The Status K-12 Science Education:

Are We Ready for the Next Generation Science Standards?

NSTA 2014

Sean Smith
Horizon Research, Inc.

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.

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

Questionnaire Topics

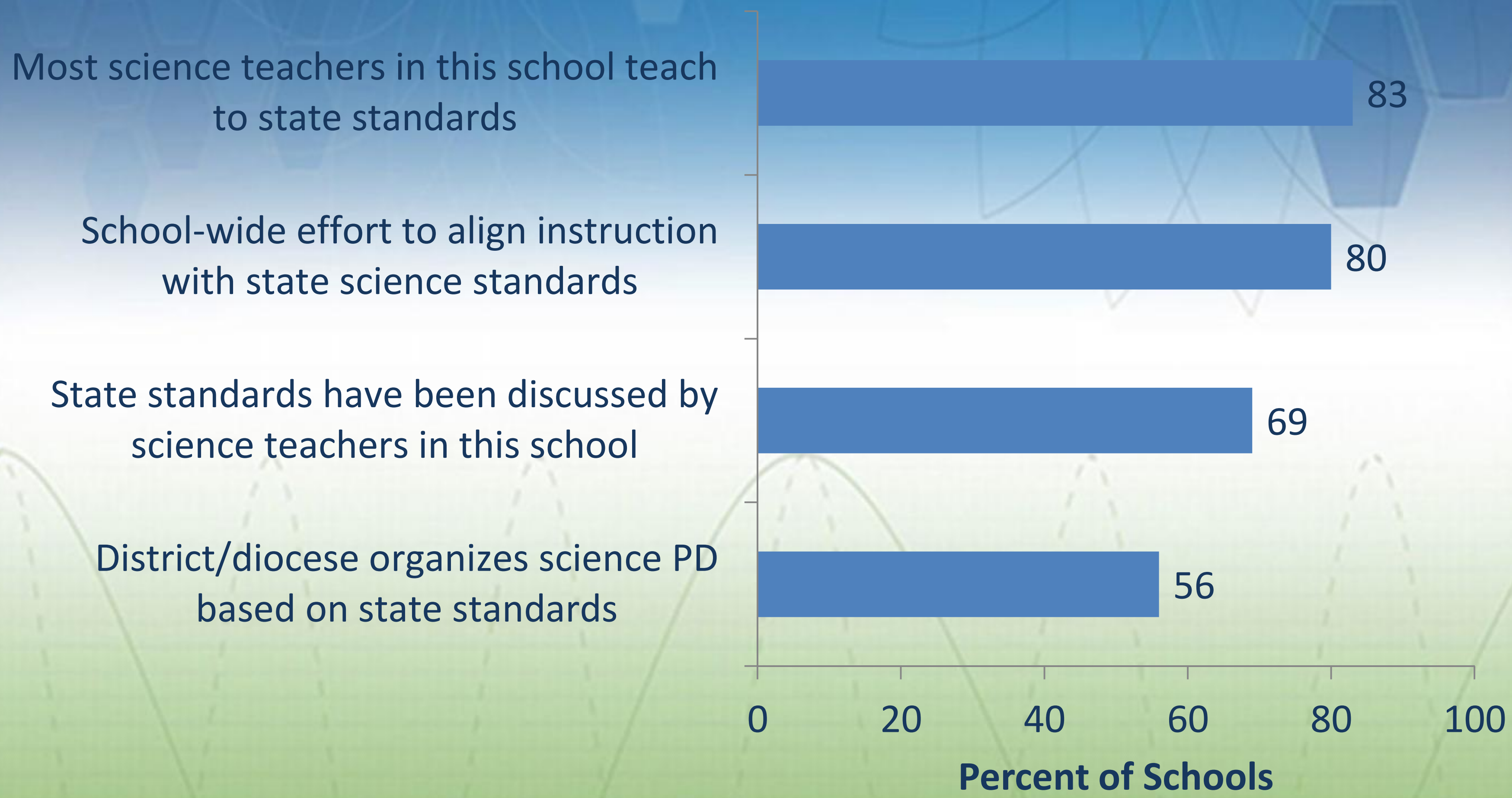
- Teacher
  - Background
  - Opinions
  - Instructional practices and resources
- School
  - Programs
  - Policies
  - Resources

Session Overview

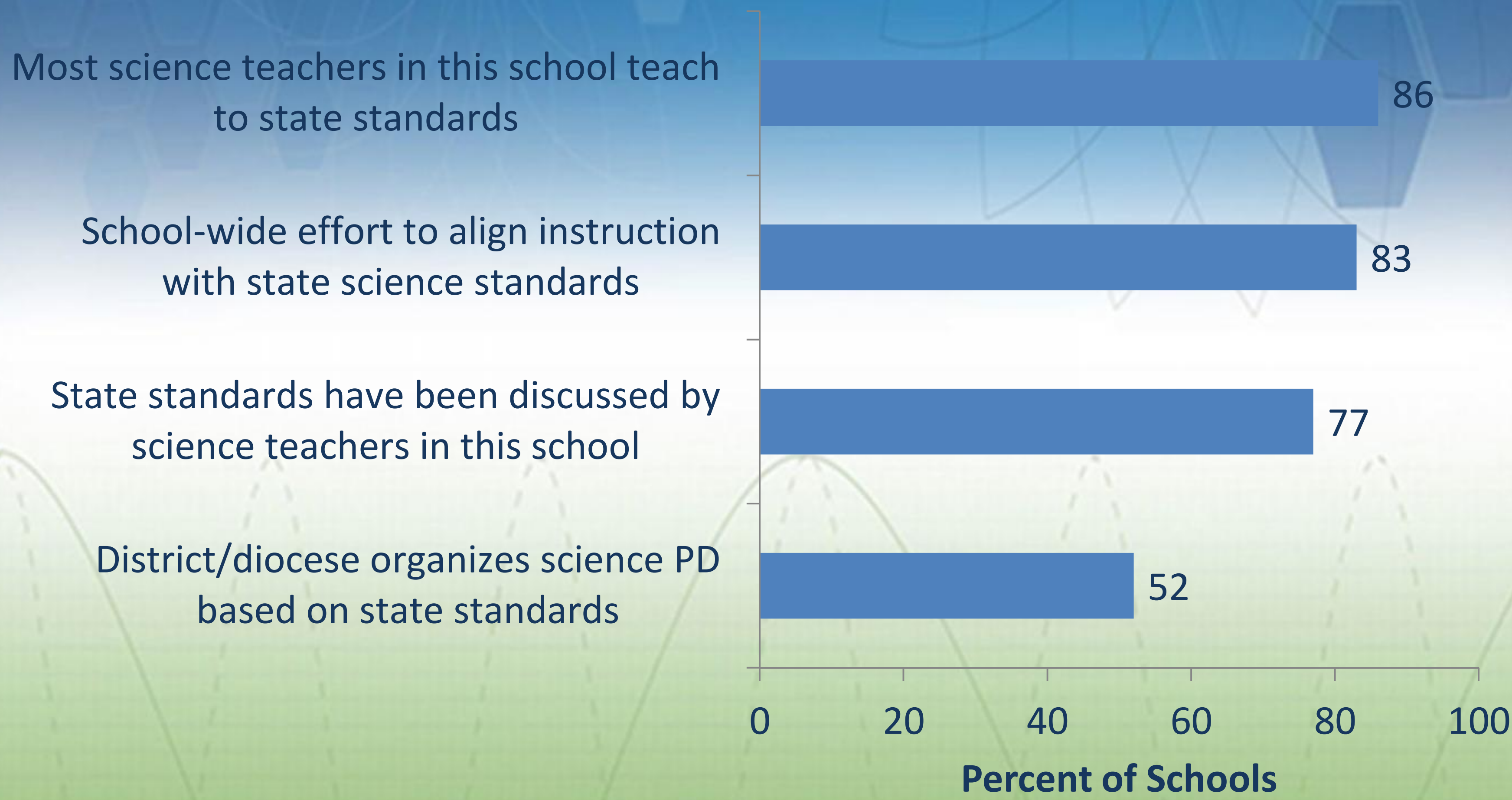
- Status areas
  - K-12 science teachers
  - Professional development
  - Instruction
  - Instructional resources
- Lens of readiness to implement the NGSS
- Discussion

The Power of Standards

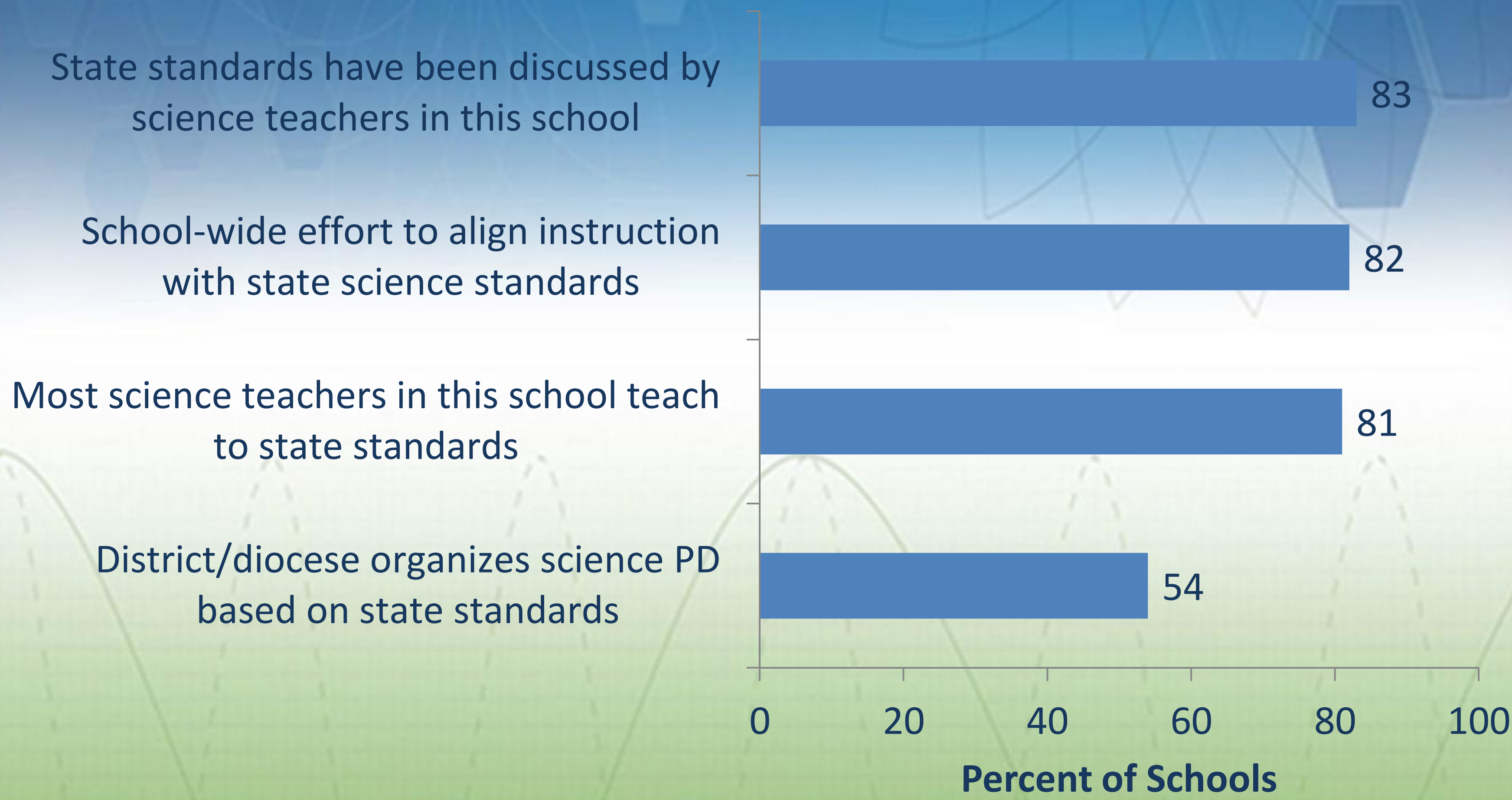
Elementary Schools Agreeing with Various Statements Regarding State Science Standards



Middle Schools Agreeing with Various Statements Regarding State Science Standards

