

# Highlights from the 2012 National Survey of Science and Mathematics Education

Eric R. Banilower  
P. Sean Smith  
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# Formative Assessment

- Take a minute and jot down your answers.
- Turn to a neighbor and discuss your predictions.

# Overview

# About the Study

- Two-stage sample that targeted:
  - 2,000 schools (public and private)
  - Over 10,000 teachers
  - Purposefully oversampled teachers of advanced mathematics, chemistry, and physics
- Four main instruments:
  - Science program questionnaire
  - Mathematics program questionnaire
  - Science teacher questionnaire
  - Mathematics teacher questionnaire

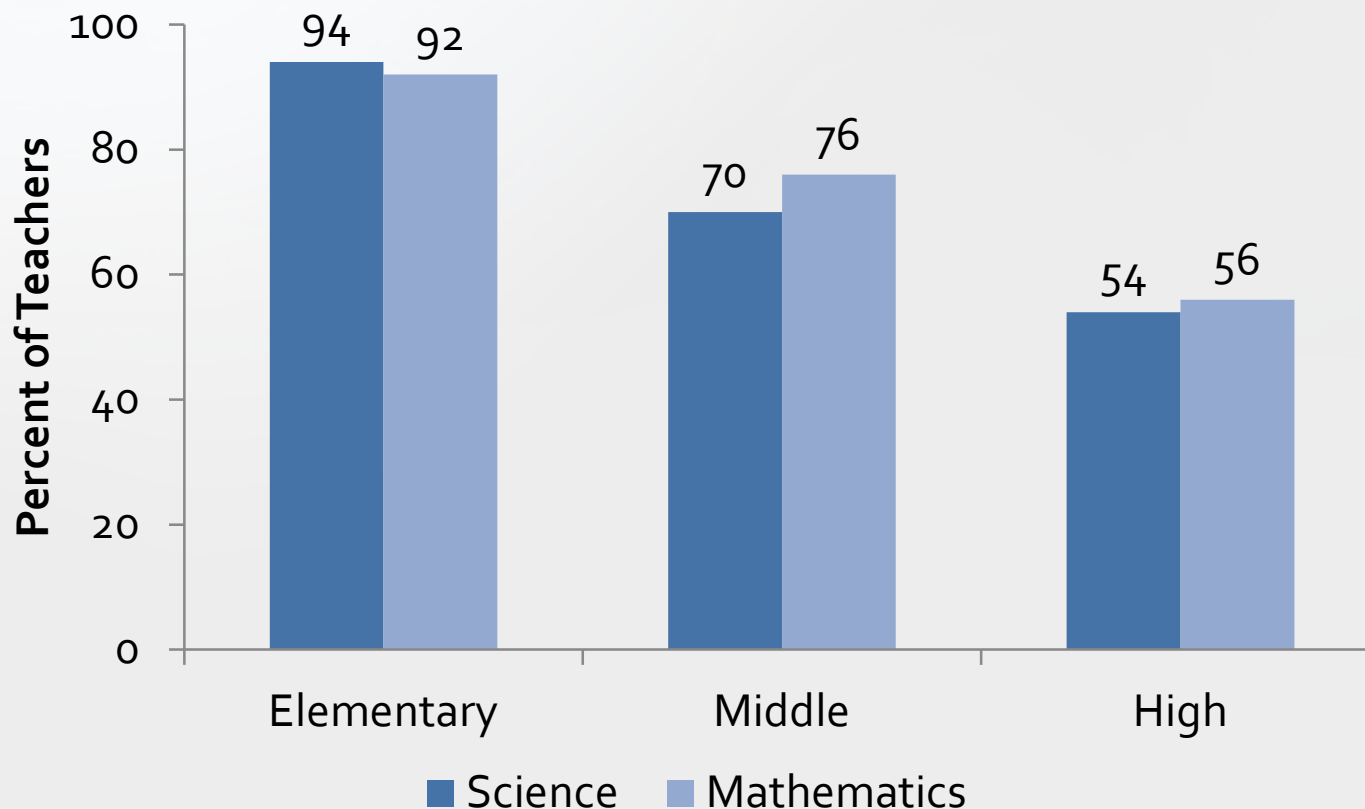
# Endorsing Organizations

- American Association of Physics Teachers
- American Chemical Society, Education Division
- American Federation of Teachers
- Association of Mathematics Teacher Educators
- Association of State Supervisors of Mathematics
- Center for the Study of Mathematics Curriculum
- Council of State Science Supervisors
- National Association of Biology Teachers
- National Association of Elementary School Principals
- National Association of Secondary School Principals
- National Catholic Education Association
- National Council of Supervisors of Mathematics
- National Council of Teachers of Mathematics
- National Earth Science Teachers Association
- National Education Association
- National School Boards Association
- National Science Education Leadership Association
- National Science Teachers Association

- We got a really good response rate:
  - 1,504 schools agreed to participate
  - Over 80 percent of program representatives
  - Over 75 percent of sampled teachers
- Sampling and analysis techniques used allow for nationally representative estimates

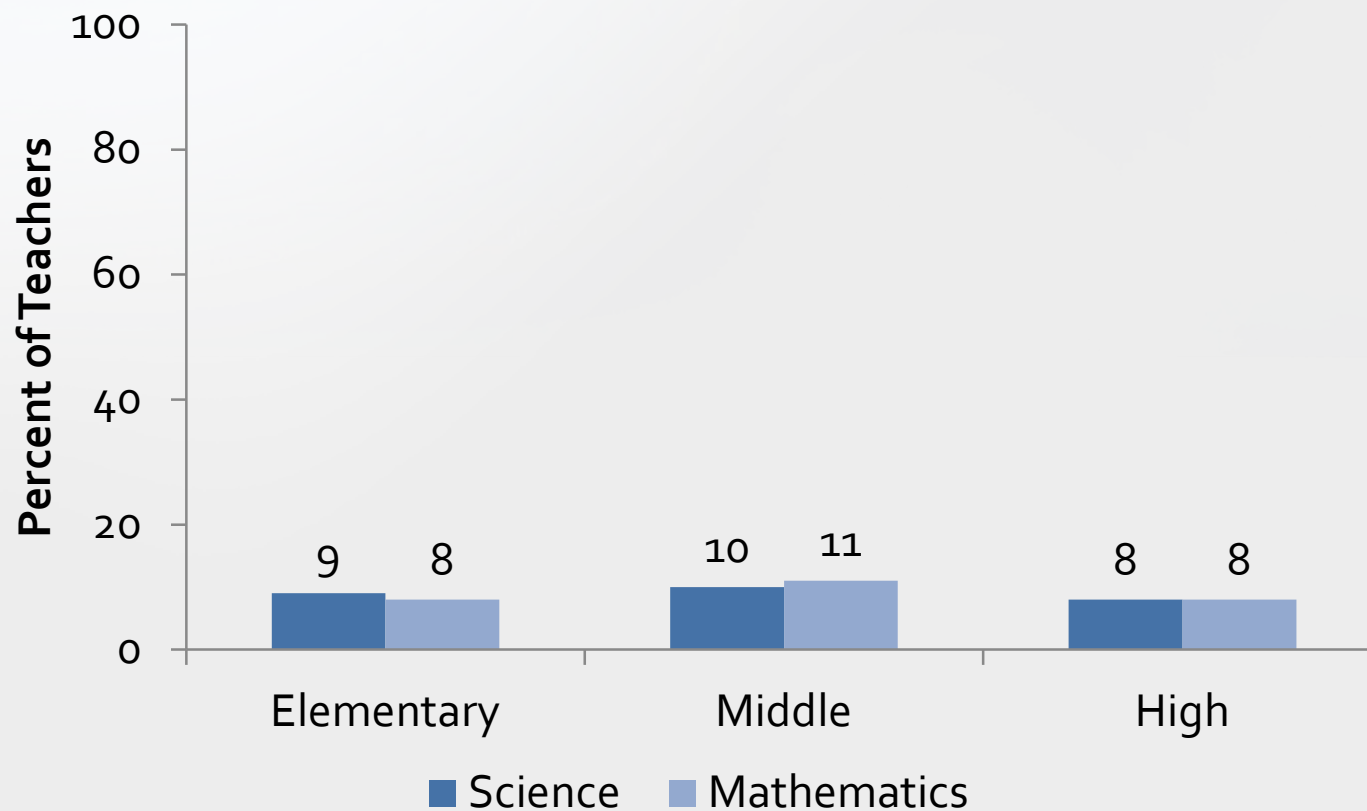
# Teacher Background

# Percent Female





# Percent Non-White

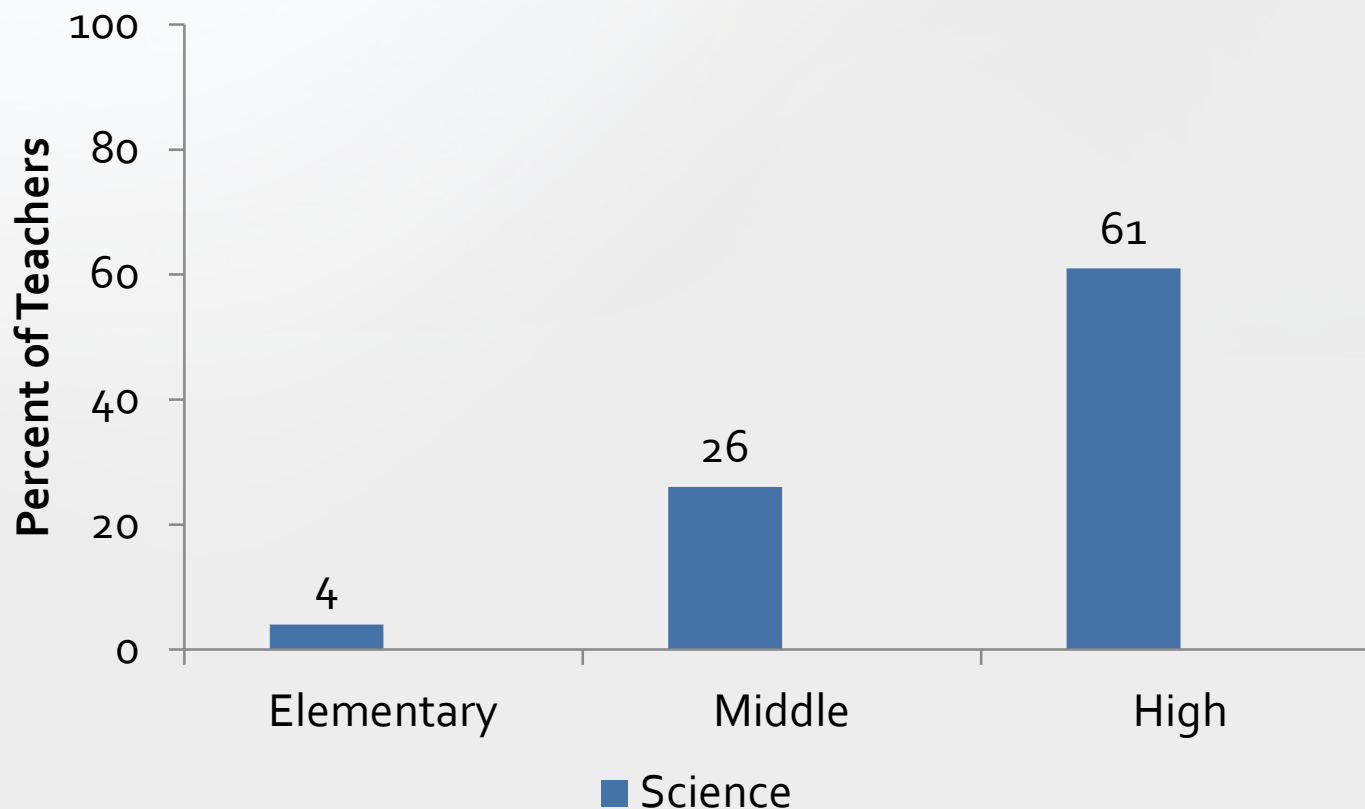


## Question 1

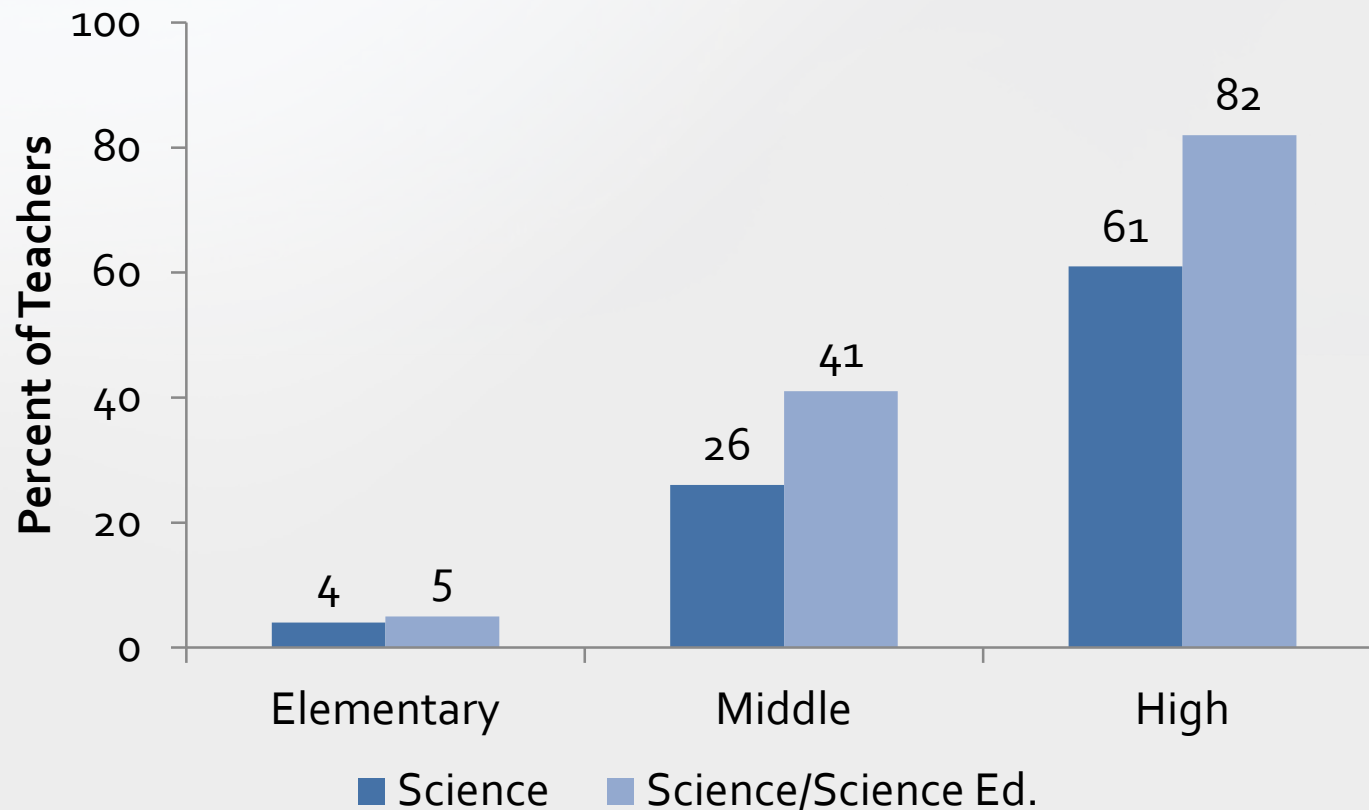
About what percentage of high school science teachers have a college degree in a science discipline?

