

STEM Education in the U.S.

Scaling STEM Conference 2013

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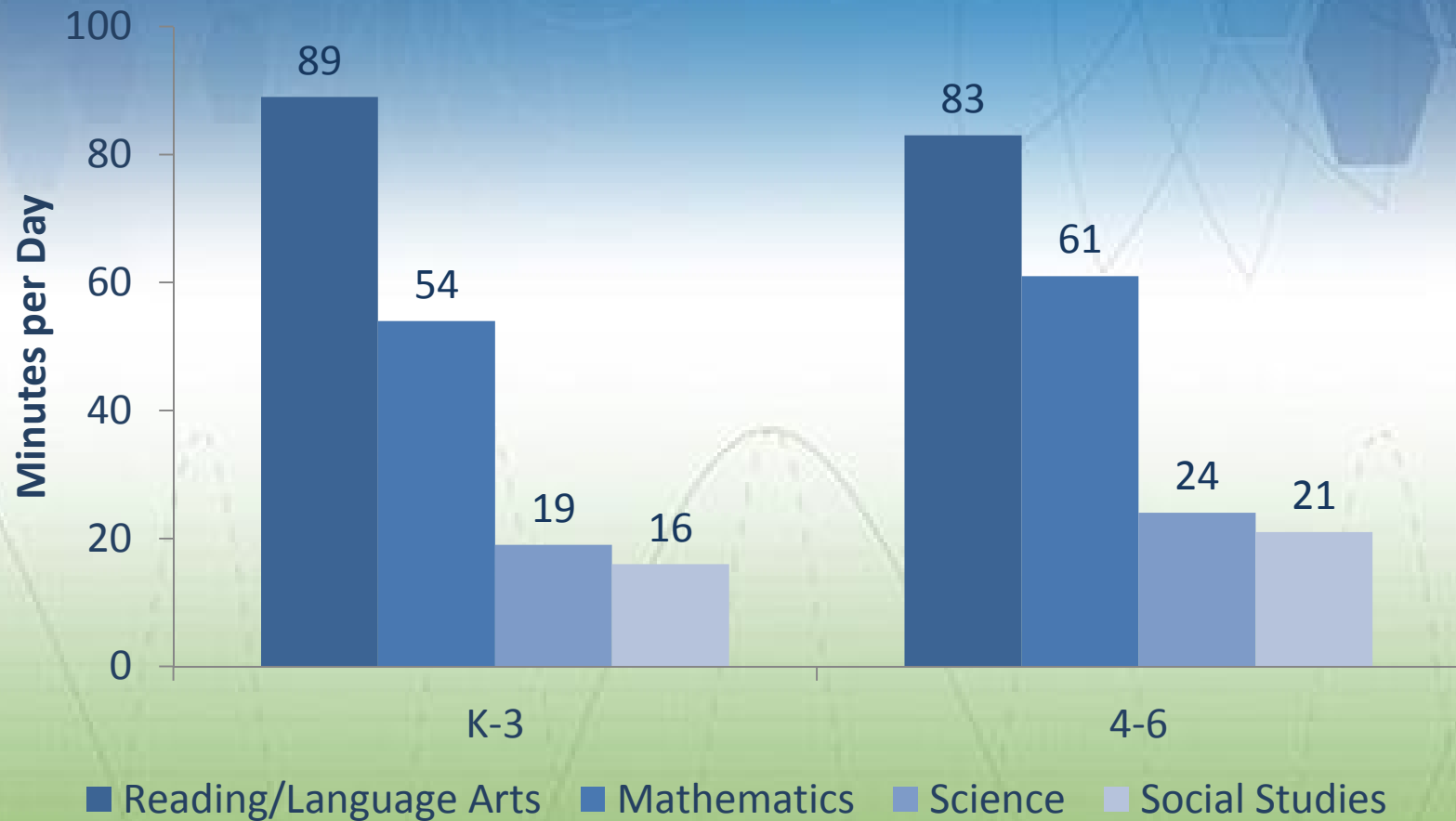
This presentation is based upon work supported by the National Science Foundation under Grant No. DRL-1008228. Any opinions, findings, and conclusions or recommendations expressed are those of the author and do not necessarily reflect the views of the National Science Foundation.

