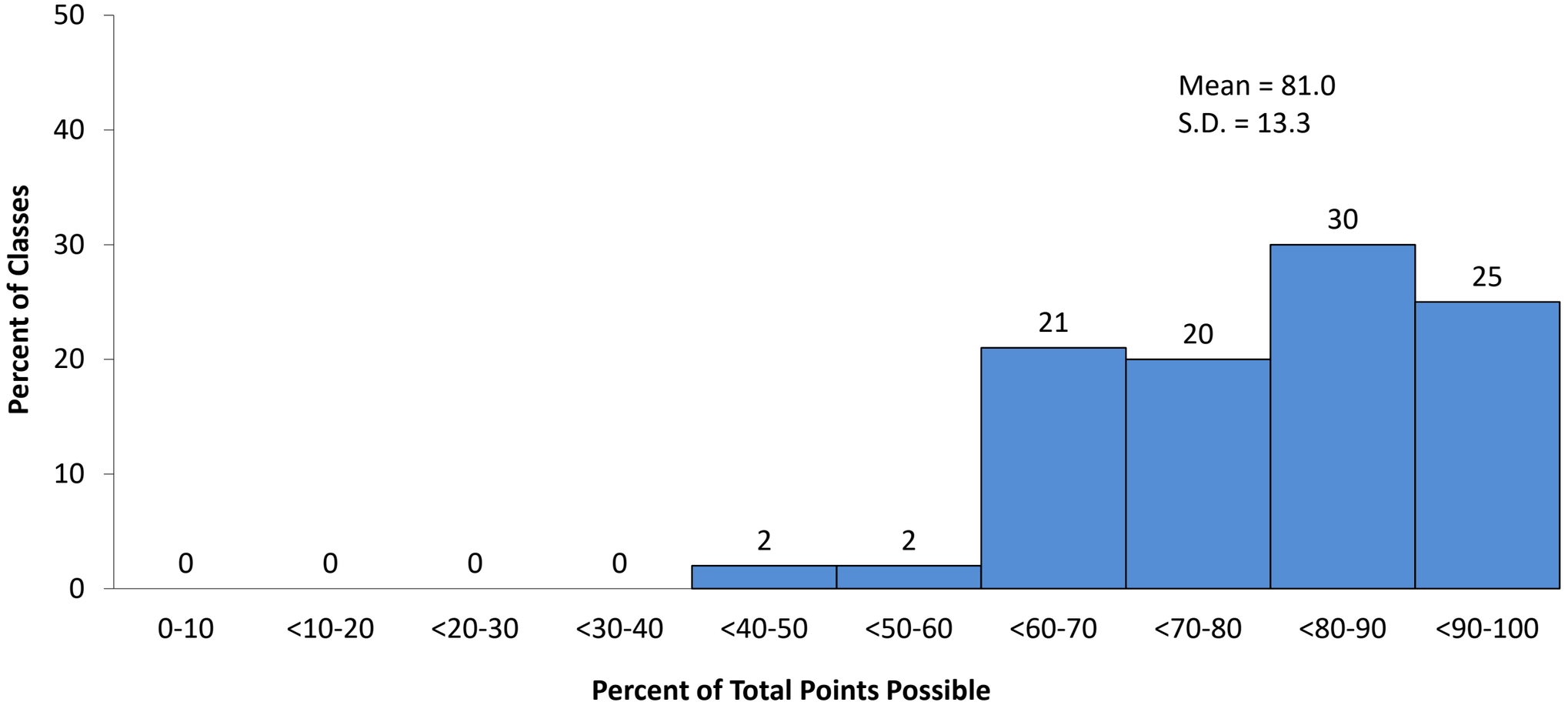
Classes

- Type of course (introductory, AP, or specialized)
- Prior achievement level of students
- Class size
- Percent of students in class from race/ethnicity groups historically underrepresented in STEM (HUS)
- Curriculum control
- Type of instructional materials used (mainly curriculum package, mainly materials teacher pulled together, or a mixture)
- Extent computer issues are problematic

Objectives Receiving a Heavy Emphasis



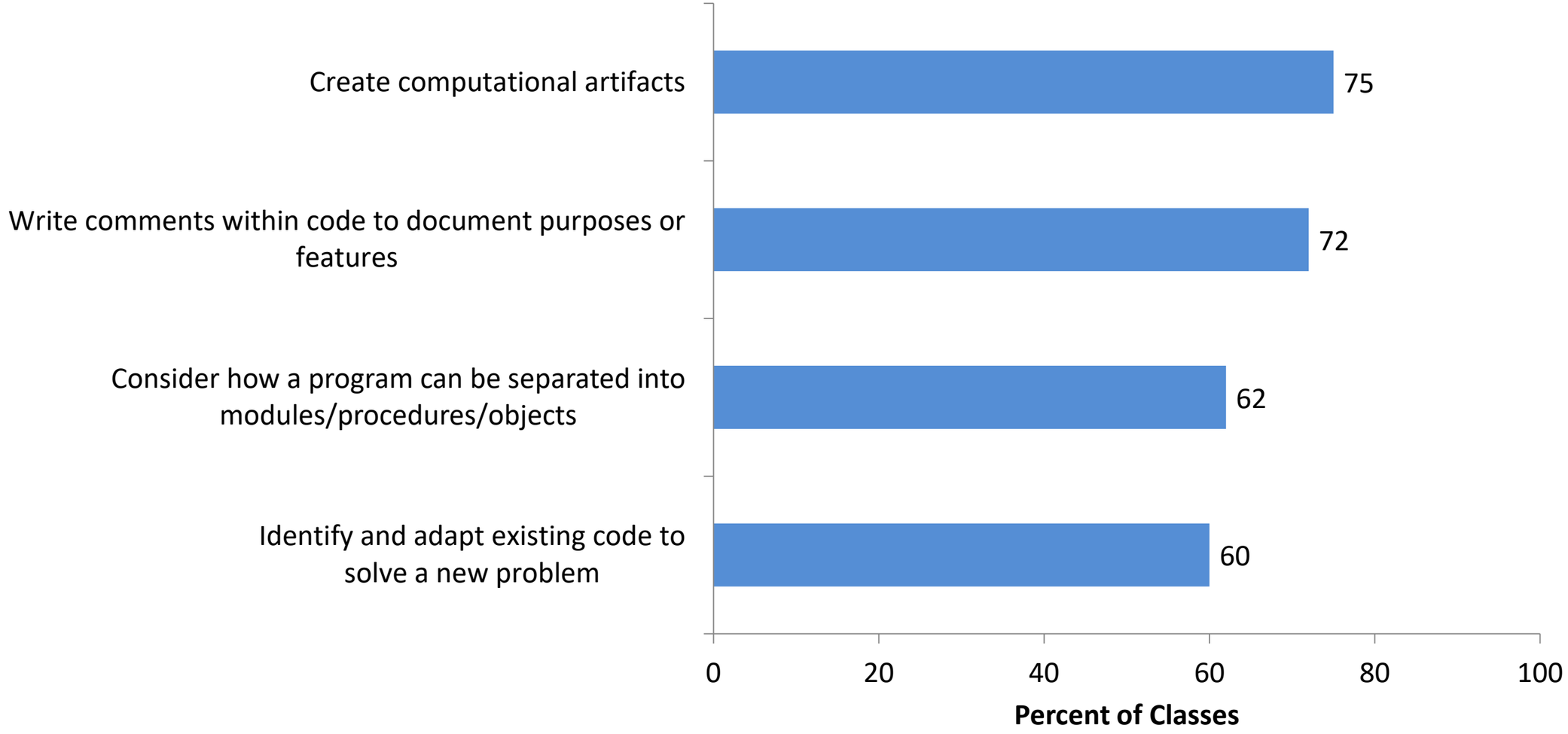
Reform-Oriented Instructional Objectives Composite