- a. 50 percent
- b. 60 percent
- c. 70 percent
- d. 80 percent

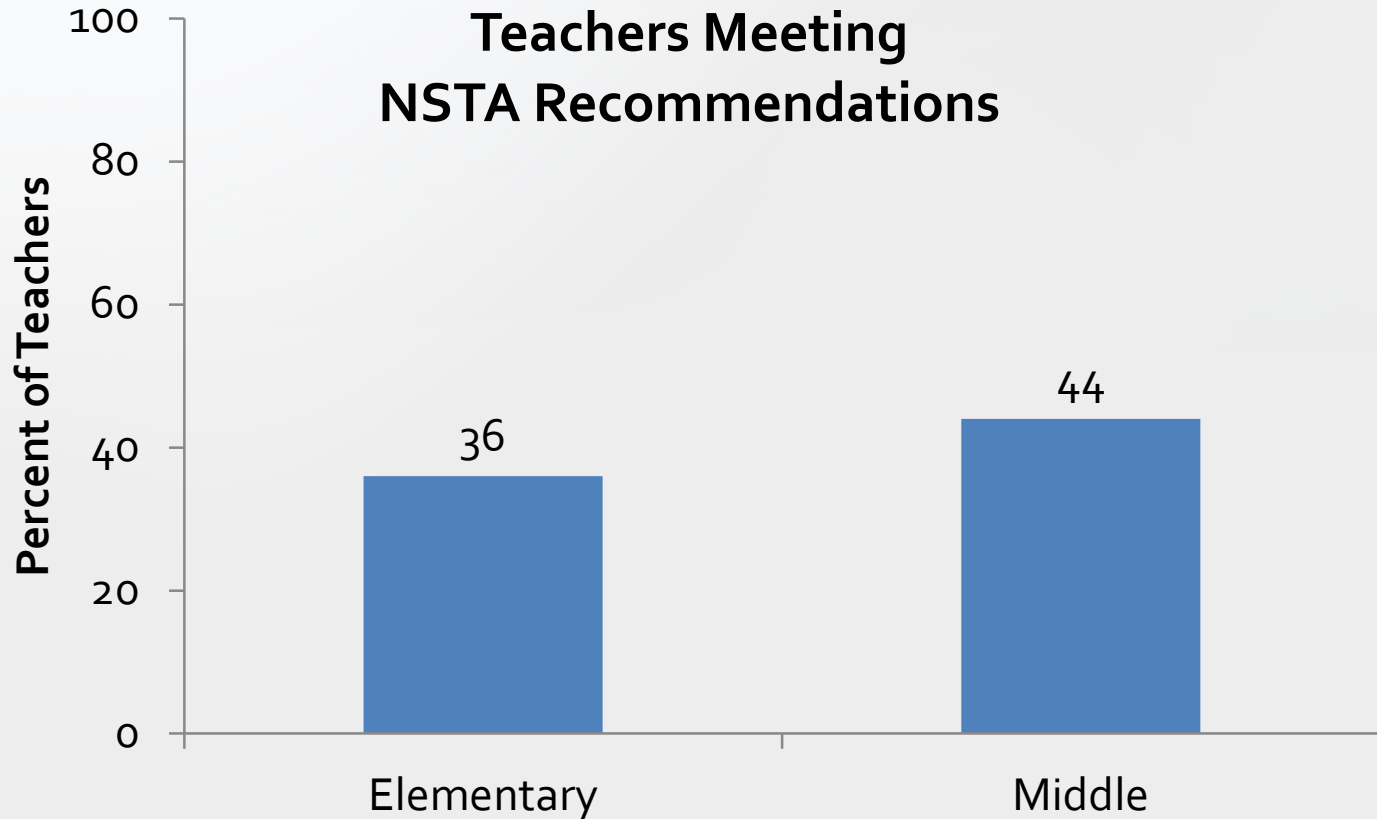
# Science Teacher Degrees



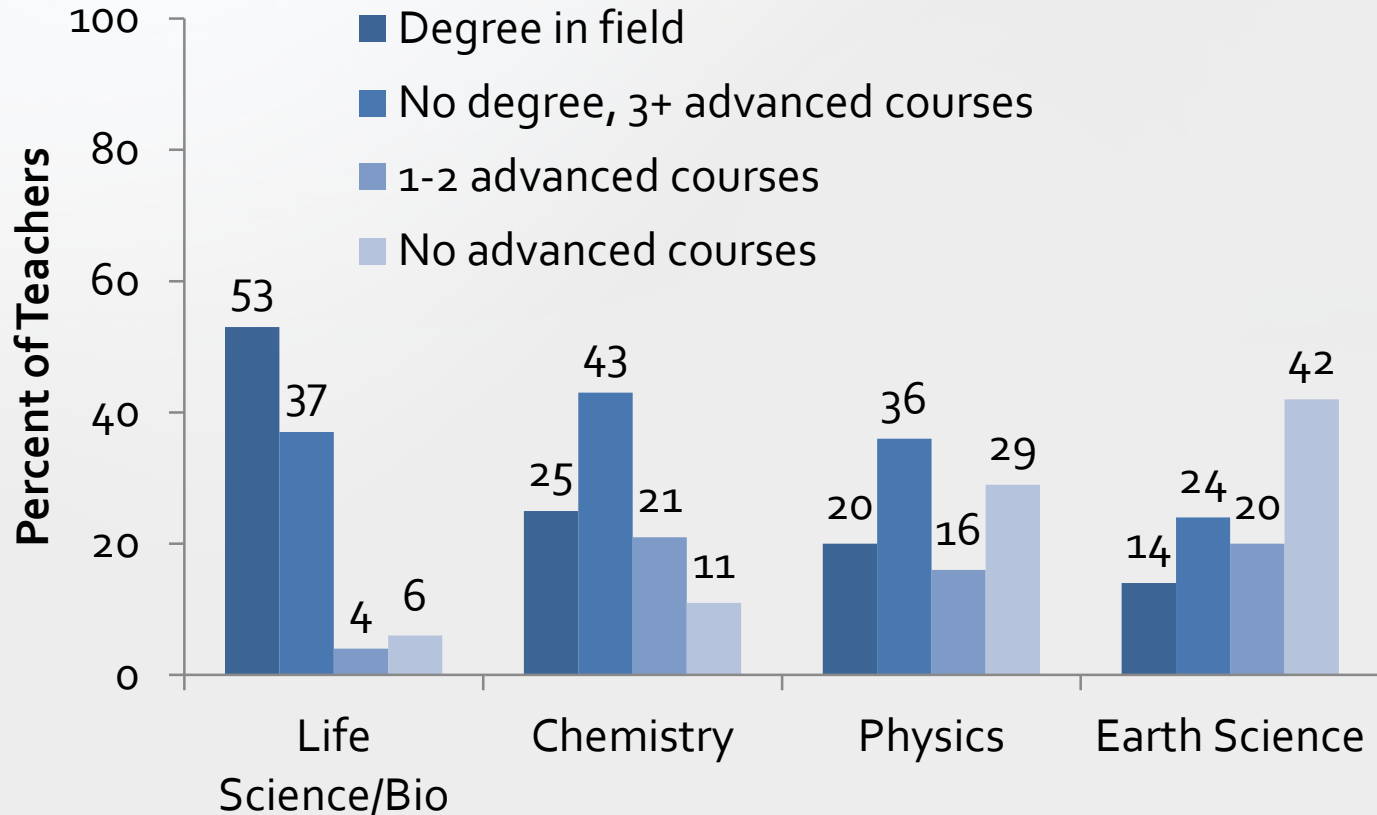
# Science Teacher Degrees



# Science Coursework



# High School Science Teachers

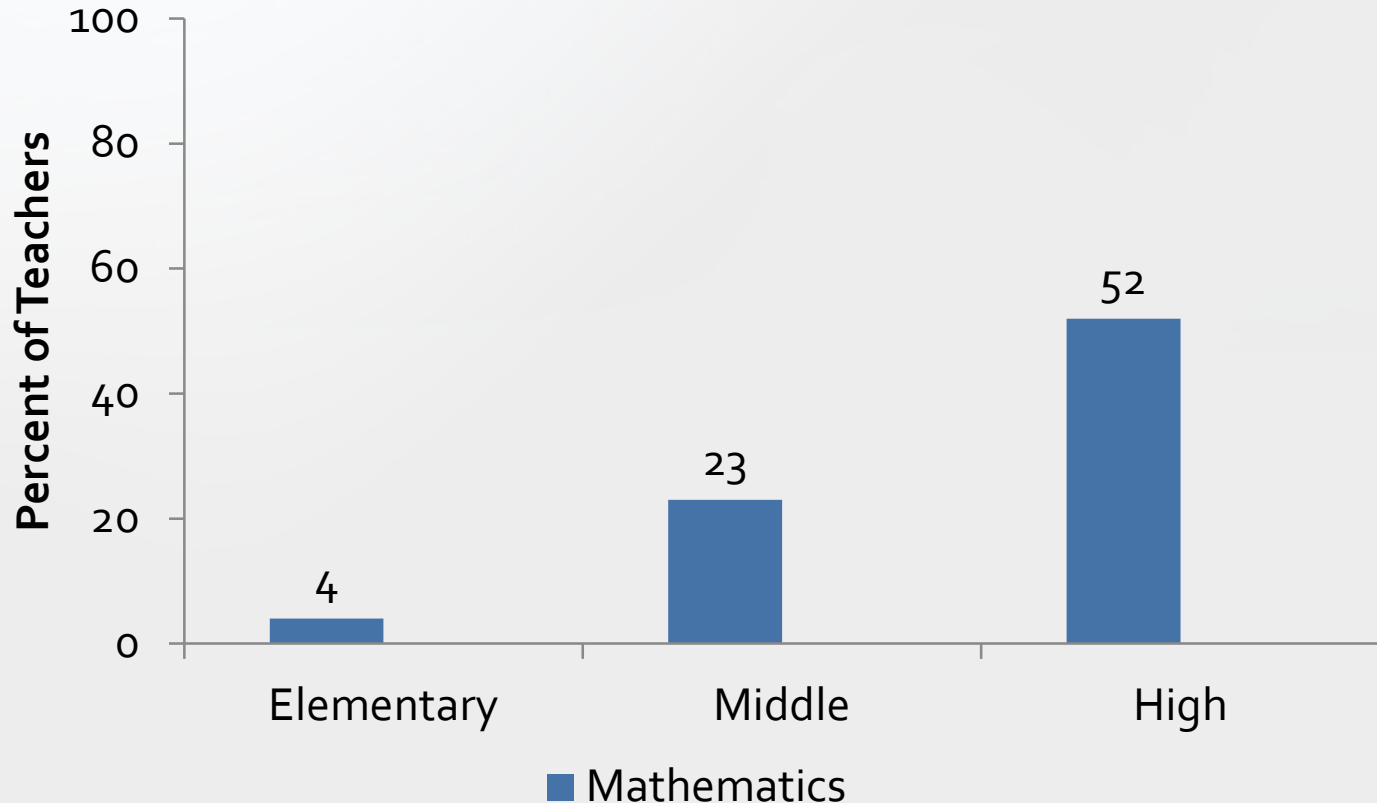


## Question 2

About what percentage of high school mathematics teachers have a college degree in mathematics?

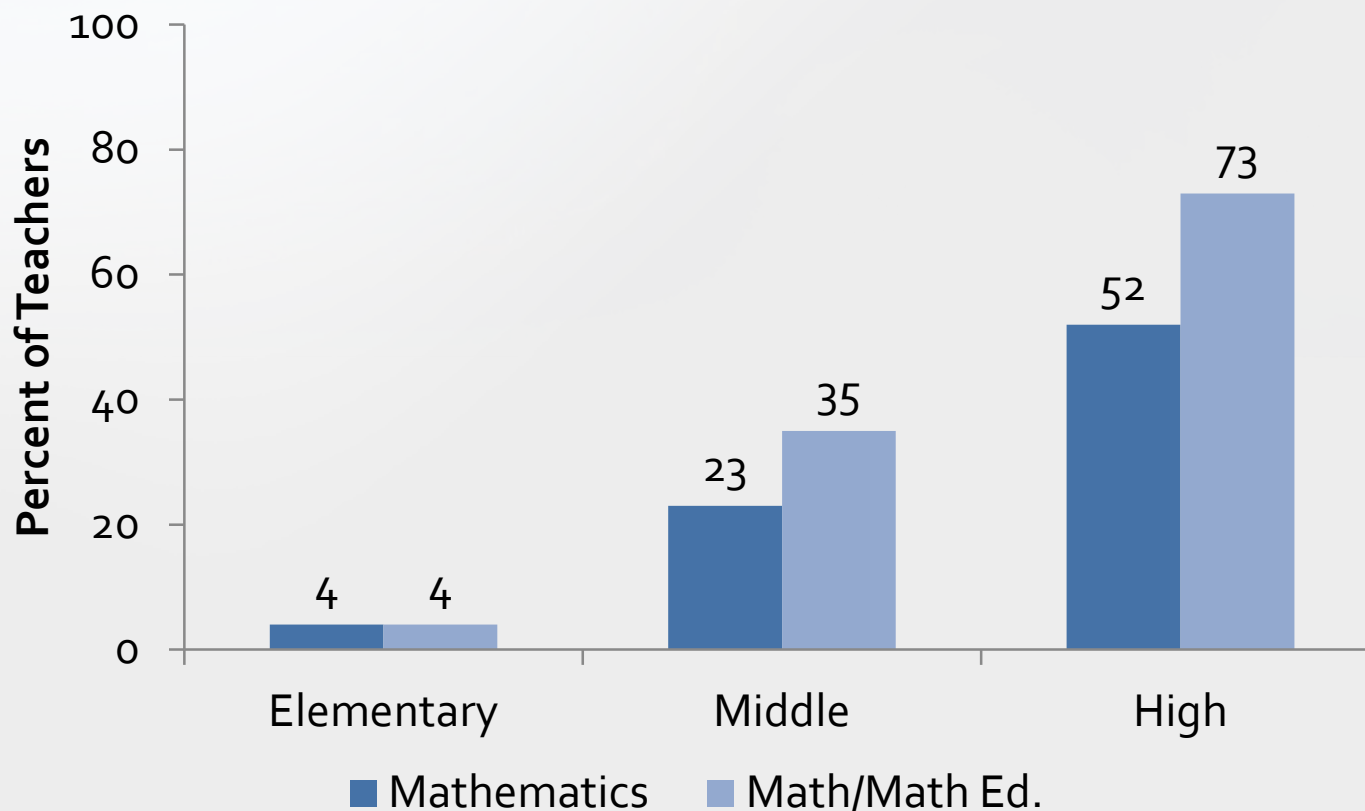
- a. 50 percent
- b. 60 percent
- c. 70 percent
- d. 80 percent

# Mathematics Teacher Degrees

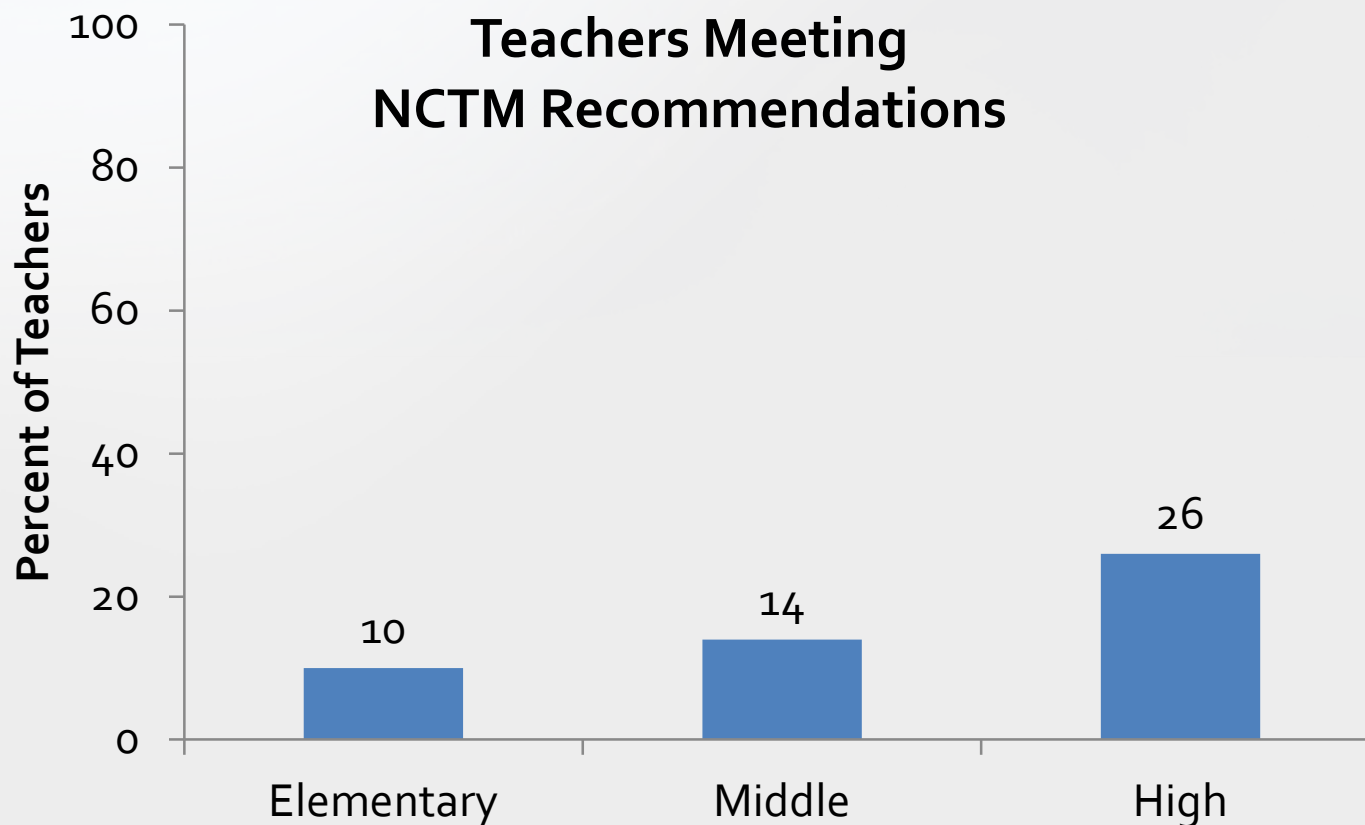




# Mathematics Teacher Degrees



# Mathematics Coursework



## Question 3

About what percentage of science and mathematics teachers believe students should be given definitions for new vocabulary at the beginning of instruction on an idea?