Question 1

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

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

Instructional Time: Elementary Classes



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

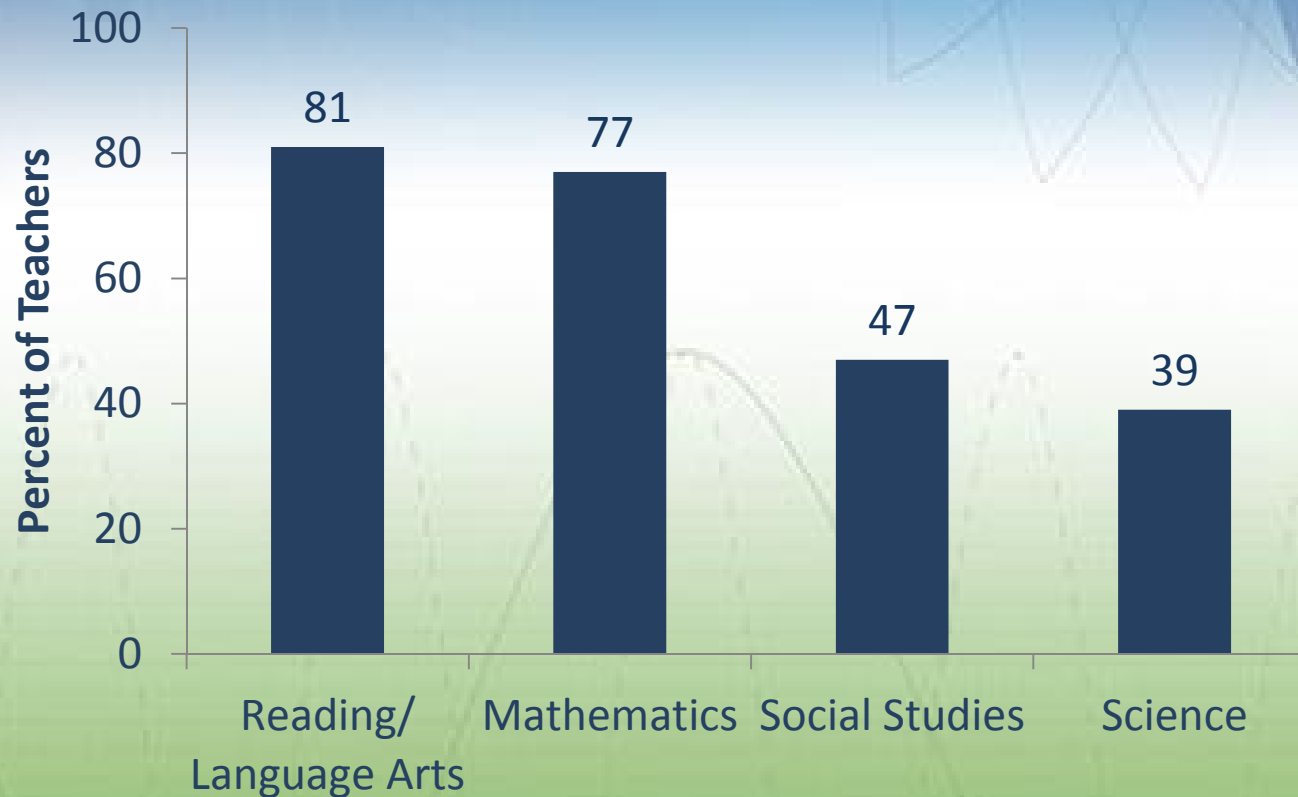
Question 2

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

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

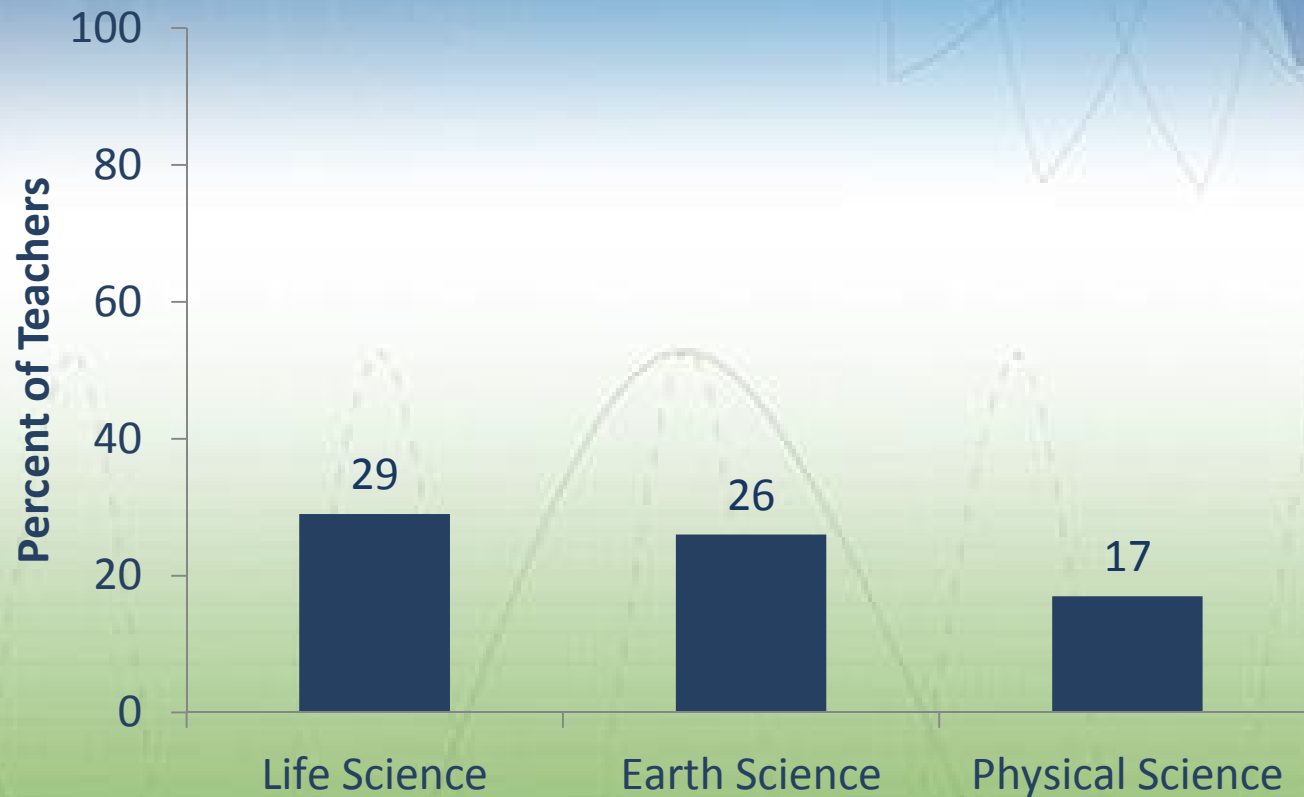
Perceptions of Preparedness: Elementary

Very Well Prepared



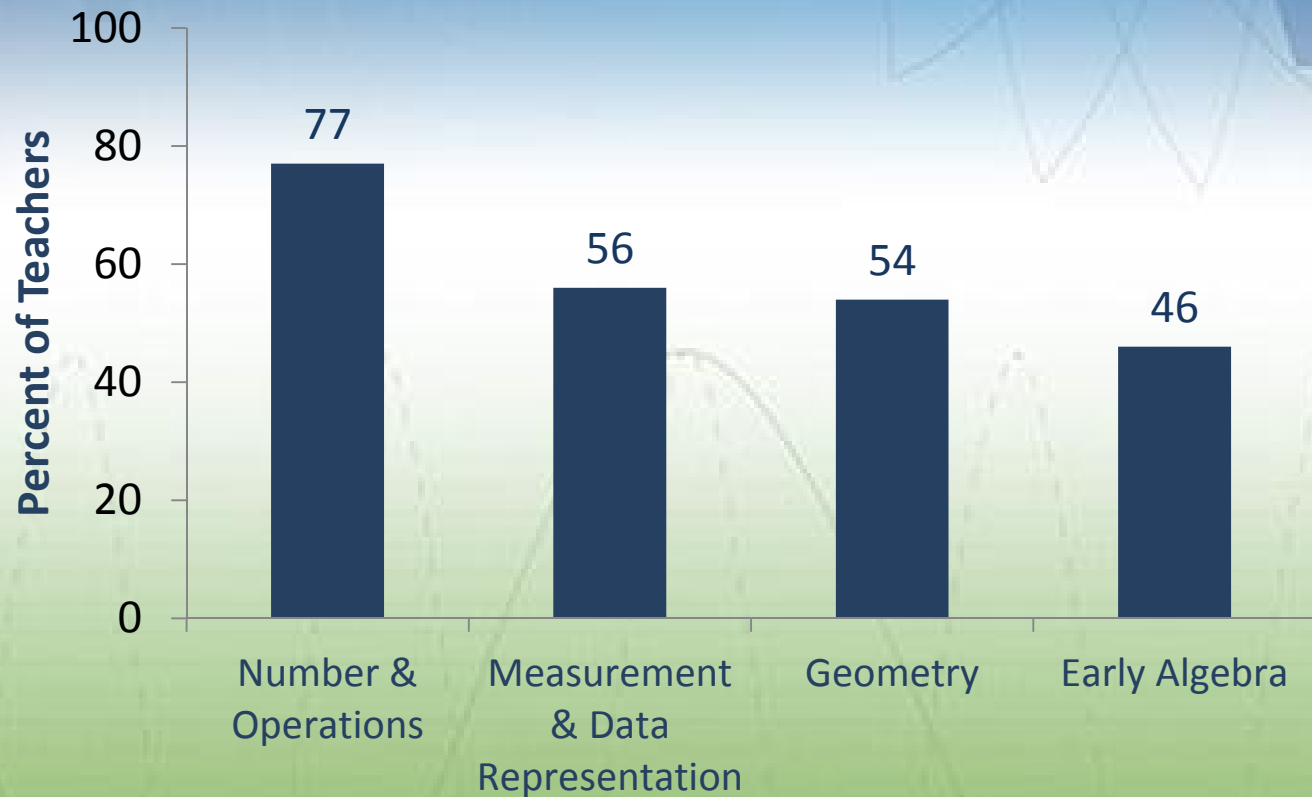
Perceptions of Preparedness: Elementary

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Perceptions of Preparedness: Elementary

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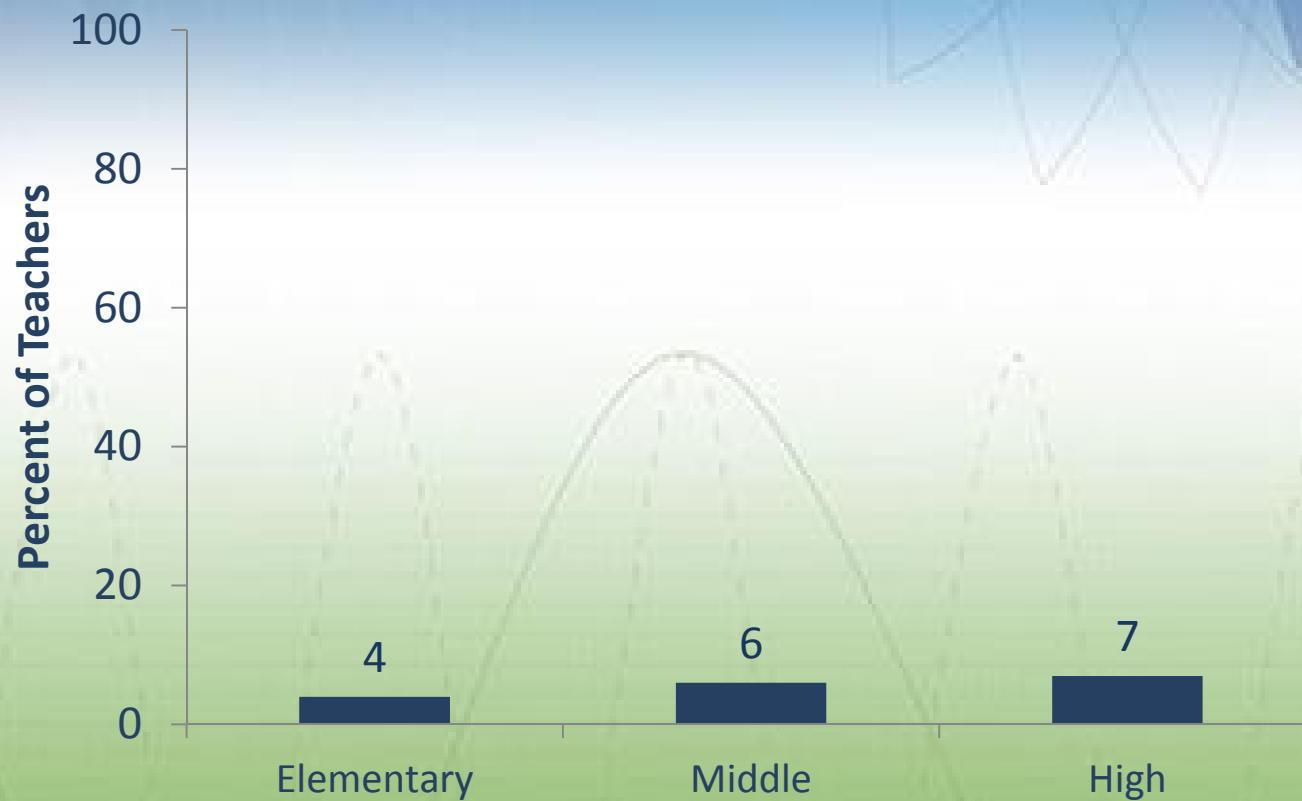
Question 3

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



Session Structure

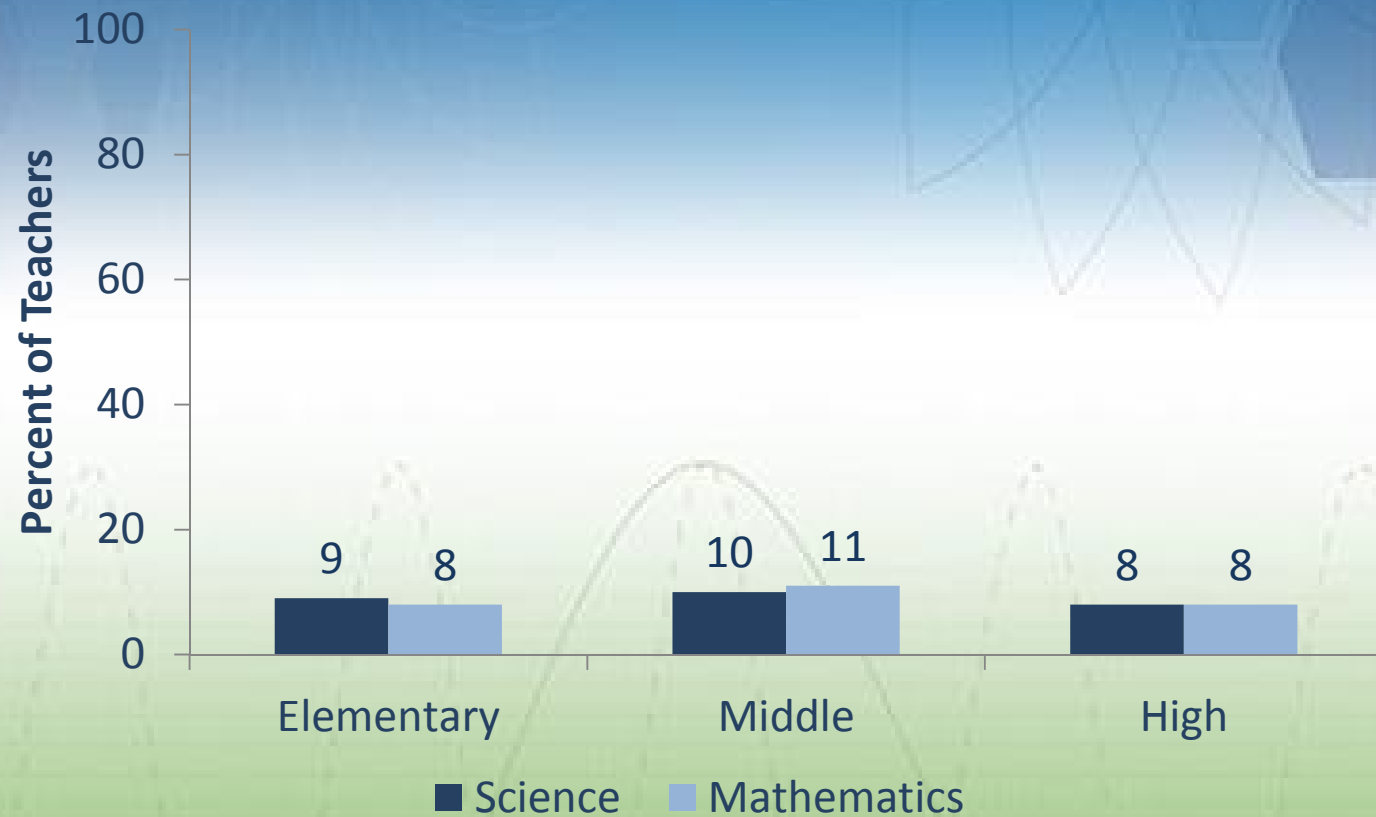
- Introductions
- About the 2012 National Survey of Science and Mathematics Education
- The STEM Teaching Force
- STEM instruction
- Professional Development
- Systemic Reform

About the 2012 National Survey of Science and Mathematics Education

- Two-stage sample that targeted:
 - 2,000 schools (public and private)
 - Over 10,000 K-12 teachers
- Excellent response rate:
 - 1,504 schools agreed to participate
 - Over 80 percent of program representatives
 - Over 75 percent of sampled teachers