Engagement in Computer Science Practices

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

Developing Computational Artifacts: Weekly

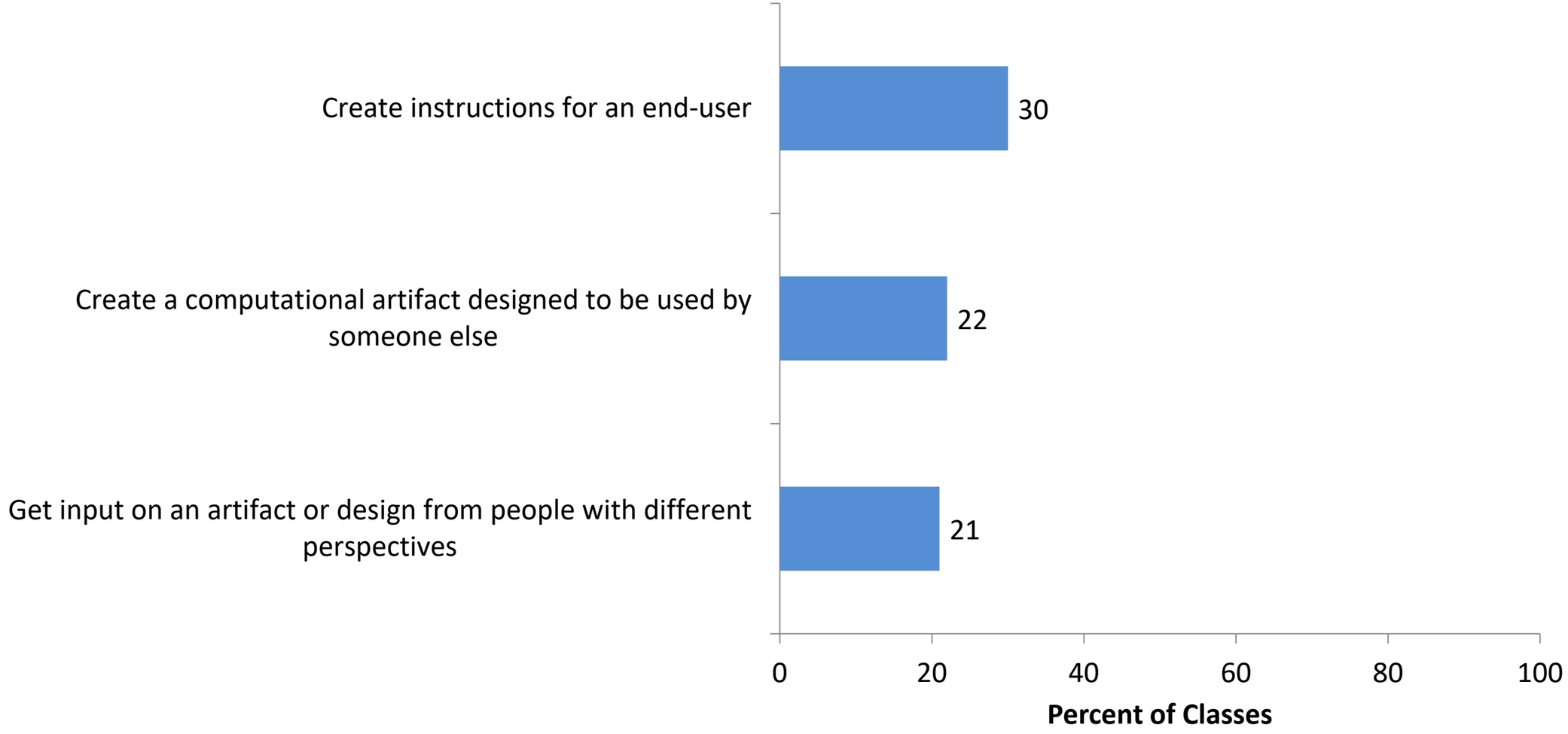


Engagement in Computer Science Practices

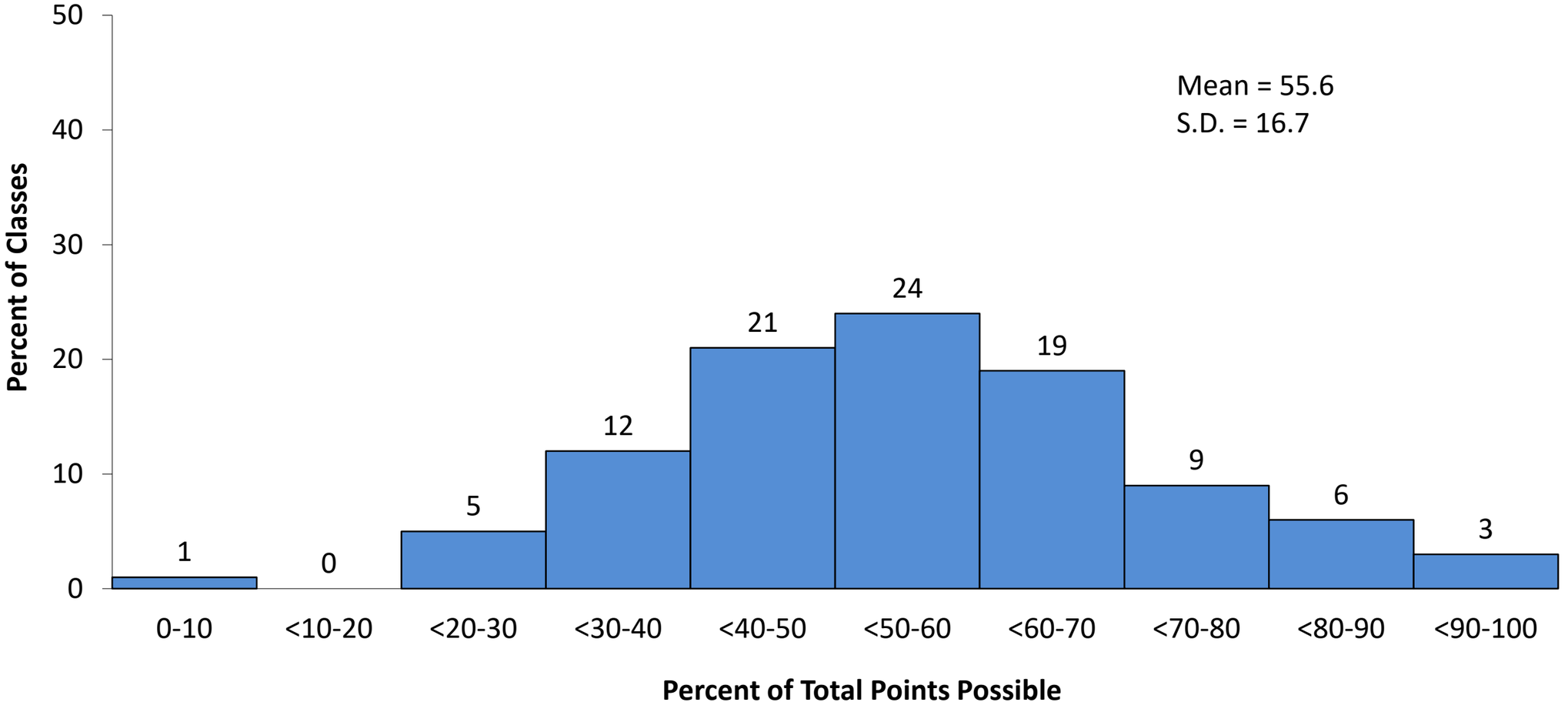
Students are often engaged in aspects of computer science related to developing computational artifacts

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



Engaging Students in the Practices of CS Composite



School Independent Variables

School Independent Variables

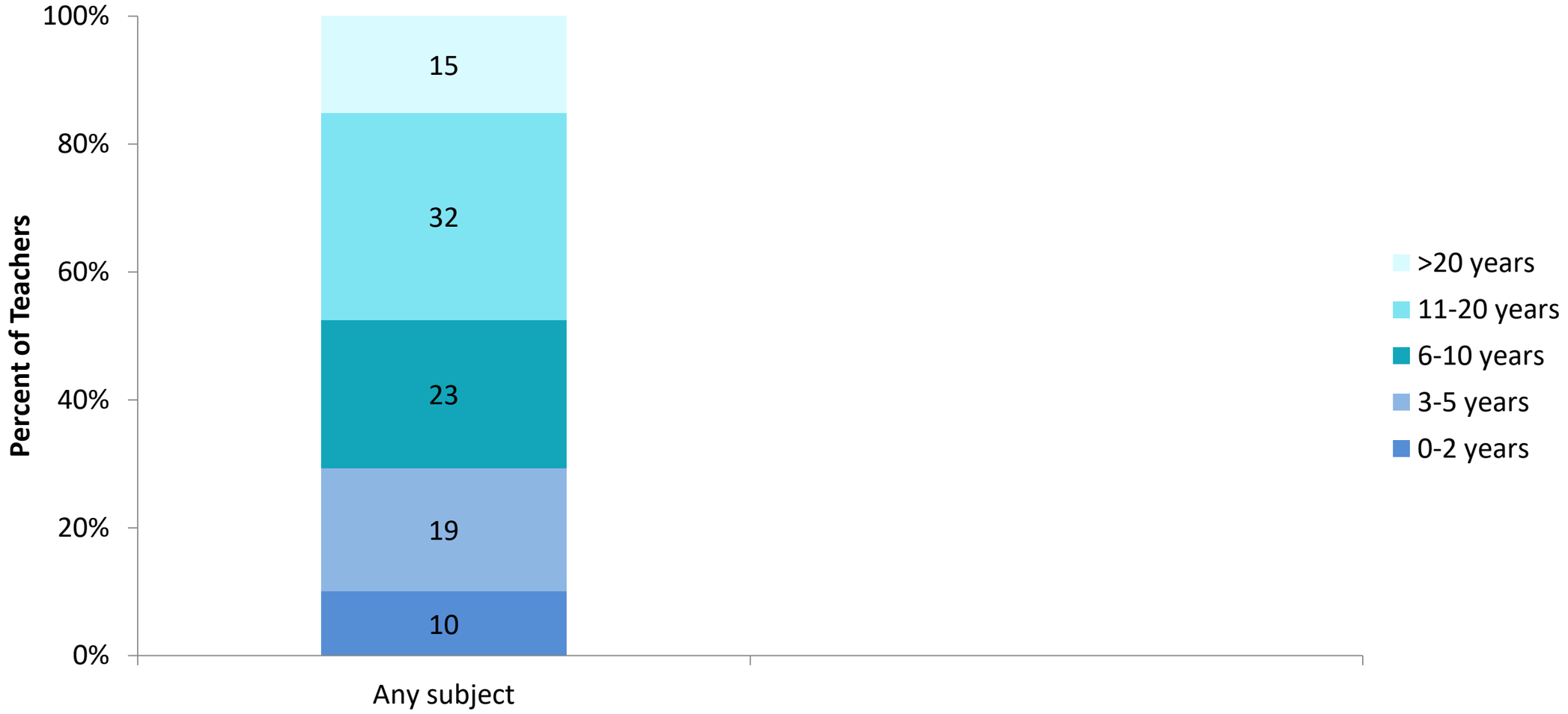
	High Schools With CS	All High Schools
Average Number of Students	721	665
Average Percent FRL	43%	44%