- a. 20 percent
- b. 40 percent
- c. 60 percent
- d. 80 percent

# Beliefs about Teaching and Learning

- Over three-quarters of science and mathematics teachers at each grade level agree that inadequacies in students' background can be overcome by effective teaching.
- A large proportion believe that students learn best in classes of similar abilities:

	Science	Mathematics
Elementary	32	51
Middle	48	69
High	65	77

## Views about Effective Instruction Vary: Science

- Three-quarters at each grade range agree that it is better to focus on ideas in depth, even if it means covering fewer topics.
- About 40 percent think teachers should explain ideas to students before having them consider evidence for it.
- More than half think hands-on/laboratory activities should be used primarily to reinforce ideas students have already learned.
- Over 70 percent think students should be given definitions for new vocab at the beginning of instruction.

## Views about Effective Instruction Vary: Math

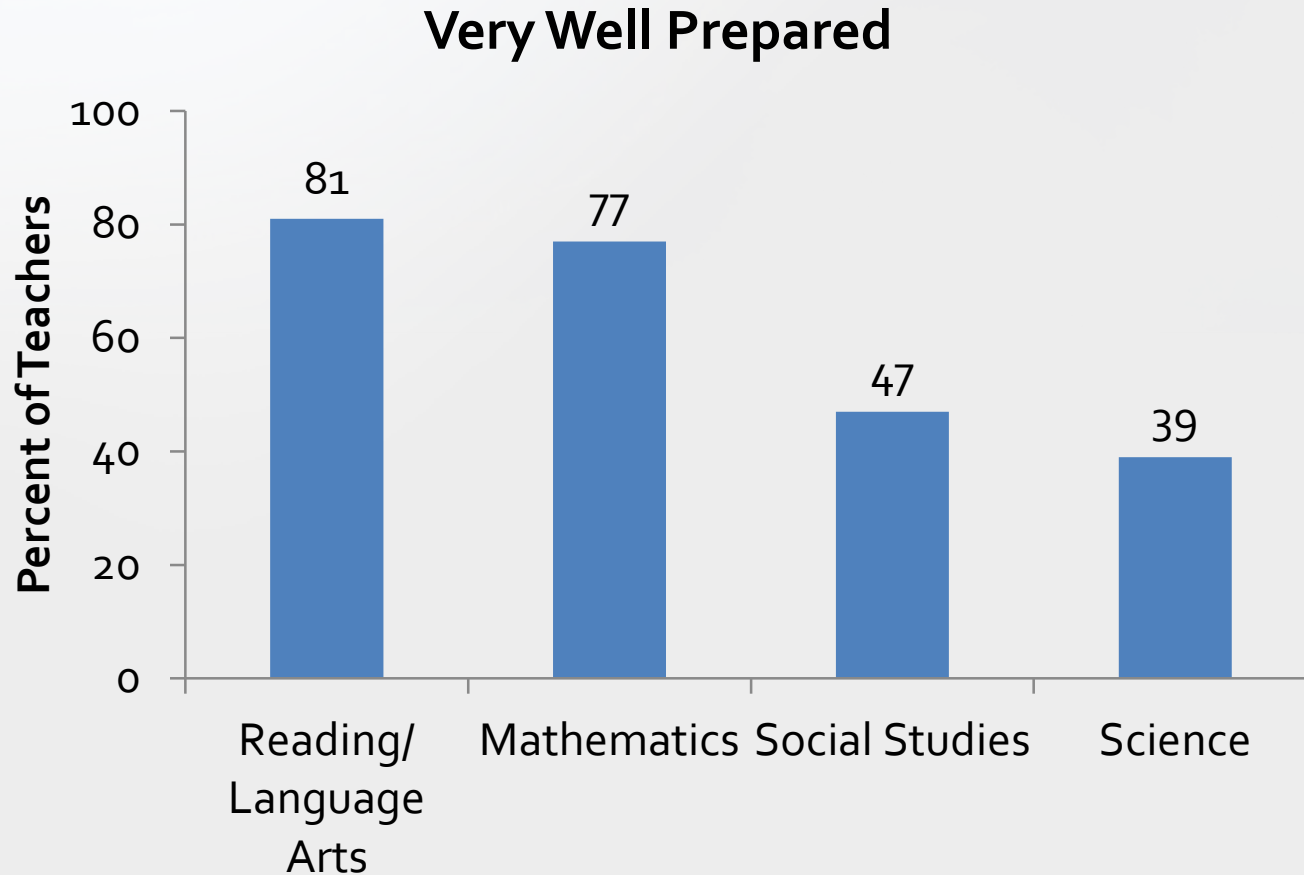
- Over three-quarters at each grade range agree that it is better to focus on ideas in depth, even if it means covering fewer topics.
- 37-48 percent think teachers should explain ideas to students before having them investigate the idea.
- 39-52 percent think hands-on activities/manipulatives should be used primarily to reinforce ideas already learned.
- 81-90 think students should be given definitions of new vocabulary at the beginning of instruction

## Question 4

What percentage of elementary teachers feel very well prepared to teach:

- I. Mathematics? \_\_\_\_\_
- II. Reading/language arts? \_\_\_\_\_
- III. Science? \_\_\_\_\_
- IV. Social Studies? \_\_\_\_\_

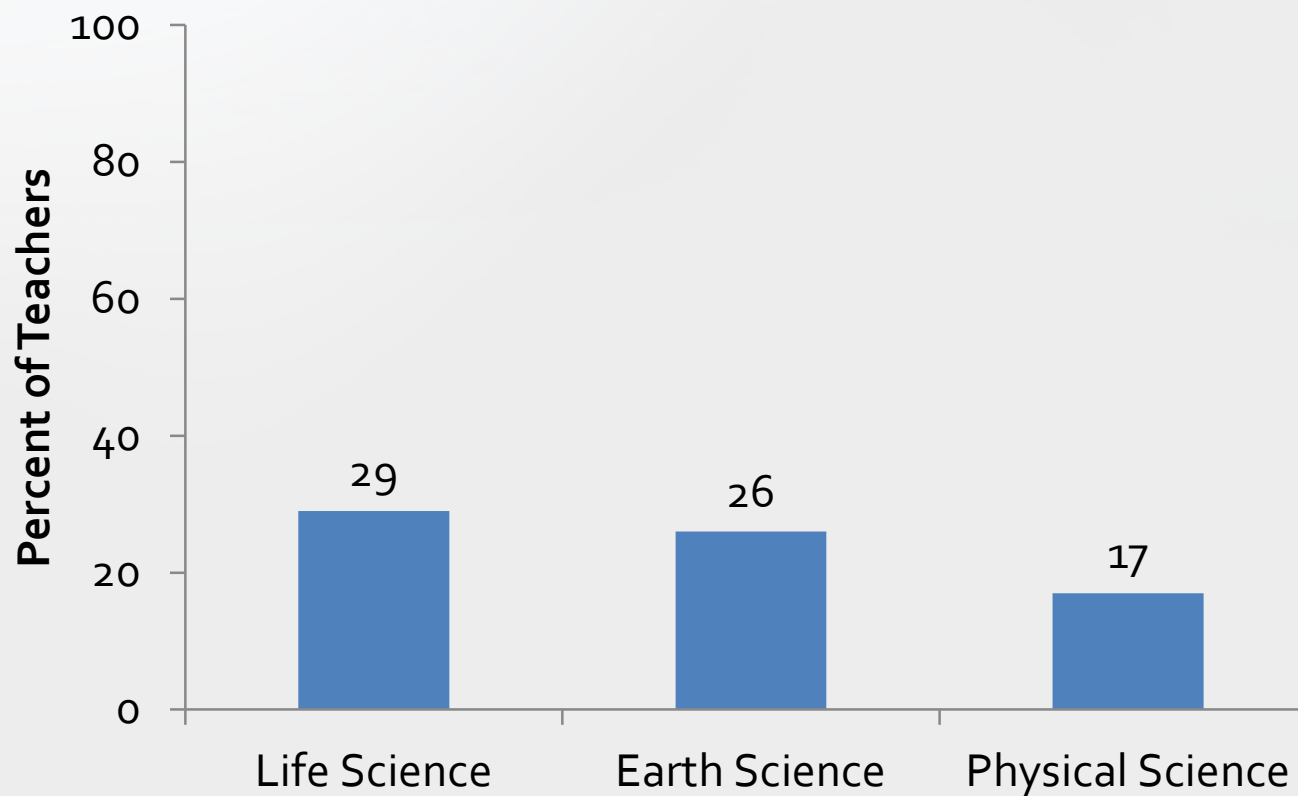
# Perceptions of Preparedness: Elementary





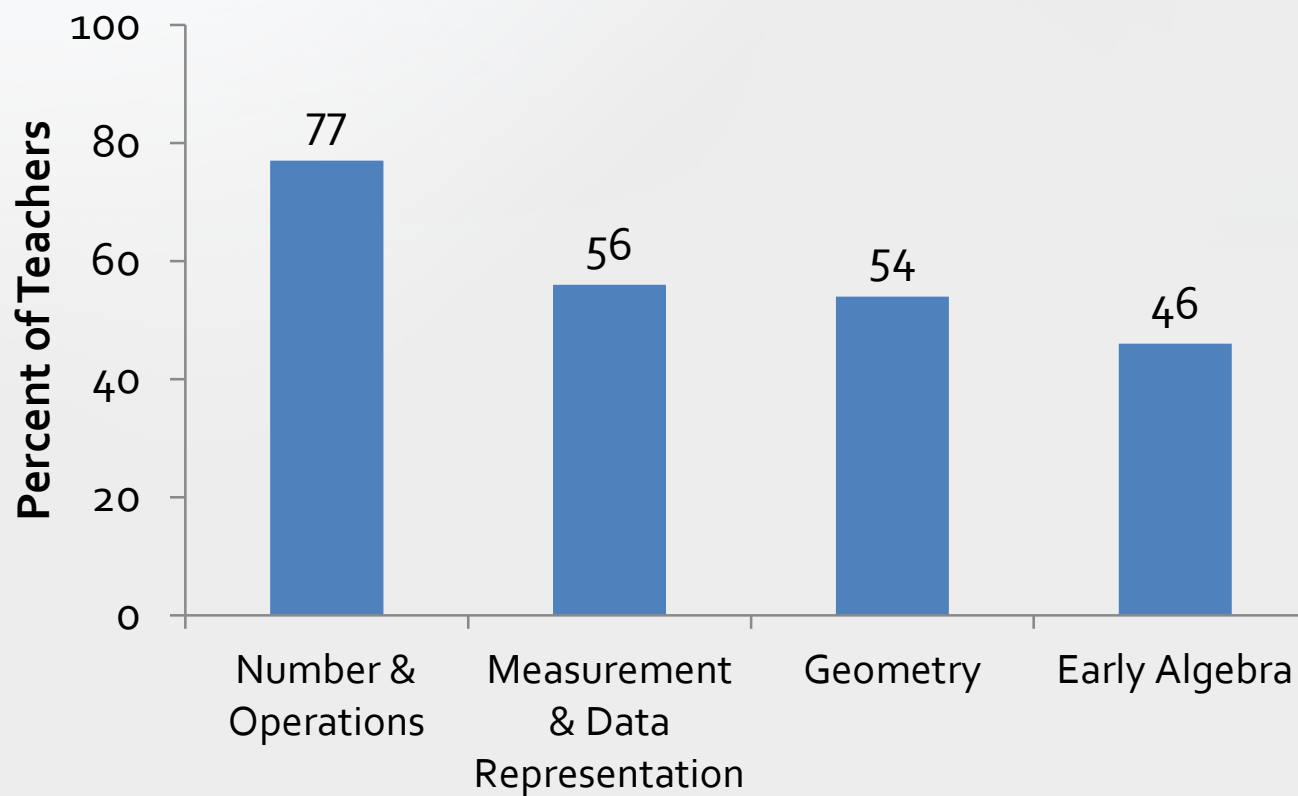
# Perceptions of Preparedness: Elementary

## Very Well Prepared



# Perceptions of Preparedness: Elementary

## Very Well Prepared



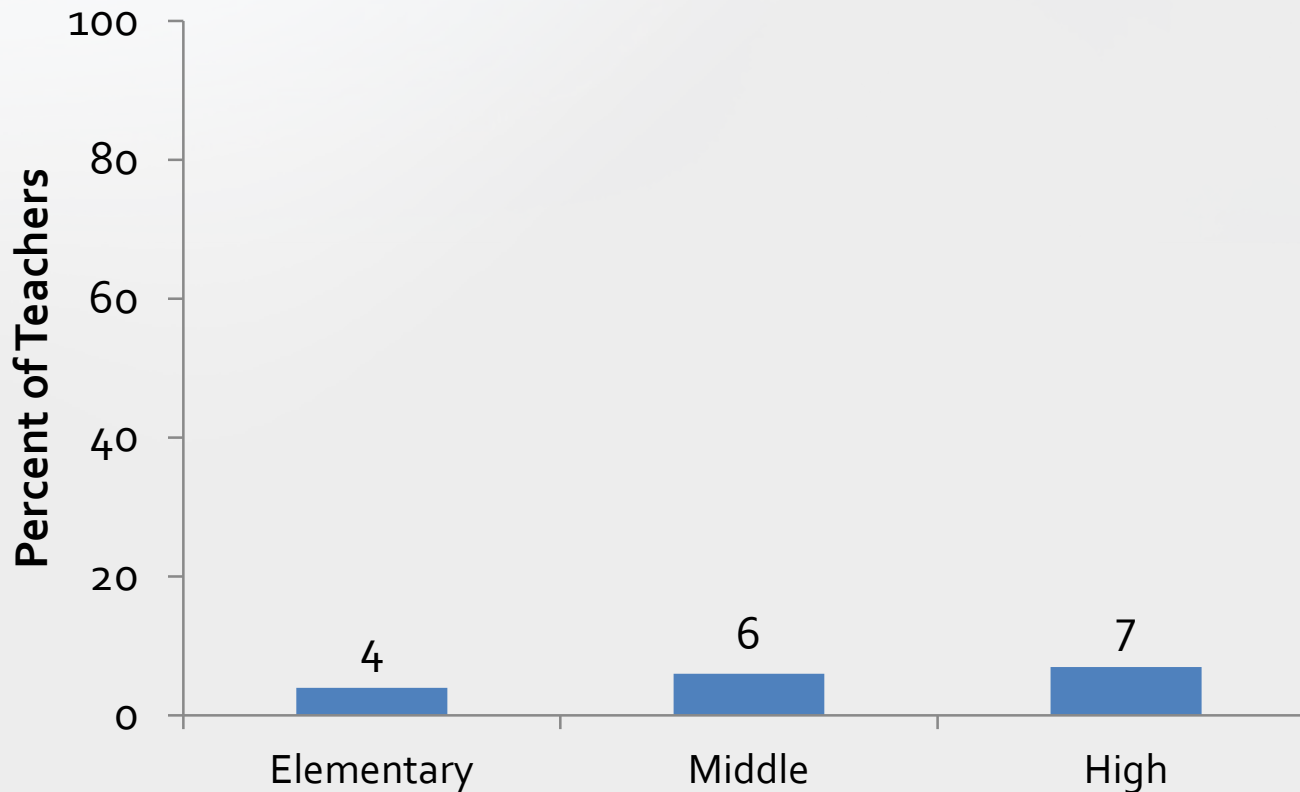
## Question 5

What percentage of teachers at each grade level feel very well prepared to teach engineering?