The STEM Teaching Force

Percent Non-White

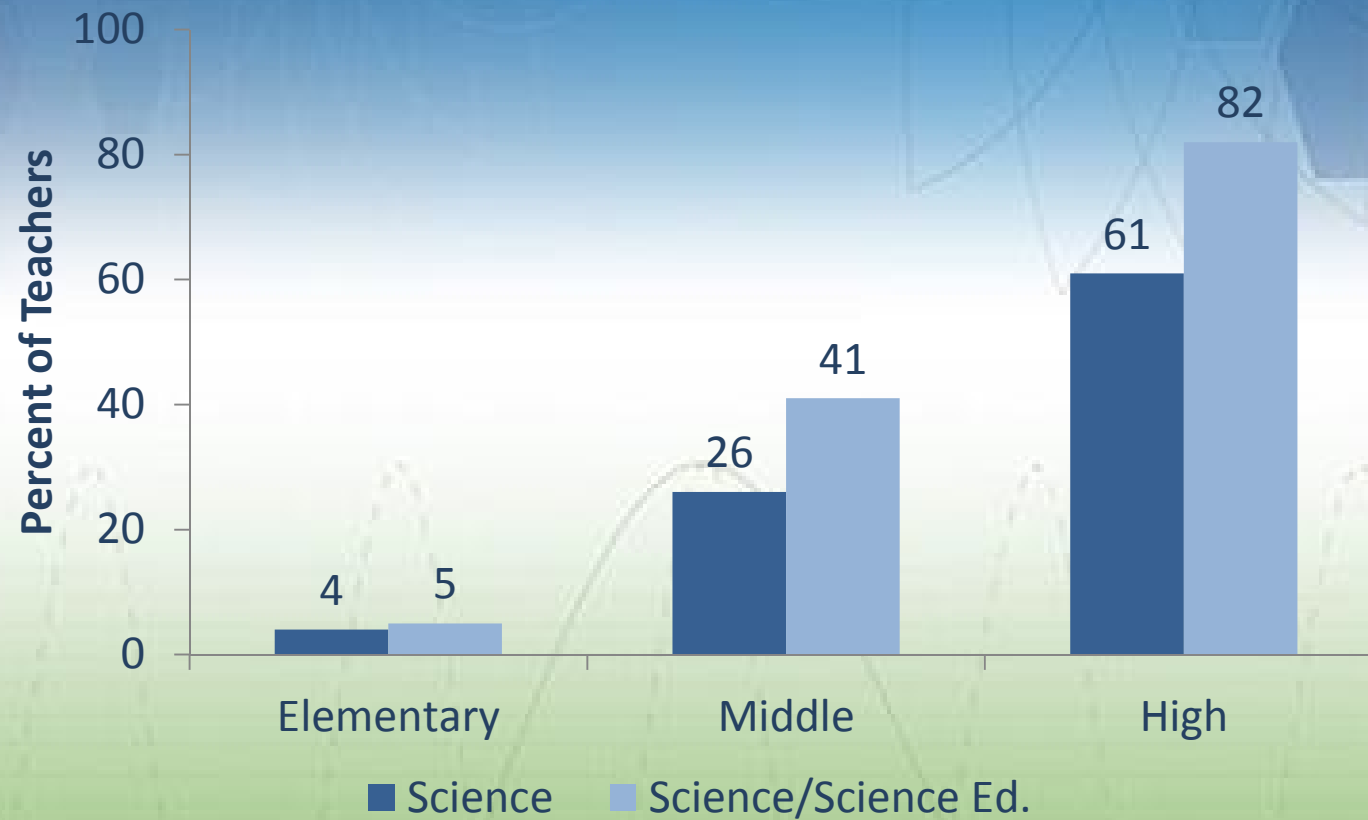


Question 4

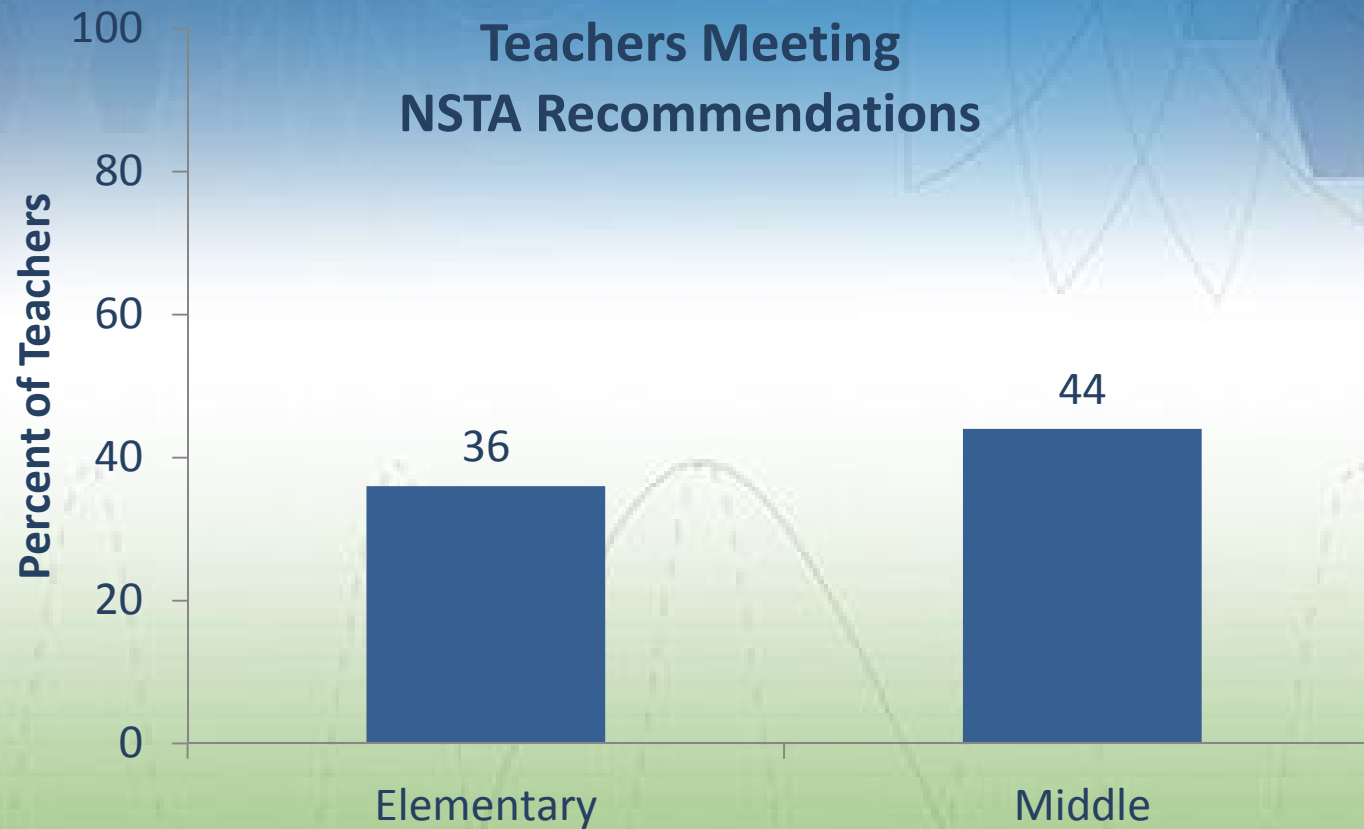
About what percentage of high school science teachers have a college degree in a science discipline?