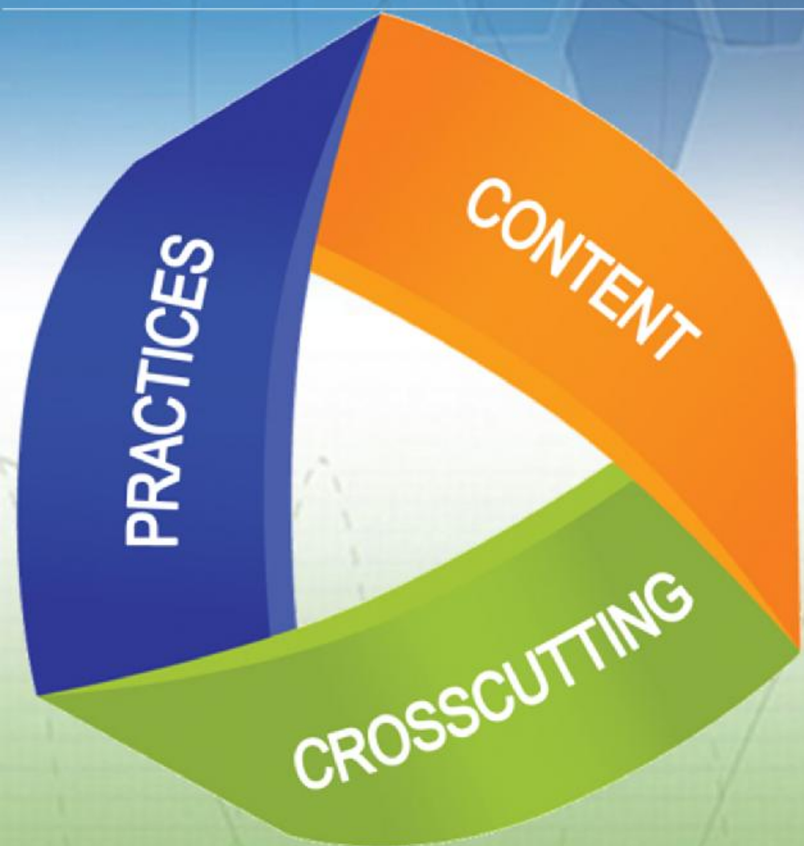


High Schools Agreeing with Various Statements Regarding State Science Standards



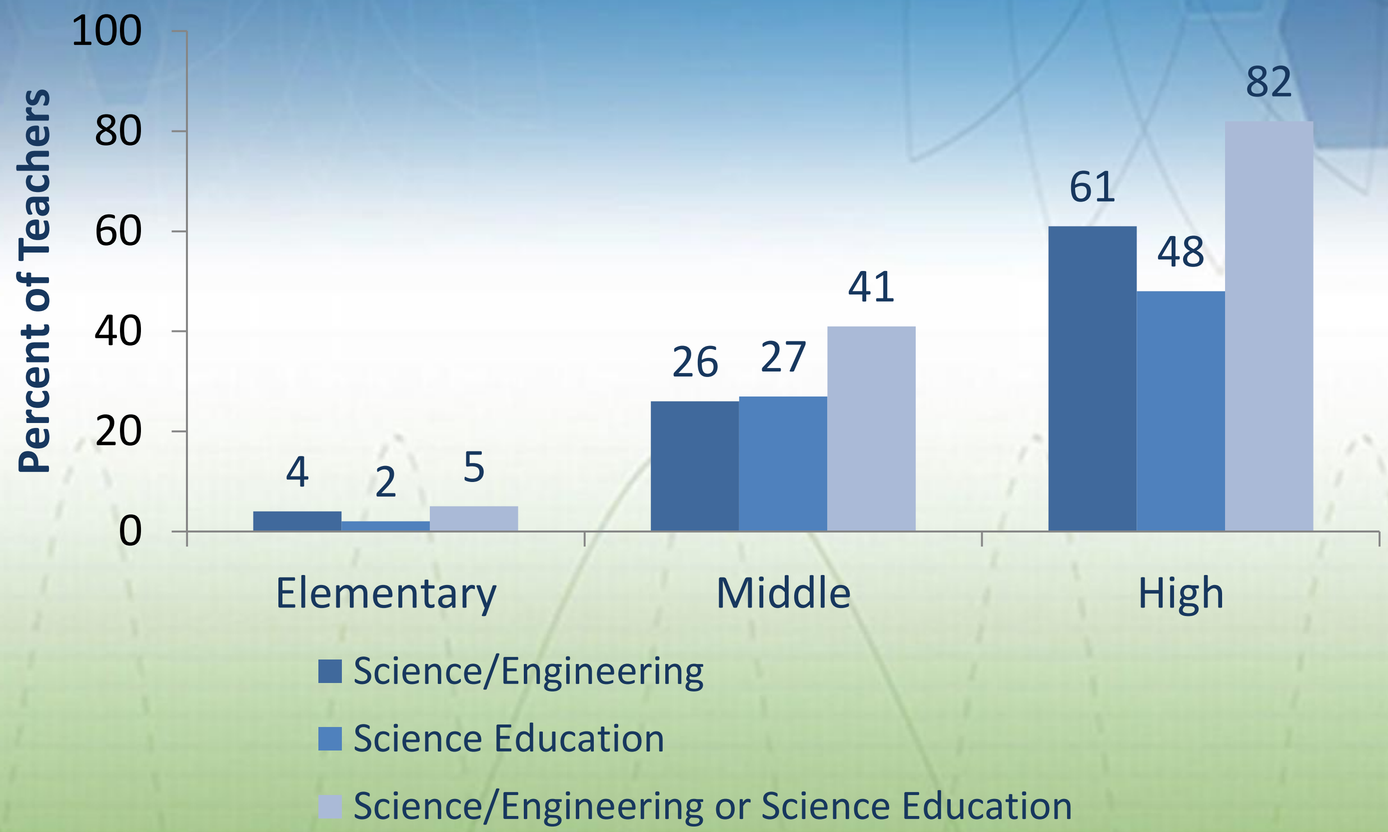
Vision of the NGSS

- Practices
- Cross-cutting concepts
- Disciplinary core ideas

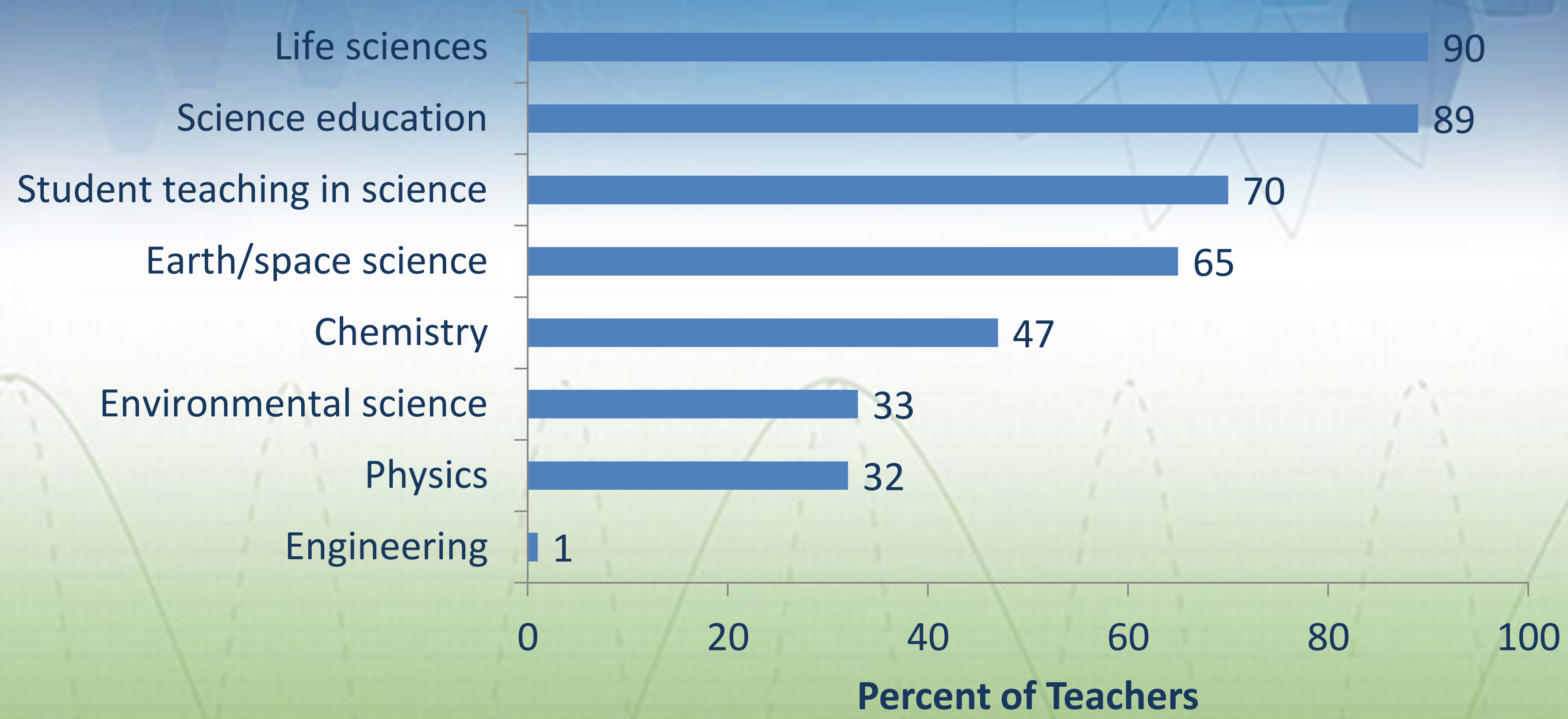


K-12 Science Teachers

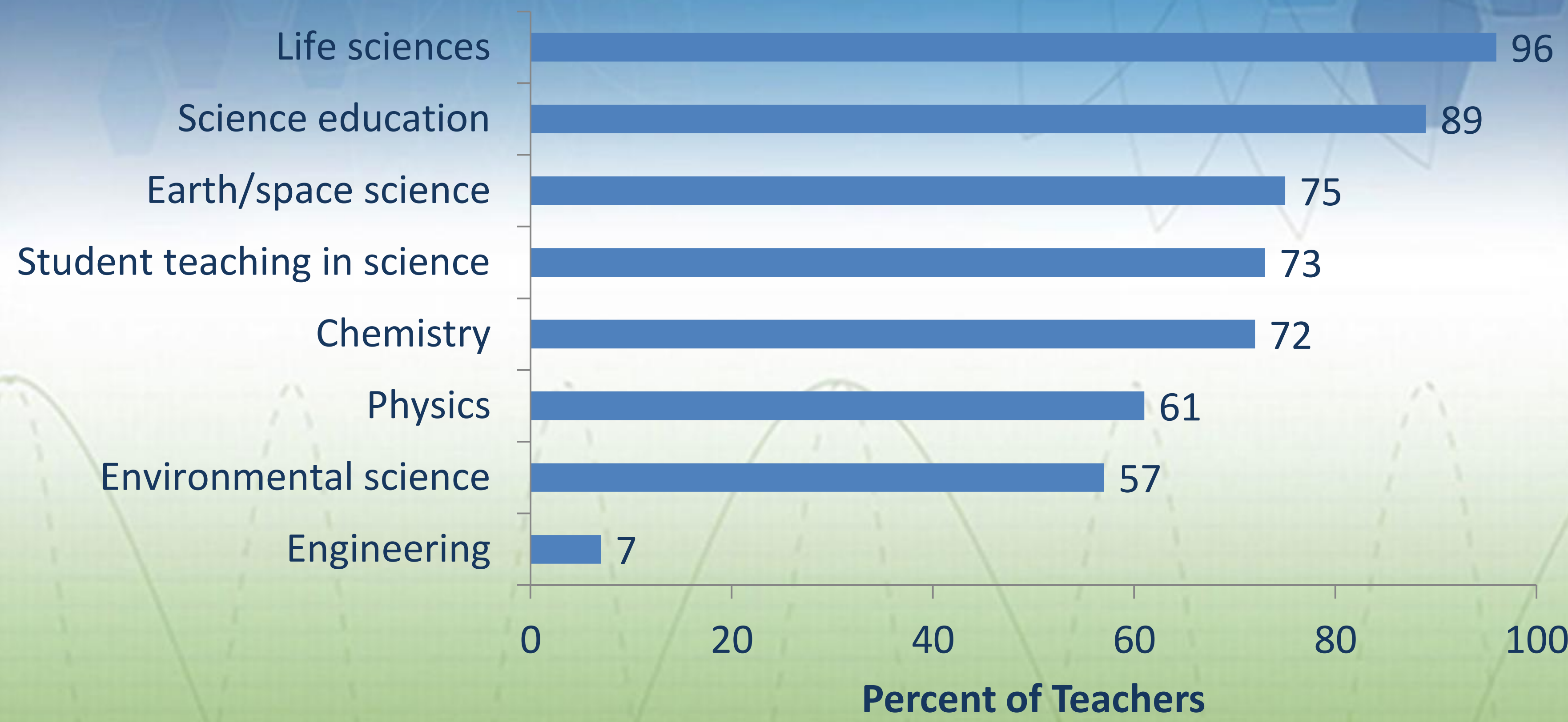
Science Teacher Degrees, by Grade Range



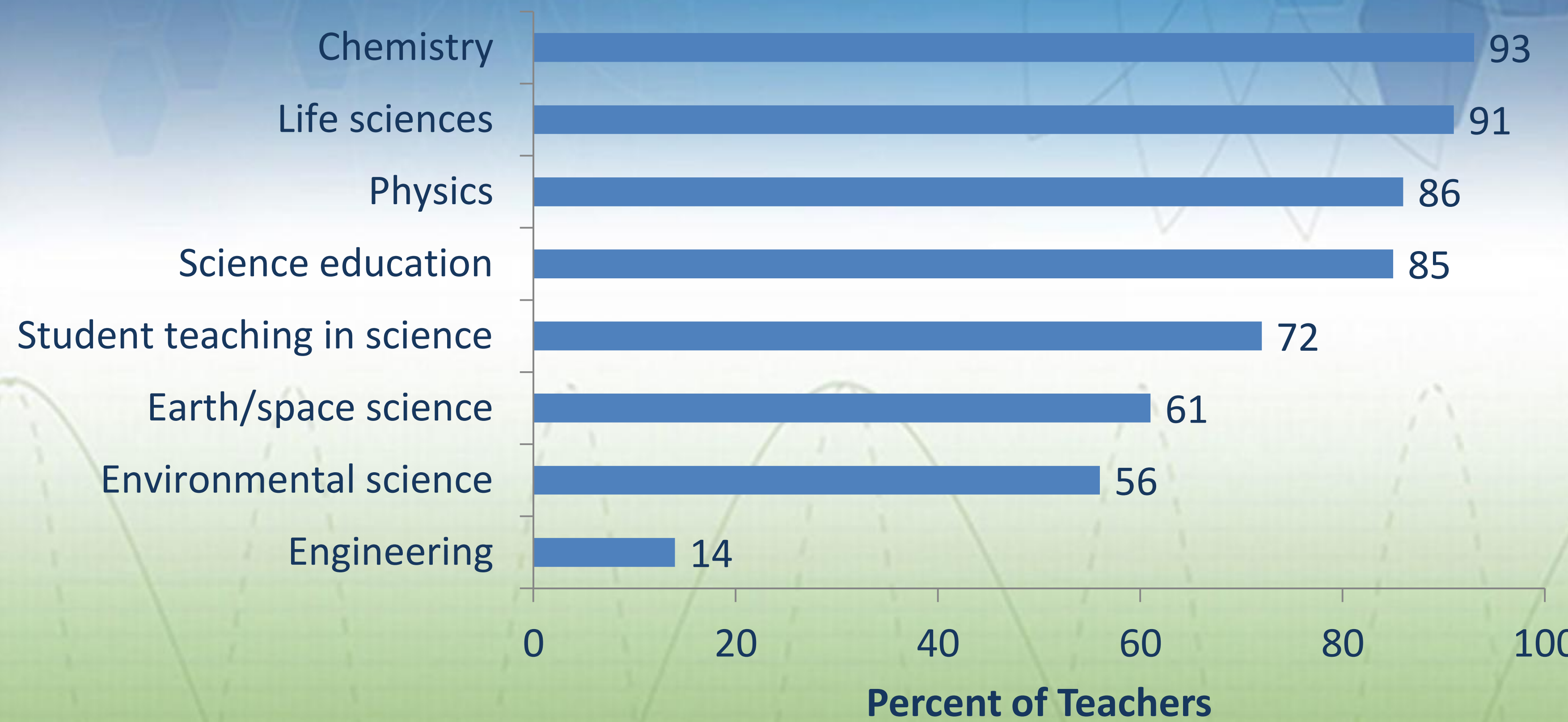
Elementary Science Teachers with at Least One College Course in Various Science Disciplines



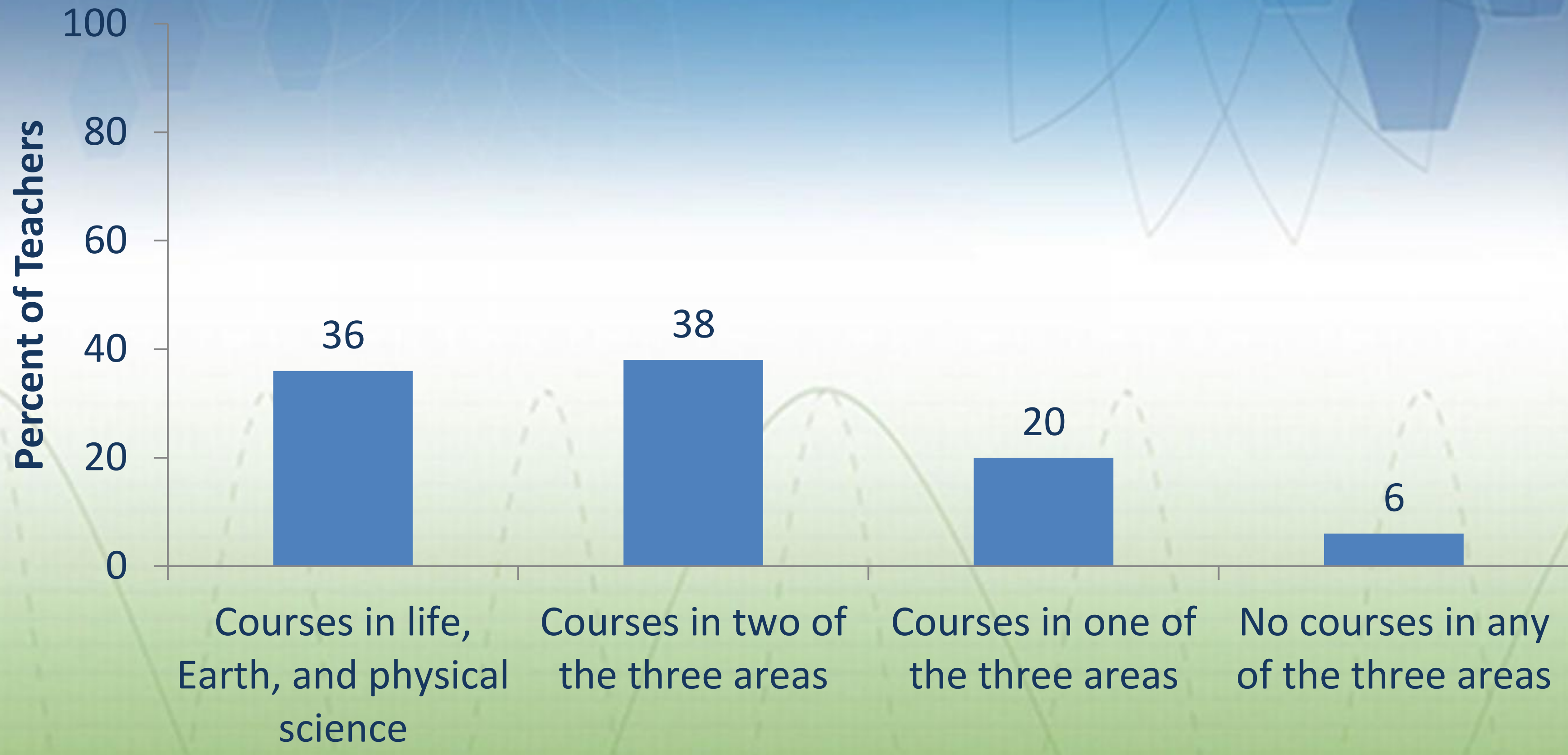
Middle School Science Teachers with at Least One College Course in Various Science Disciplines



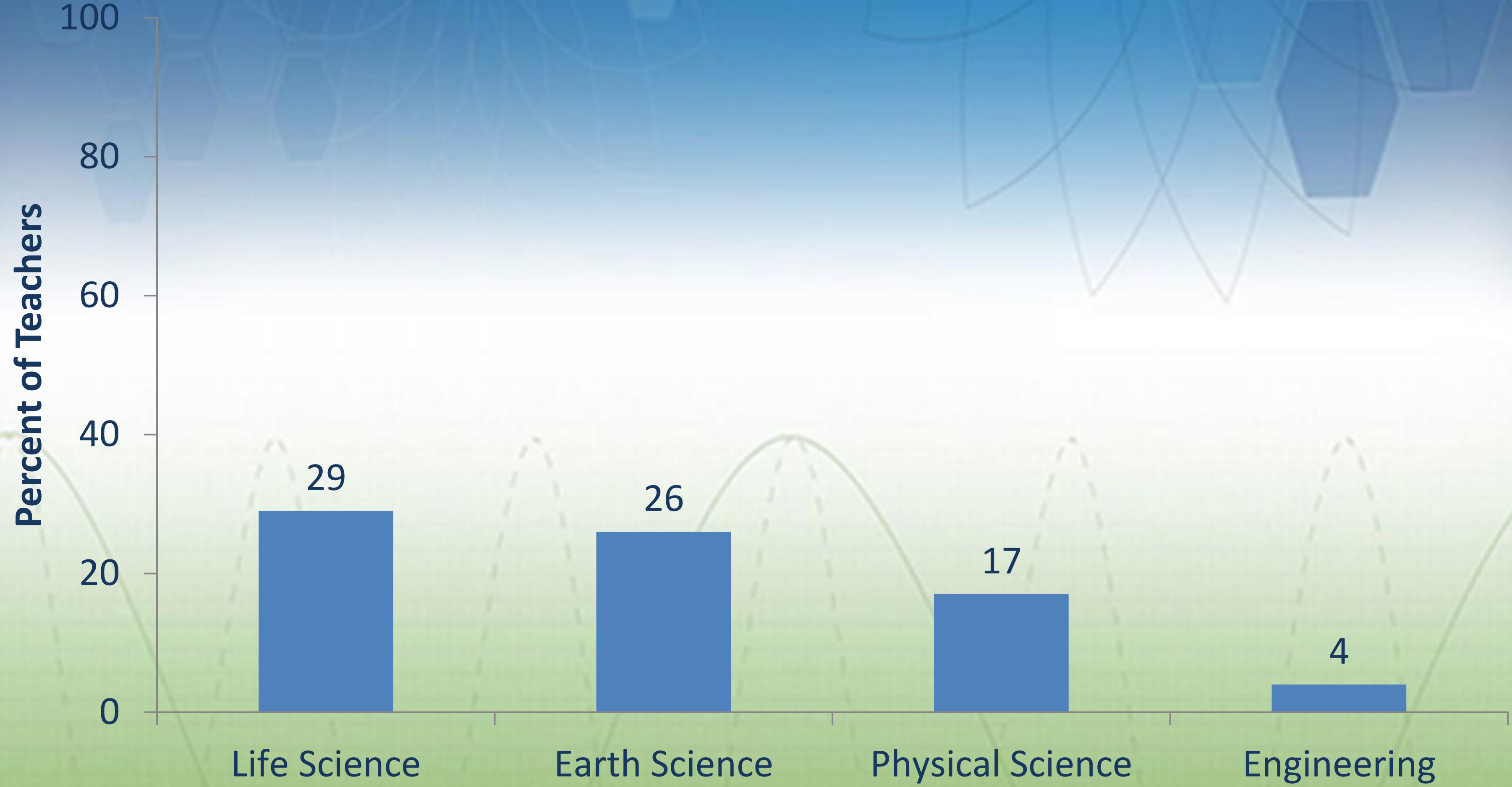
High School Science Teachers with at Least One College Course in Various Science Disciplines