- I. Elementary \_\_\_\_\_
- II. Middle \_\_\_\_\_
- III. High \_\_\_\_\_

# Preparedness to Teach Engineering

## Very Well Prepared



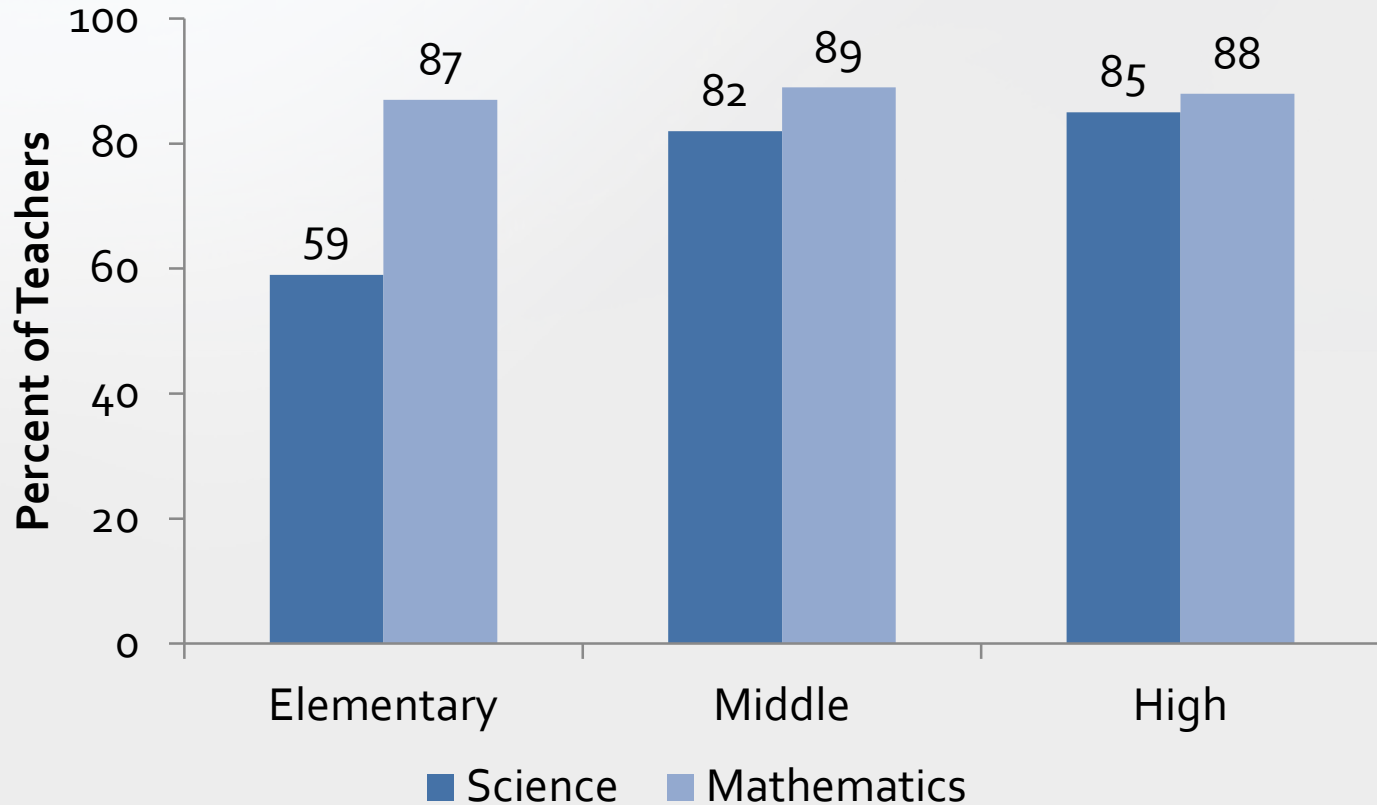
# Professional Development

## Question 6

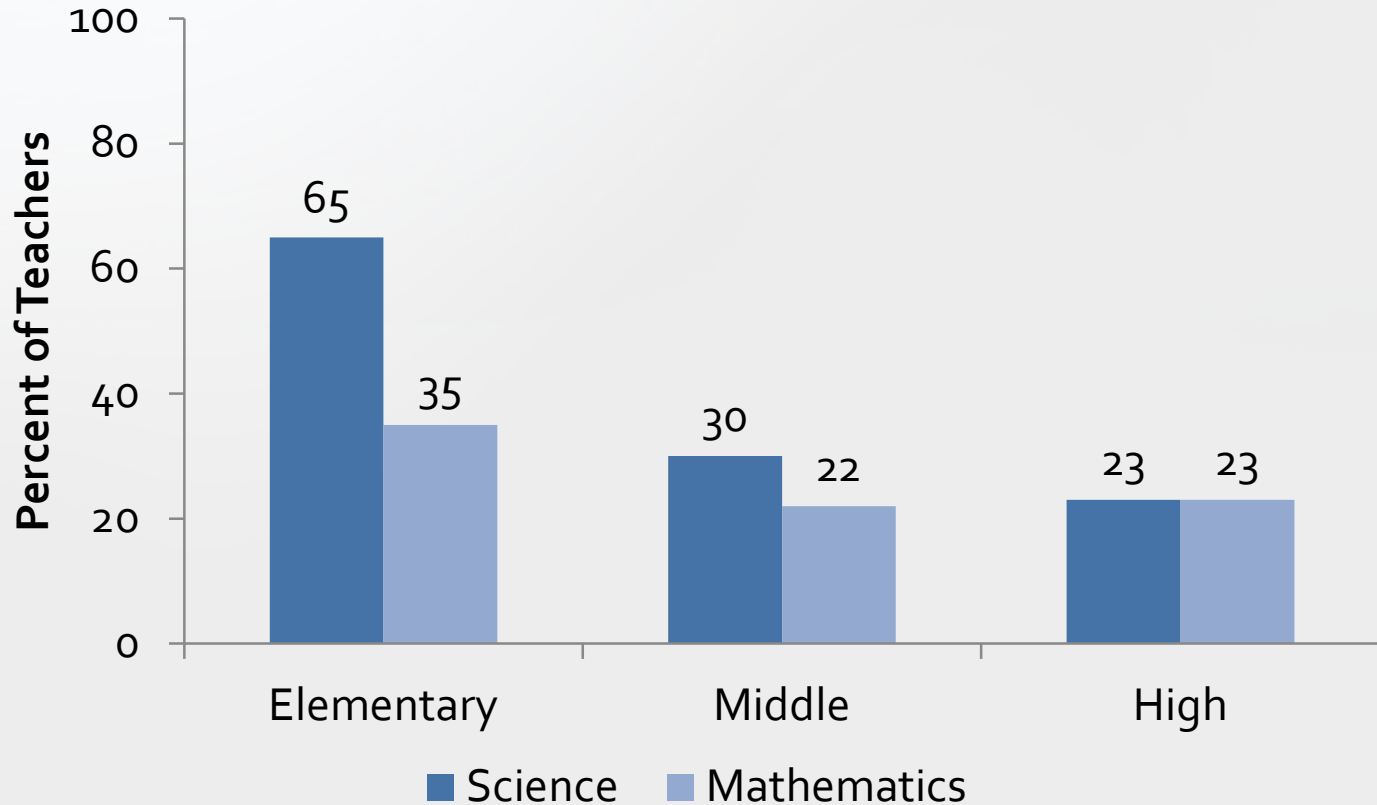
About what percentage of elementary teachers have participated in science-specific PD in the last three years?