School Independent Variables

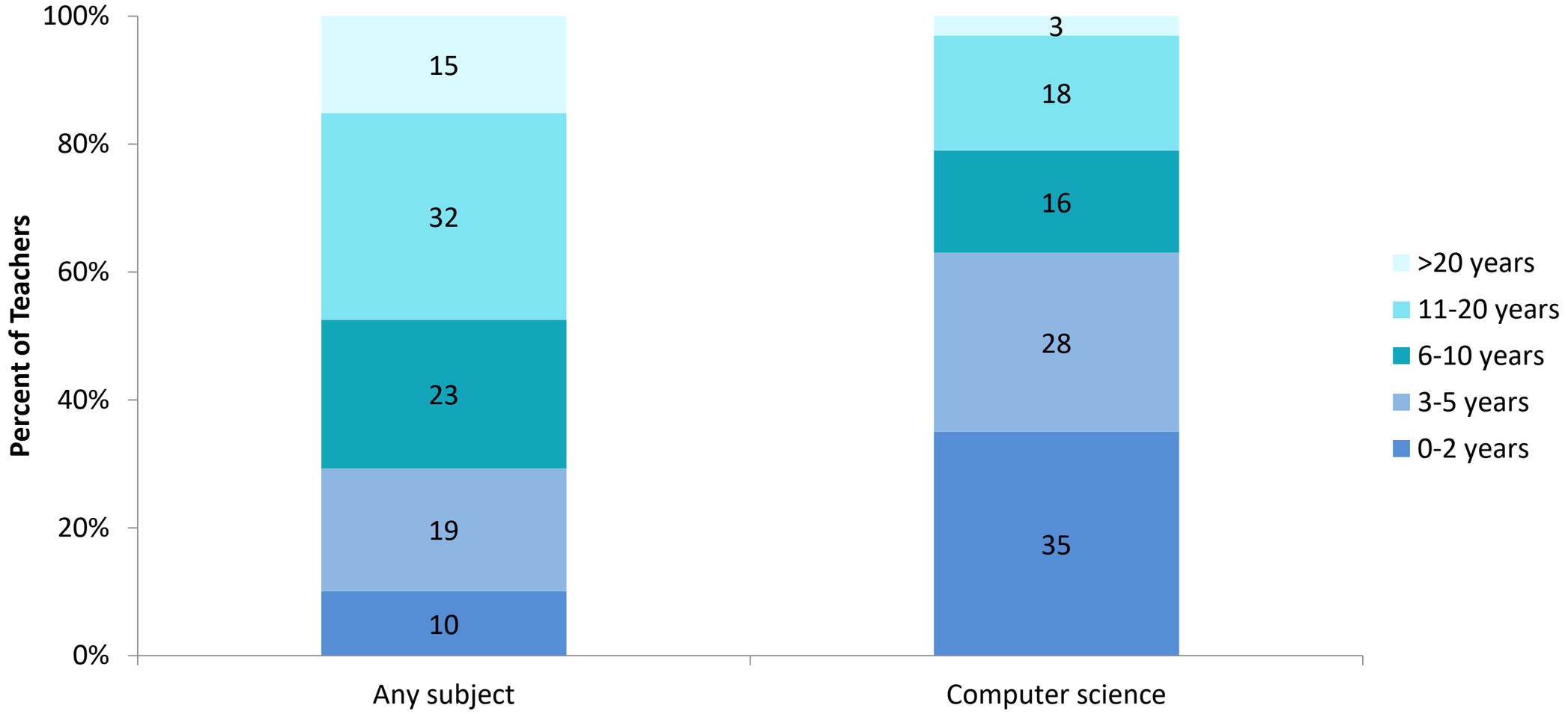
	% of High Schools With CS	% of All High Schools
Community Type		
Rural	34	36
Suburban	39	38
Urban	27	26
School Type		
Public	77	78
Private	23	22
Scheduling		
Block	37	33
Traditional	63	67