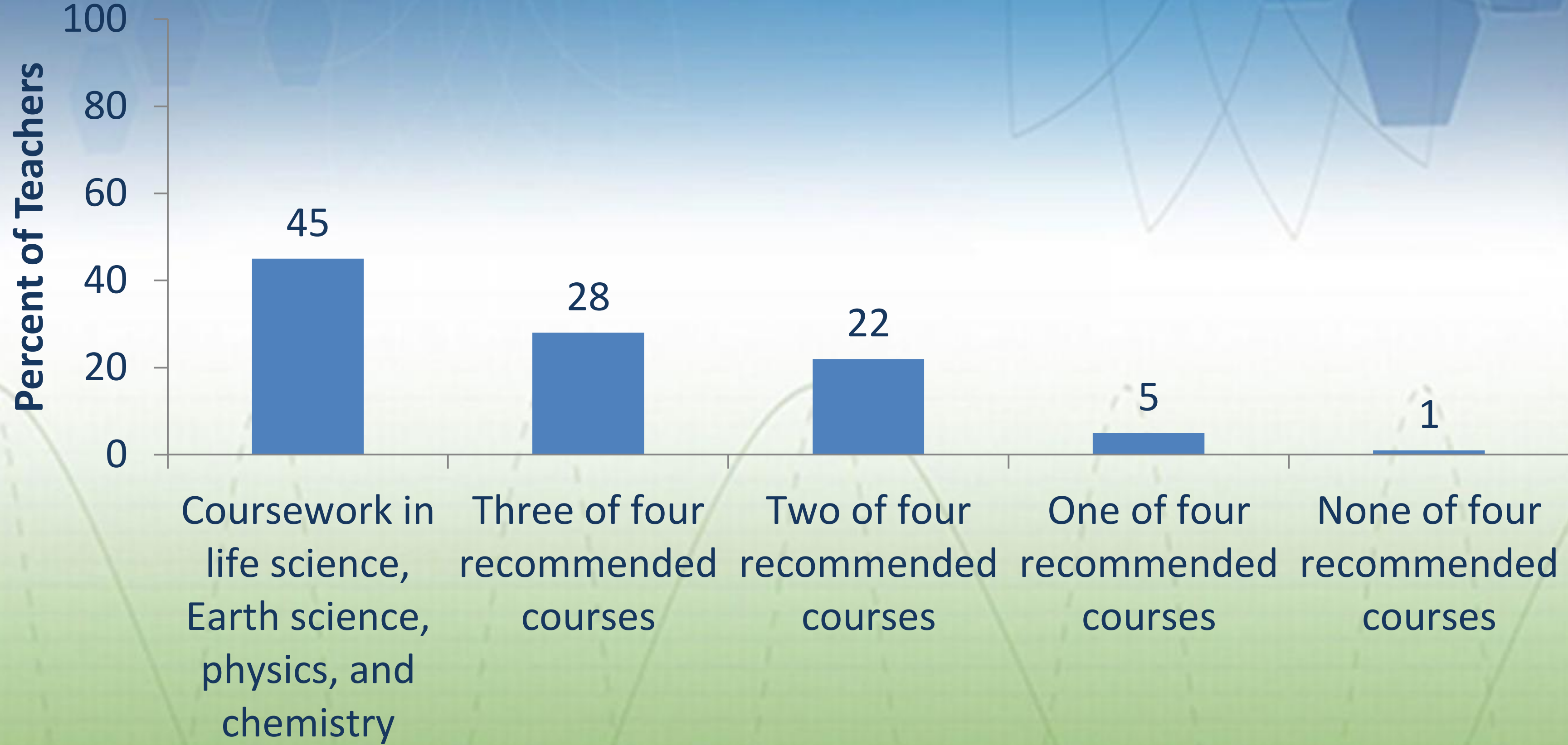
Elementary Science Teachers Meeting NSTA Course-Background Recommendations



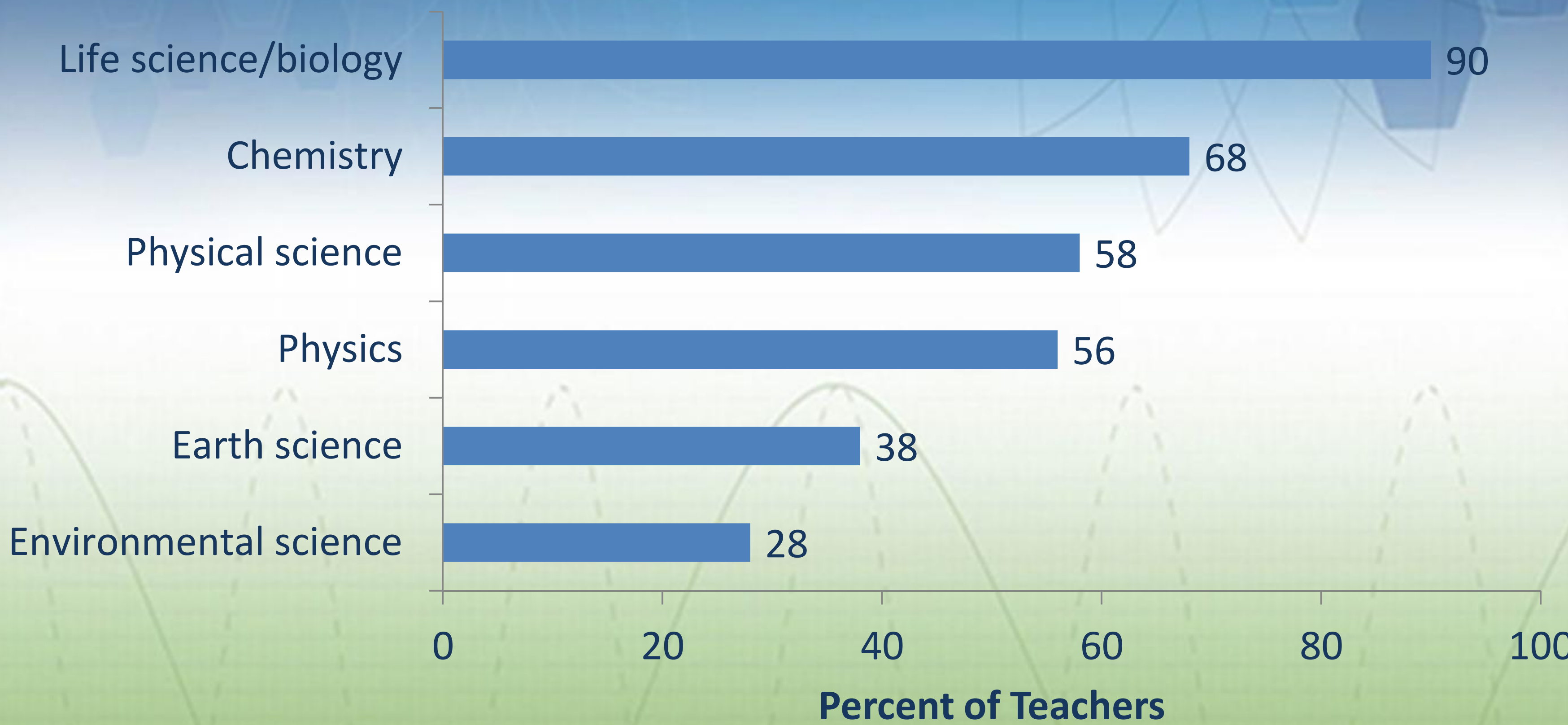
Elementary Teachers Considering Themselves Very Well Prepared to Teach Various Science Disciplines



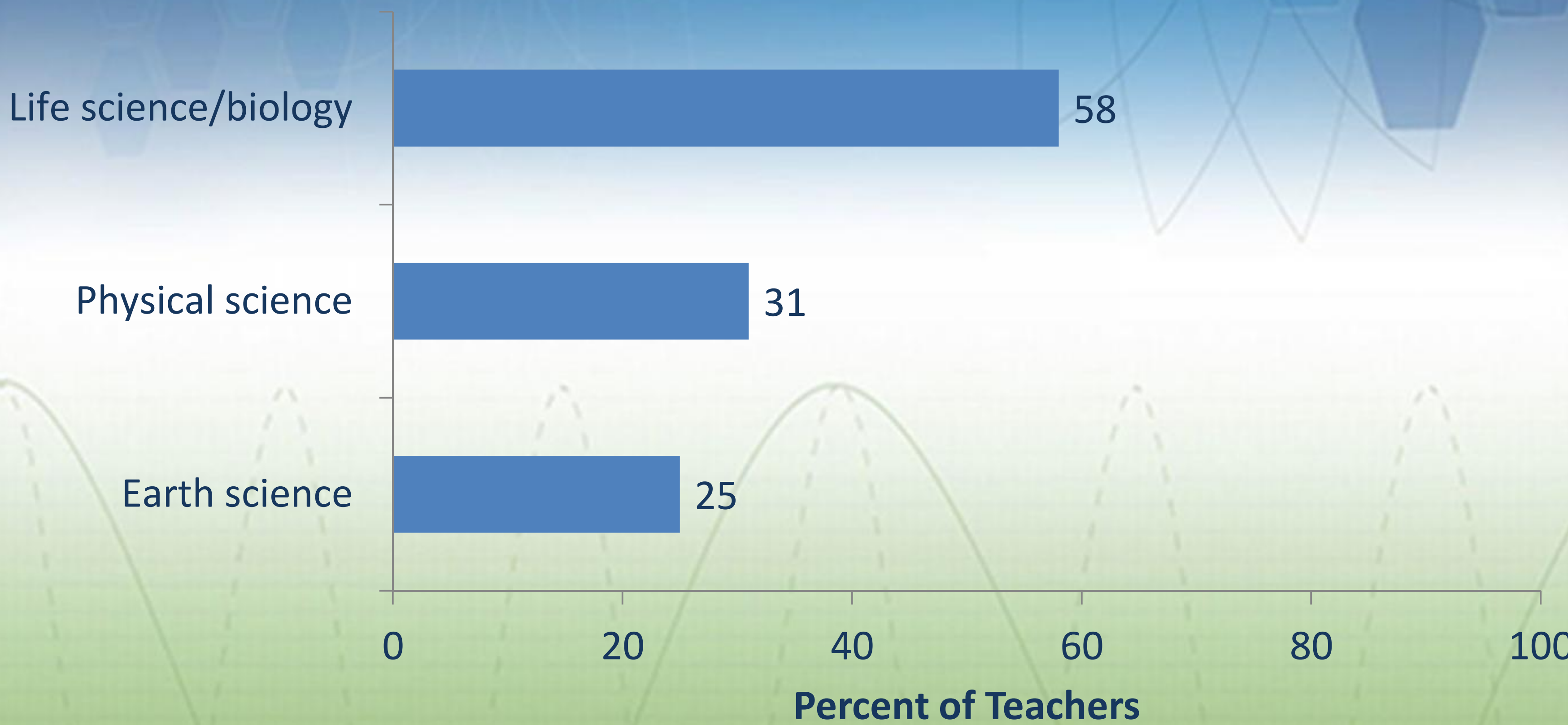
Middle School General/Integrated Science Teachers Meeting NSTA Course-Background Standards



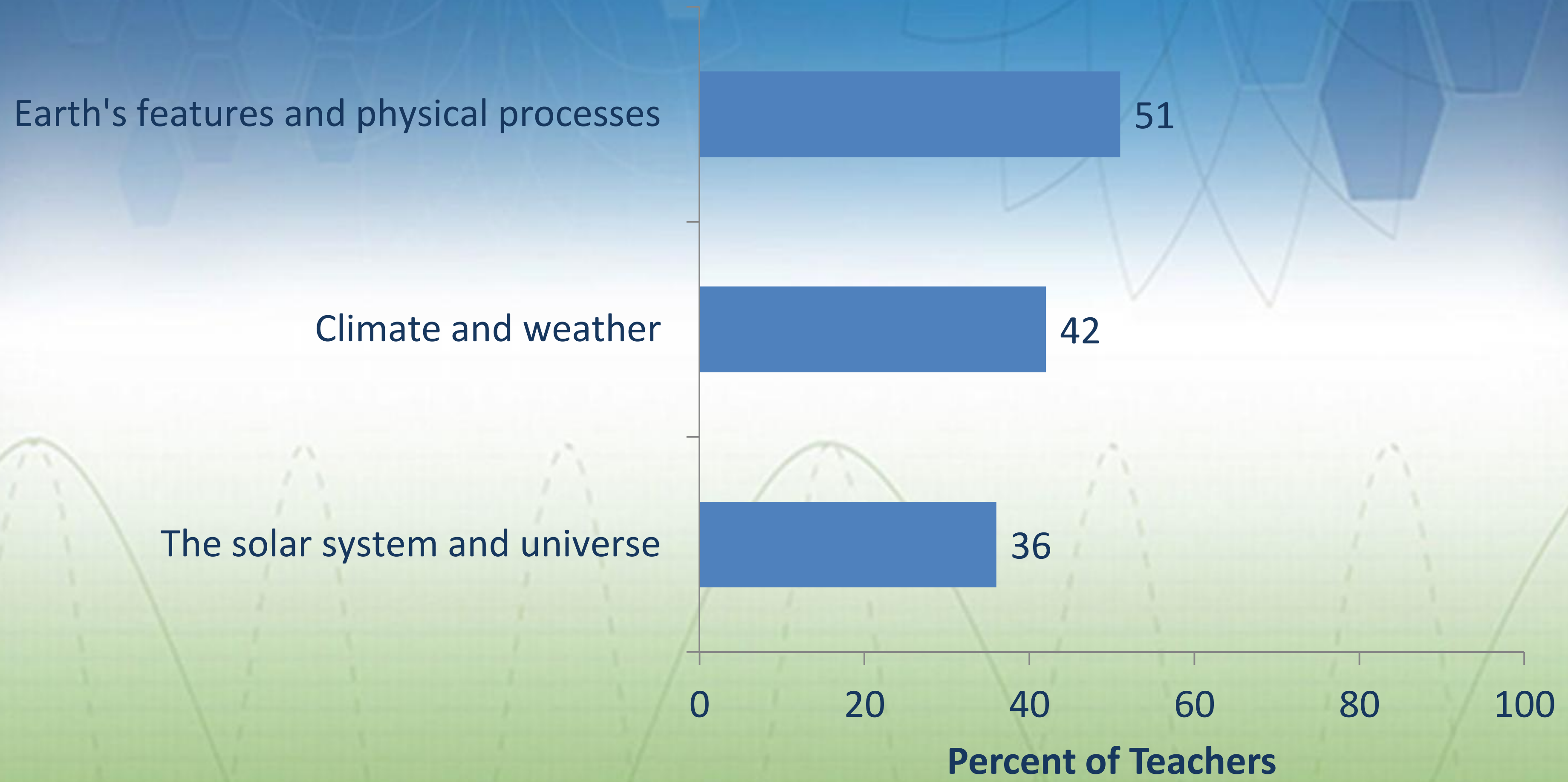
High School Science Teachers with Degree in Field or 3+ Courses Beyond Introductory