- a. 30 percent
- b. 40 percent
- c. 50 percent
- d. 60 percent

# Teachers Participating in PD in Last 3 Yrs

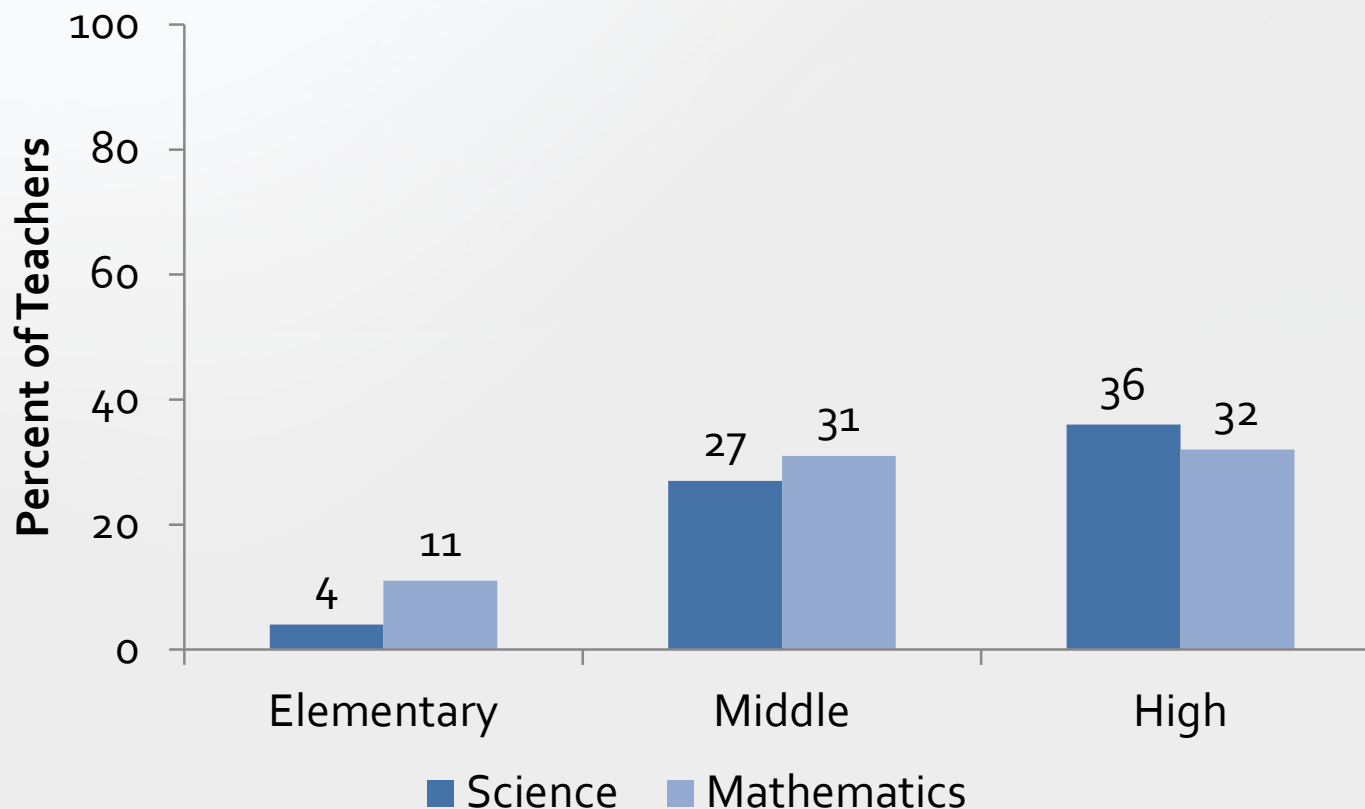


# Less than 6 hours of PD in last 3 years



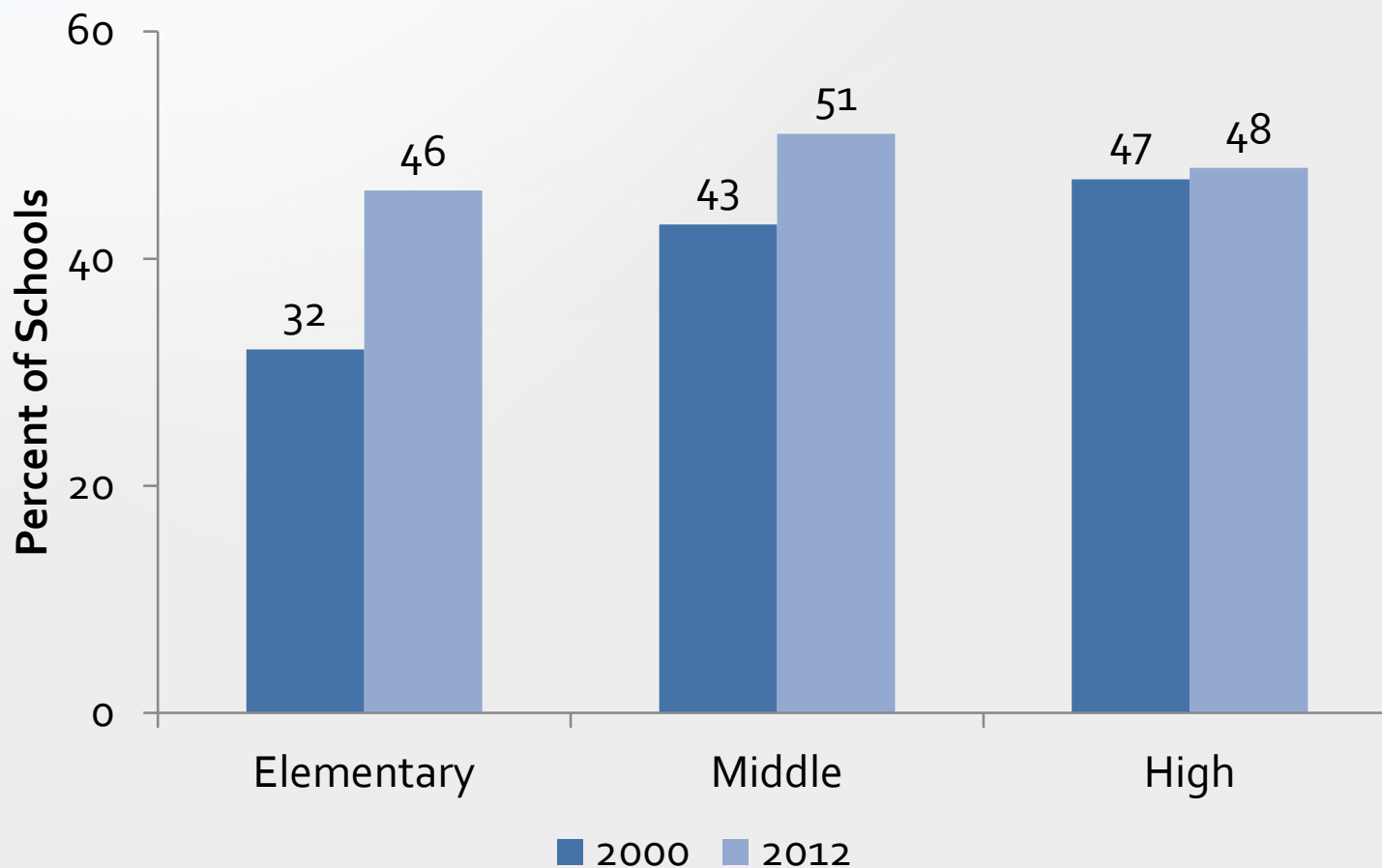


# More than 35 hours of PD in last 3 years



# Professional Learning Communities (PLCs)

# PLCs Offered at Schools

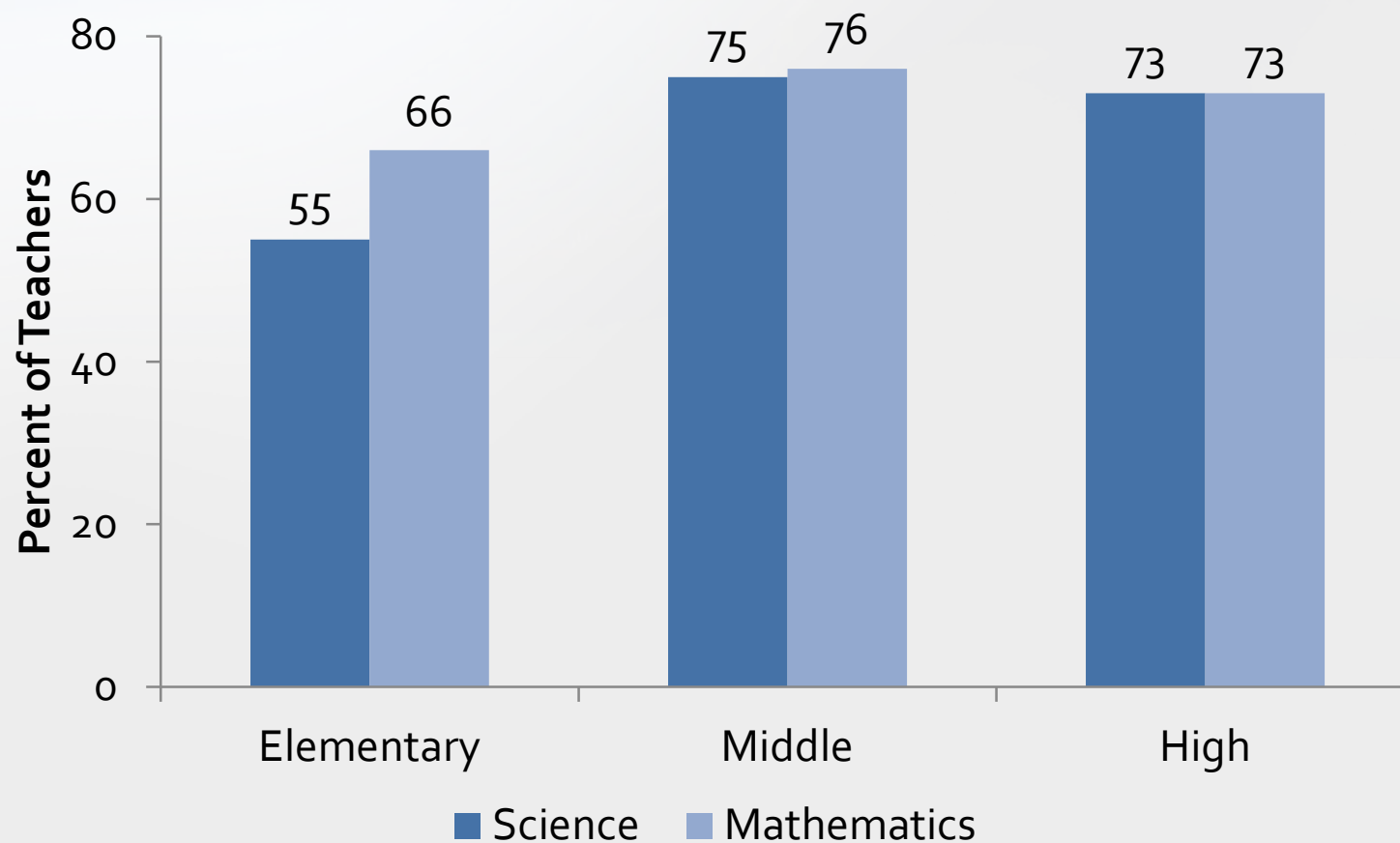


## Question 7

About what percentage of high school mathematics teachers have participated in a mathematics-specific professional learning community (PLC) in the last three years?

- a. 60 percent
- b. 70 percent
- c. 80 percent
- d. 90 percent

# Participation in PLCs



# The Typical PLC...

- Requires participation
- Meets for the entire year
- Meets at least twice a month
- Has a designated leader from within the school
- Limits participation to teachers from within school
- Includes teachers from multiple grade levels

# Emphasis of PLCs

	Percent of Schools with PLCs	
	Science	Mathematics
Analyze student assessment results	73	83
Analyze instructional materials	65	65
Plan lessons together	67	62
Analyze classroom artifacts	37	34
Engage in science/mathematics investigations	25	30

# Science and Mathematics Courses



# Elementary Science and Mathematics

- Nearly all elementary teachers teach mathematics every day of every week.
- Science is a different story:

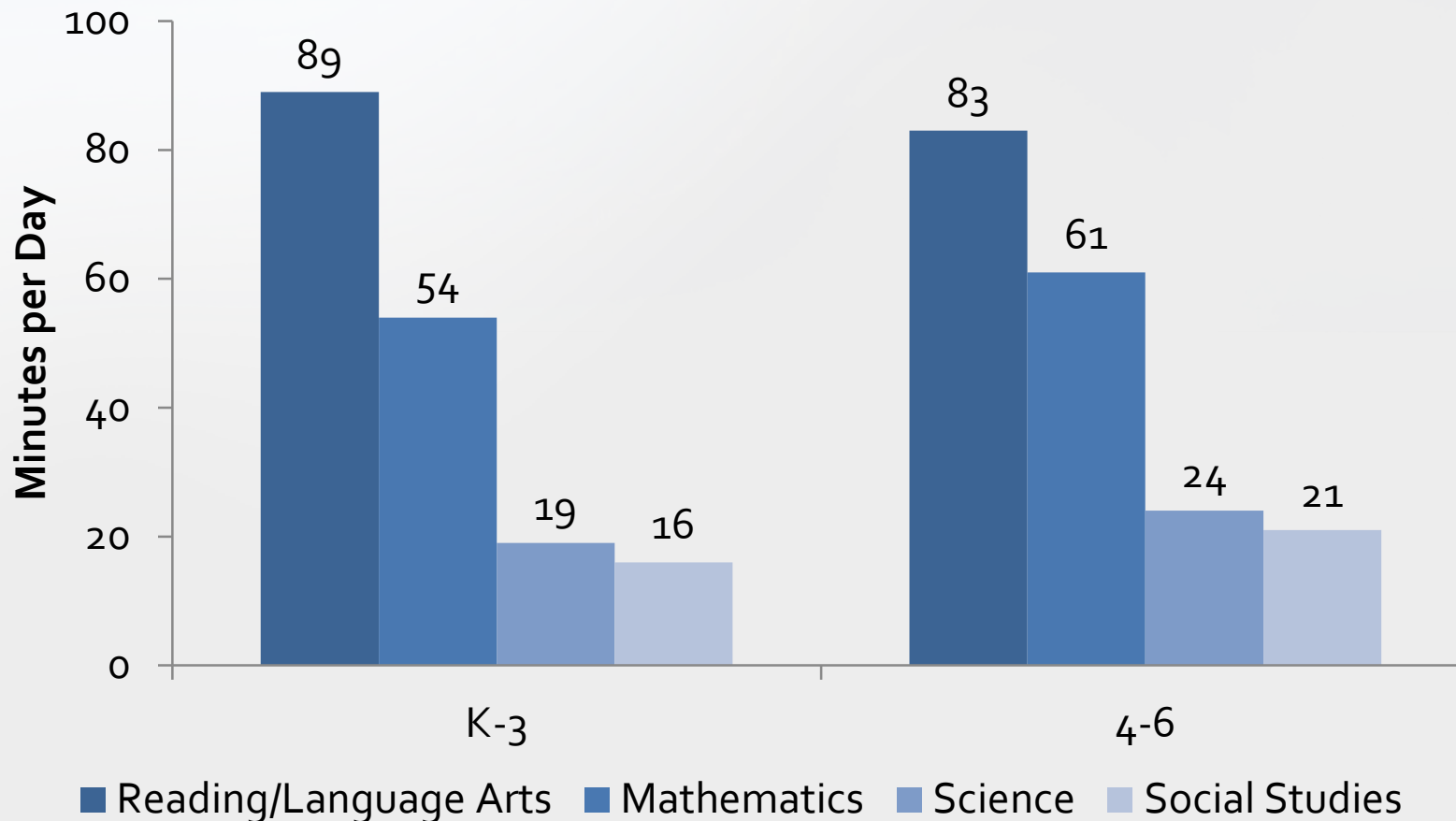
	Percent of Classes	
	K-3	4-6
All/Most Days, every week	20	35
Three or fewer days, every week	39	33
Some weeks, but not every week	41	32

## Question 8

On average, how many minutes per day in elementary classes is devoted to instruction in:

- I. Mathematics? \_\_\_\_\_
- II. Reading/language arts? \_\_\_\_\_
- III. Science? \_\_\_\_\_
- IV. Social Studies? \_\_\_\_\_

# Instructional Time: Elementary Classes



# AP Science

- 47 percent of high schools offer at least one AP science course:
  - 43 percent offer AP Biology
  - 34 percent offer AP Chemistry
  - 22 percent offer AP Physics B
  - 17 percent offer AP Environmental Science
  - 12 percent offer AP Physics C

# Middle School Mathematics Courses

- About  $\frac{3}{4}$  of middle schools offer Algebra 1
- Only about  $\frac{1}{4}$  offer Geometry
- Majority of middle school students do not take either one in middle school

# AP Mathematics

- Over half of high schools offer AP mathematics
  - 52 percent offer AP Calculus AB
  - 27 percent offer AP Statistics
  - 23 percent offer AP Calculus BC

## Question 9

Compared to lower level courses, students in advanced science and mathematics courses are:

- a. Less diverse.
- b. Just as diverse.
- c. More diverse.

# Student Enrollment: HS Science

	<b>Percent Female</b>
• Non-College Prep	46
• 1 <sup>st</sup> Year Biology	49
• 1 <sup>st</sup> Year Chemistry	51
• 1 <sup>st</sup> Year Physics	49
• Advanced Courses	54



# Student Enrollment: HS Science

## Percent Non-Asian Minority

- Non-College Prep 36
- 1<sup>st</sup> Year Biology 33
- 1<sup>st</sup> Year Chemistry 30
- 1<sup>st</sup> Year Physics 23
- Advanced Courses 21

# Student Enrollment: HS Mathematics

## Percent Female

- Non-College Prep 42
- Formal Level 1 48
- Formal Level 2 50
- Formal Level 3 51
- Formal Level 4 48
- College-Credit Courses 48

# Student Enrollment: HS Mathematics

## Percent Non-Asian Minority

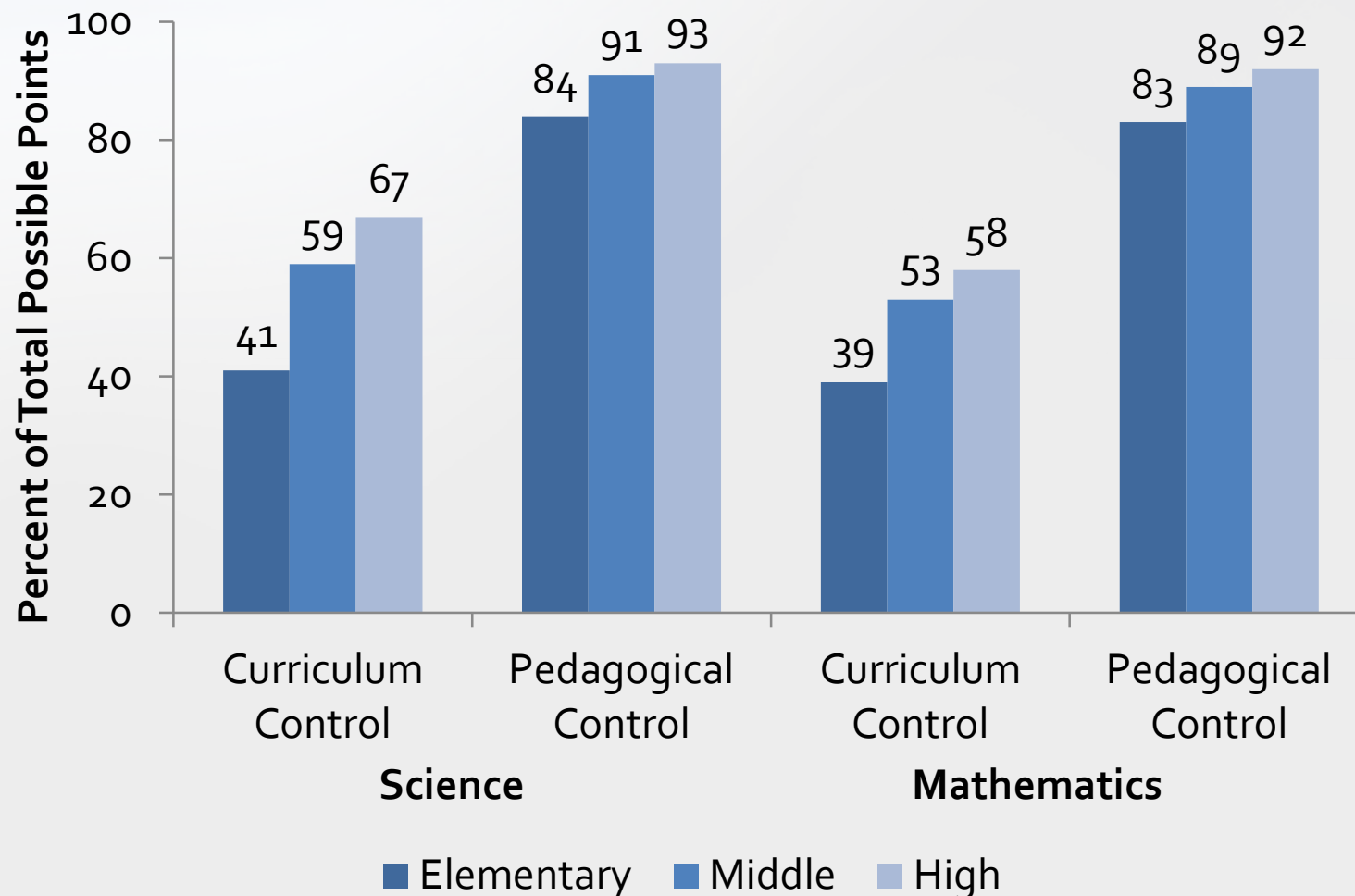
- Non-College Prep 45
- Formal Level 1 39
- Formal Level 2 31
- Formal Level 3 27
- Formal Level 4 22
- College-Credit Courses 17