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

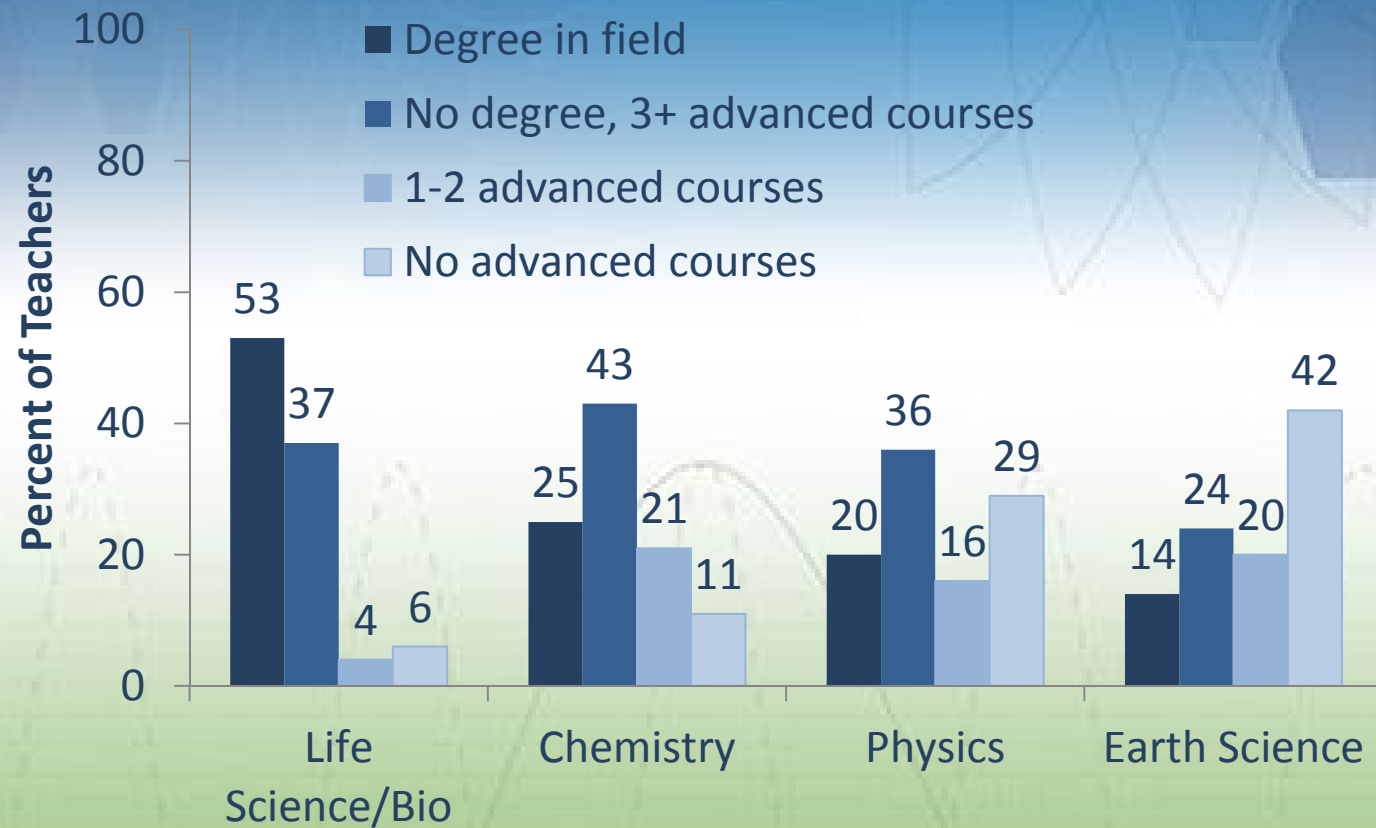
Science Teacher Degrees



Science Coursework



High School Science Teachers

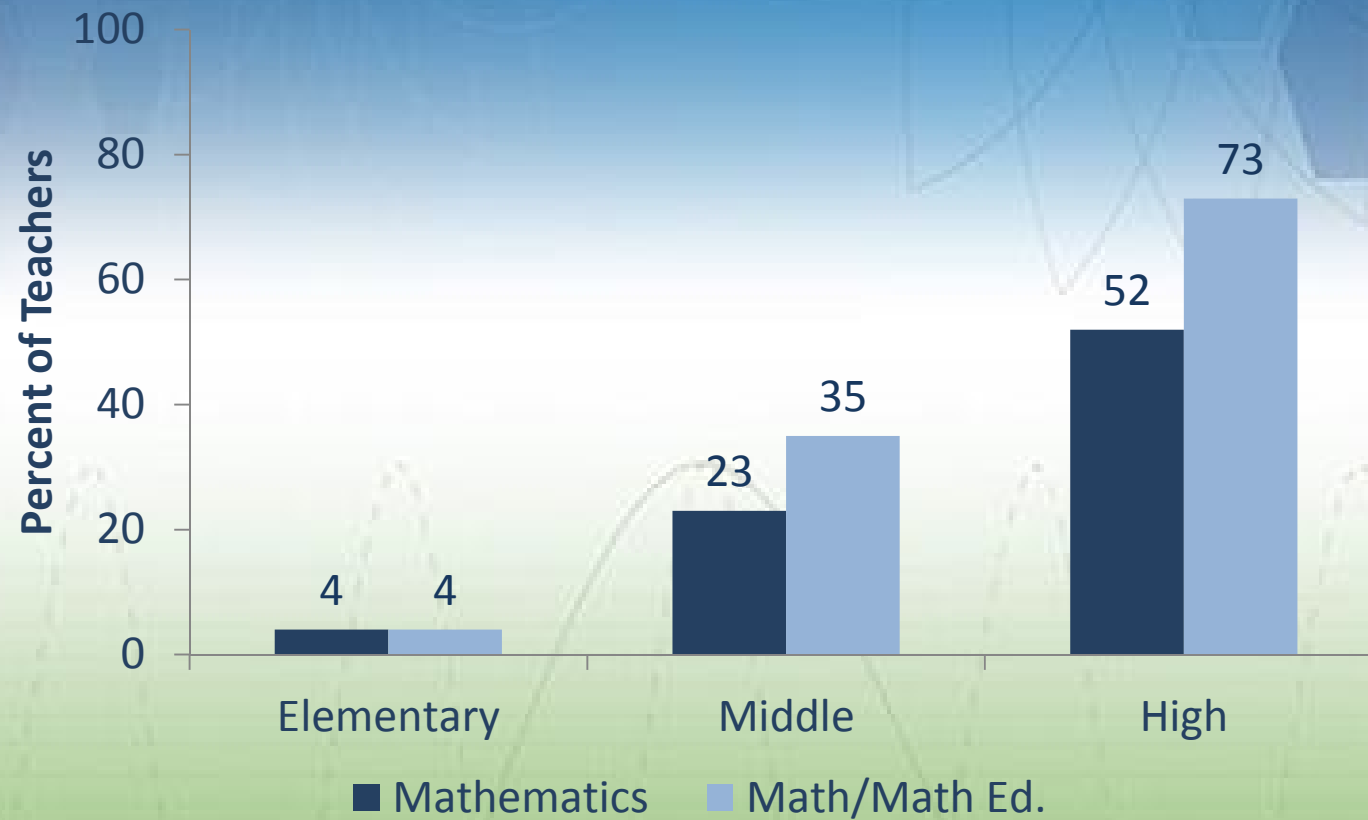


Question 5

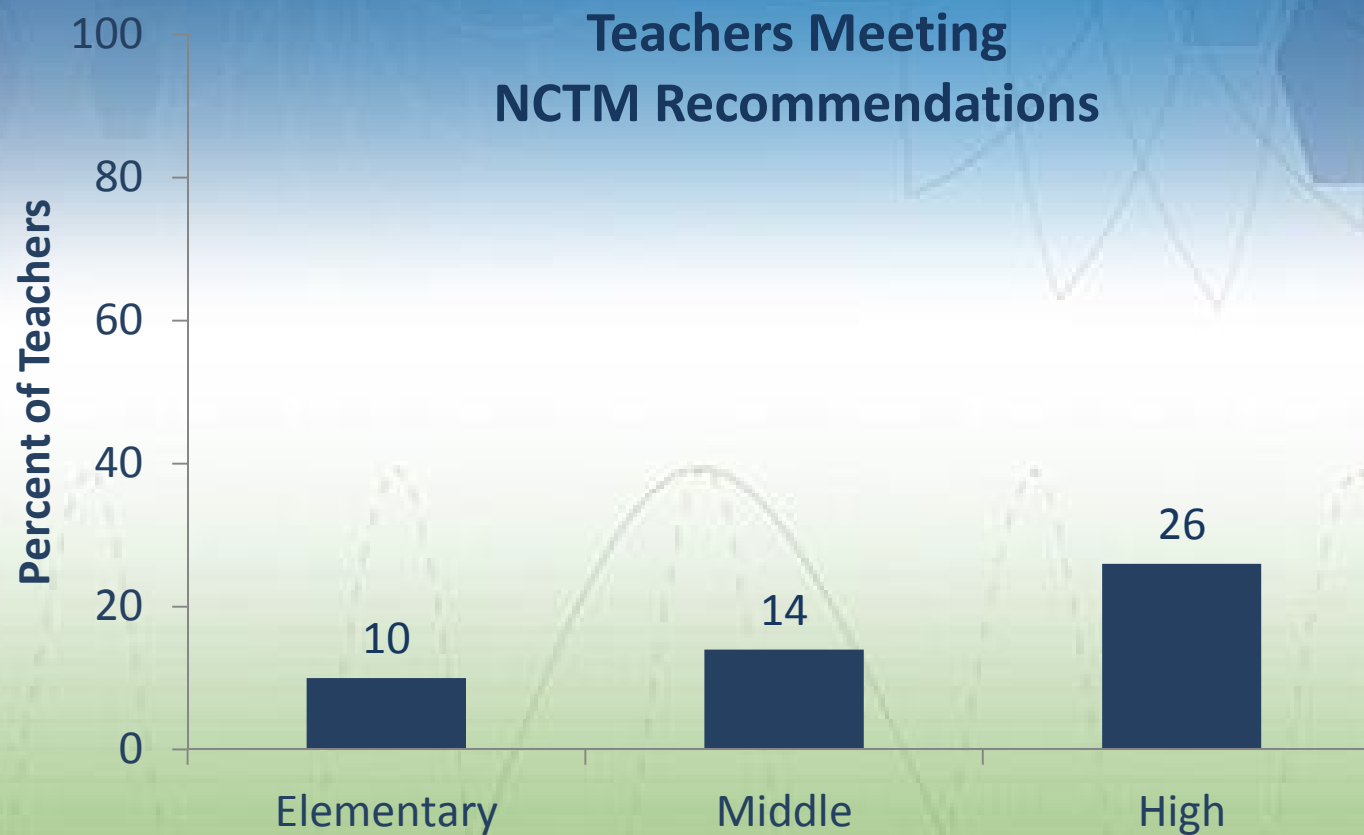
About what percentage of high school mathematics teachers have a college degree in mathematics?

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

Mathematics Teacher Degrees



Mathematics Coursework



Teacher Beliefs

Question 6

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 vocabulary at the beginning of instruction.

Views about Effective Instruction Vary: Mathematics

- 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

The Future STEM Workforce

Question 7

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

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

Student Enrollment: HS Science

Percent Female

- Non-College Prep 46
- 1st Year Biology 49
- 1st Year Chemistry 51
- 1st Year Physics 49
- Advanced Courses 54

Student Enrollment: HS Science

Percent Non-Asian Minority

- Non-College Prep 36
- 1st Year Biology 33
- 1st Year Chemistry 30
- 1st 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