Teacher Independent Variables

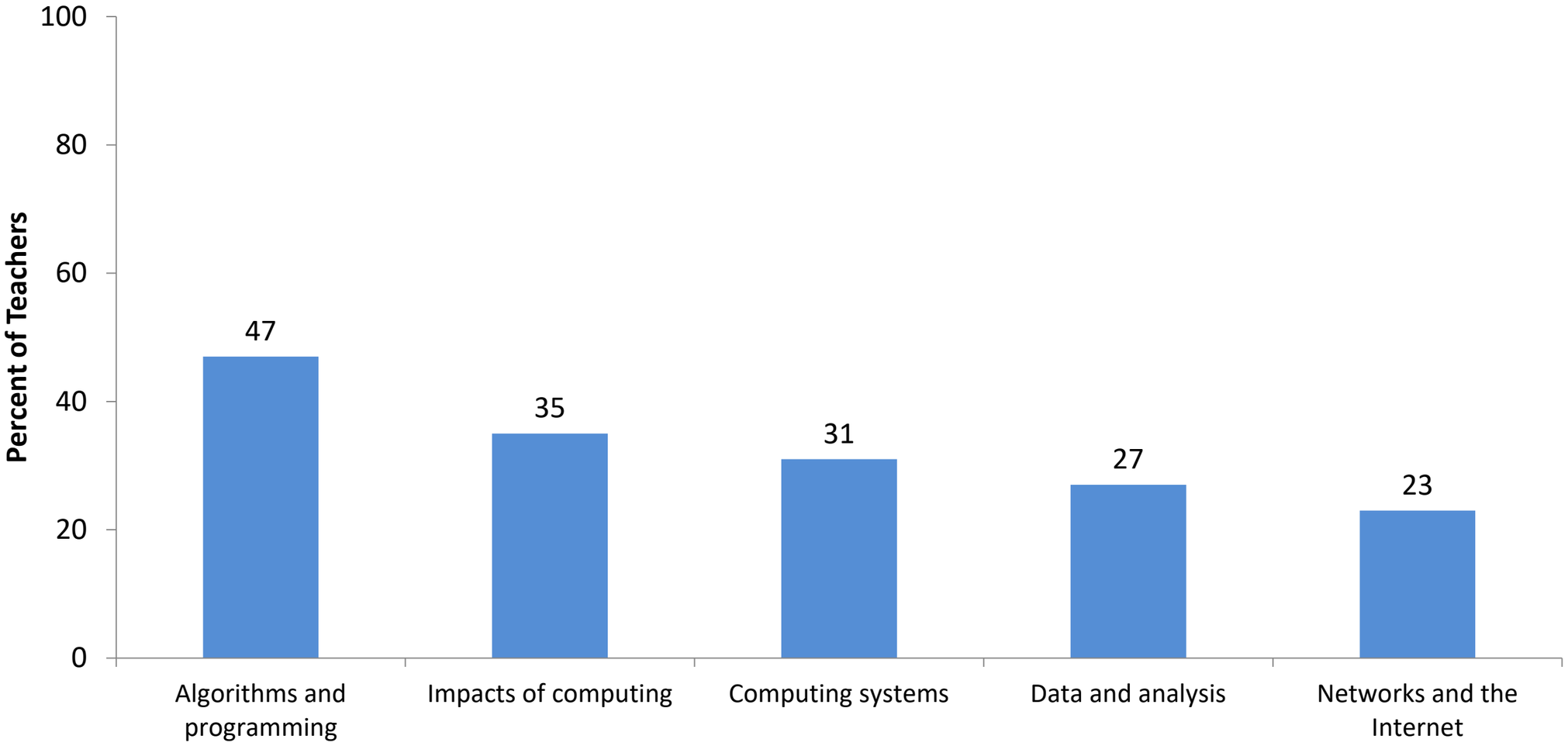
Years of Teaching Experience



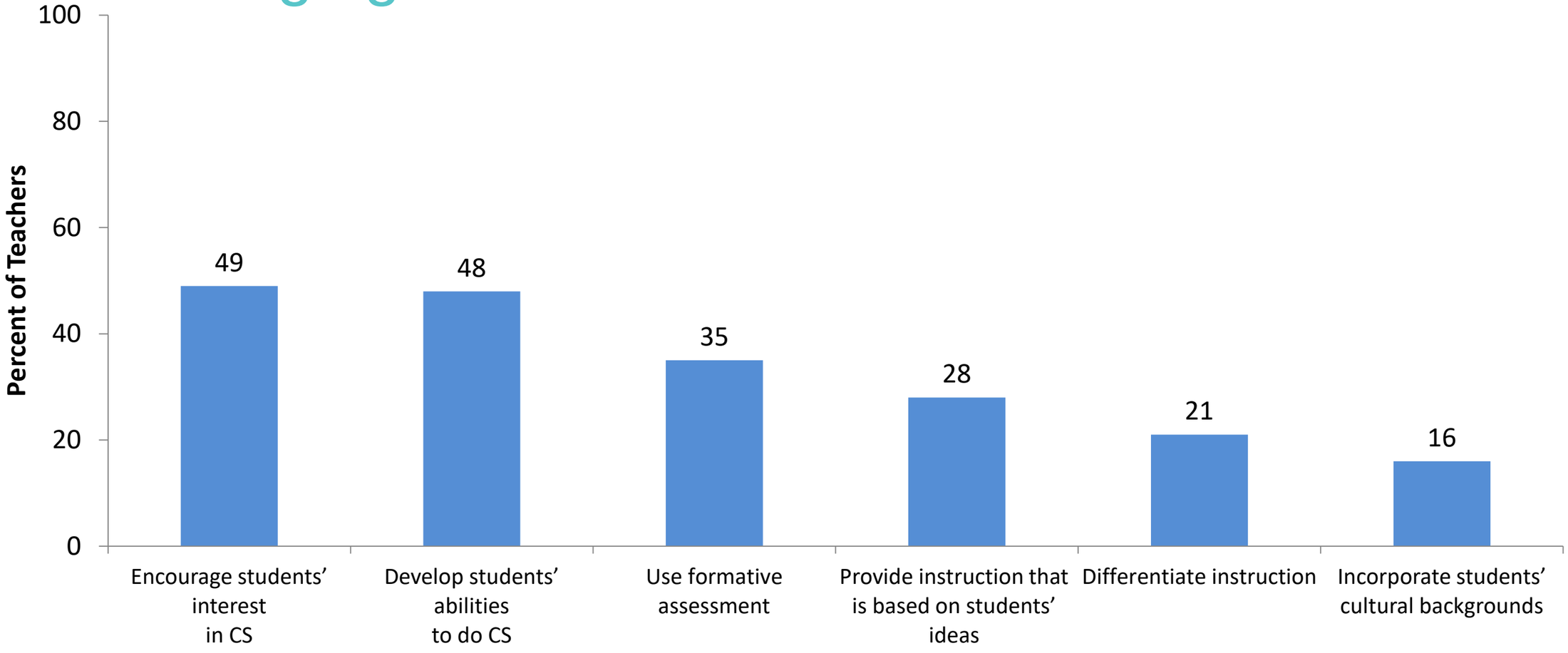
Years of Teaching Experience



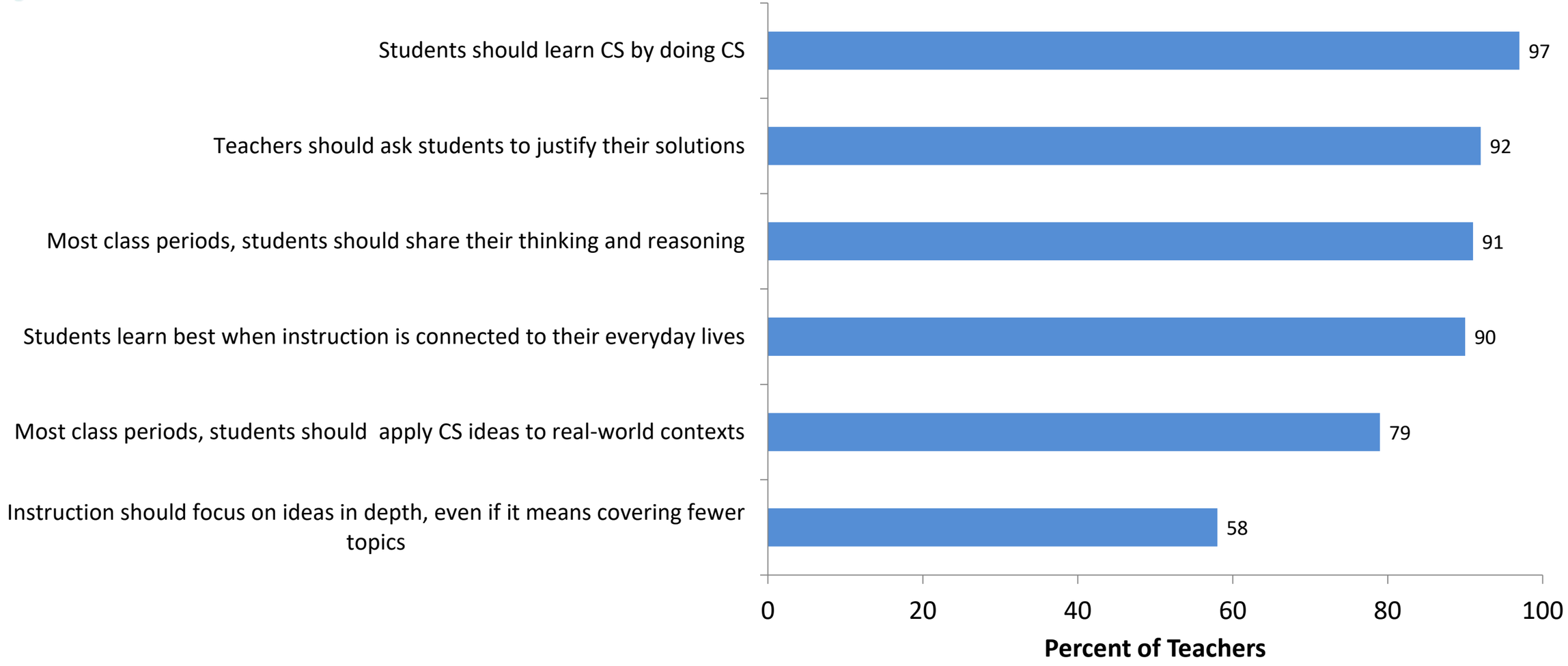
Perceptions of Preparedness: Very Well Prepared to Teach CS Topics