# Science and Mathematics Instruction

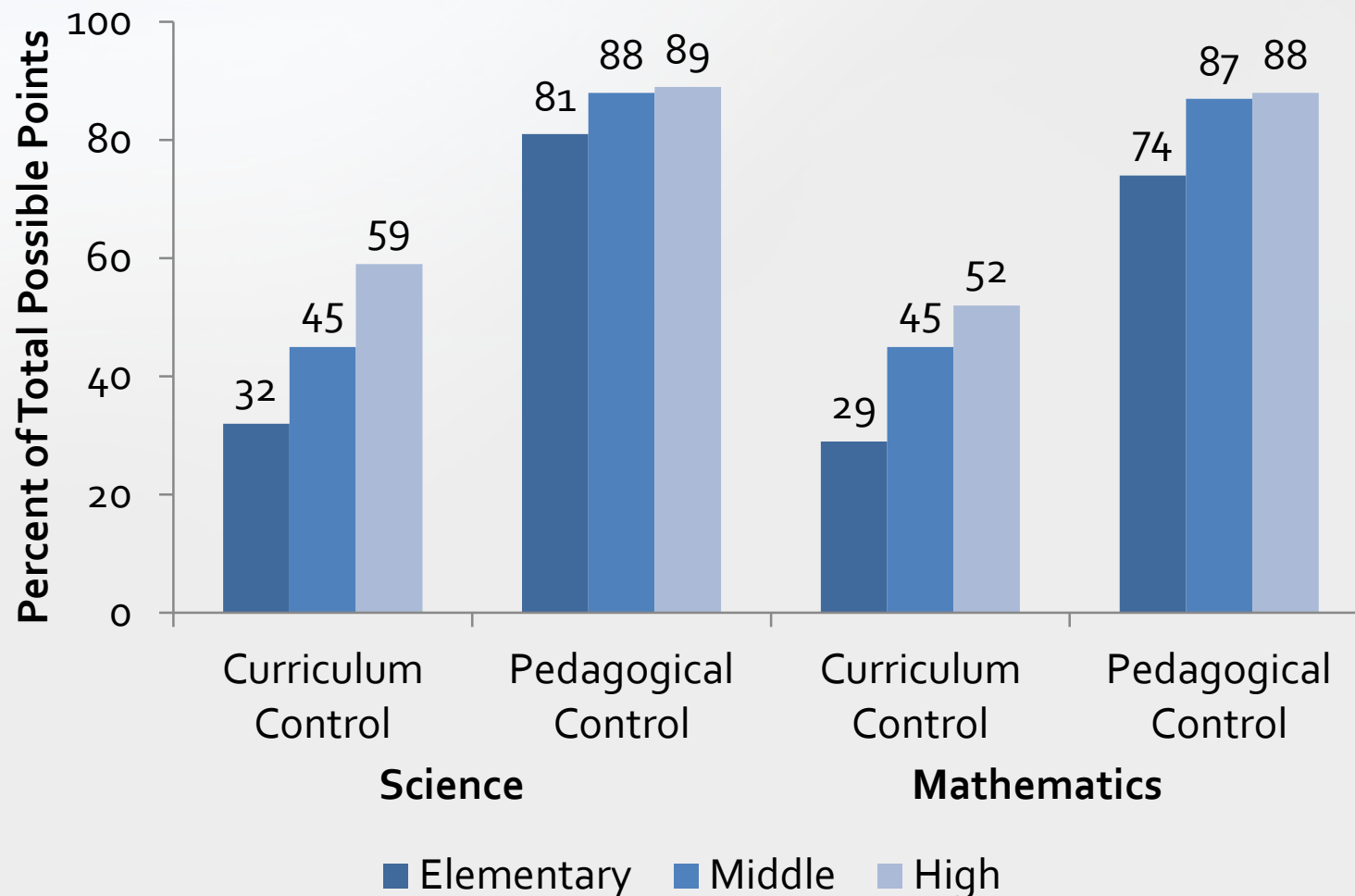
2012 National Survey of Science and Mathematics Education

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# Teacher Control: 2000

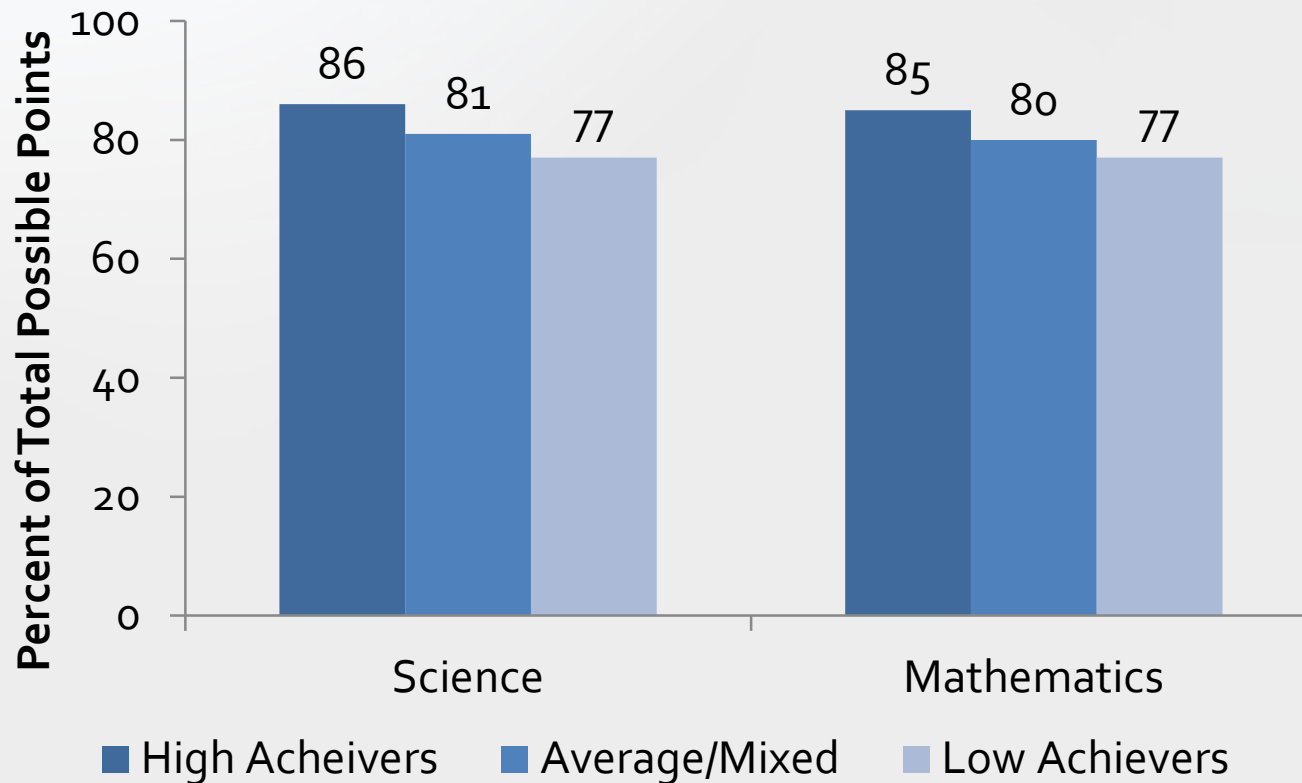


# Teacher Control: 2012

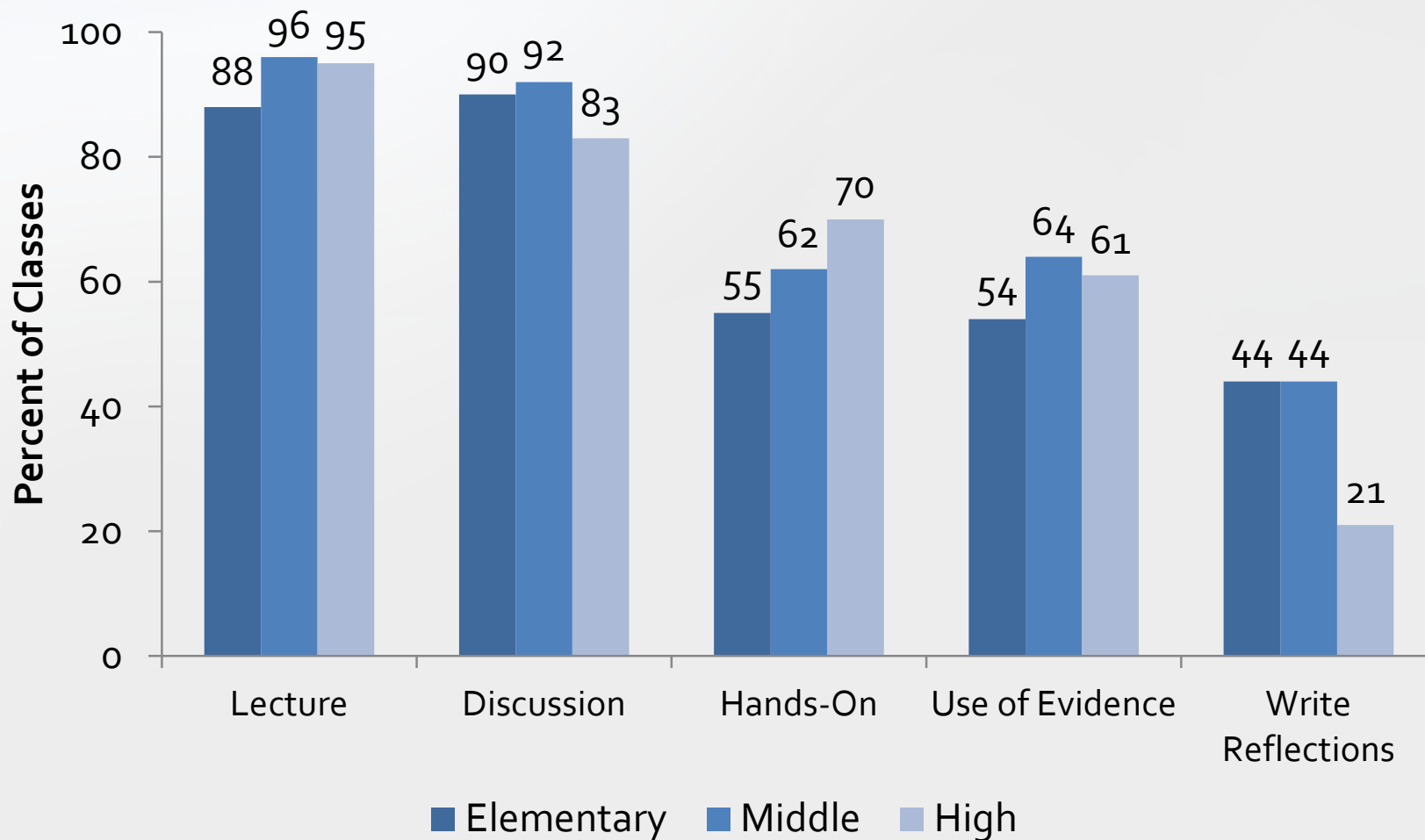


# Reform-Oriented Instructional Objectives

## Objectives by Prior Achievement Level

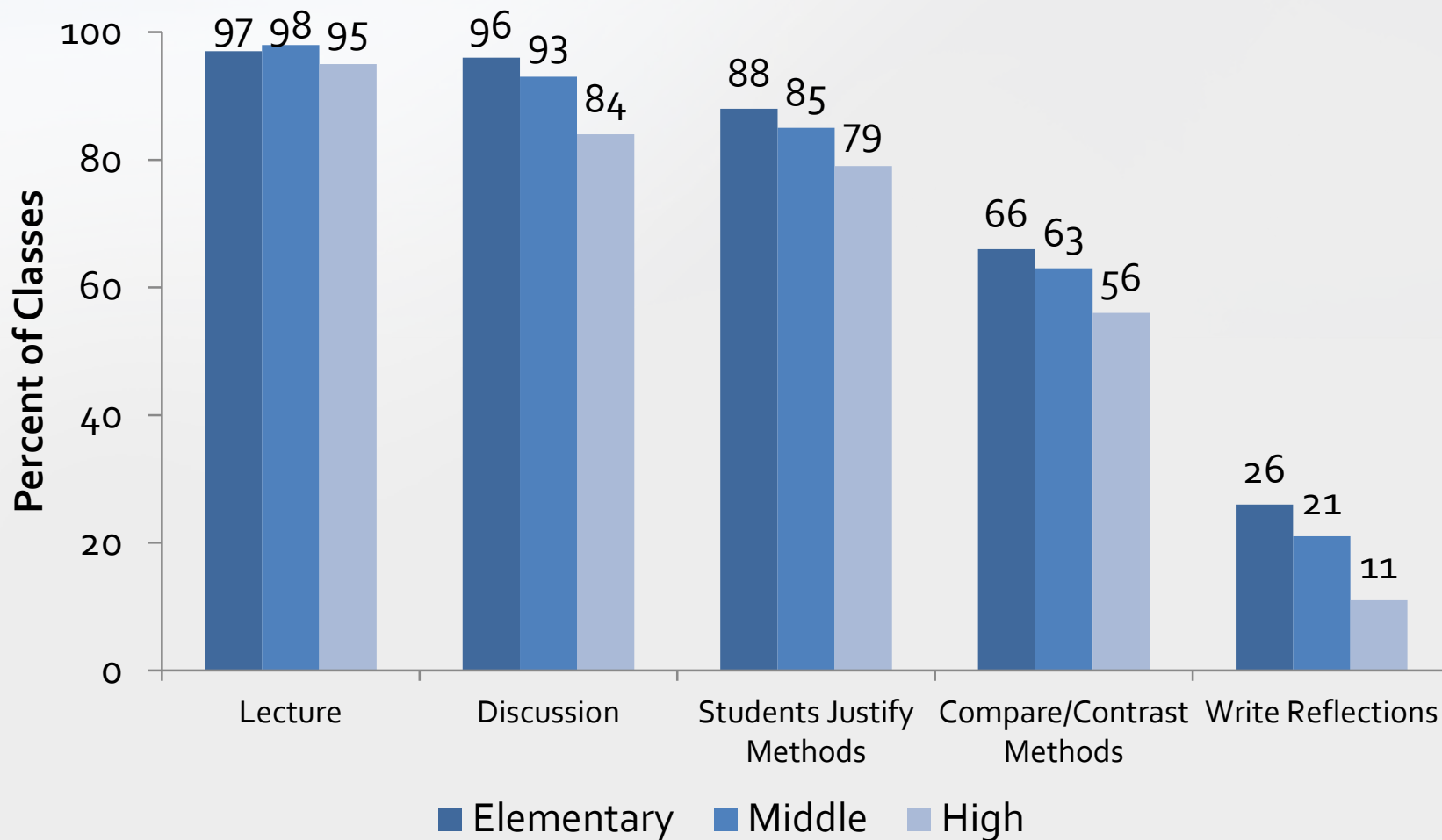


# Weekly Instructional Practices: Science





# Weekly Instructional Practices: Math



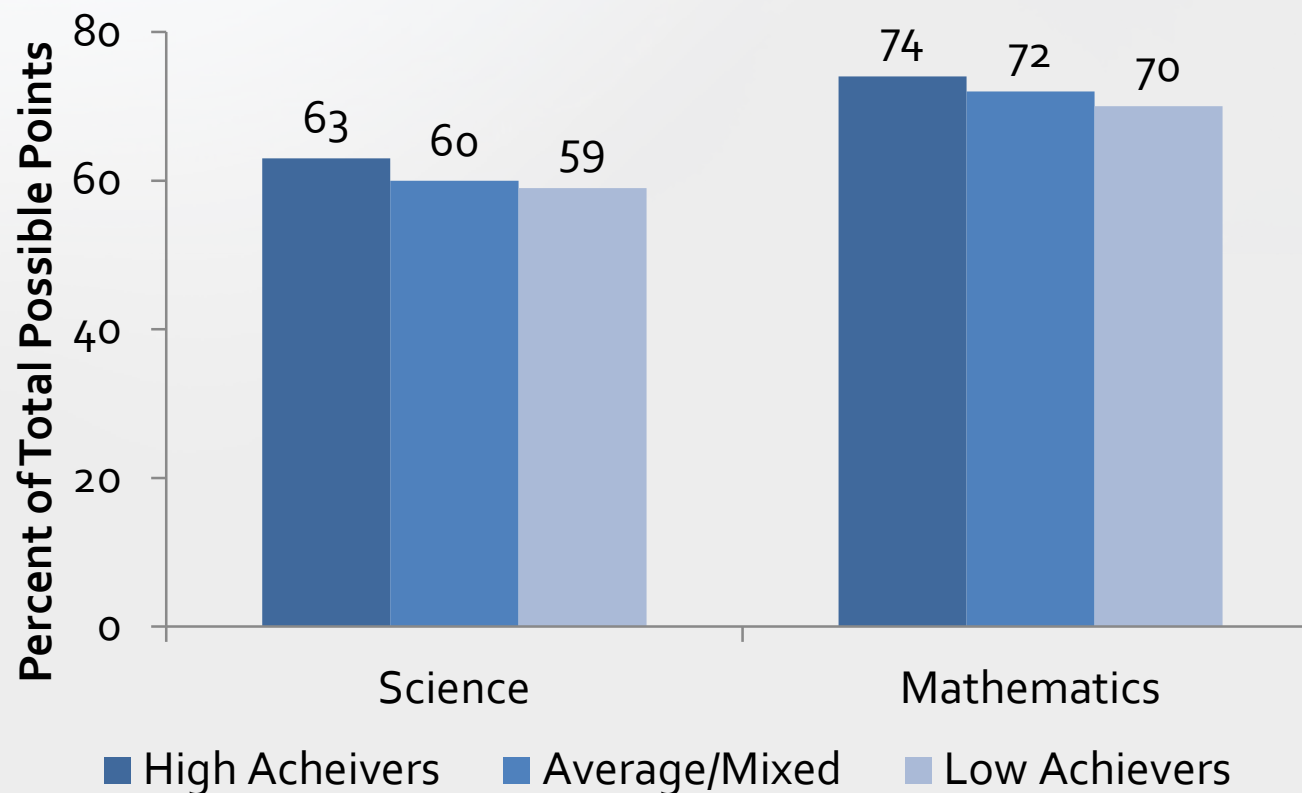
## Question 10

Compared to classes composed of high achieving students, classes of low achieving students are:

- a. Less likely to experience reform-oriented teaching.
- b. Just as likely to experience reform-oriented teaching.
- c. More likely to experience reform-oriented teaching.