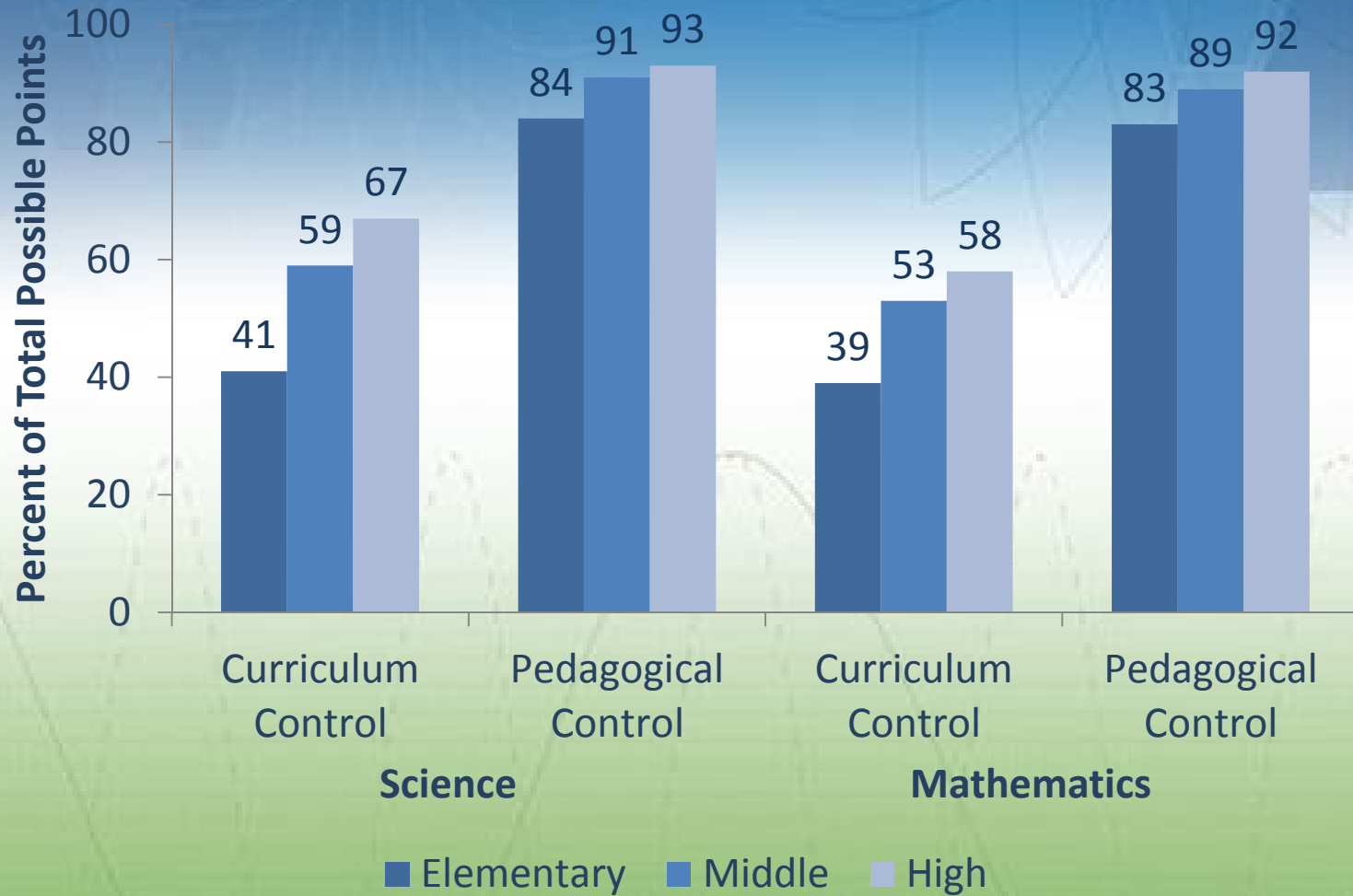
Student Enrollment: HS Mathematics

Percent Non-Asian Minority

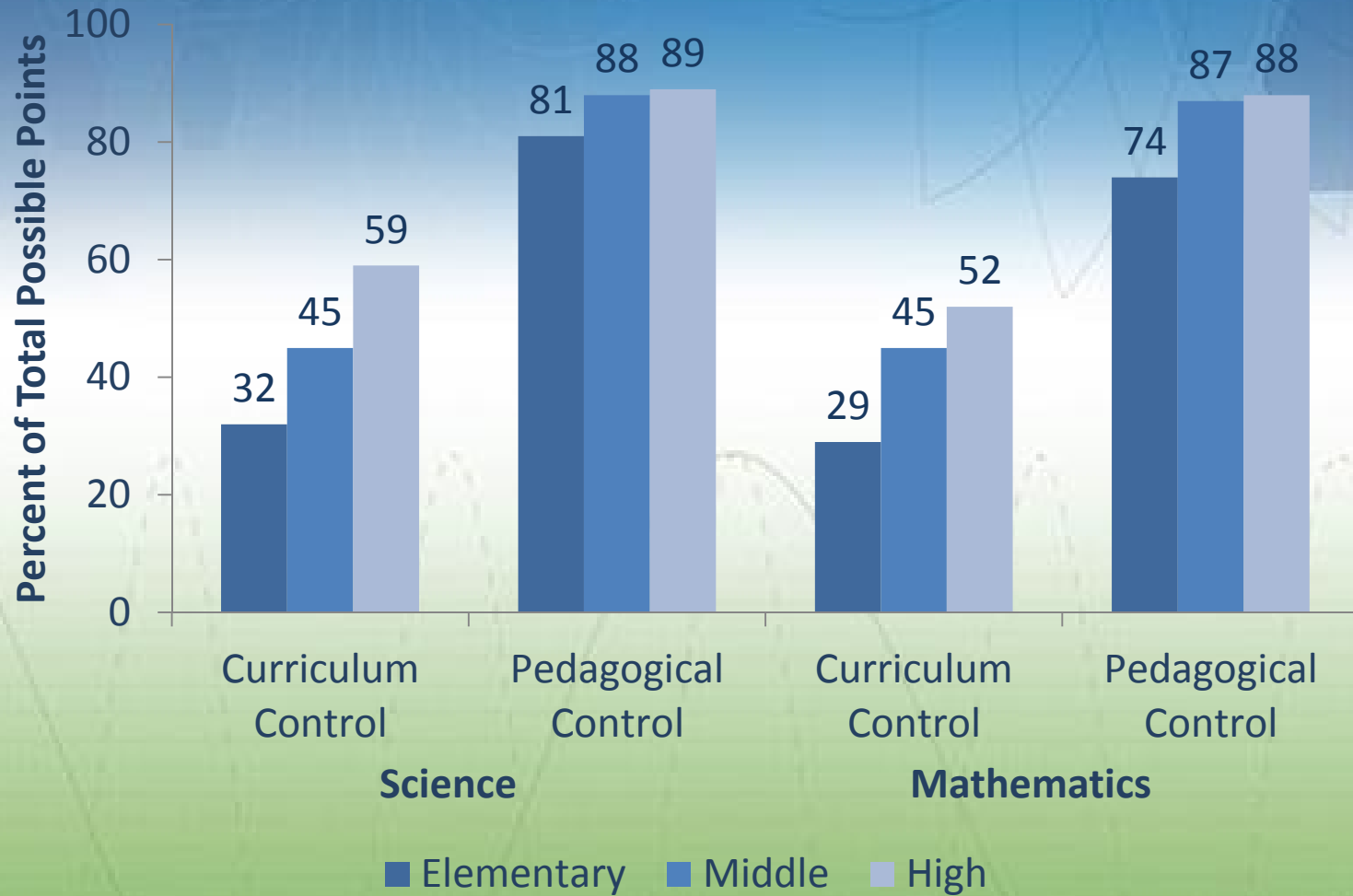
- Non-College Prep 45
- Formal Level 1 39
- Formal Level 2 31
- Formal Level 3 27
- Formal Level 4 22
- College-Credit Courses 17