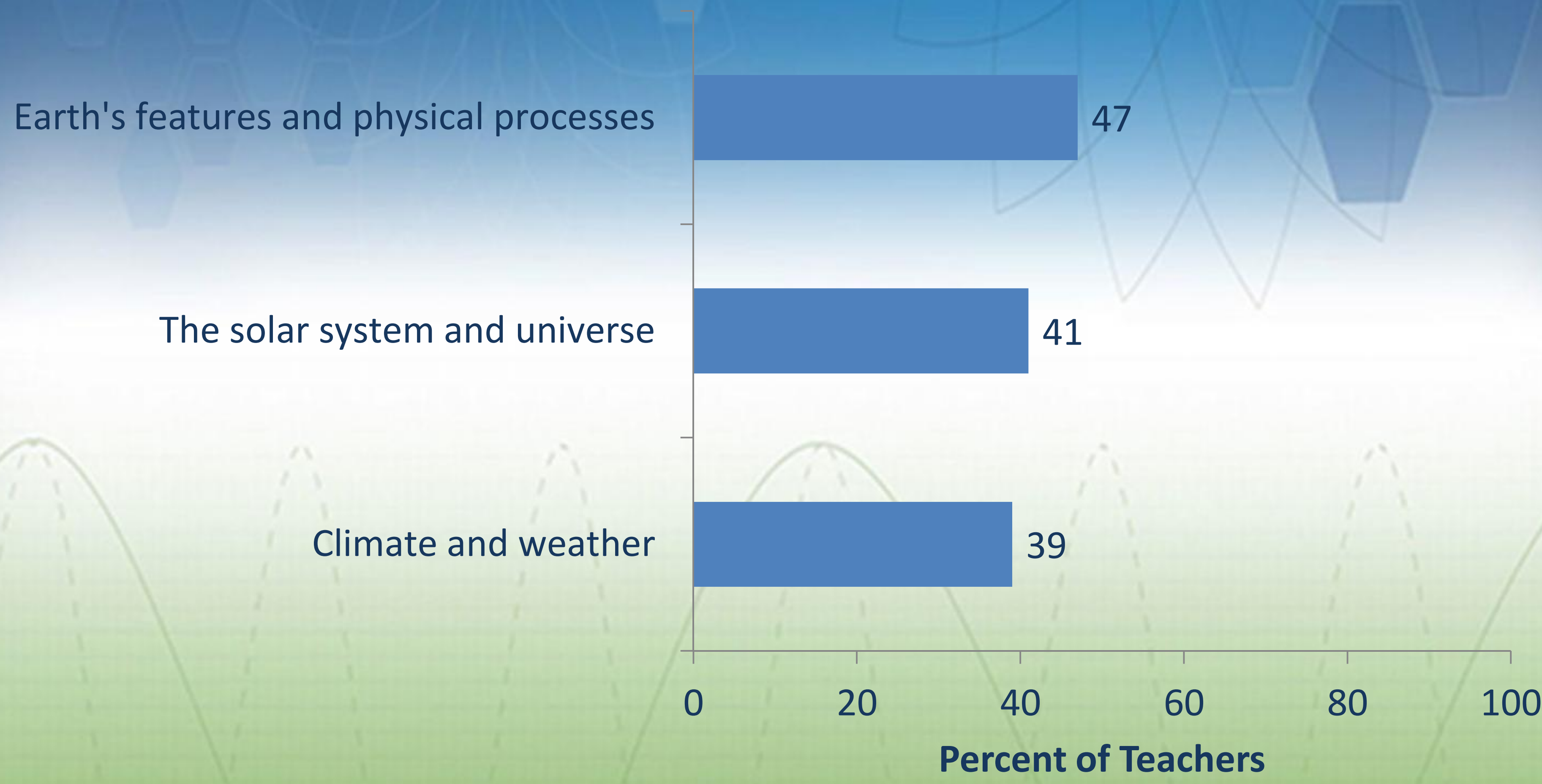
Middle School Science Teachers with Degree in Field or 3+ Courses Beyond Introductory



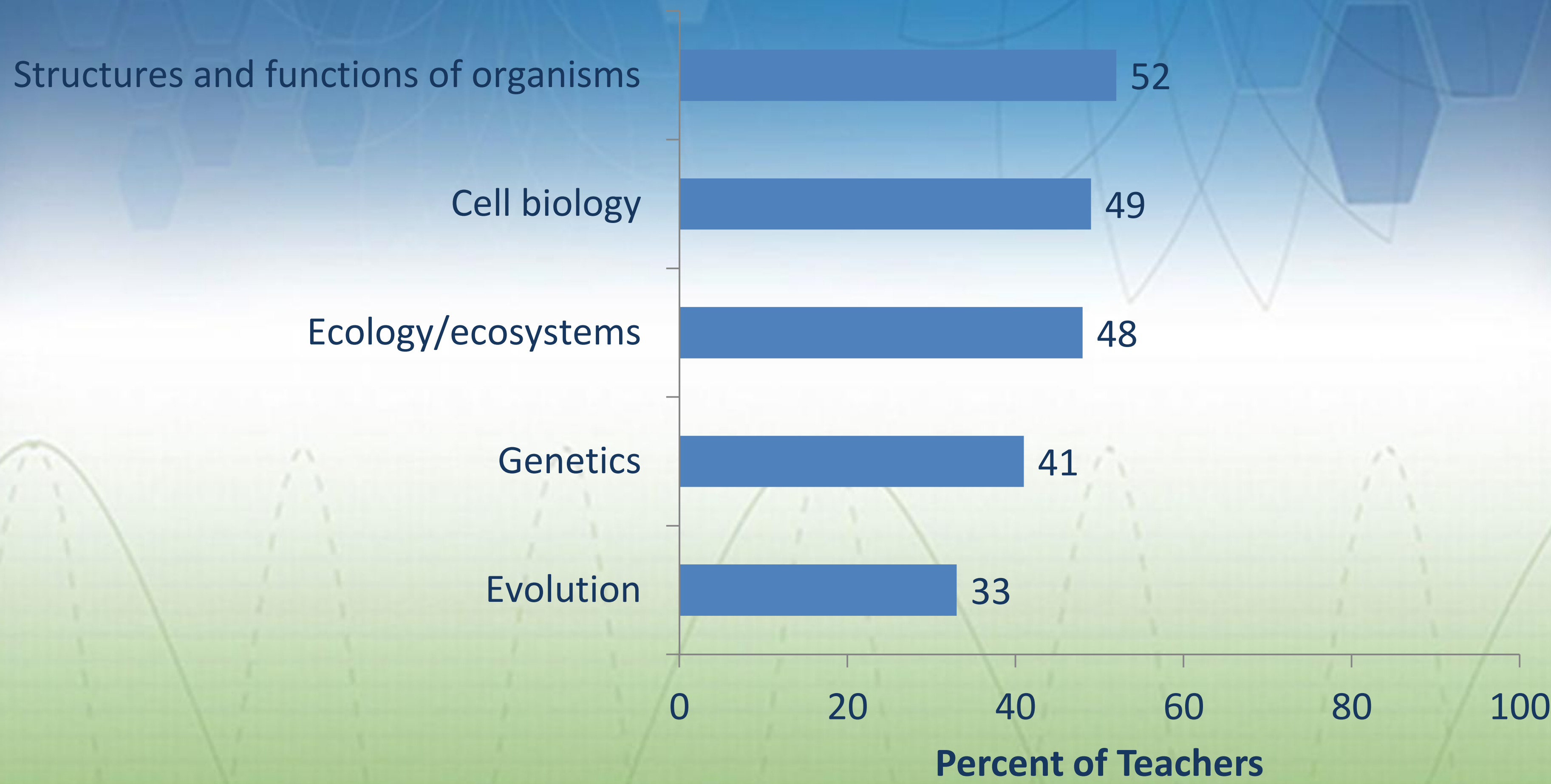
Middle School Science Teachers Considering Themselves Very Well Prepared to Teach Earth/Space Science Topics



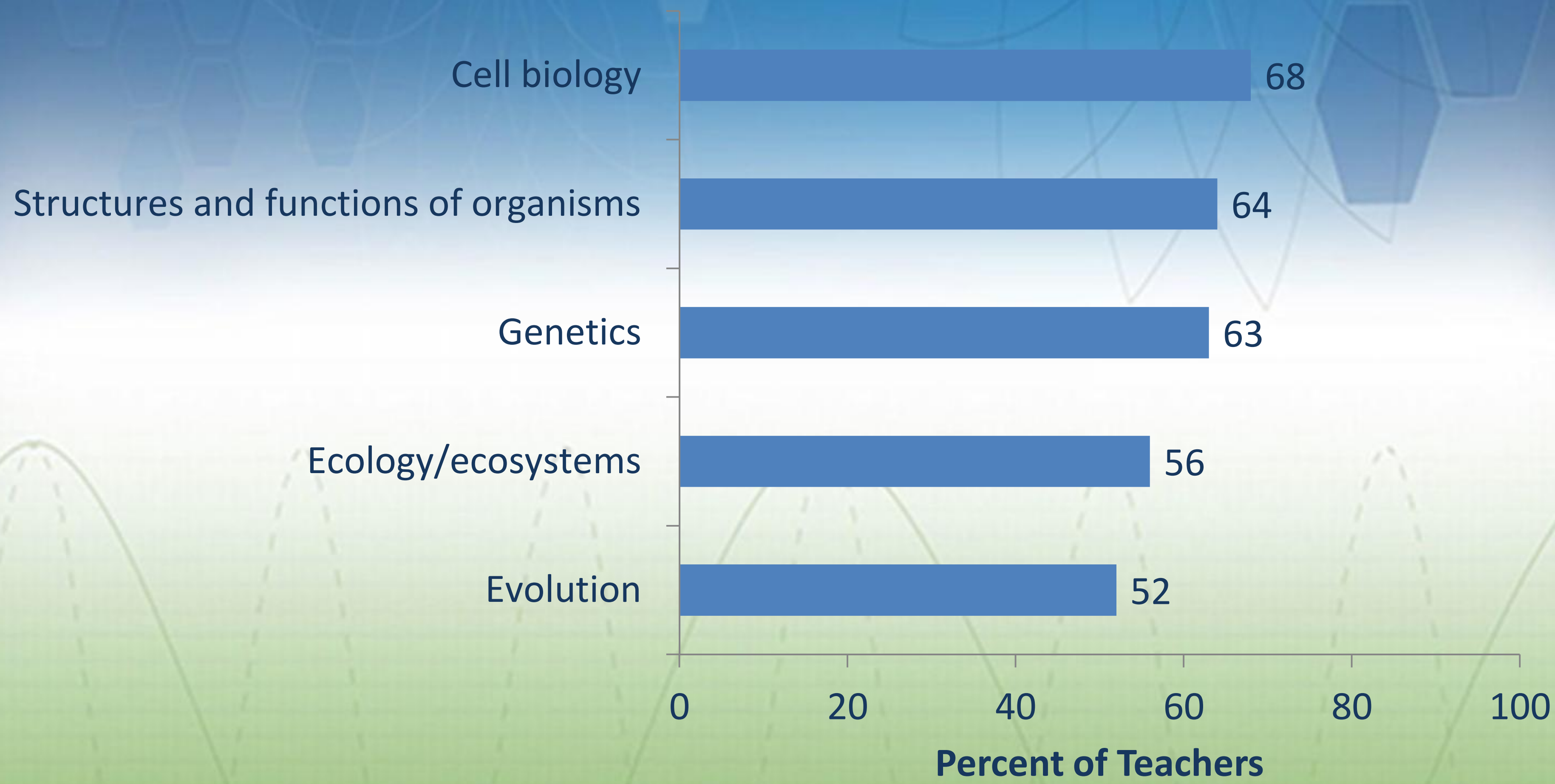
High School Science Teachers Considering Themselves Very Well Prepared to Teach Earth/Space Science Topics



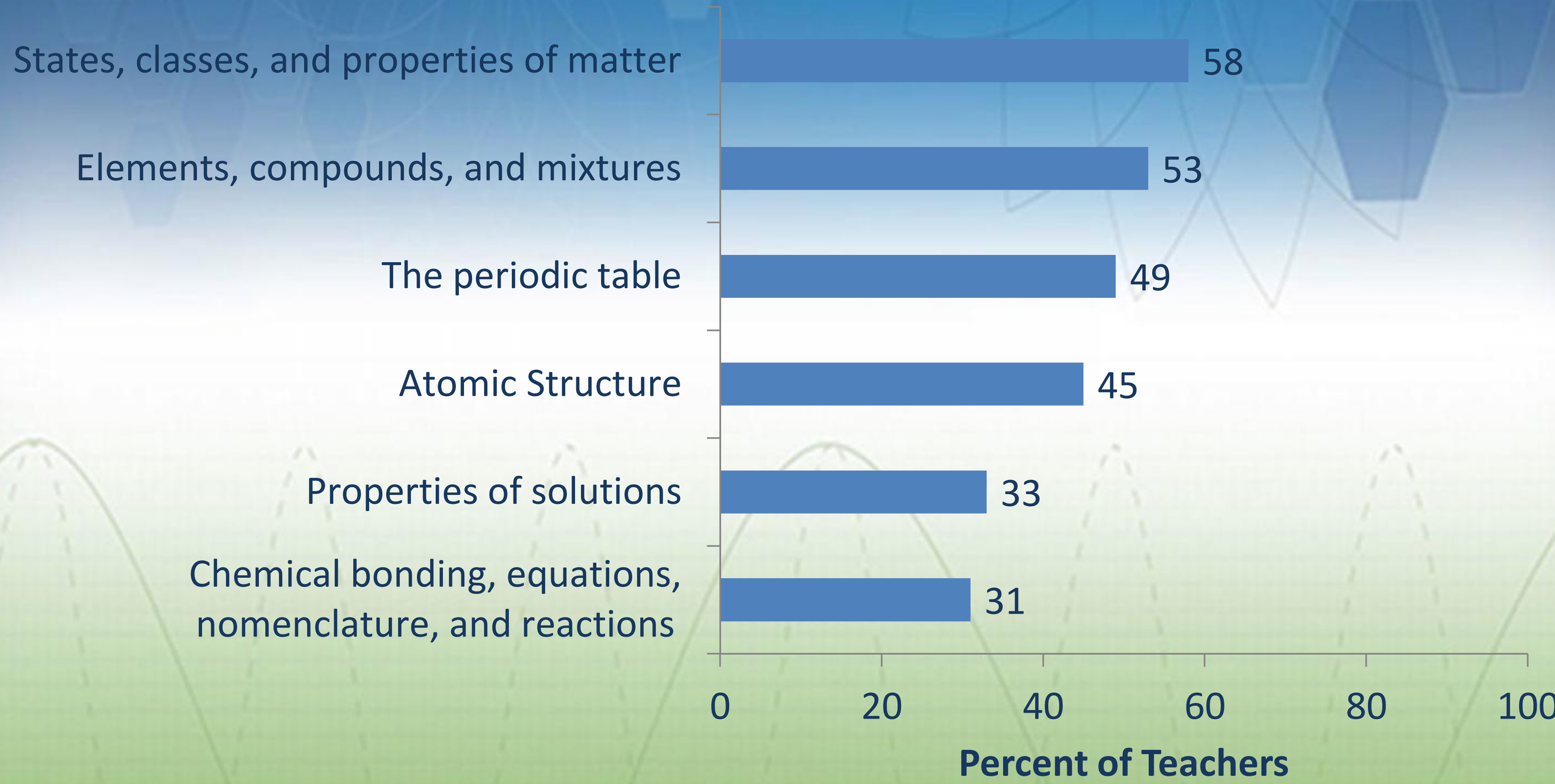
Middle School Science Teachers Considering Themselves Very Well Prepared to Teach Biology/Life Science Topics



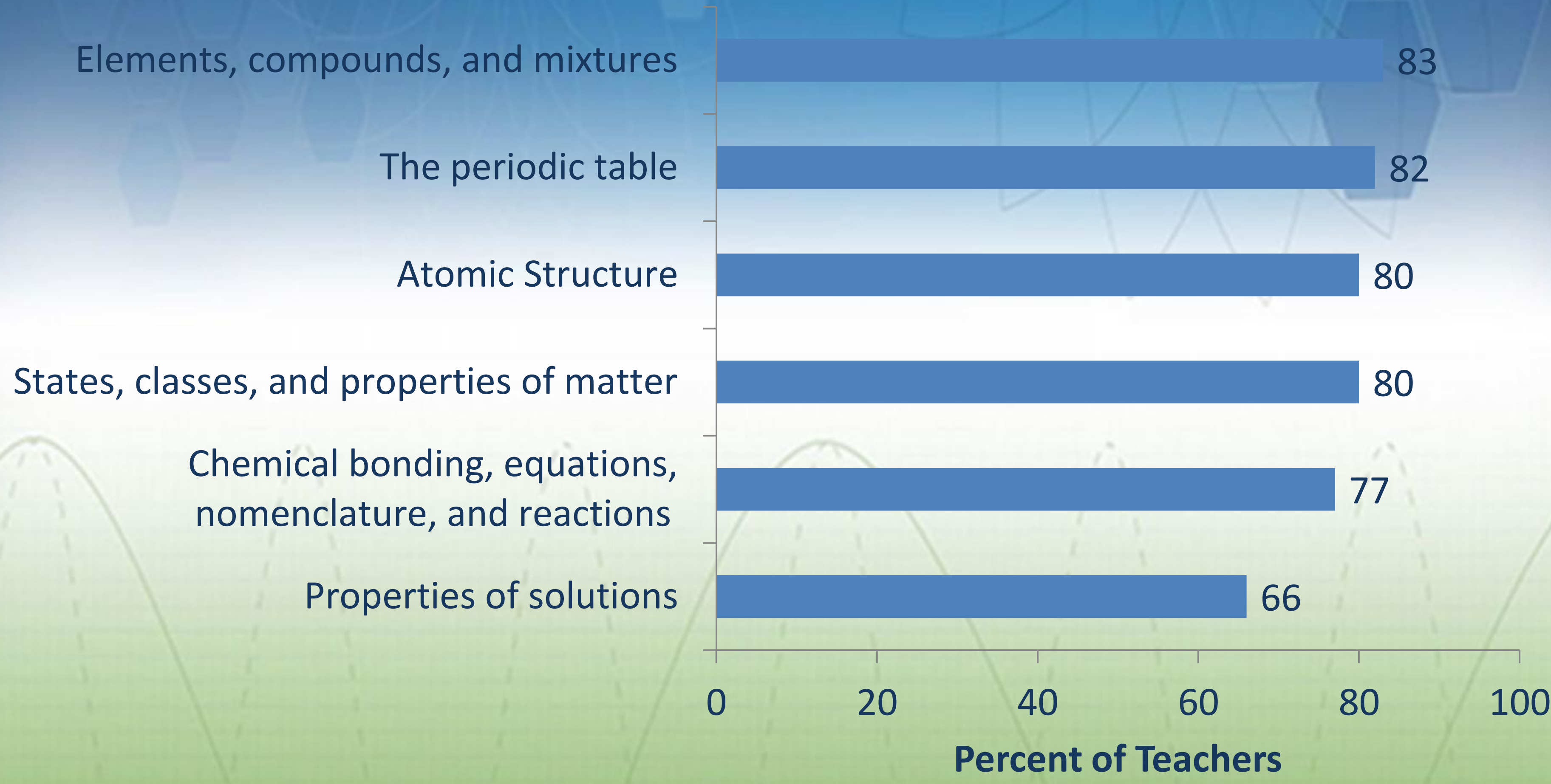
High School Science Teachers Considering Themselves Very Well Prepared to Teach Biology/Life Science Topics