# Reform-Oriented Teaching Practices

## Practices by Prior Achievement Level



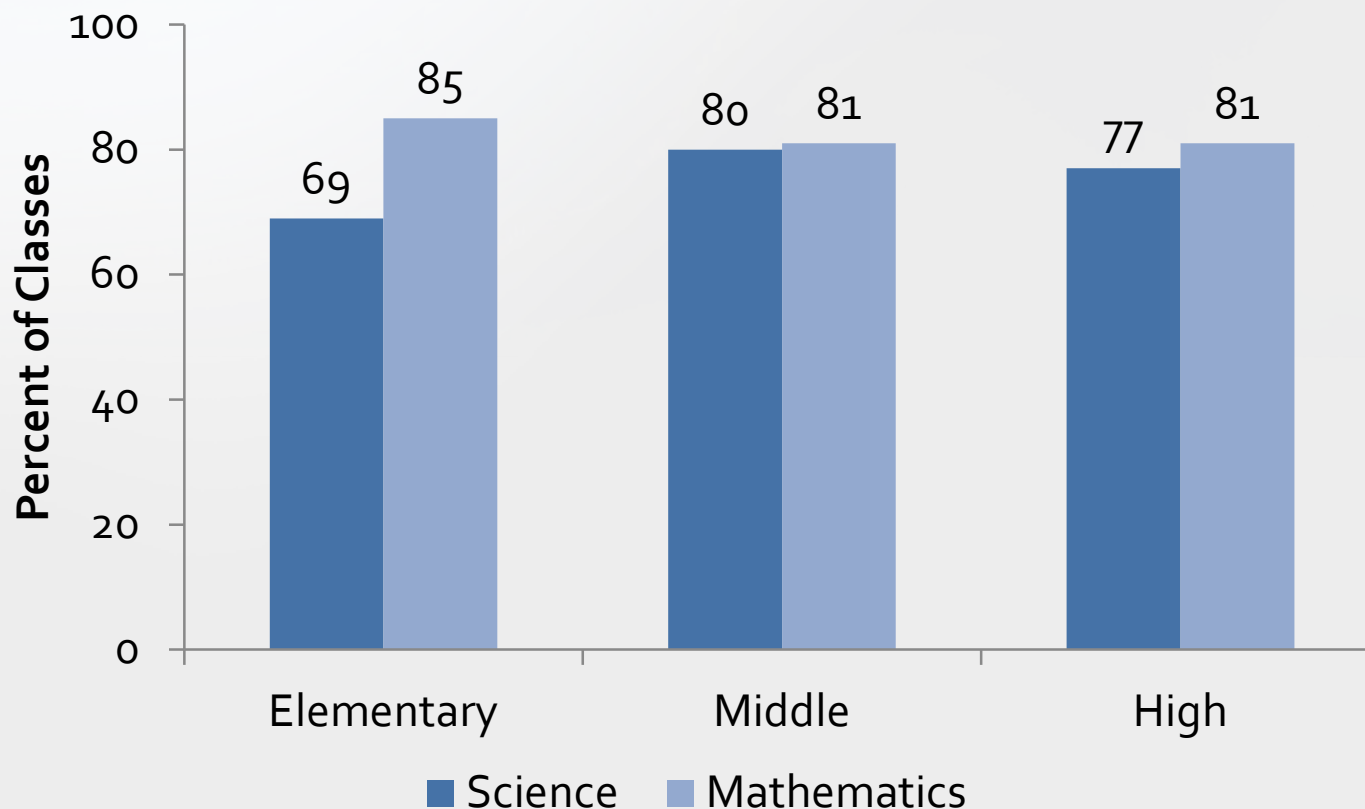
# Influence of Textbooks

## Question 11

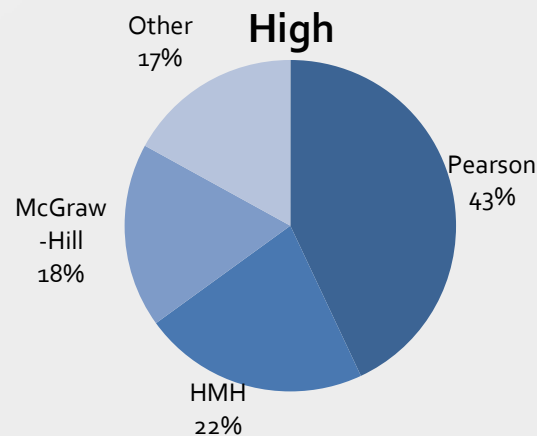
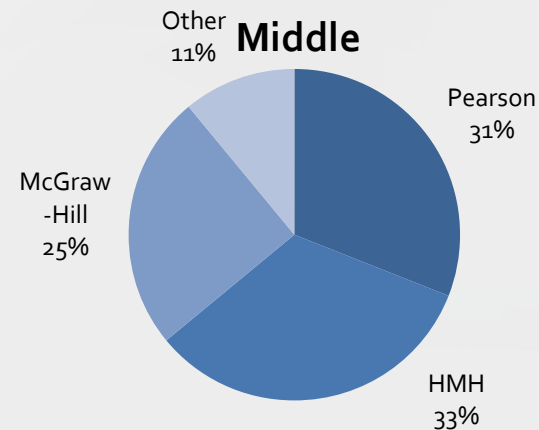
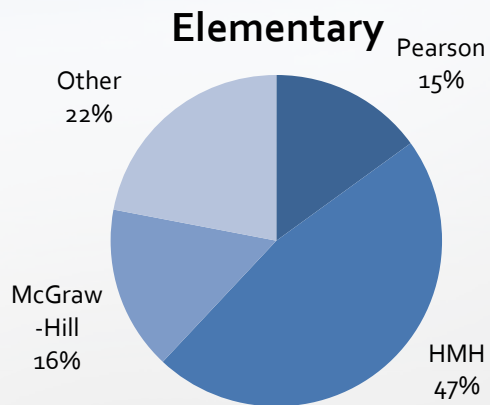
About what percentage of middle school science classes use a published textbook or module as the primary instructional material?

- a. 40 percent
- b. 60 percent
- c. 80 percent
- d. 100 percent

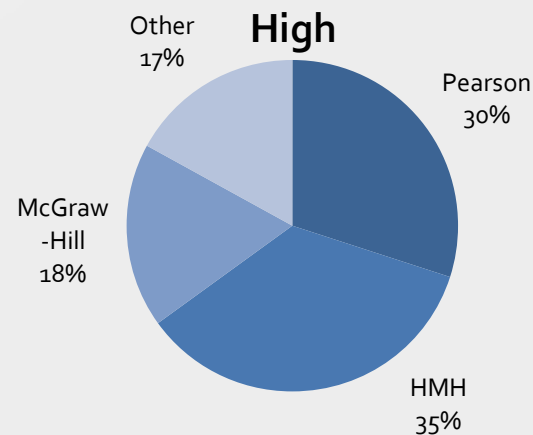
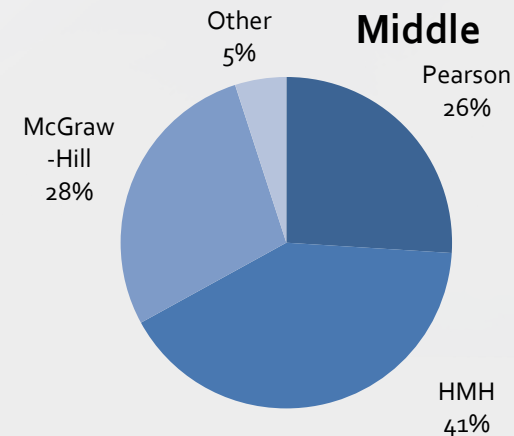
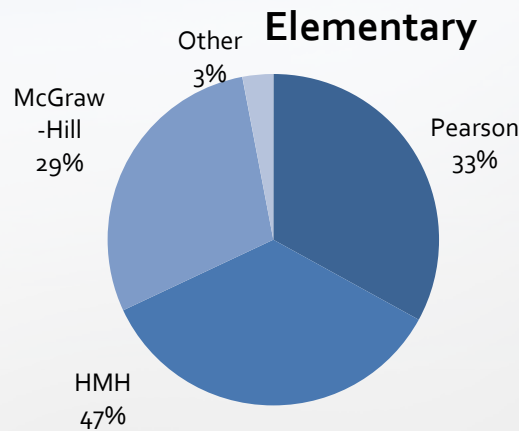
# Classes Using a Published Text



# Publisher Market Share— Science Materials



# Publisher Market Share— Mathematics Materials





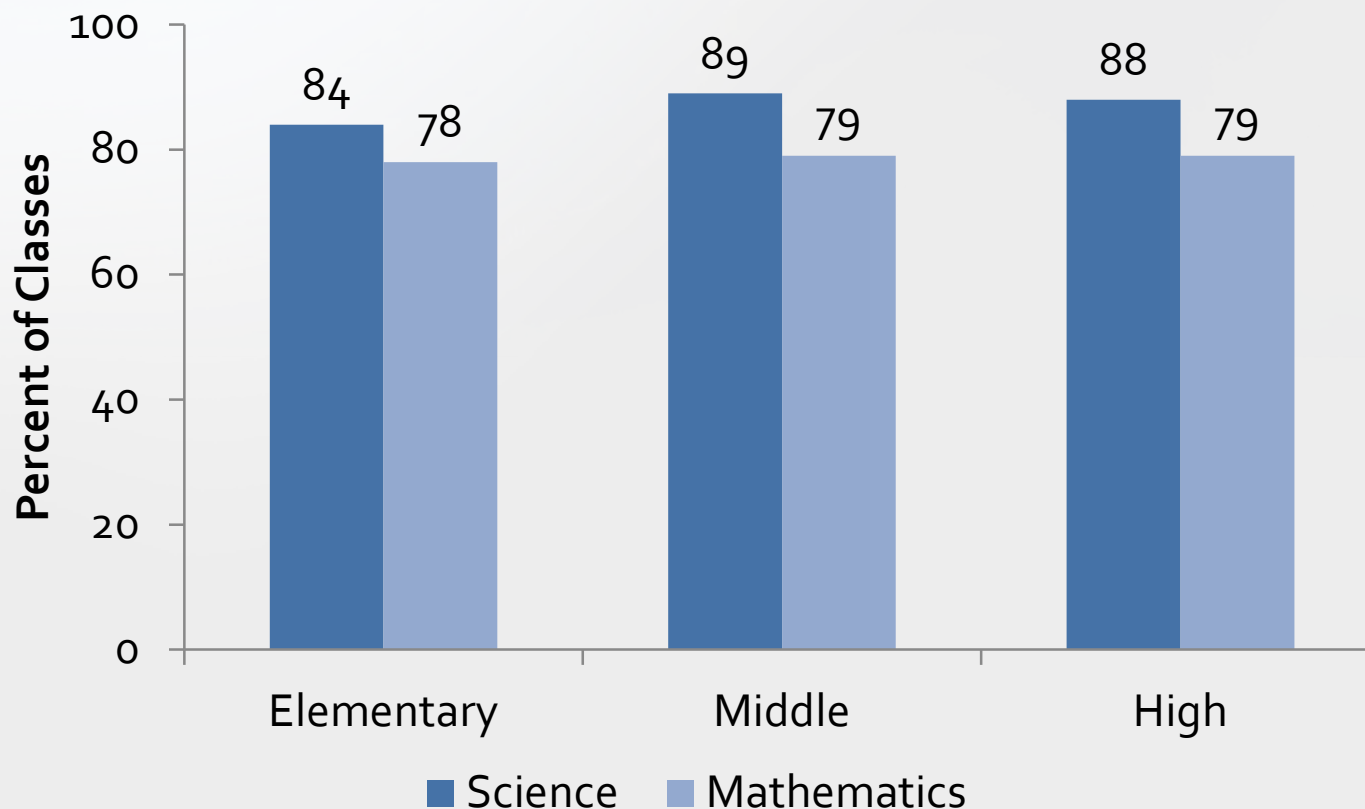
# Science Materials Used Most of the Time

	Percent of Science Classes		
	Elementary	Middle	High
<b>Mainly commercially published textbook</b>			
One textbook	26	34	52
Multiple textbooks	5	11	7
<b>Mainly commercially published modules</b>			
Modules from a single publisher	12	11	2
Modules from multiple publishers	4	3	2
<b>Other</b>			
Mix of commercially published textbooks and commercially published modules	22	20	15
Non-commercially published materials	31	20	23

# How Teachers Use their Materials

- More than half use the textbook to guide both the overall and detailed structure of the unit.
- A large proportion also supplement and subset their textbook.

## Skipping Because They Know of Something Better



# Why Teachers Supplement

- Over 90 percent supplement to differentiate instruction and provide additional practice.
- Over half supplement for test prep.
- A substantial proportion supplement because their pacing guide tells them to.