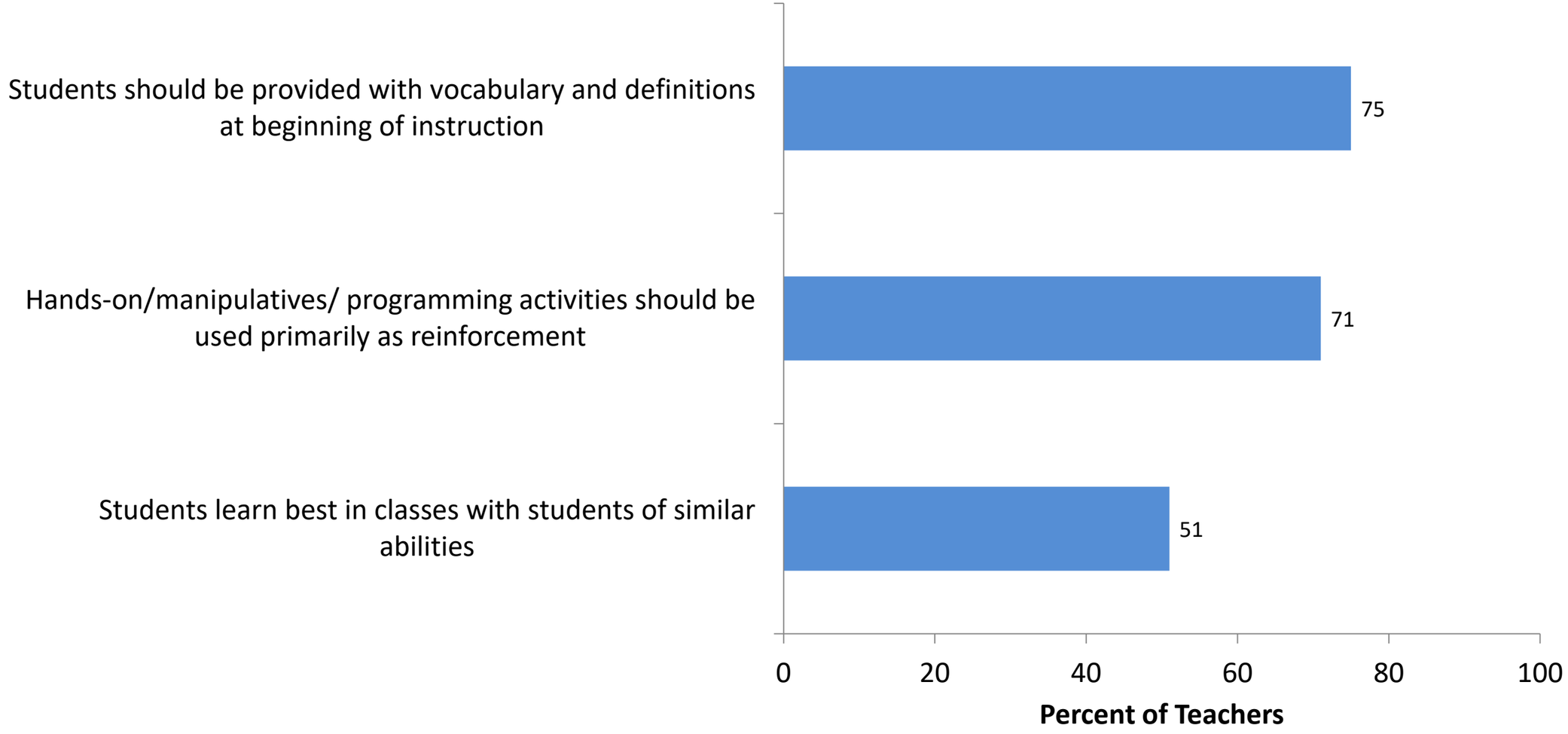
Perceptions of Preparedness: Very Well Prepared to Use Student-Centered Pedagogies



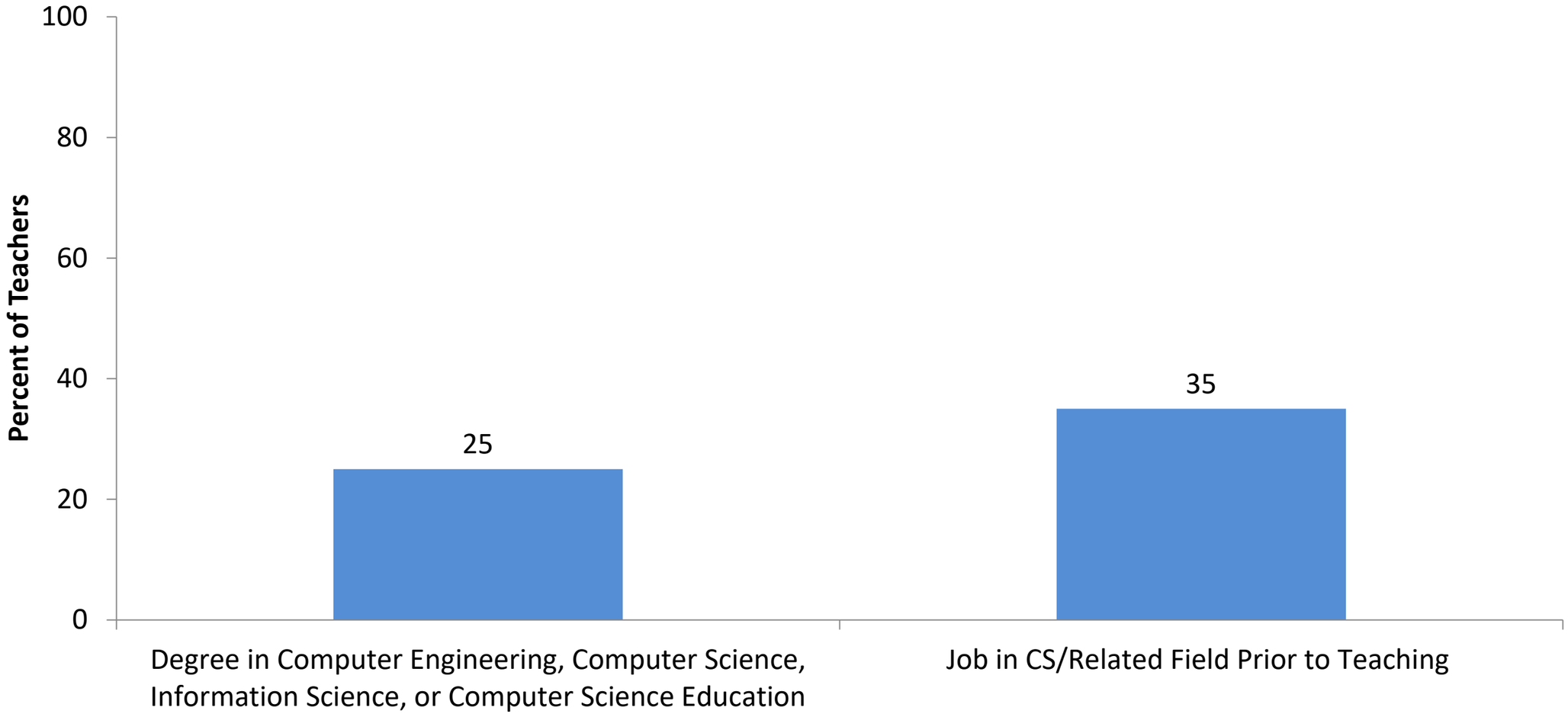
Teachers Agreeing With Various Reform-Oriented Teaching Beliefs



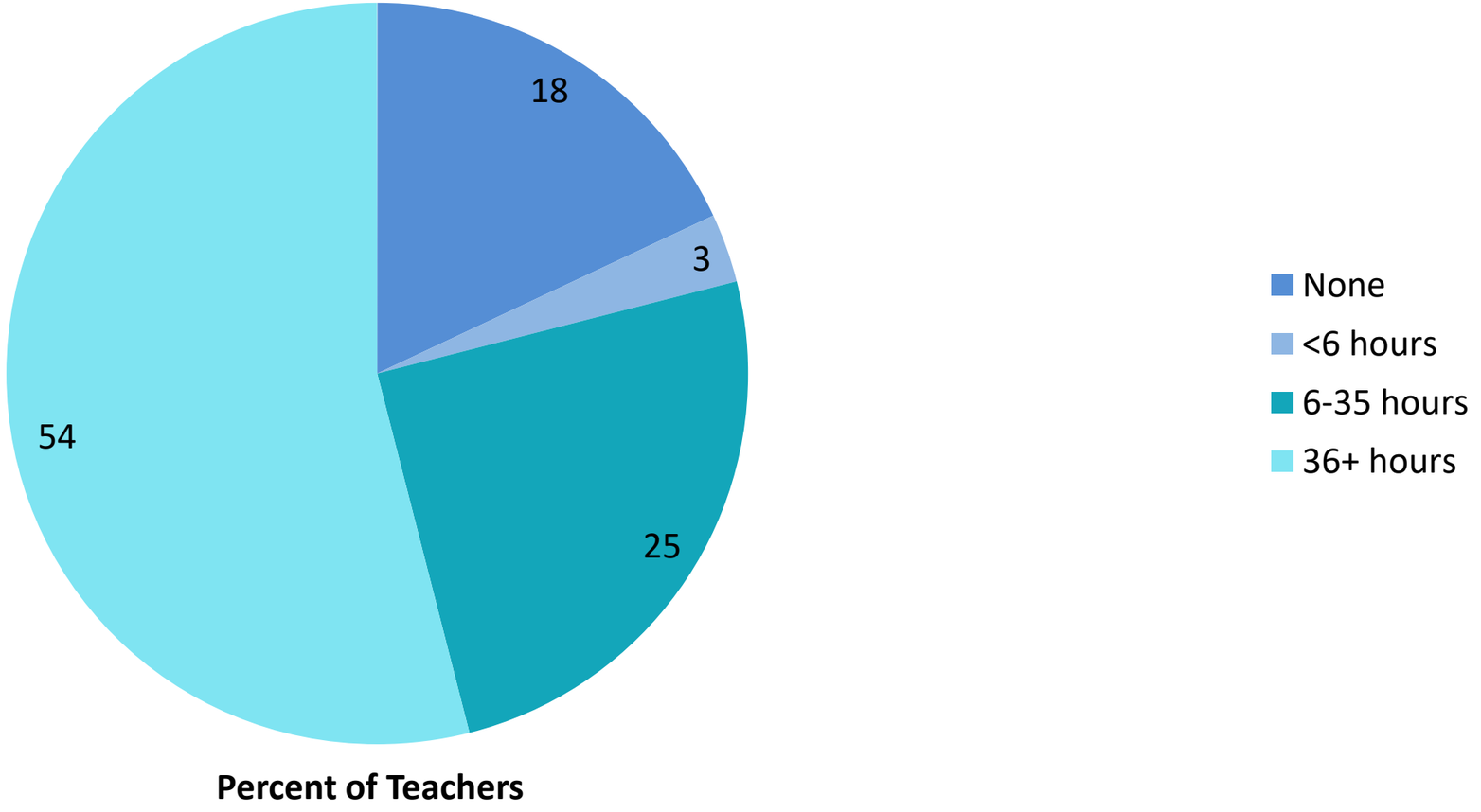
Teachers Agreeing With Various Traditional Teaching Beliefs