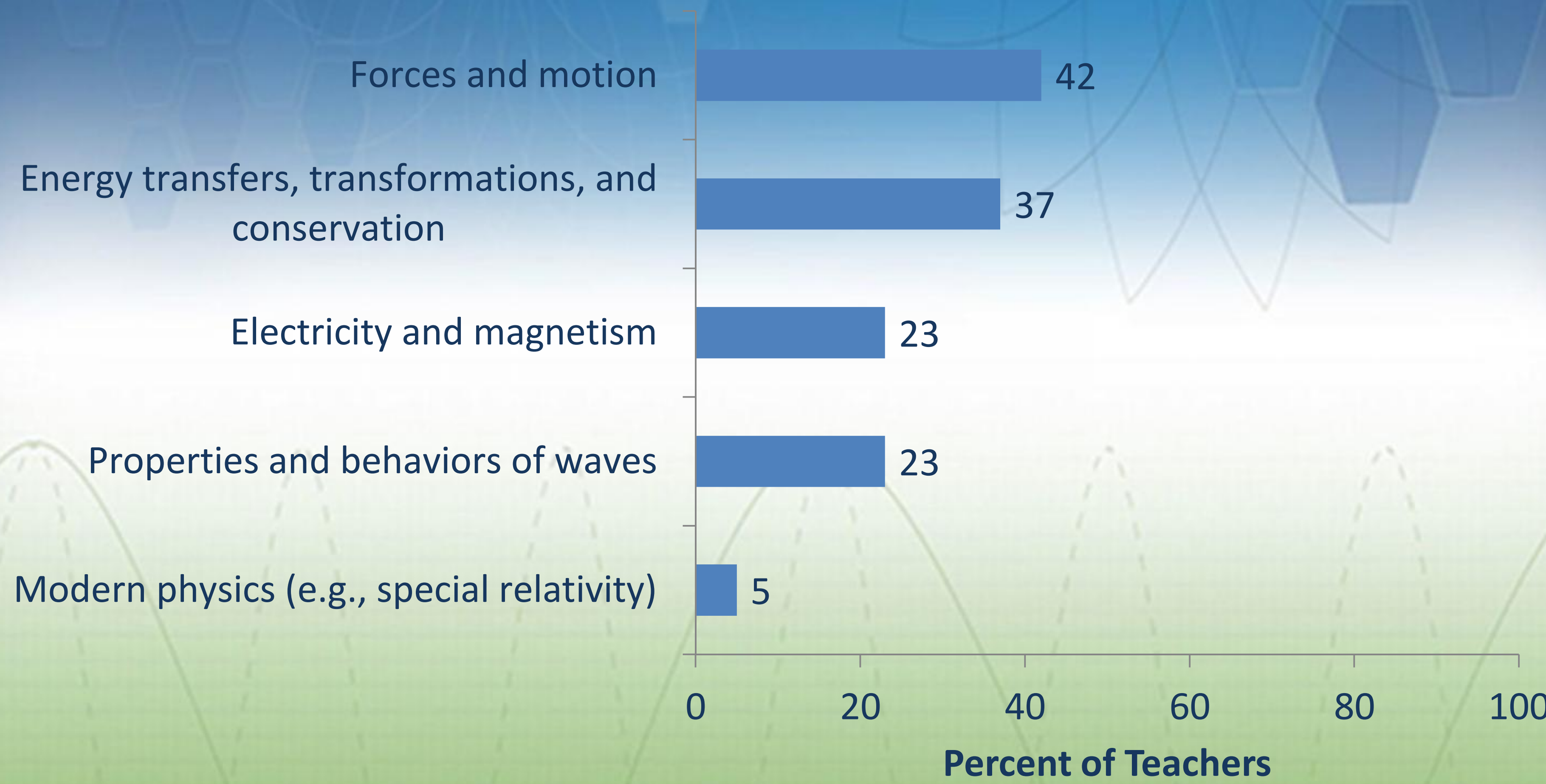
Middle School Science Teachers Considering Themselves Very Well Prepared to Teach Chemistry Topics



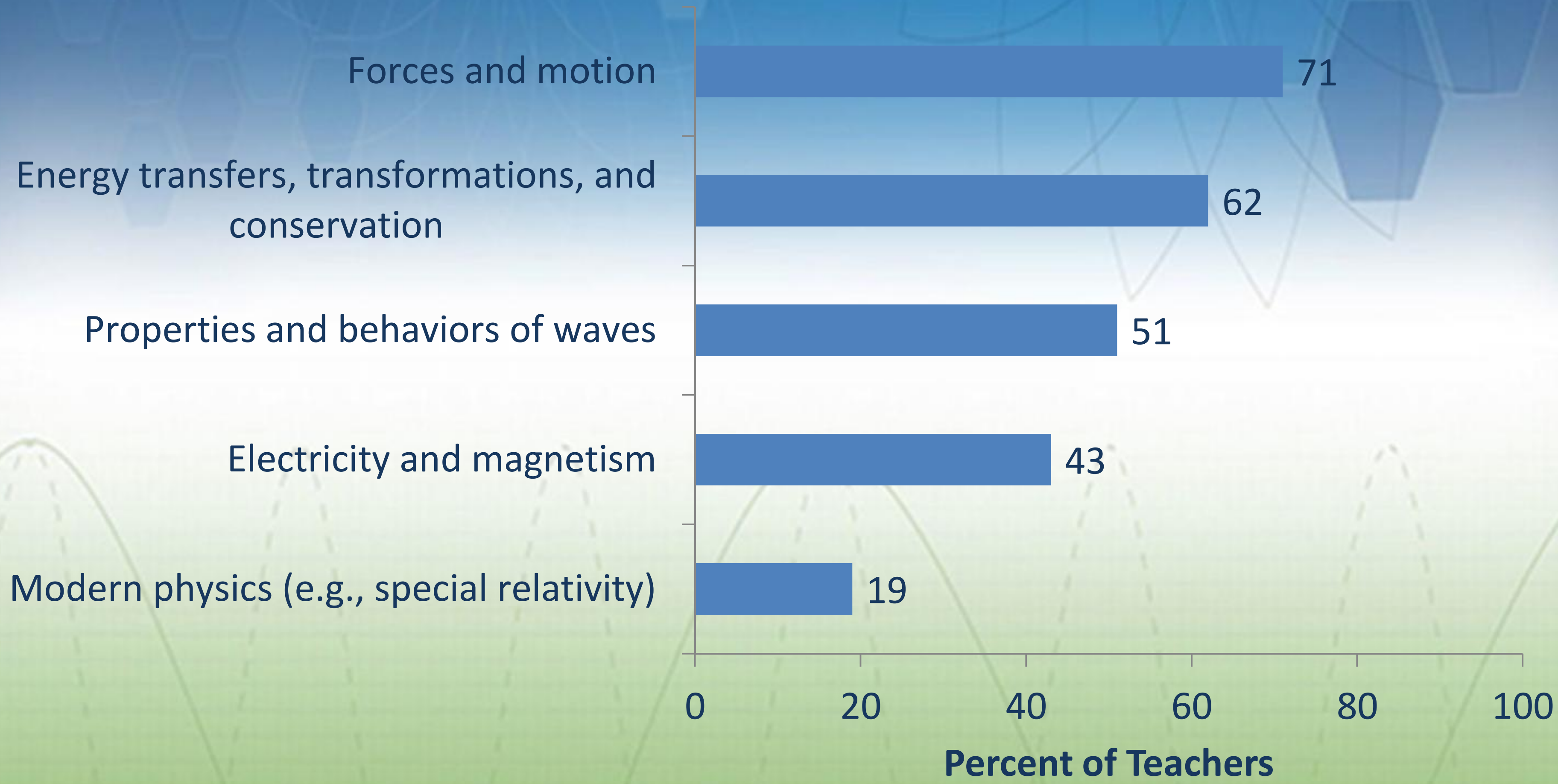
High School Science Teachers Considering Themselves Very Well Prepared to Teach Chemistry Topics



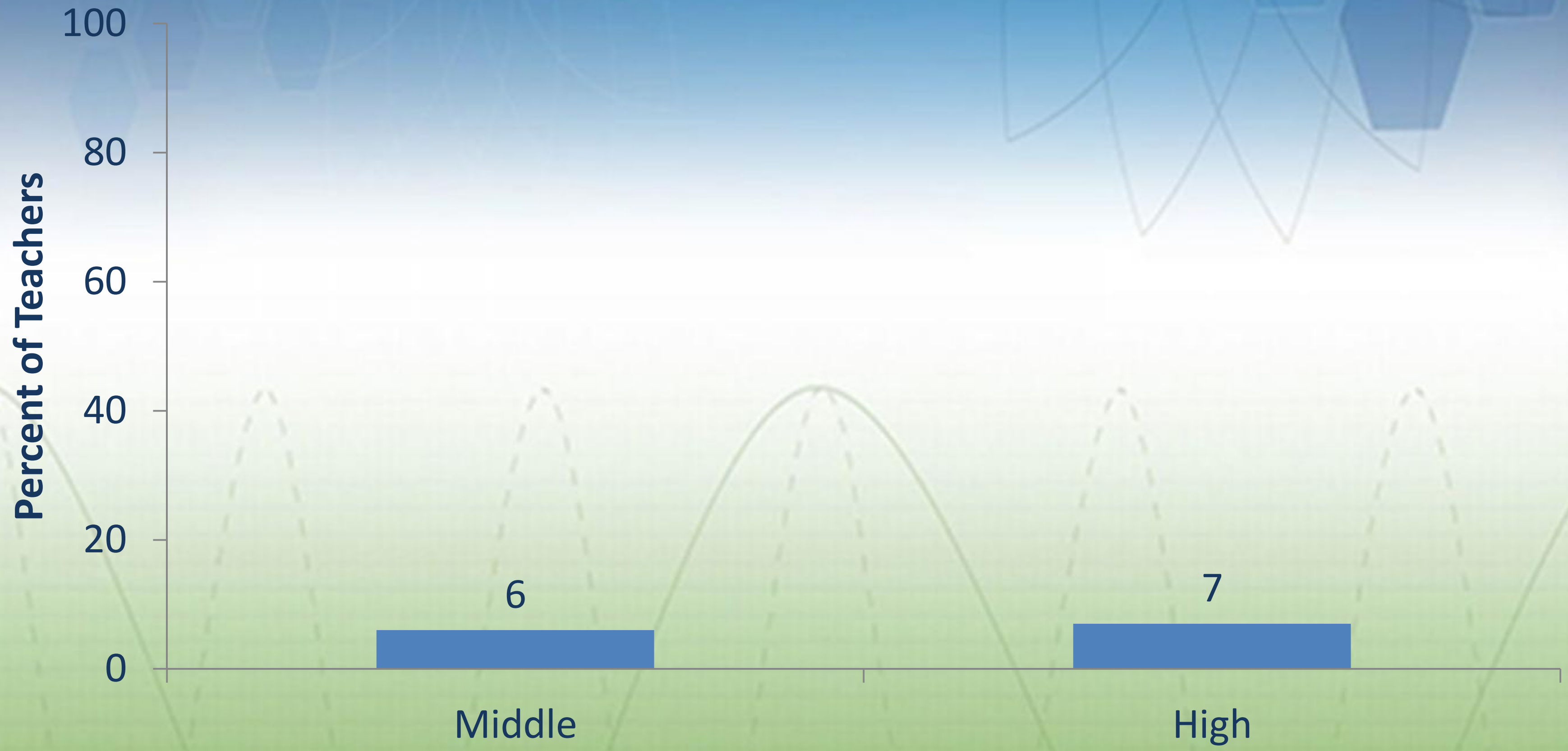
Middle School Science Teachers Considering Themselves Very Well Prepared to Teach Physics Topics



High School Science Teachers Considering Themselves Very Well Prepared to Teach Physics Topics



Secondary Teachers Considering Themselves Very Well Prepared to Teach Engineering



Discussion Question

How would you characterize teachers' perceptions of their preparedness versus their actual preparedness? What are the implications of differences between the perceived and the actual?

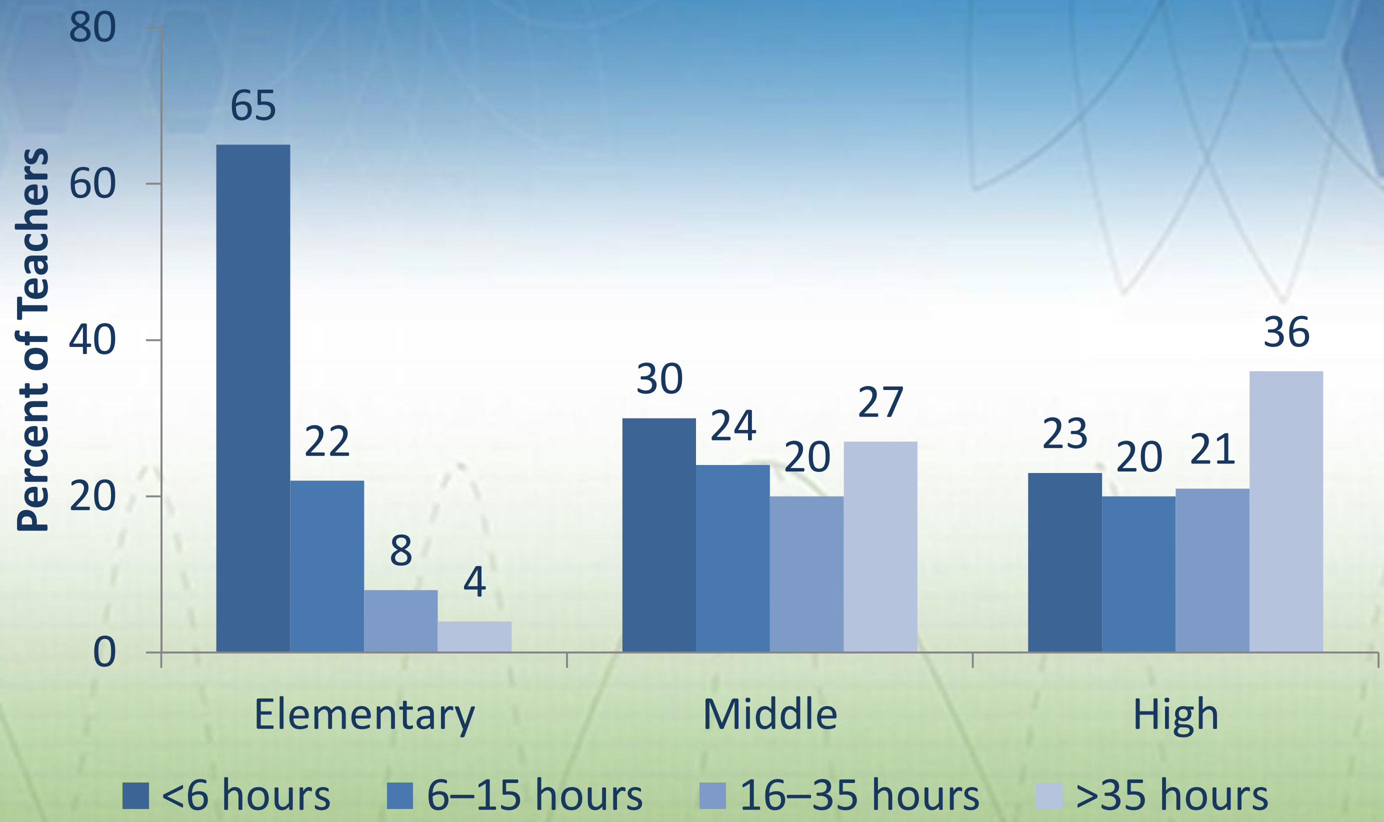
Teacher Pedagogical Beliefs

	Percent of Teachers Agreeing		
	K-5	6-8	9-12
Most class periods should provide opportunities for students to share their thinking and reasoning	98	95	92
Most class periods should conclude with a summary of the key ideas addressed	96	93	88
Students should be provided with the purpose for a lesson as it begins	93	90	88
Most class periods should include some review of previously covered ideas and skills	91	89	86