Science and Mathematics Instruction

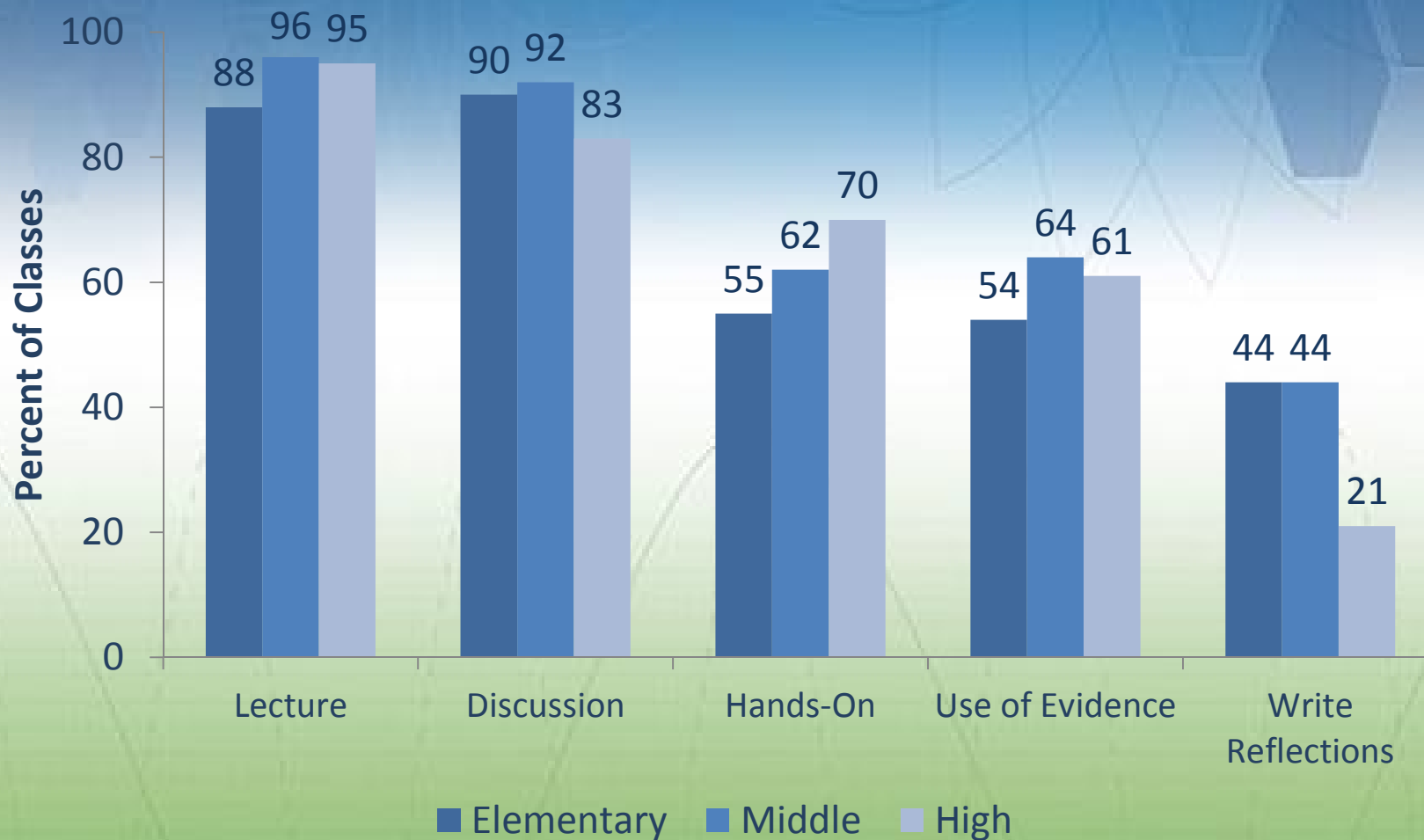
Teacher Control: 2000



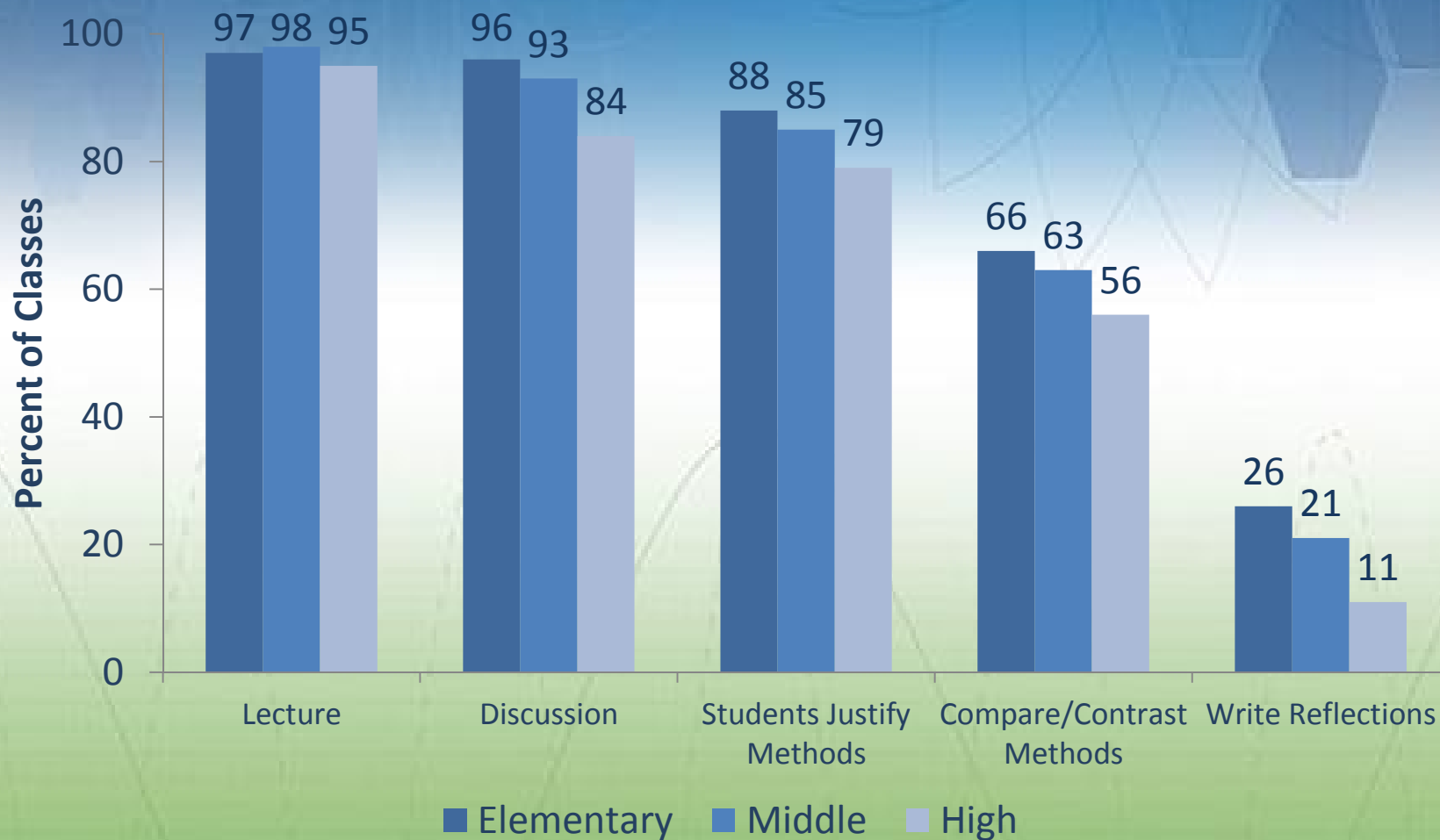
Teacher Control: 2012



Weekly Instructional Practices: Science



Weekly Instructional Practices: Math



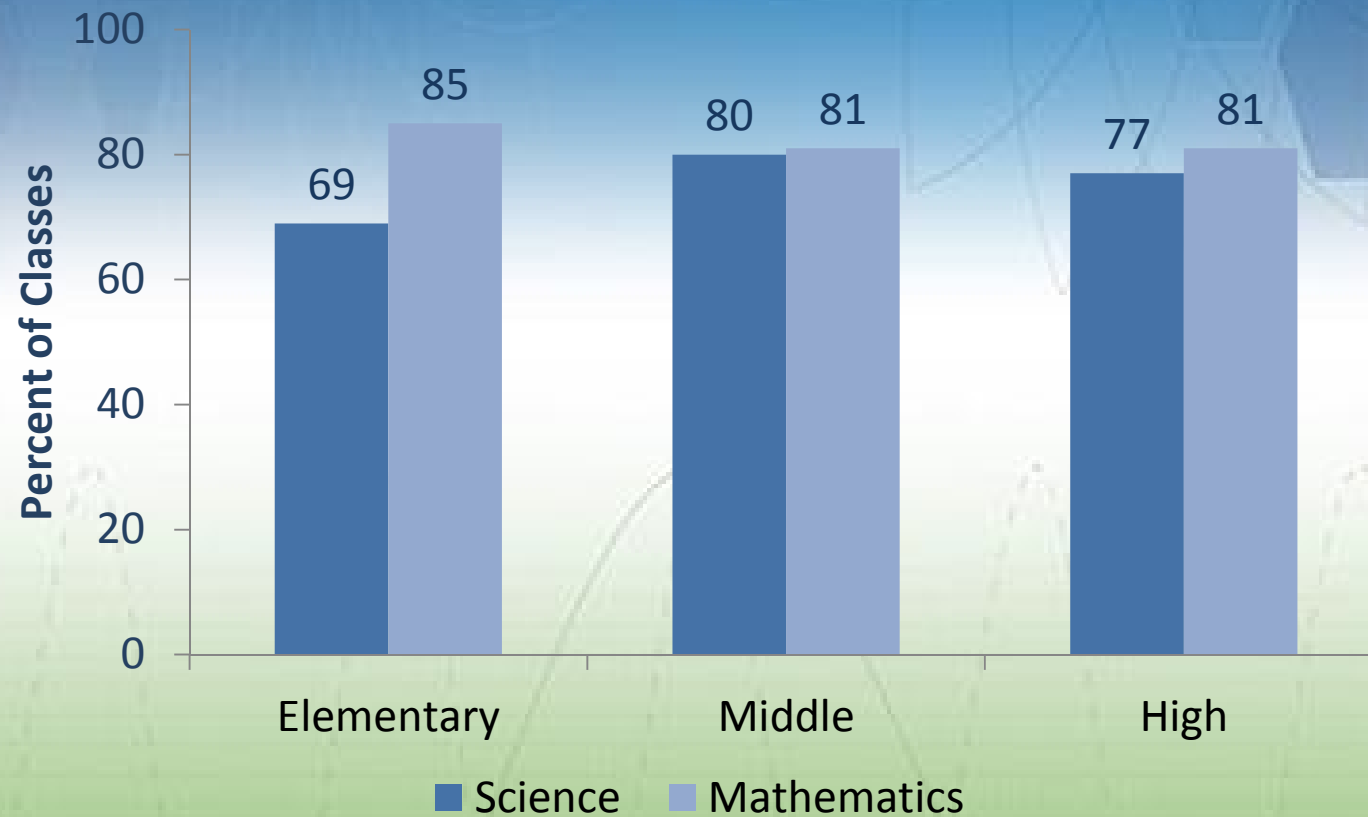
Influence of Textbooks

Question 8

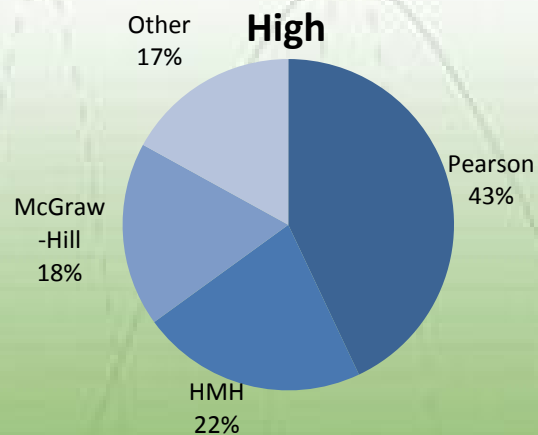
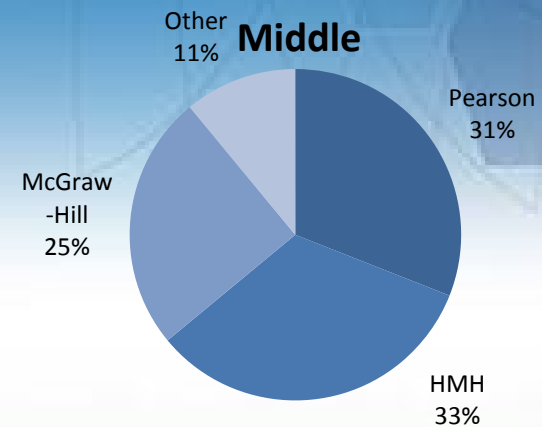
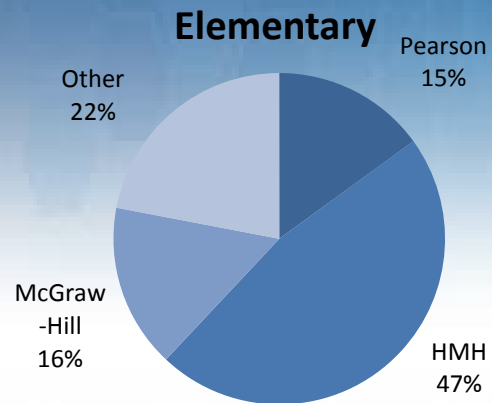
About what percentage of middle school science classes use a published textbook or module as the primary instructional material?

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

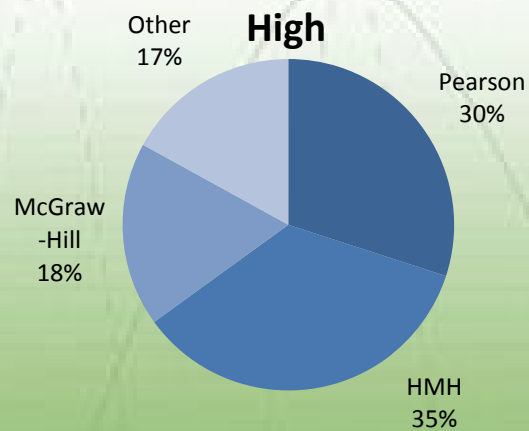
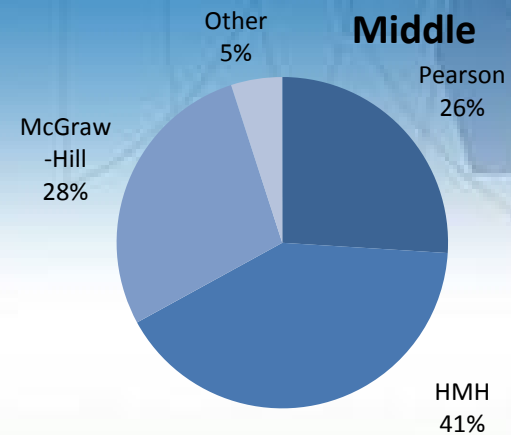
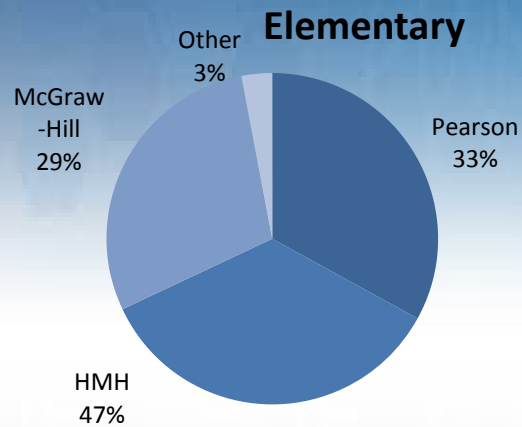
Classes Using a Published Text



Publisher Market Share— Science Materials



Publisher Market Share— Mathematics Materials



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.

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.

STEM PD

Features of High Quality PD

- Focuses on content knowledge
- Emphasizes active learning
- Promotes coherence
- Provides a large amount of training sustained over time
- Encourages collaboration among teachers.