CS Background



Hours of CS PD in Previous 3 Years

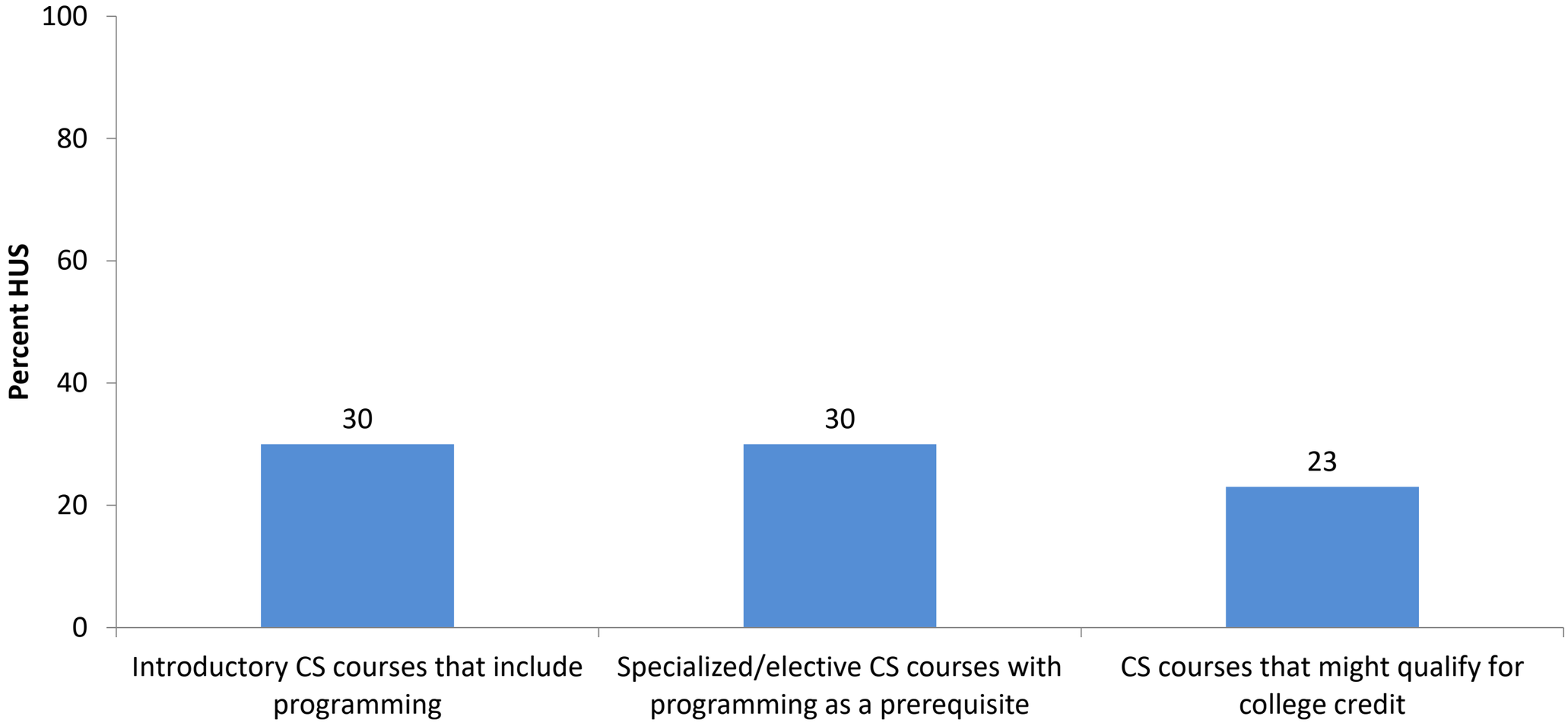


Class Independent Variables

Class Independent Variables

	Percent of Classes
Course Type	
Introductory	48
Specialized/Elective	18
AP	35
Prior Achievement Level of Students	
Mostly Average/Mix of Levels	63
Mostly High	37