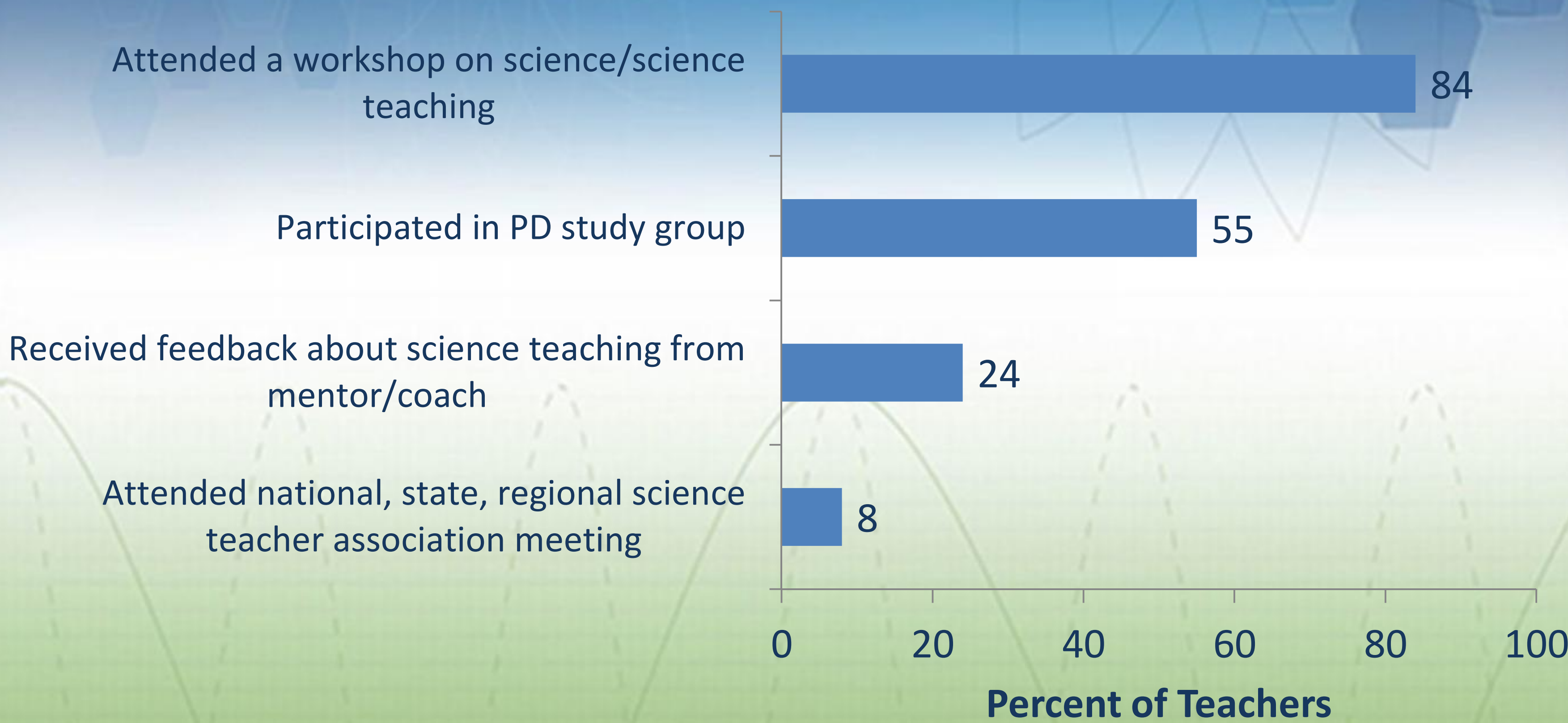
	Percent of Teachers Agreeing		
	K-5	**6-8**	**9-12**
At the beginning of instruction on a science idea, students should be provided with definitions for new scientific vocabulary that will be used	85	78	70
Hands-on/laboratory activities should be used primarily to reinforce a science idea that the students have already learned	54	57	56
Teachers should explain an idea to students before having them consider evidence that relates to the idea	45	41	39

Teacher Professional Development

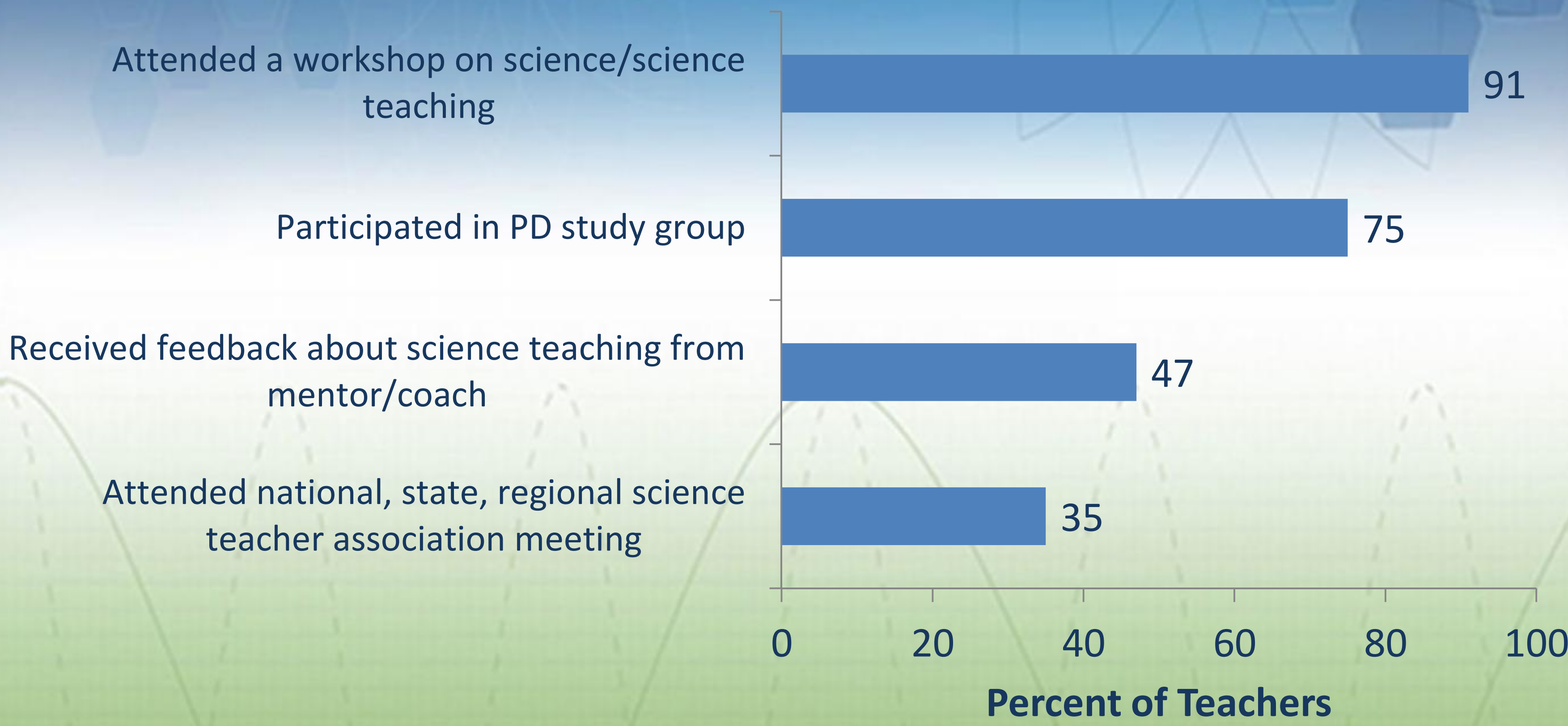
Science Teachers' Time Spent on Science-Focused PD in Last 3 years, by Grade Range



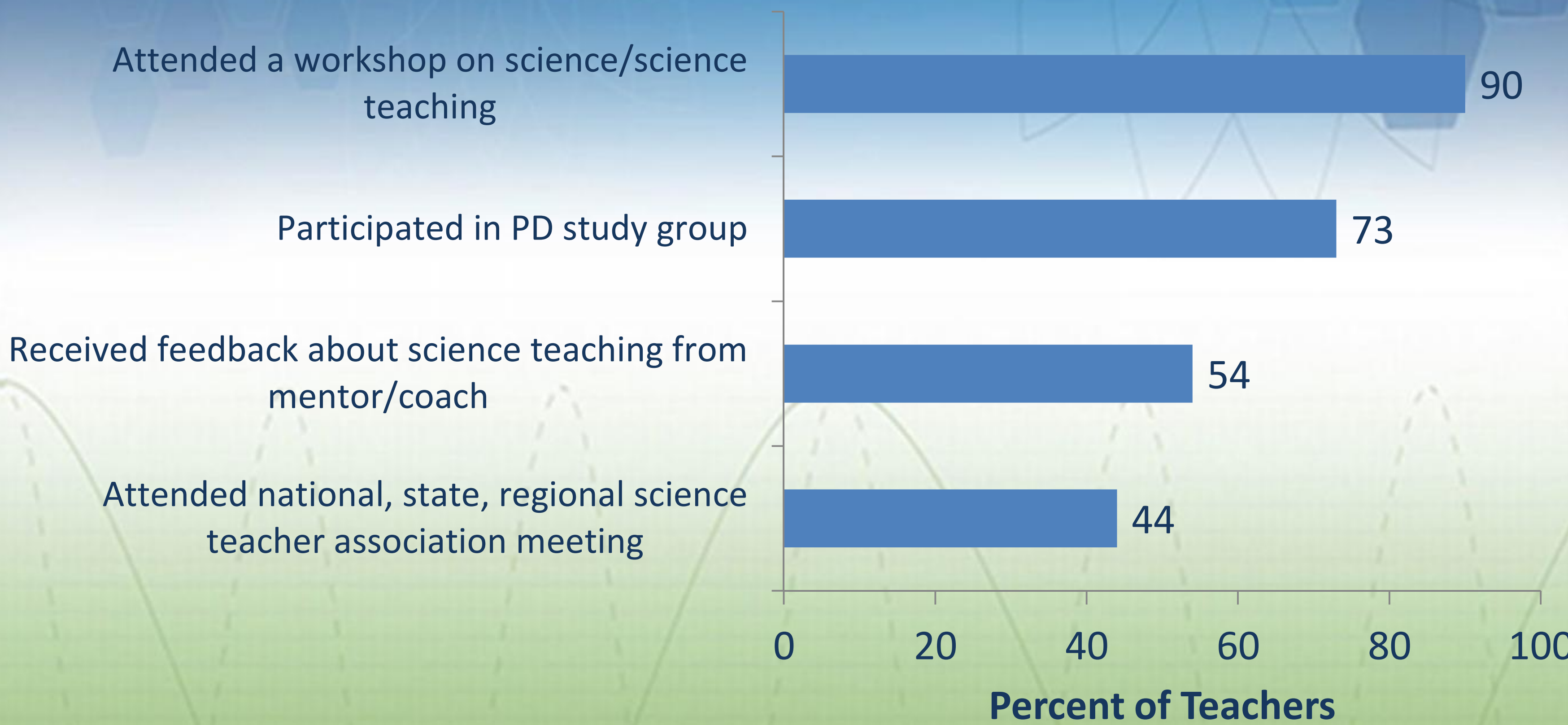
Elementary School Science Teachers Participating in Various PD Activities in the Last 3 Years



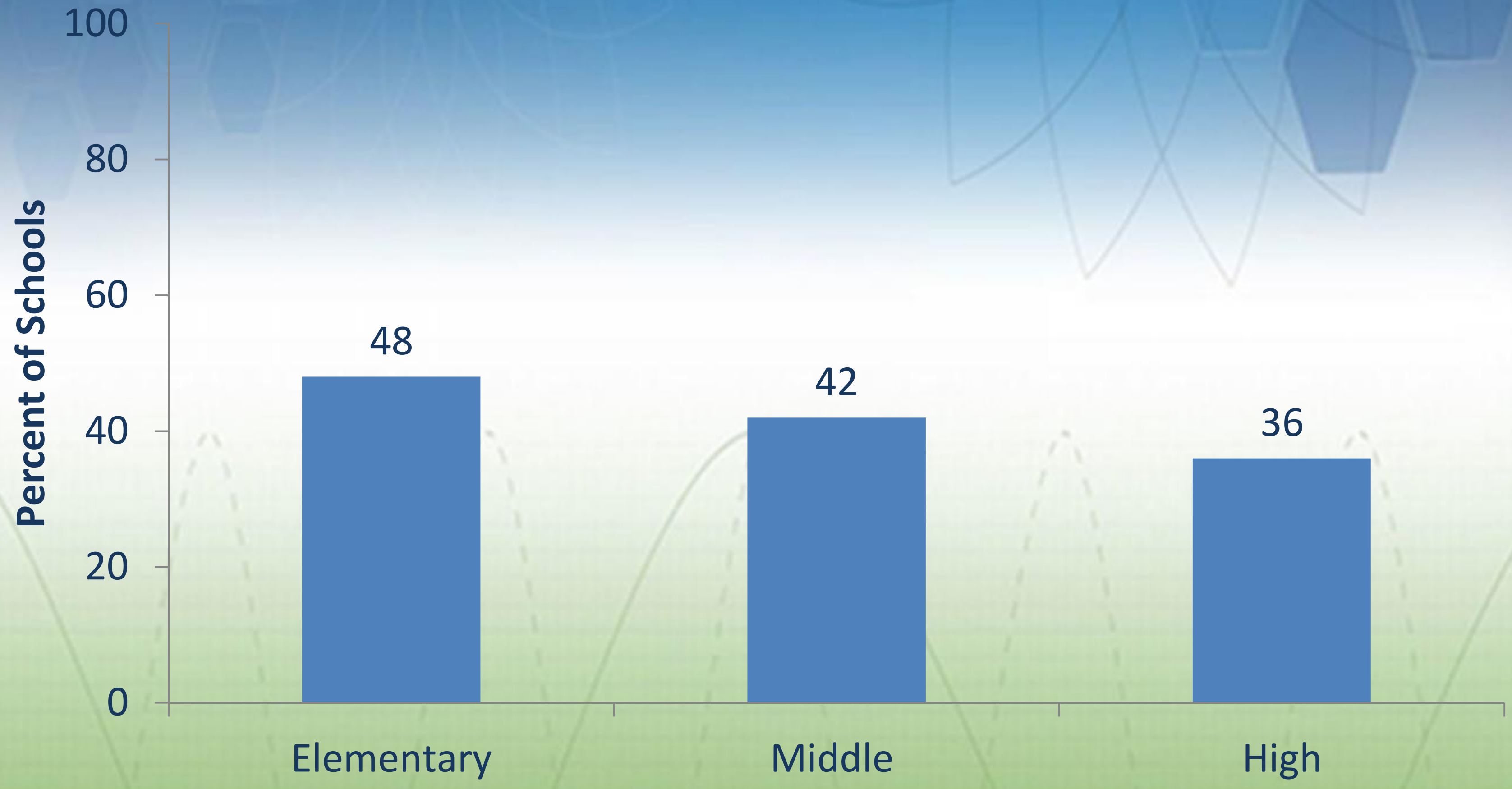
Middle School Science Teachers Participating in Various PD Activities in the Last 3 Years



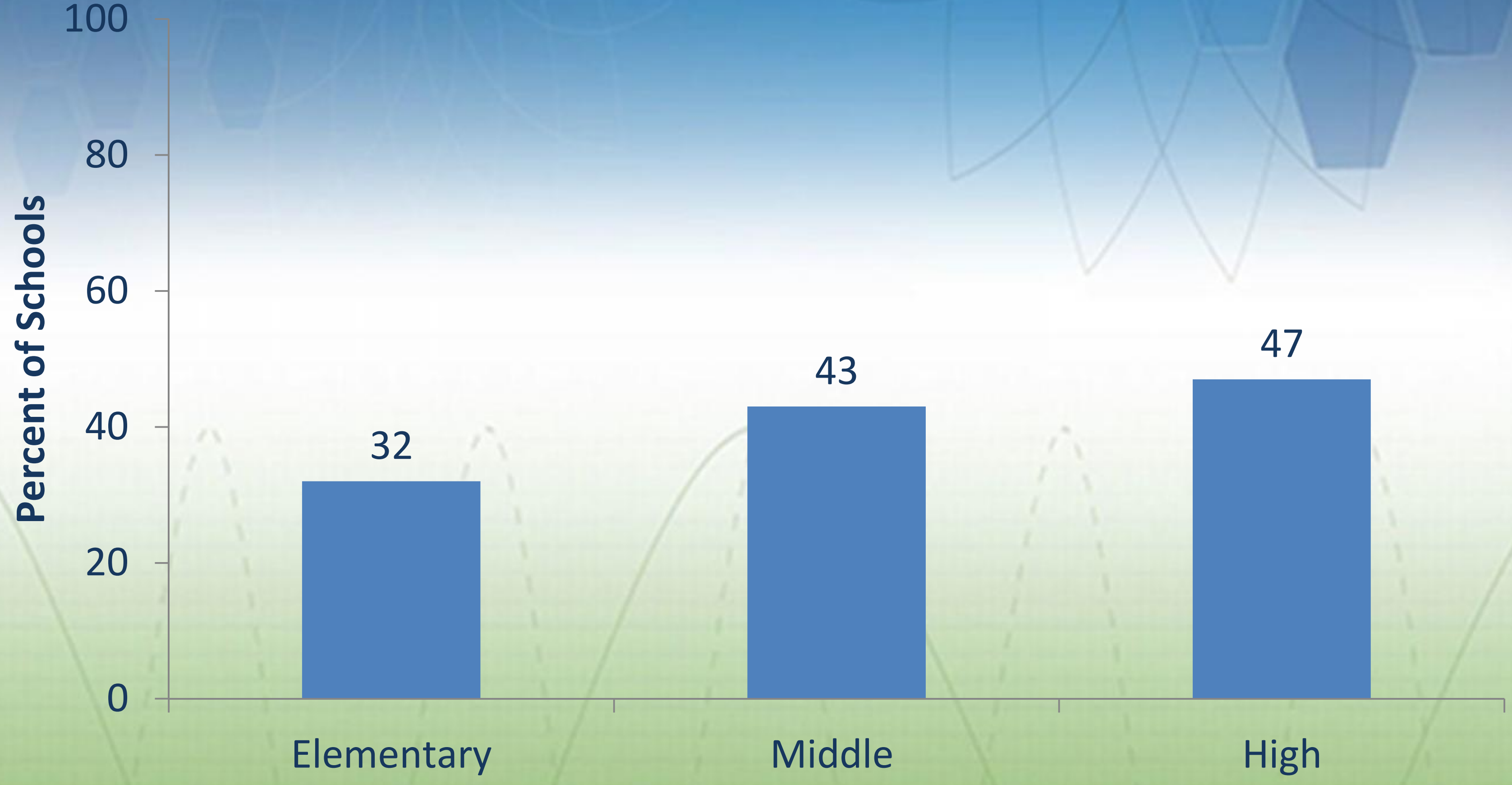
High School Science Teachers Participating in Various PD Activities in the Last 3 Years