# Adequacy of Resources

## Question 12

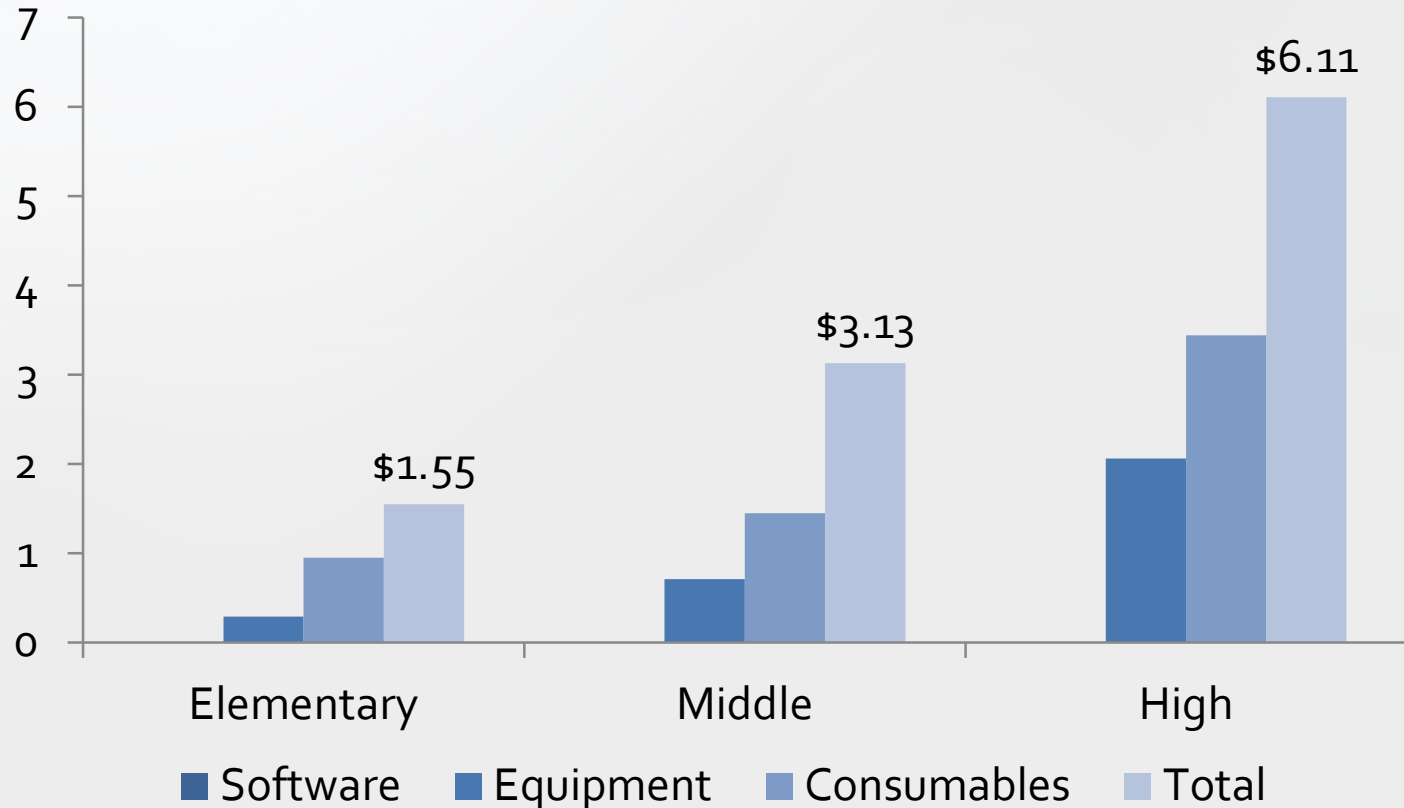
What is the median amount spent per pupil on science equipment, supplies, and software (total) in:

Elementary schools? \_\_\_\_\_

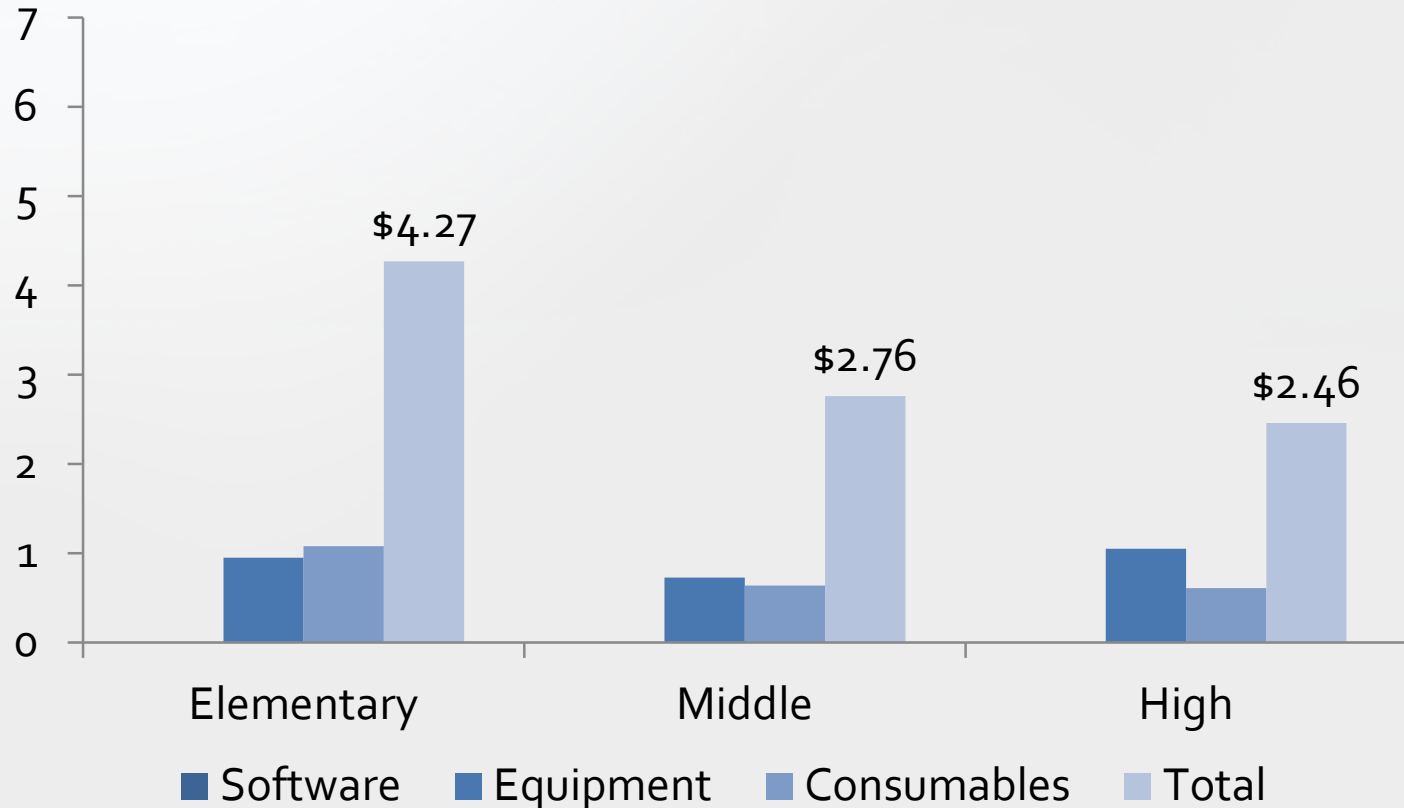
Middle schools? \_\_\_\_\_

High schools? \_\_\_\_\_

# Median \$ Per Pupil Spent in Science



# Median \$ Per Pupil Spent in Mathematics





# Median \$ per Pupil Spent in Science

	PPS
<b>Community Type</b>	
Rural	4.58
Suburban	2.98
Urban	2.45
<b>Region</b>	
Midwest	3.25
Northeast	5.18
South	2.93
West	2.19

## Median \$ per Pupil Spent in Mathematics

	PPS
<b>Community Type</b>	
Rural	3.78
Suburban	2.49
Urban	1.91
<b>Region</b>	
Midwest	3.18
Northeast	4.15
South	2.42
West	1.45

# Adequacy of Resources

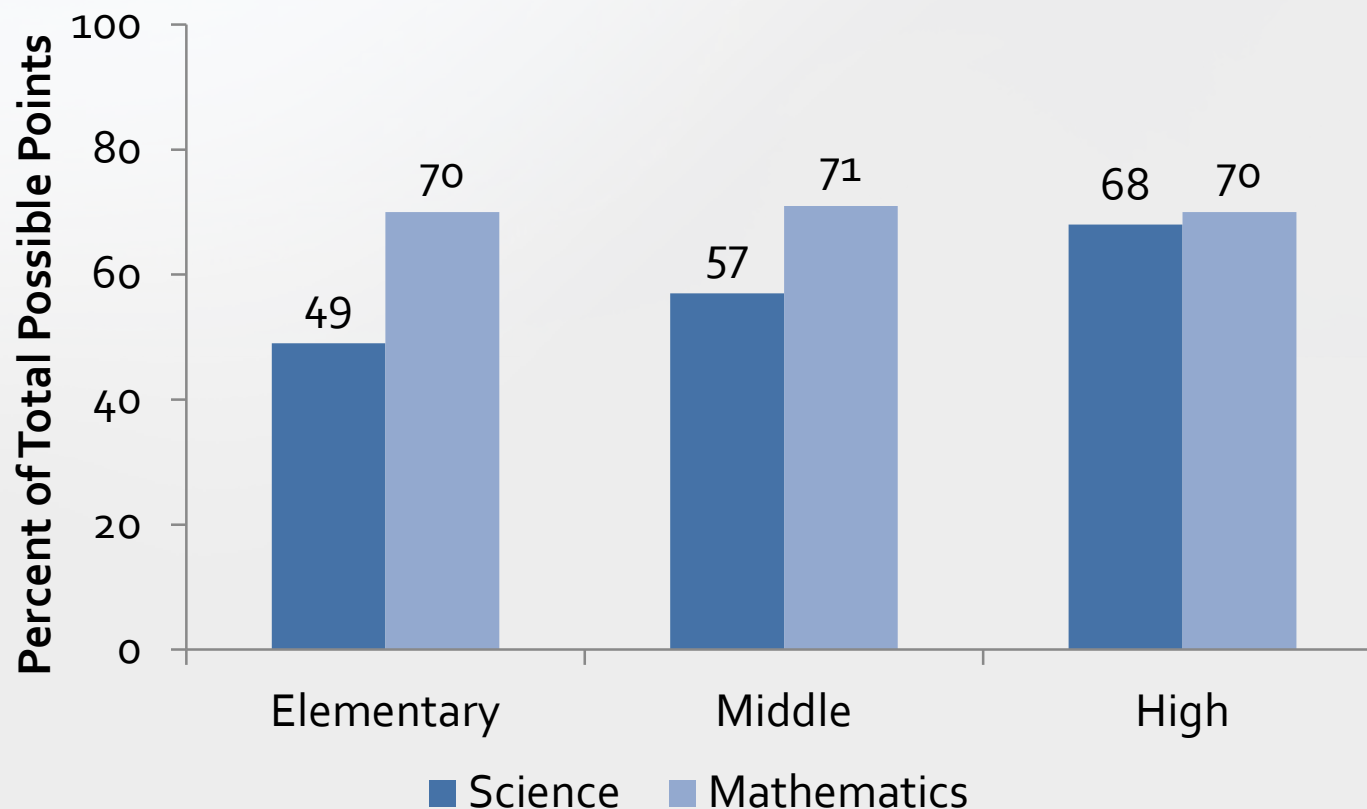
## Science

- Consumable supplies
- Equipment
- Facilities
- Instructional technology

## Mathematics

- Consumable supplies
- Manipulatives
- Measurement tools
- Instructional technology

## Adequacy of Resources



# Influence of State Standards

## Question 13

In roughly what percentage of high schools is there a school-wide effort to align mathematics instruction with state mathematics standards?

- a. 40 percent
- b. 60 percent
- c. 80 percent
- d. 100 percent

# Influence of State Science Standards

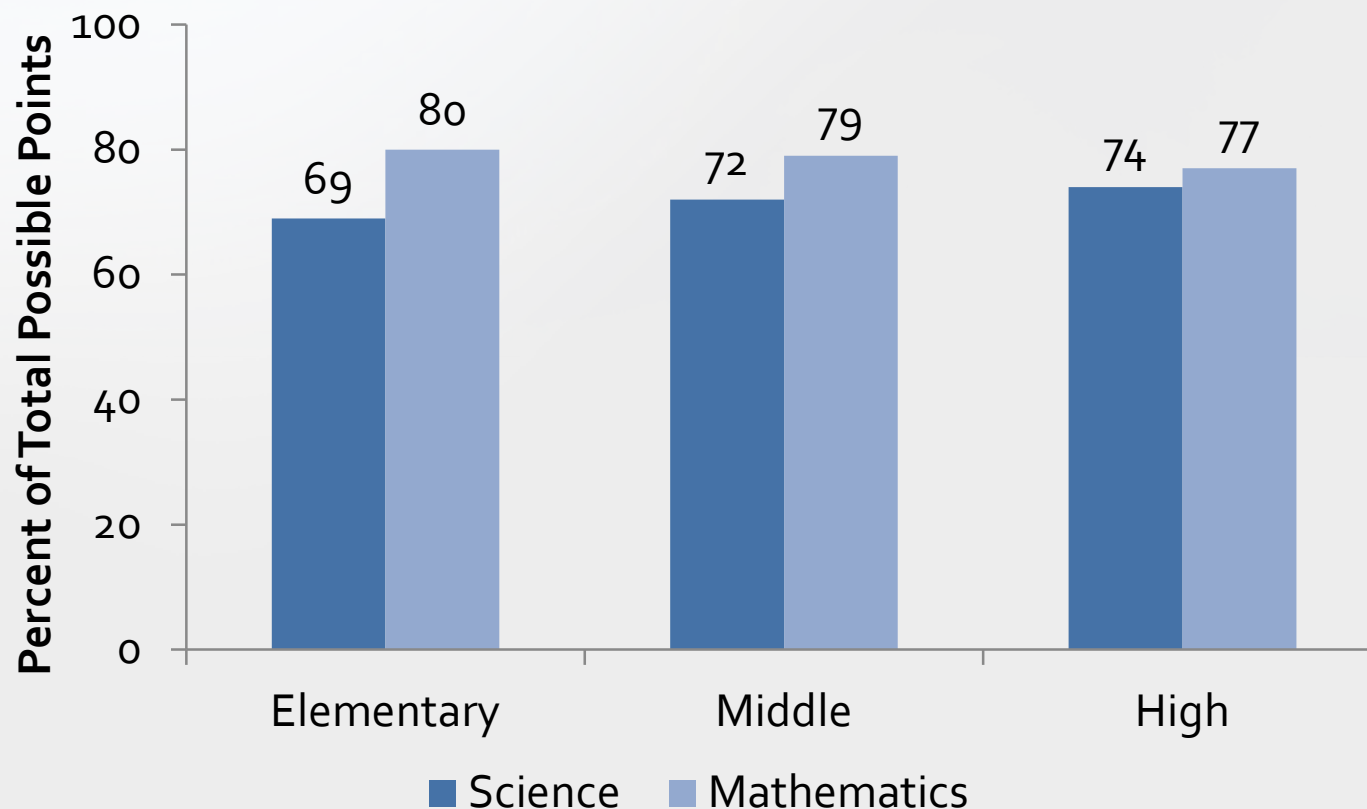
	Percent of Schools		
	Elementary	Middle	High
Standards have been thoroughly discussed by science teachers in this school	69	77	83
School-wide effort to align science instruction with the state science standards	80	83	82
Most science teachers in this school teach to the state standards	83	86	81
District organizes science professional development based on state standards	56	52	54

# Influence of State Mathematics Standards

	Percent of Schools		
	Elementary	Middle	High
School-wide effort to align mathematics instruction with the state mathematics standards	91	91	85
Most mathematics teachers in this school teach to the state standards	91	90	84
Standards have been thoroughly discussed by mathematics teachers in this school	85	86	83
District organizes mathematics professional development based on state standards	70	66	66



## Focus on Standards



# Summary

- Elementary science continues to be the forgotten step-child of education
- Inequities with regard to instruction, resources, and course-taking opportunities continue to exist
- While textbooks drive much of instruction, teachers deviate from them quite a bit, raising questions about instructional coherence.

# Dissemination

- Technical reports:
  - Overall
  - Compendium of Tables
  - Subject-specific reports
- Conferences:
  - NARST (2 symposia and a paper)
  - NCTM
  - AAPT
- Journal articles
  - Equity
  - Predictors of practice
- Endorsing organizations
- Project website: [horizon-research.com/2012nssme](http://horizon-research.com/2012nssme)
- Social media

## For More Information

<http://www.horizon-research.com/2012nssme/>

<http://www.facebook.com/2012NSSME>

<https://twitter.com/2012NSSME>

[nssme@horizon-research.com](mailto:nssme@horizon-research.com)

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