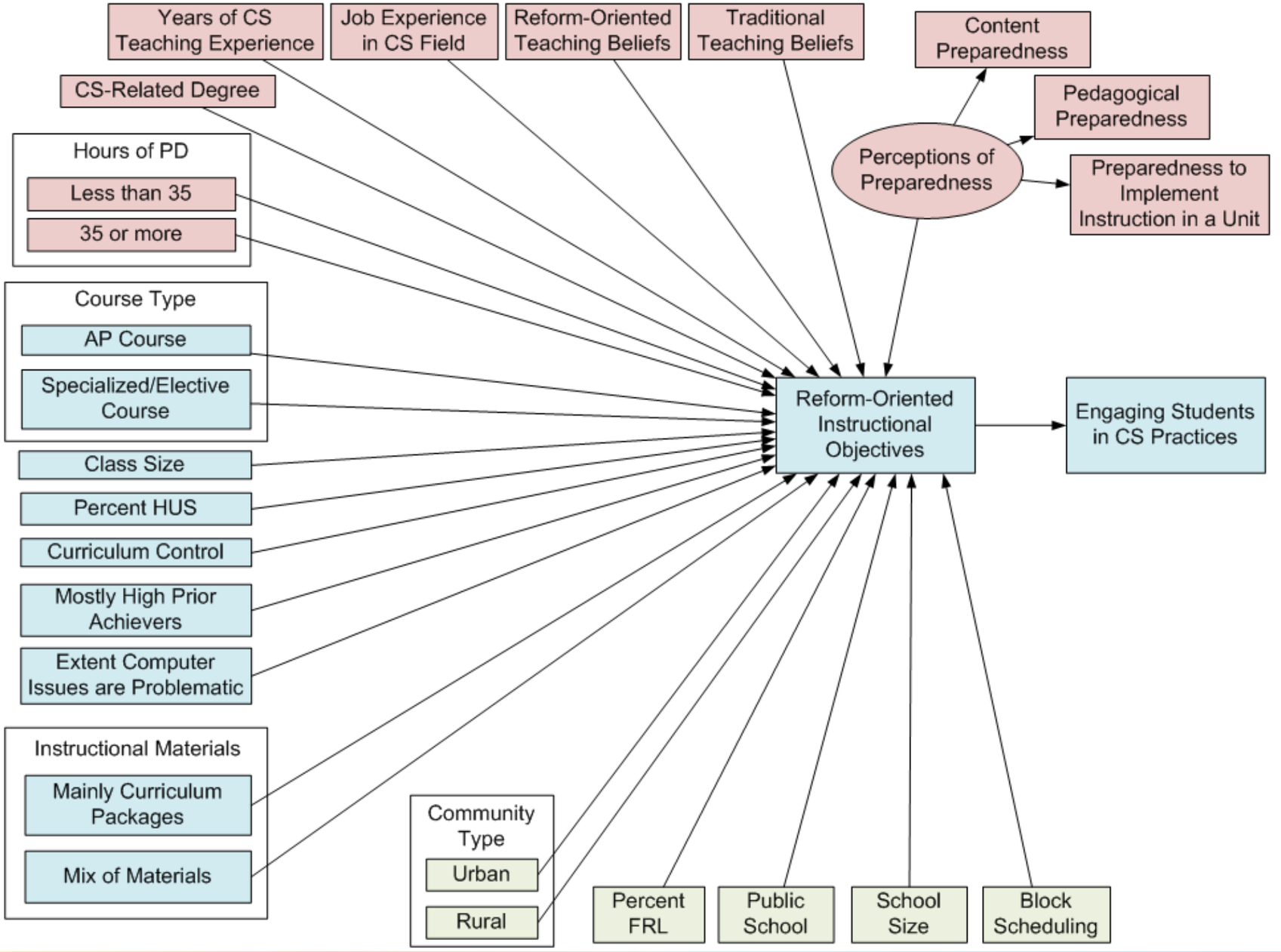
HUS Students Taking CS Courses

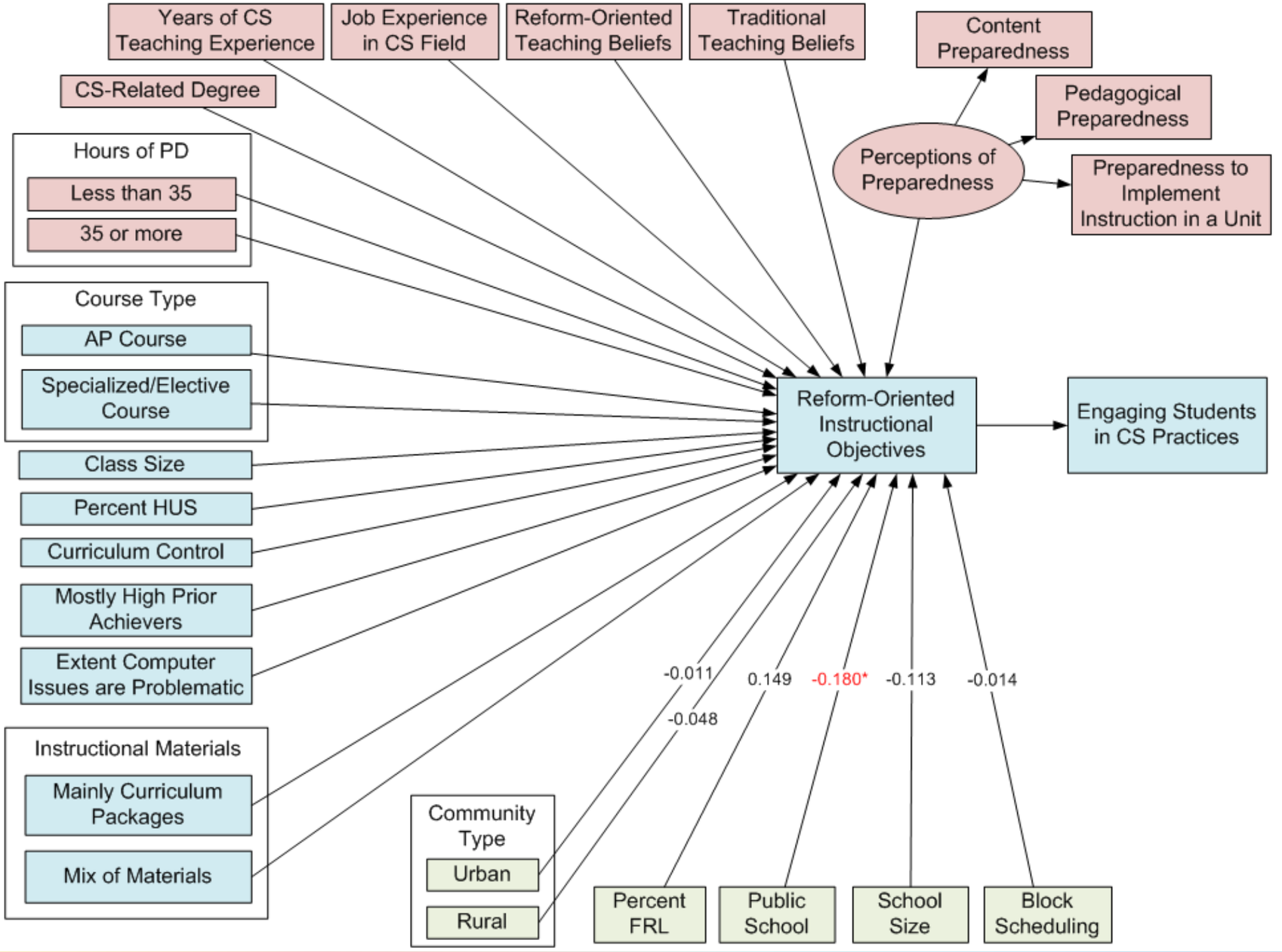


Materials Instruction is Based On

	Percent of Classes
Mainly curriculum packages (e.g., commercially published textbooks)	12
Mainly materials pulled together on their own	41
Mix of both	47