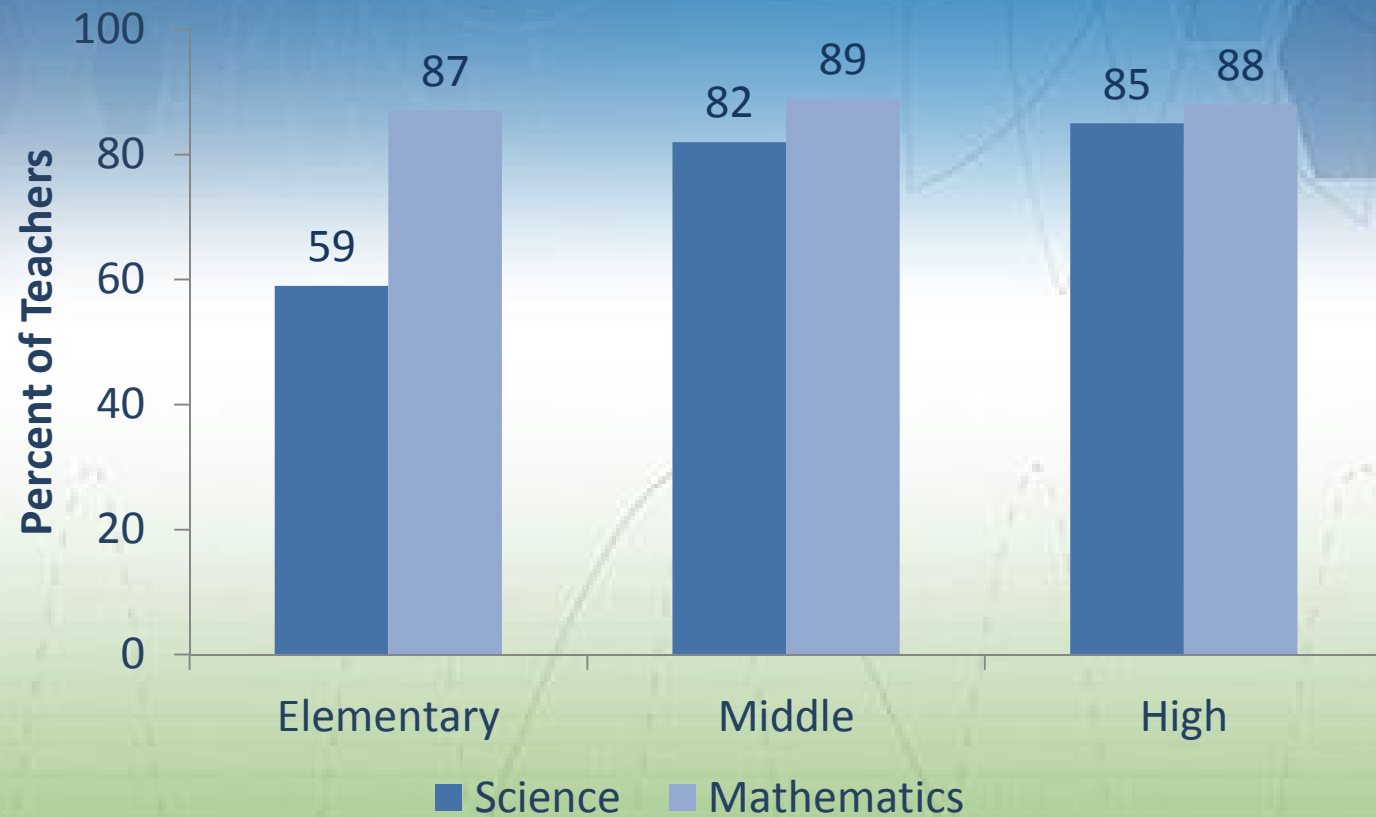
(Garet, M. S., Porter, A. C., Desimone, L., Birman, B. F., & Yoon, K. S. (2001). What makes professional development effective? Results from a national sample of teachers. *American educational research journal*, 38(4), 915–945.)

Question 9

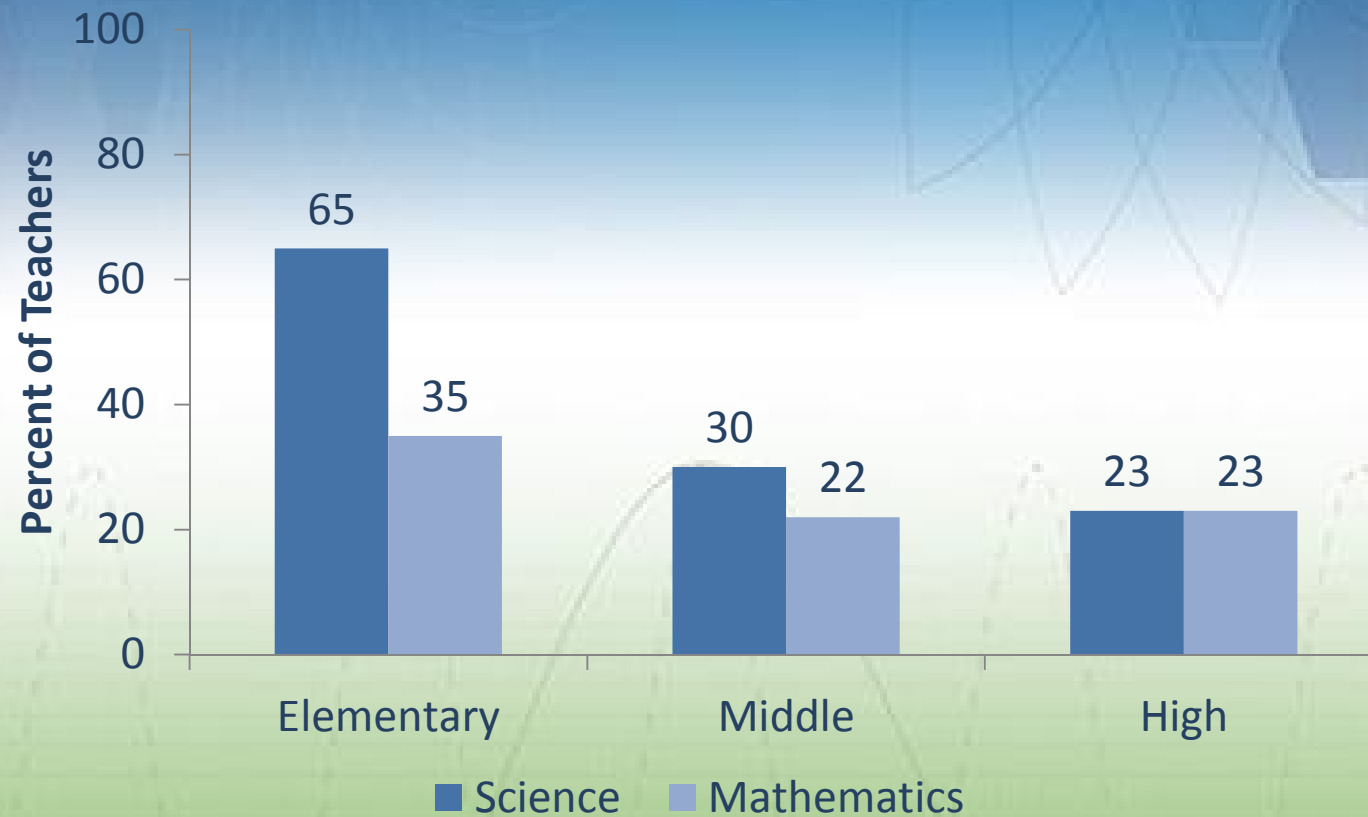
About what percentage of elementary teachers have participated in science-specific PD in the last three years?

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

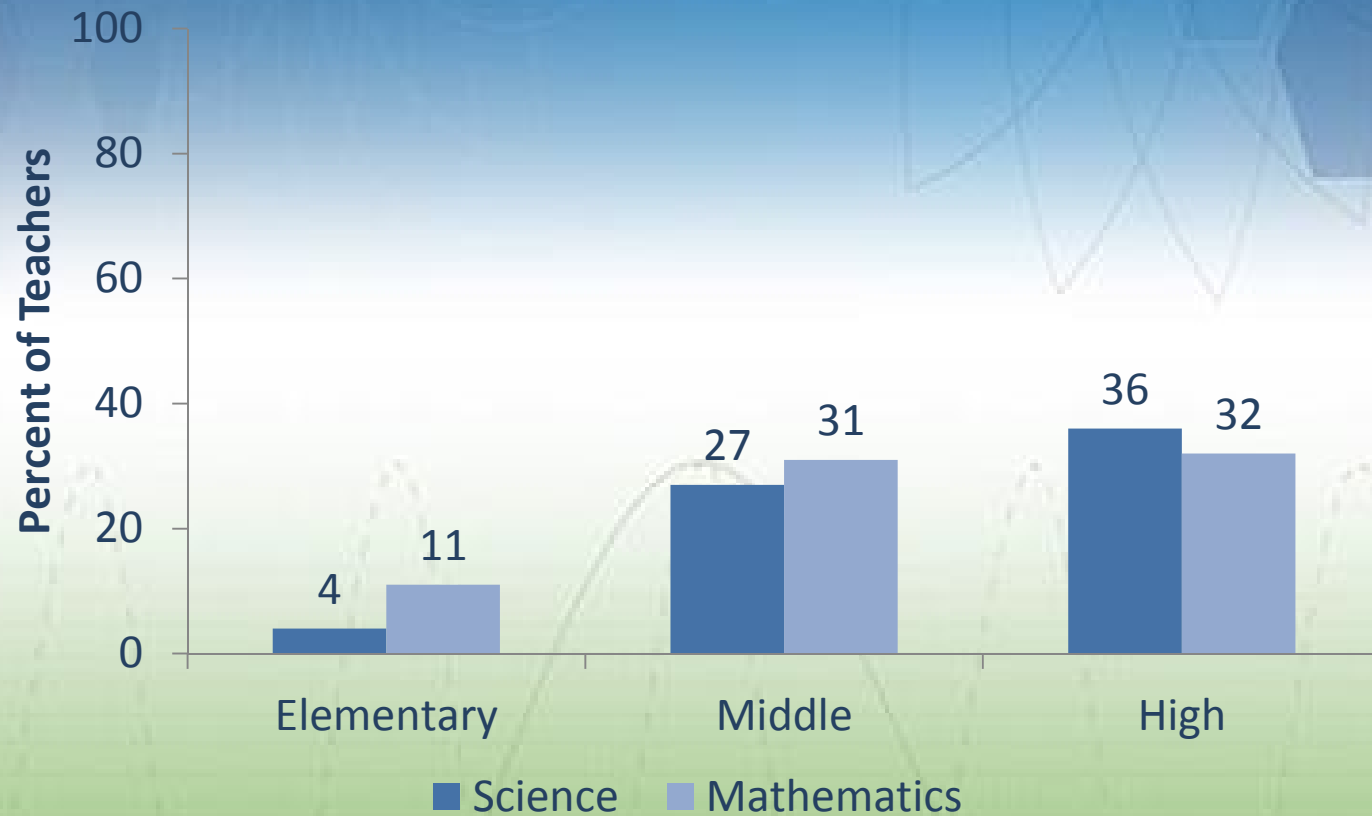
Teachers Participating in PD in Last 3 Years