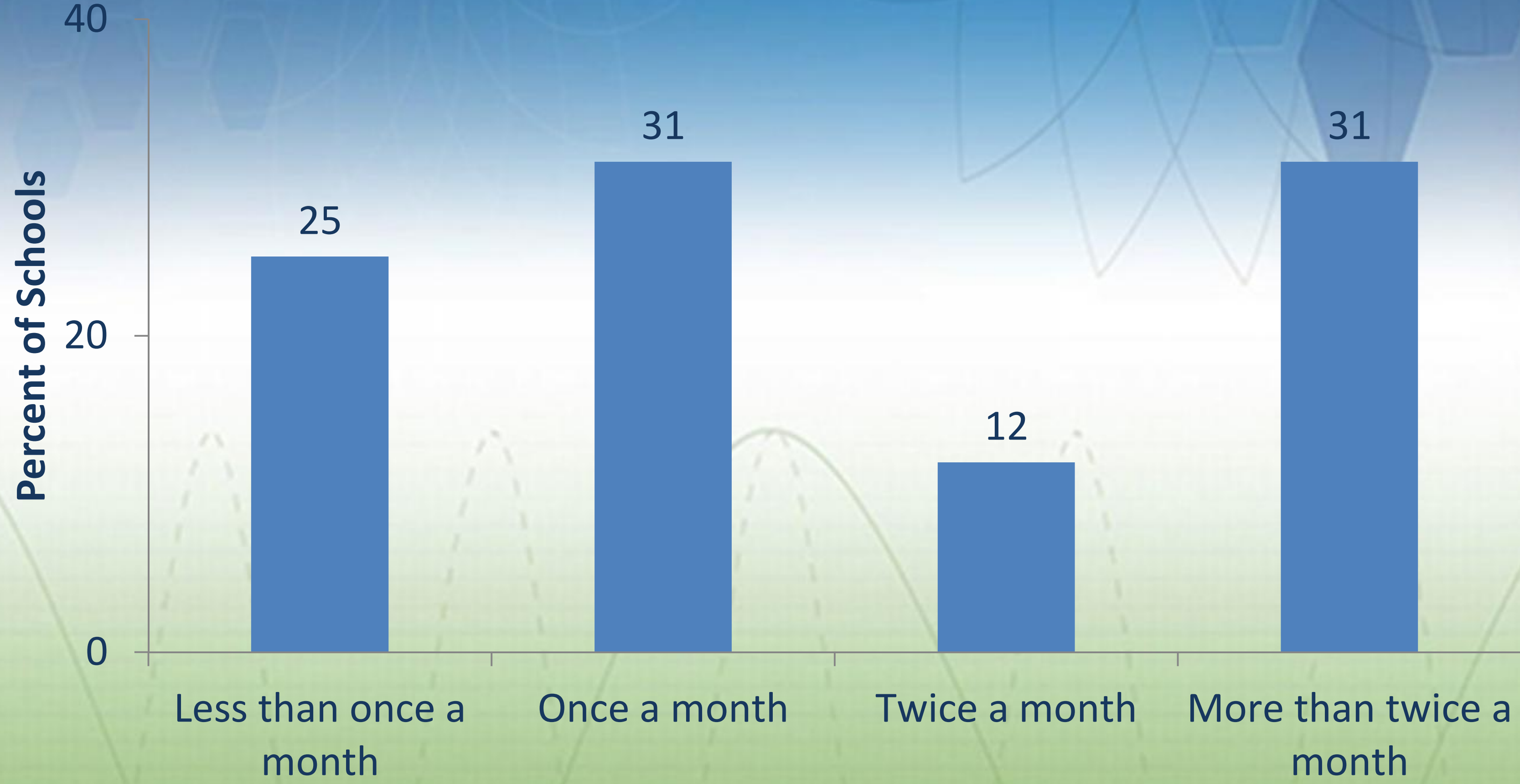
Science PD Workshops Offered Locally in the Last 3 Years, by Grade Range



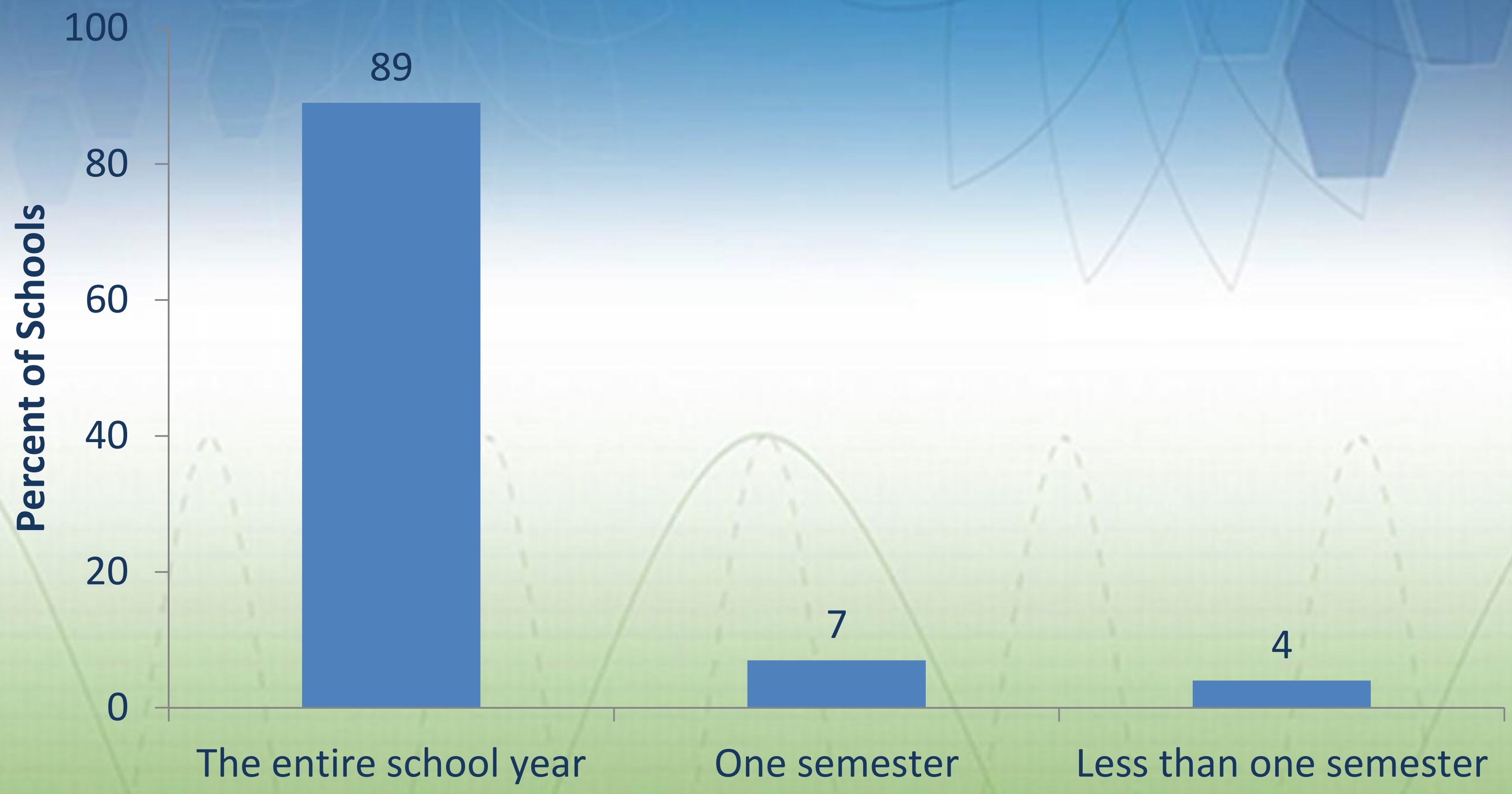
Science Teacher Study Groups Offered at Schools in the Last 3 Years, by Grade Range



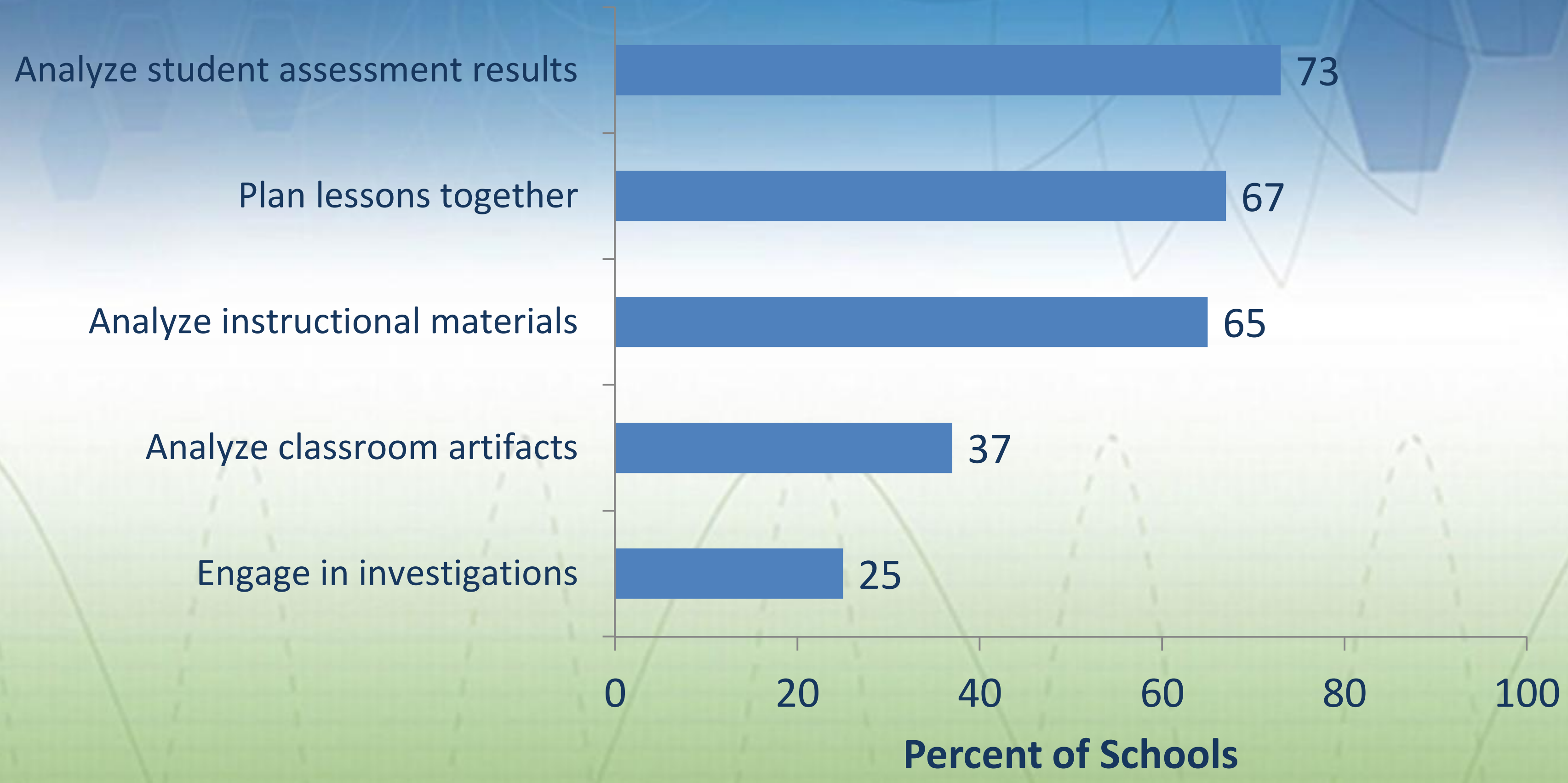
Frequency of Science Teacher Study Groups



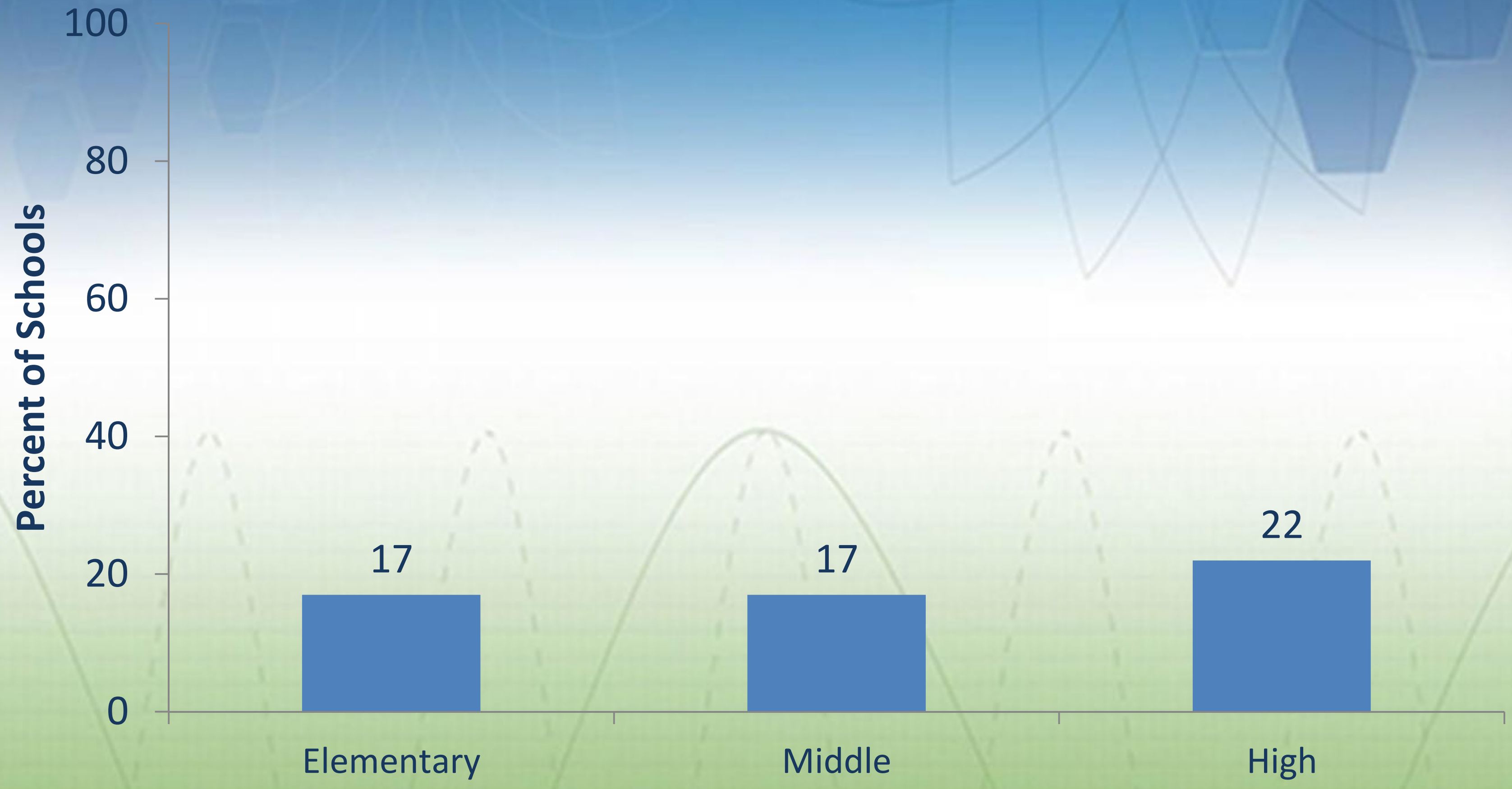
Duration of Science Teacher Study Groups



Description of Activities in Typical Science Teacher Study Groups



Schools Providing One-on-One Science Coaching



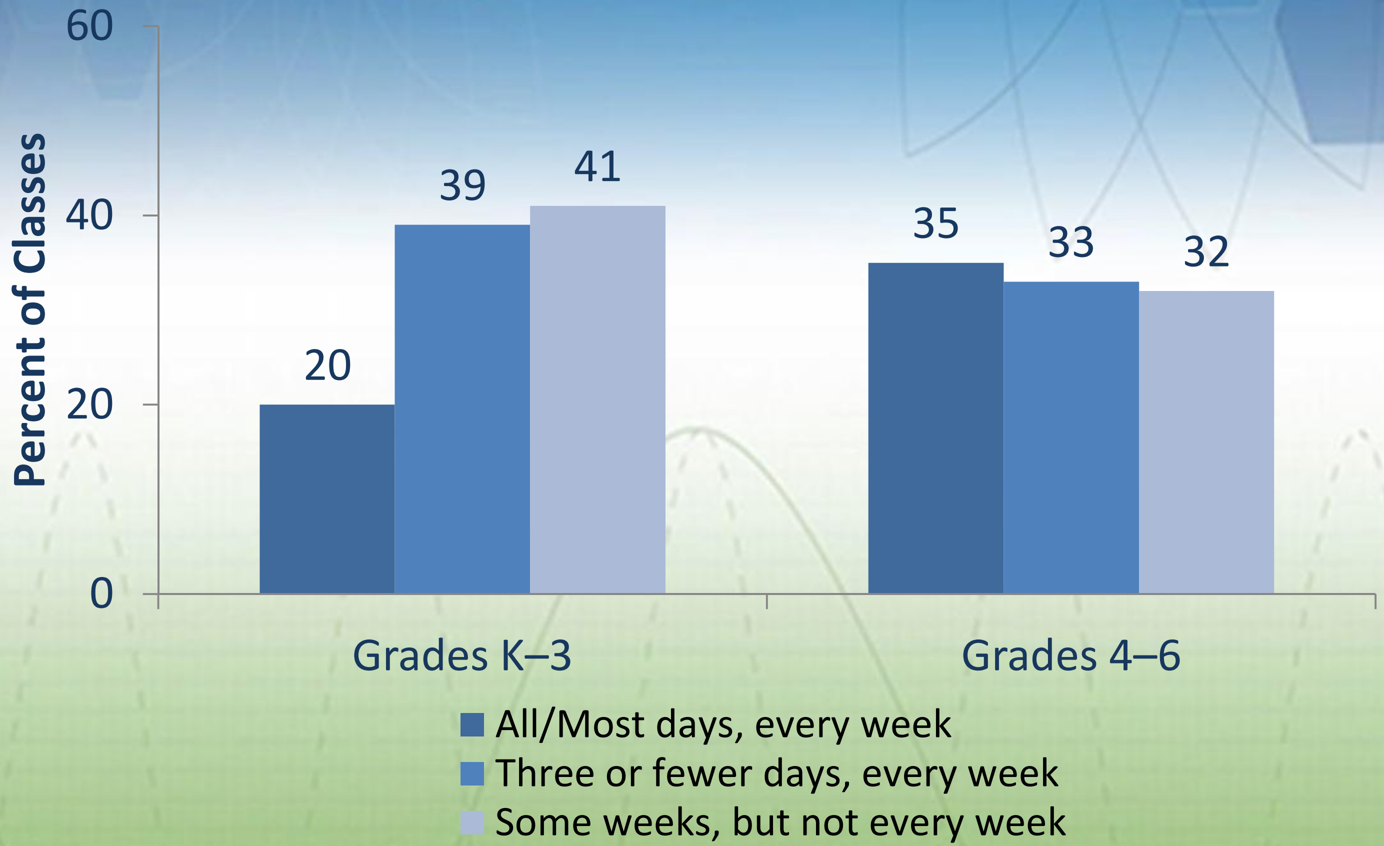
Discussion Question

Implementing the NGSS will likely require substantial professional development for teachers.