Path Model


Years of CS Teaching Experience
Job Experience in CS Field
Reform-Oriented Teaching Beliefs
Traditional Teaching Beliefs
CS-Related Degree
Hours of PD
Less than 35
35 or more
Course Type
AP Course
Specialized/Elective Course
Class Size
Percent HUS
Curriculum Control
Mostly High Prior Achievers
Extent Computer Issues are Problematic
Instructional Materials
Mainly Curriculum Packages
Mix of Materials
Community Type
Urban
Rural
Content Preparedness
Pedagogical Preparedness
Perceptions of Preparedness
Preparedness to Implement Instruction in a Unit
Reform-Oriented Instructional Objectives
Engaging Students in CS Practices
Percent FRL
Public School
School Size
Block Scheduling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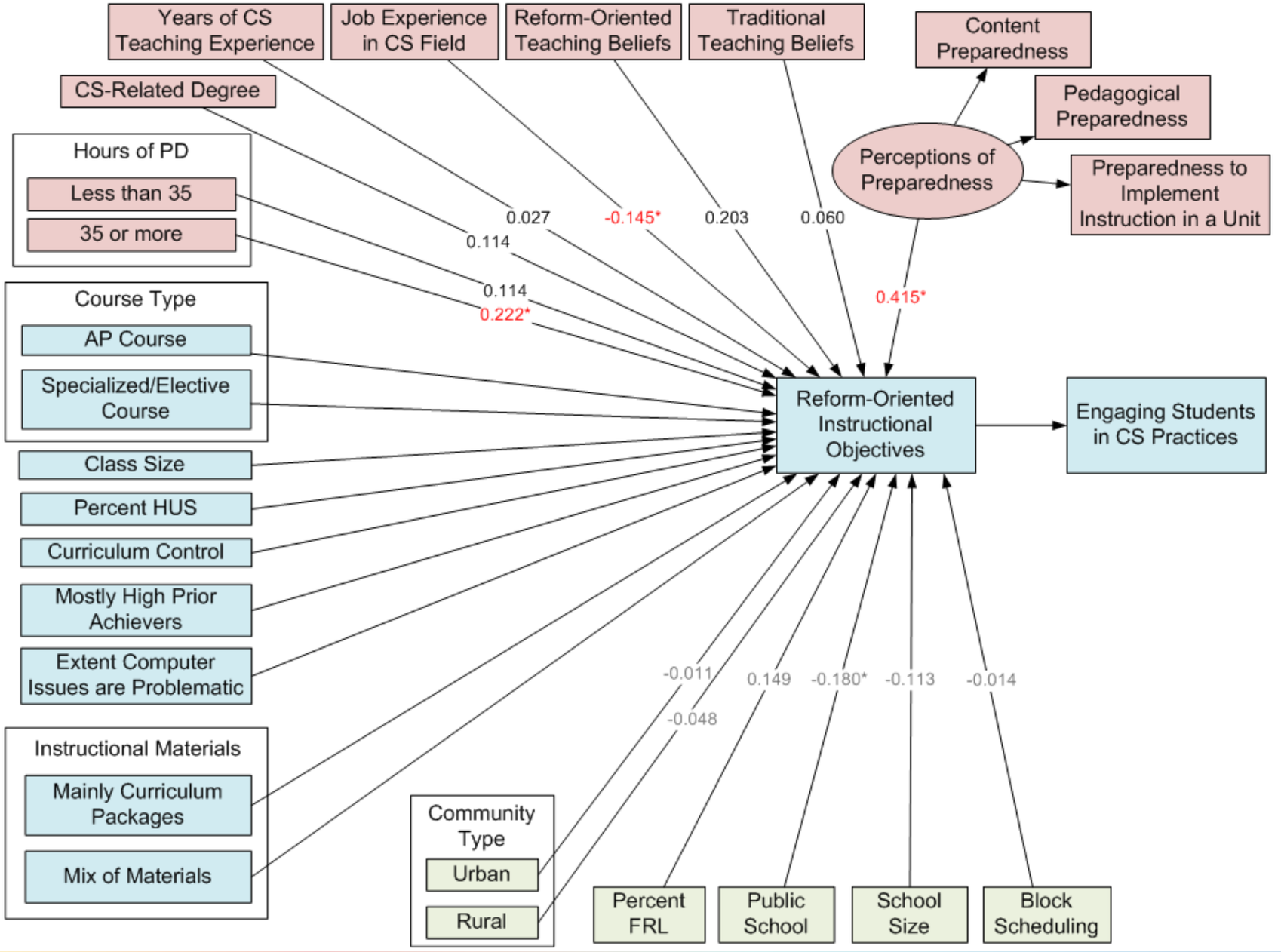
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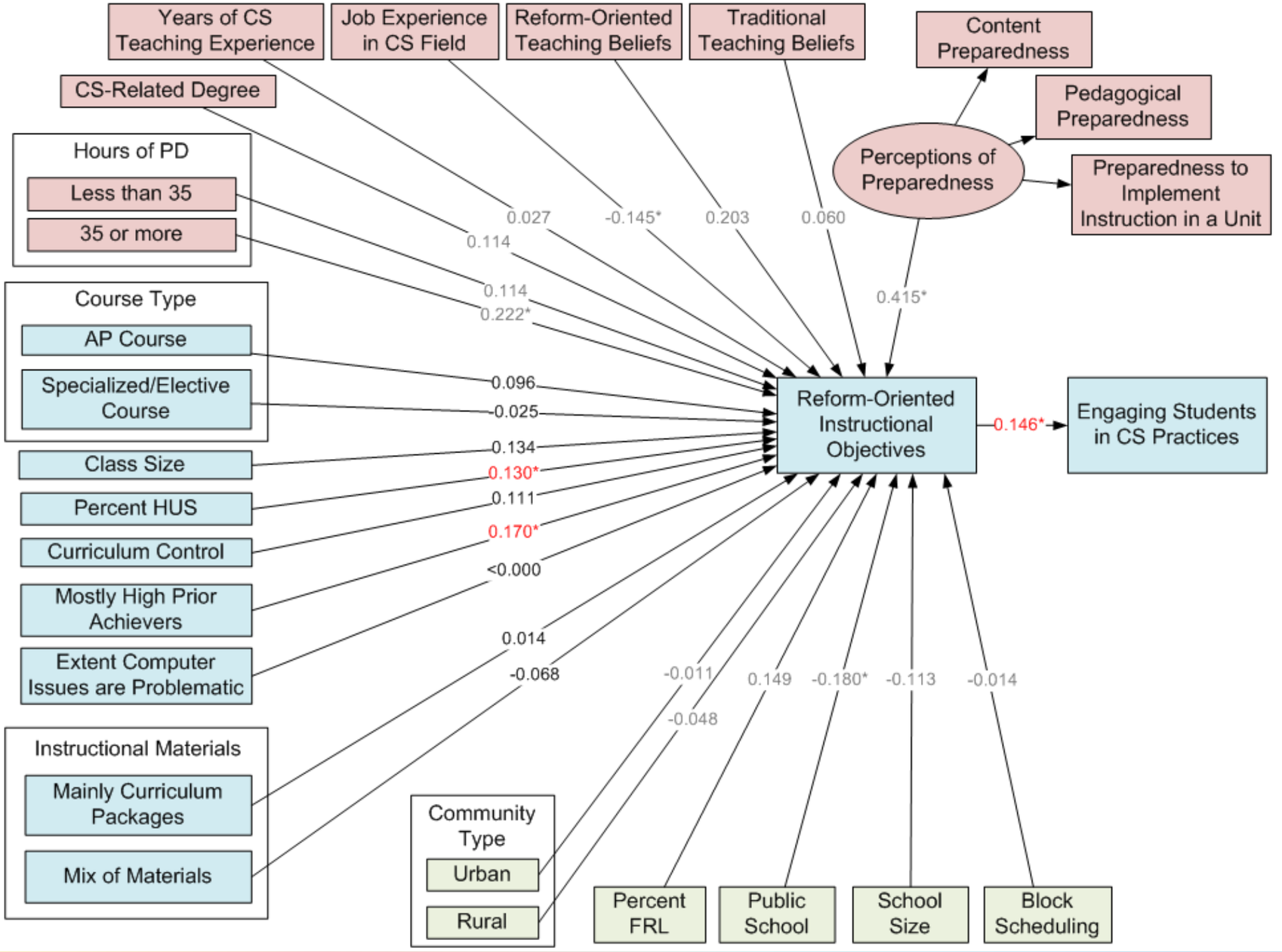
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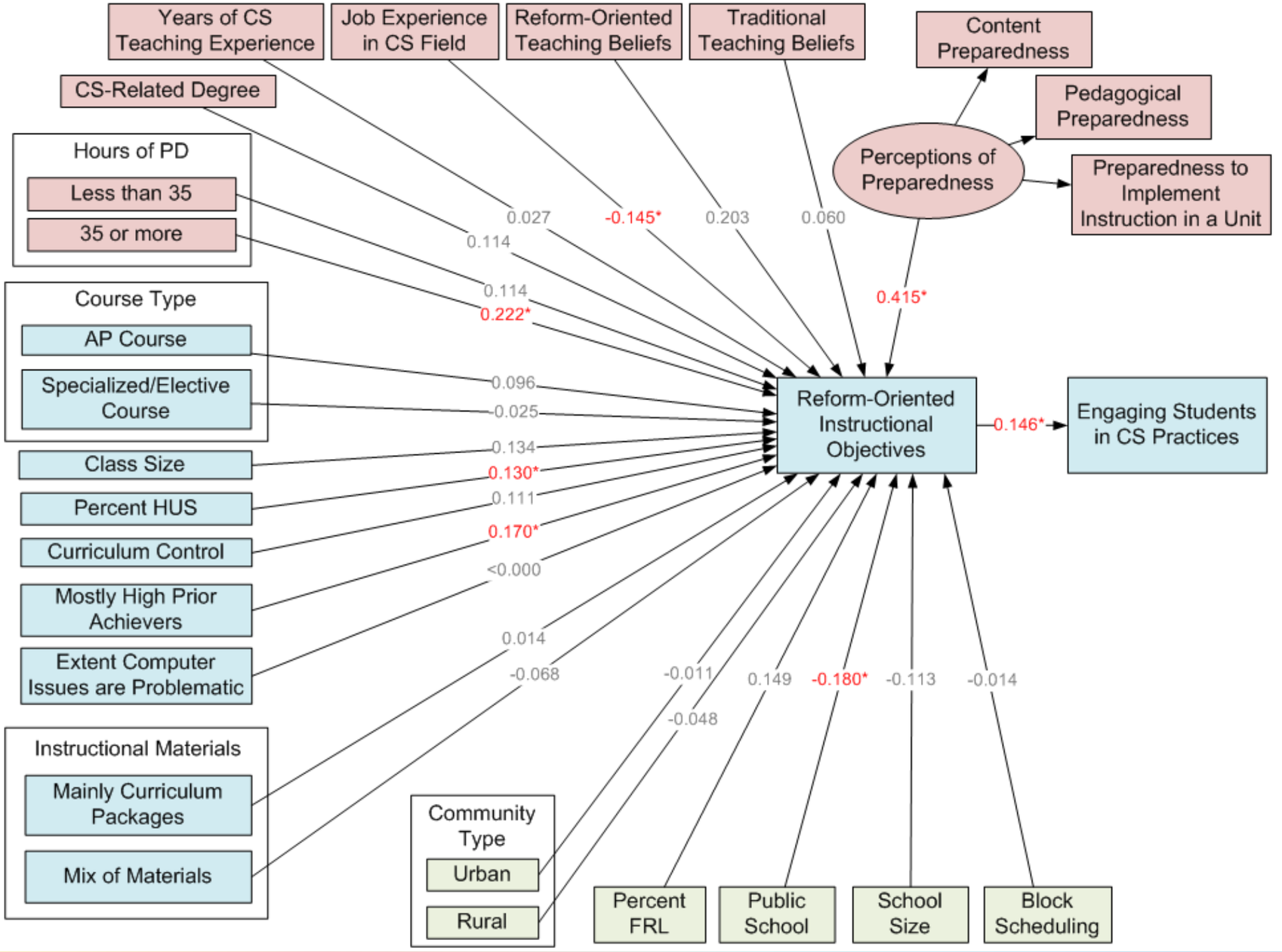
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Total Effects on Engaging Students in CS Practices

	Total Effect Size
Amount of CS PD in previous 3 years (vs. none)	
Less than 35 hours	0.177
35 or more hours	0.563
Perceptions of Preparedness	0.260
Traditional Teaching Beliefs	0.183
Type of instructional material (vs. mainly materials pulled together on their own)	
Mainly curriculum packages (e.g., commercially published textbooks)	0.148
Mix of both	0.024
Reform-Oriented Instructional Objectives	0.146
Class size	0.207
Community type (vs. Suburban)	
Rural	0.194
Urban	0.126
Block scheduling	0.113

The full paper is available for download here:

https://dl.acm.org/doi/abs/10.1145/3328778.3366831

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Several reports and presentations from the study are available, free of charge, on our website.

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