Less than 6 hours of PD in last 3 years



More than 35 hours of PD in last 3 years

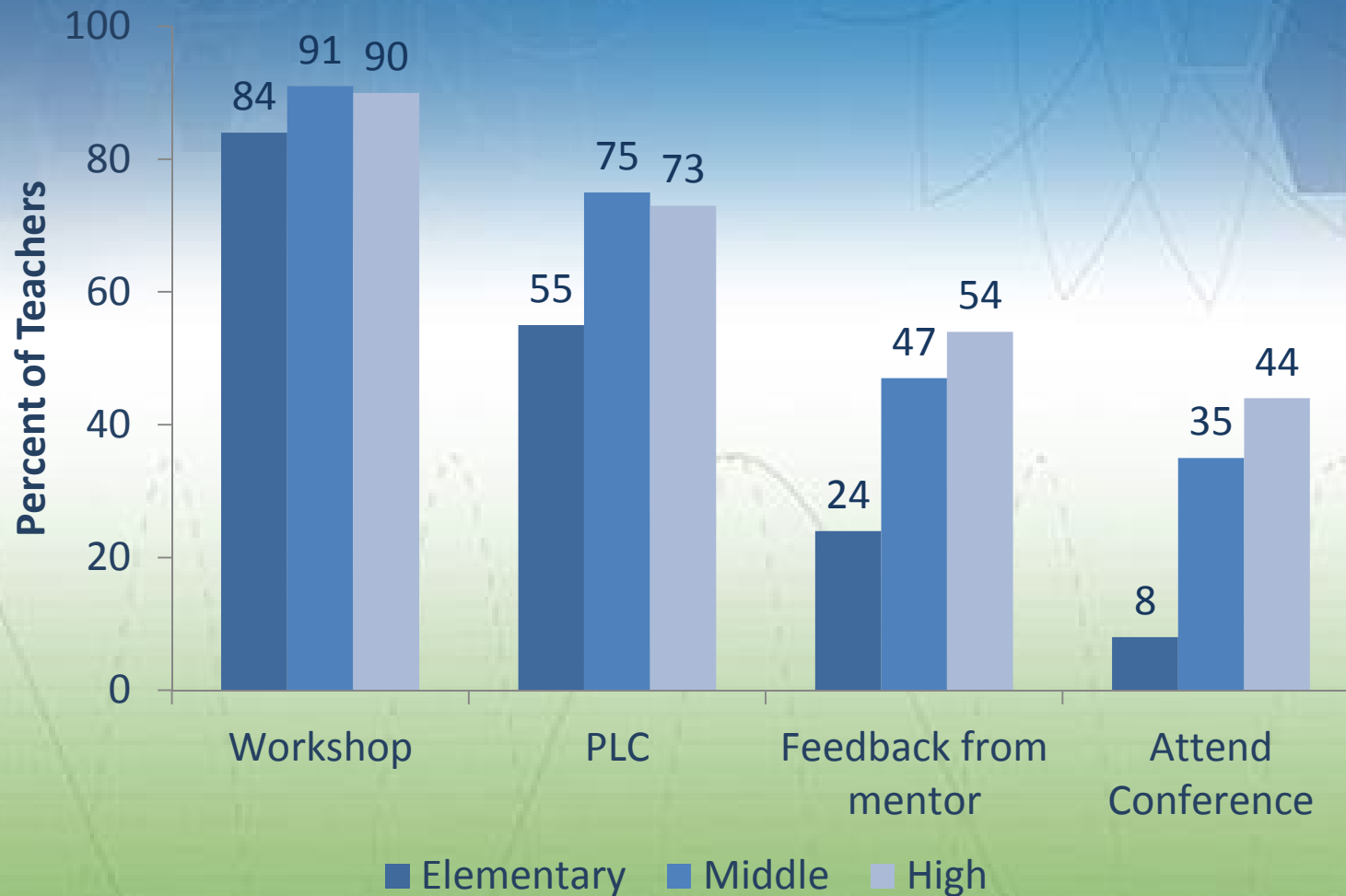


Question 10

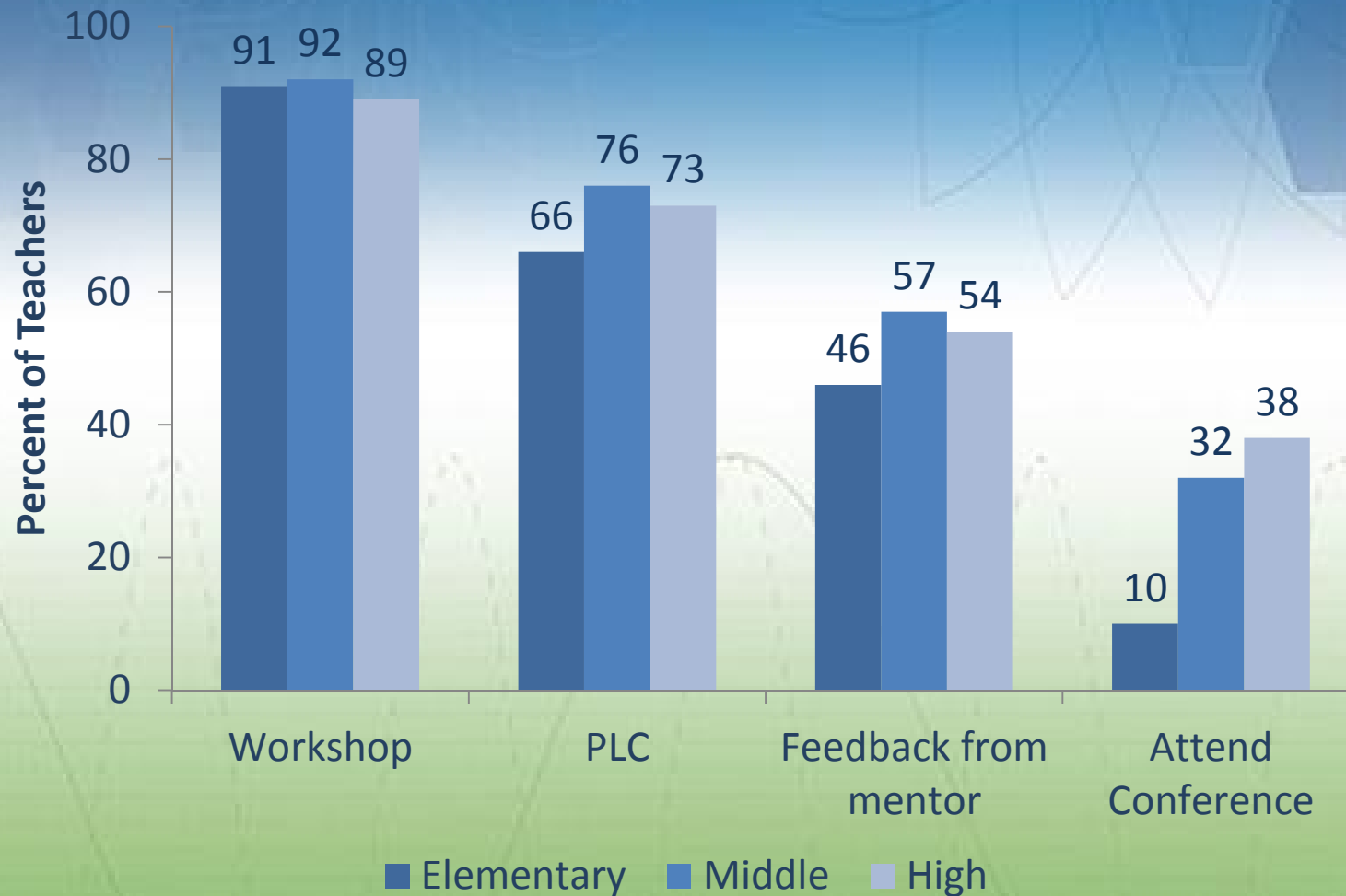
About what percentage of high school mathematics teachers have participated in a mathematics-specific professional learning community (PLC) in the last three years?

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

Science Teacher PD in Last 3 Years



Math Teacher PD in Last 3 Years

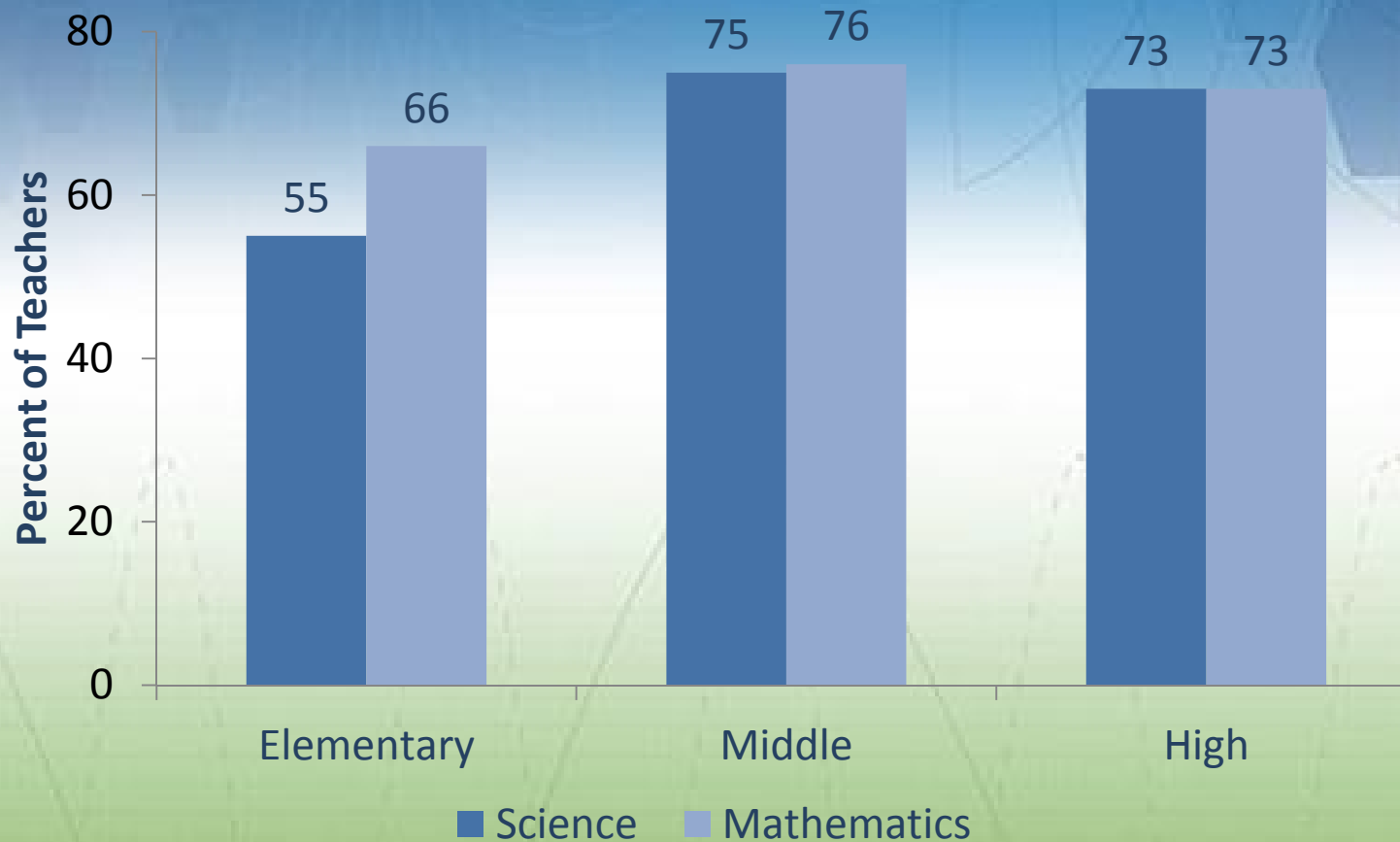


Features of High Quality PD

- Focuses on content knowledge
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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

Professional Development Resources

TE-MAT

Teacher Education Materials Project

An online database of reviews of materials for K-12 mathematics and science professional development providers



National Science Foundation
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2012 NSSME | THE 2012 NATIONAL SURVEY OF
SCIENCE AND MATHEMATICS EDUCATION



What's In TE-MAT

- Materials designed to support the work of K-12 mathematics and science professional development providers
- A conceptual framework that highlights key elements critical to professional development.

www.te-mat.org

Systems Approach to Change

Components of the System

- Classroom instruction
- Pre-service teacher preparation and induction
- Professional development
- Administration
- Instructional materials
- Assessments
- District and state policies
 - Curriculum
 - Accountability

Where Can You Make a Difference?

- Classroom instruction
- Pre-service teacher preparation and induction
- Professional development
- Administration
- Instructional materials
- Assessments
- District and state policies
 - Curriculum
 - Accountability

For More Information on the 2012 NSSME

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

Acknowledgement

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