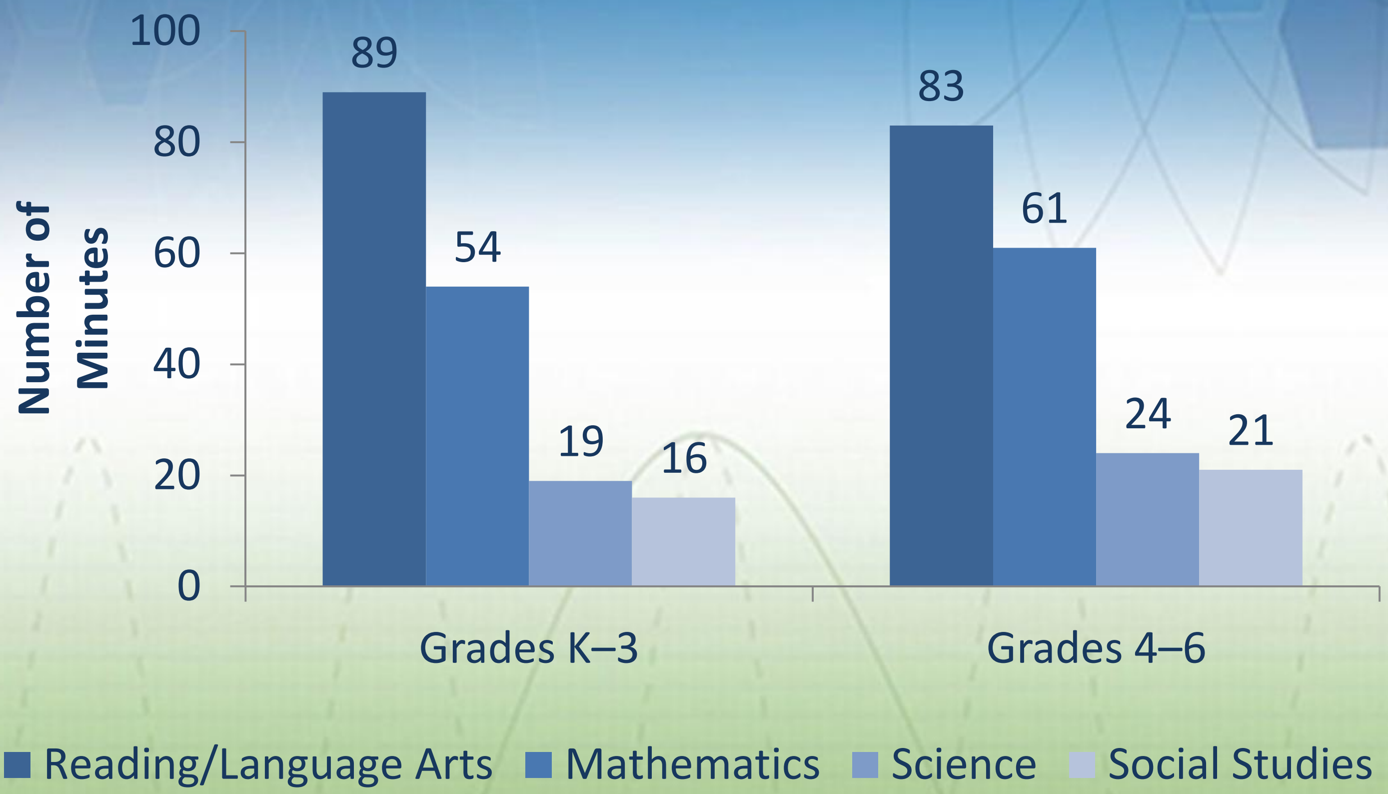
1. How would you describe the nature/format of the PD teachers currently attend?
2. What obstacles and opportunities do you see in these data on science professional development?

Science Instruction

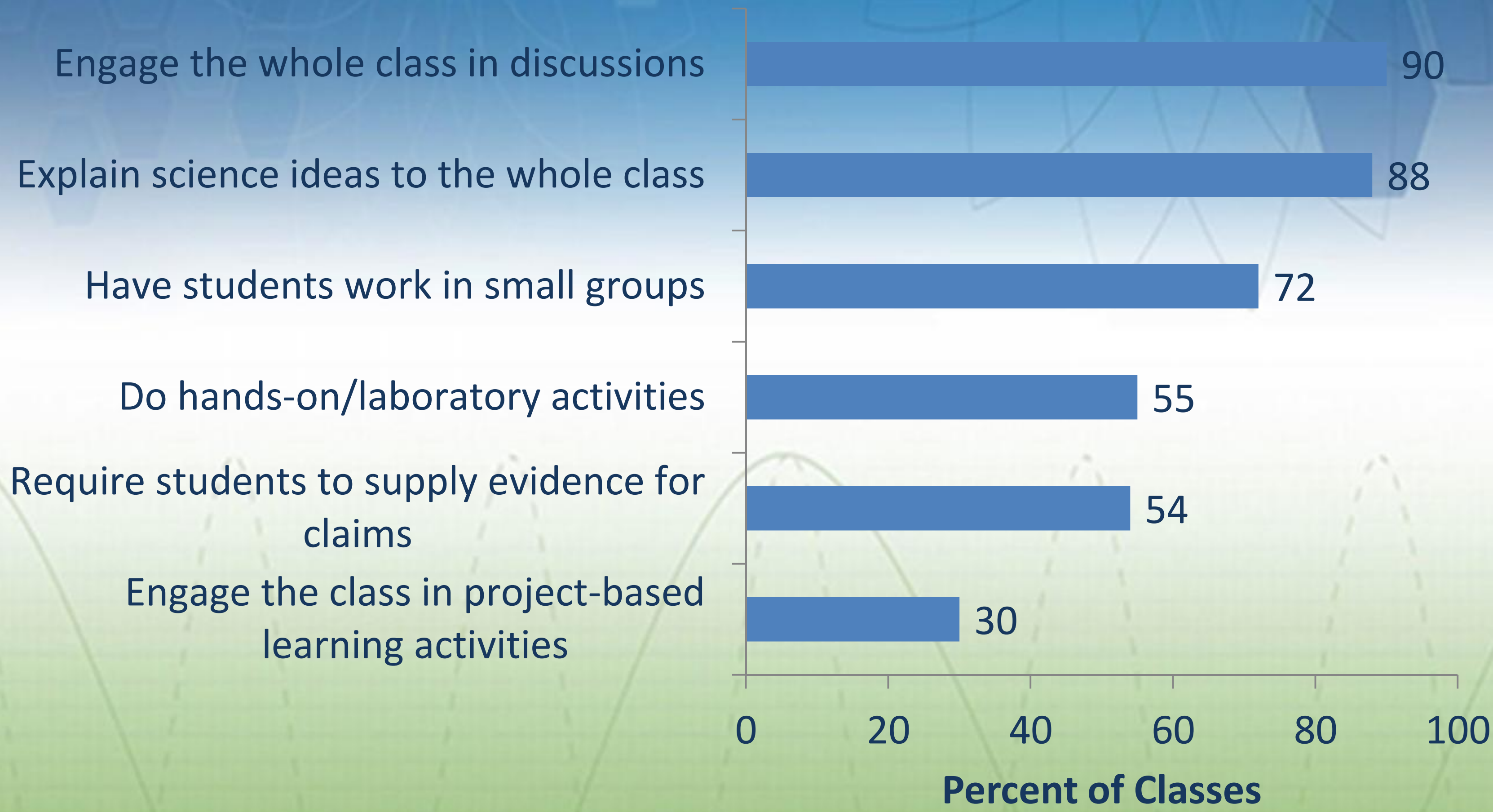
Frequency with Which Self-Contained Elementary Classes Receive Science Instruction



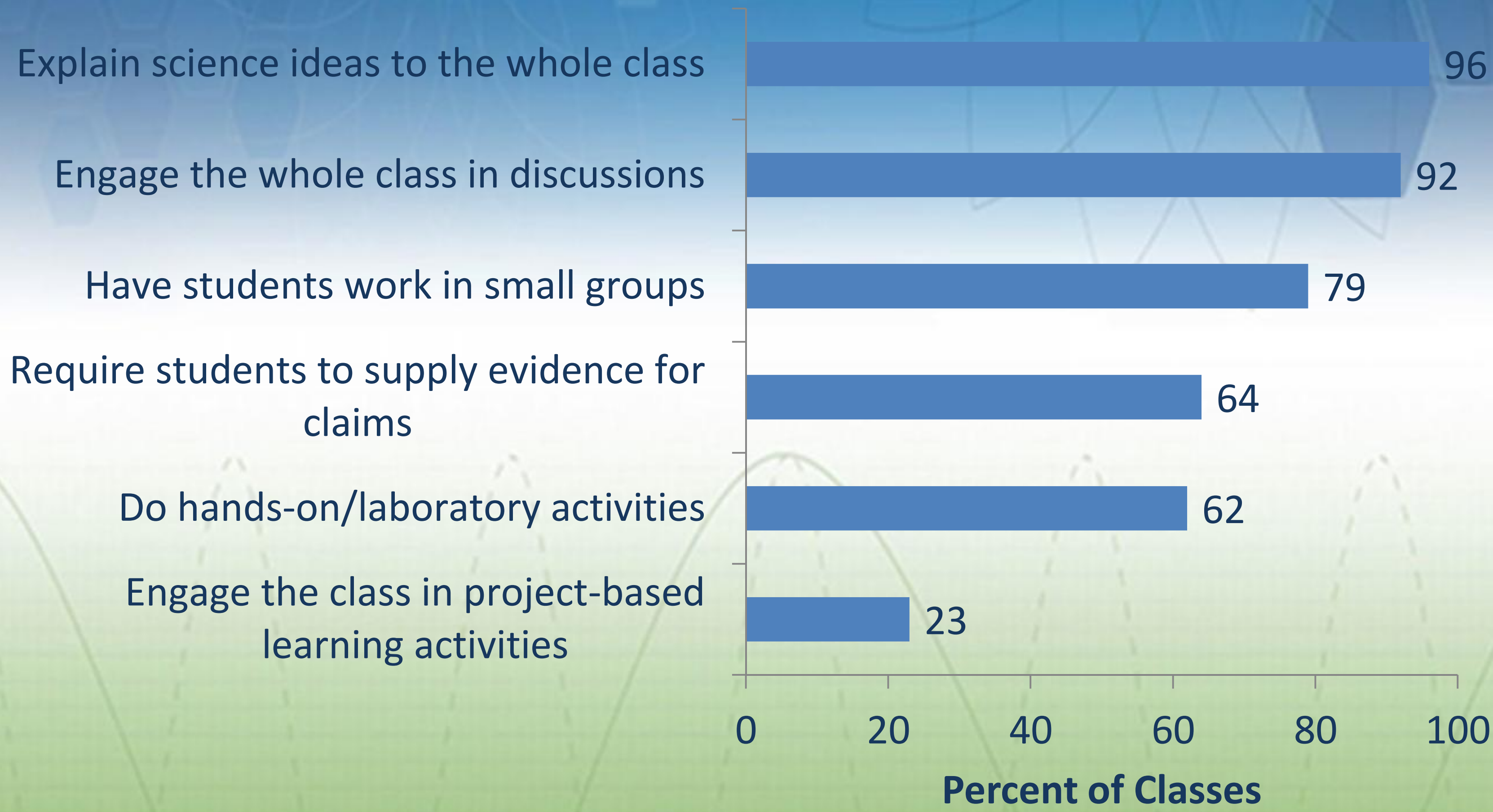
Average Number of Minutes Spent Teaching Subjects in Self-Contained Classes, by Grades



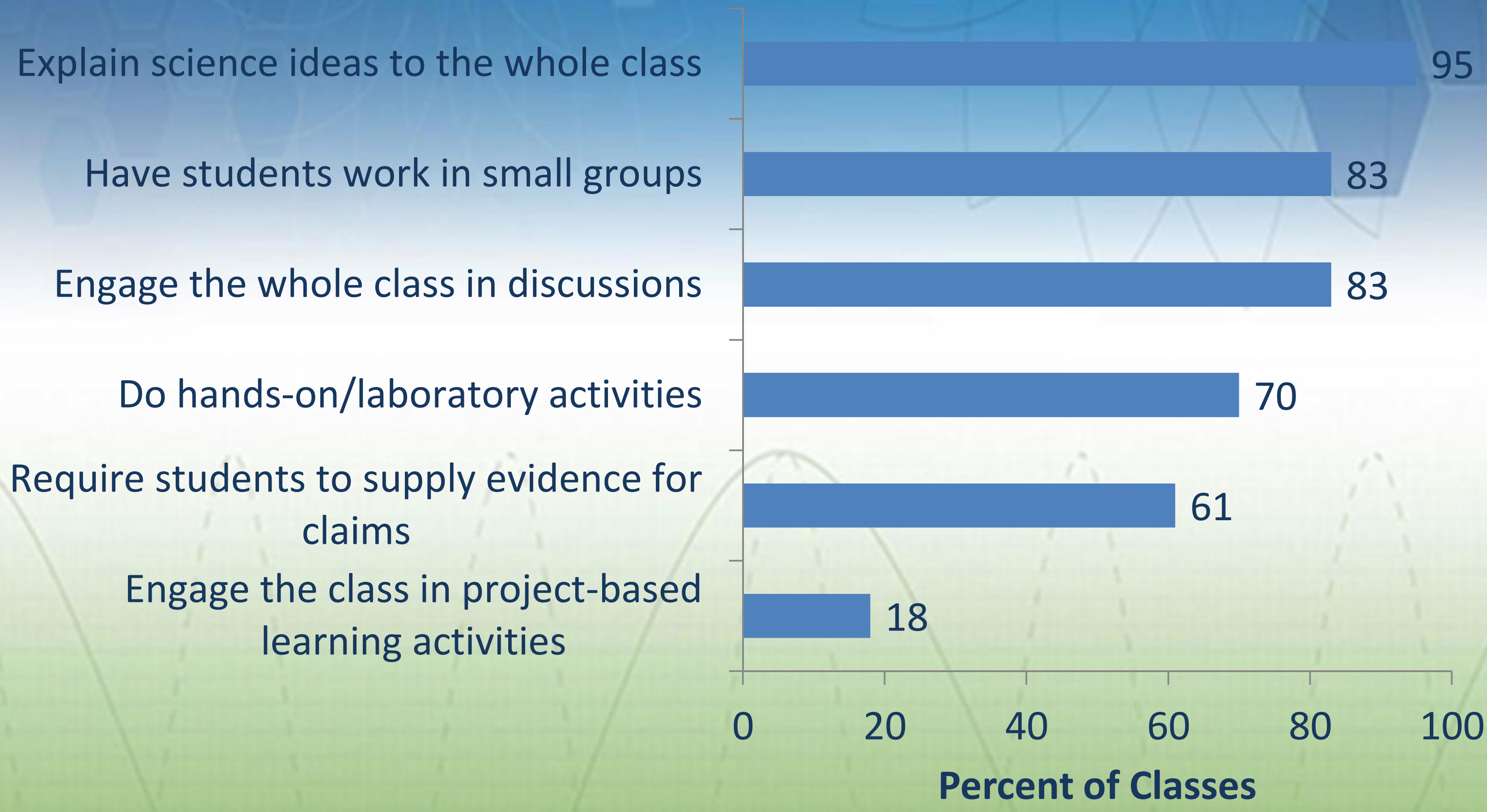
Elementary School Science Classes Using Various Activities at Least Once a Week

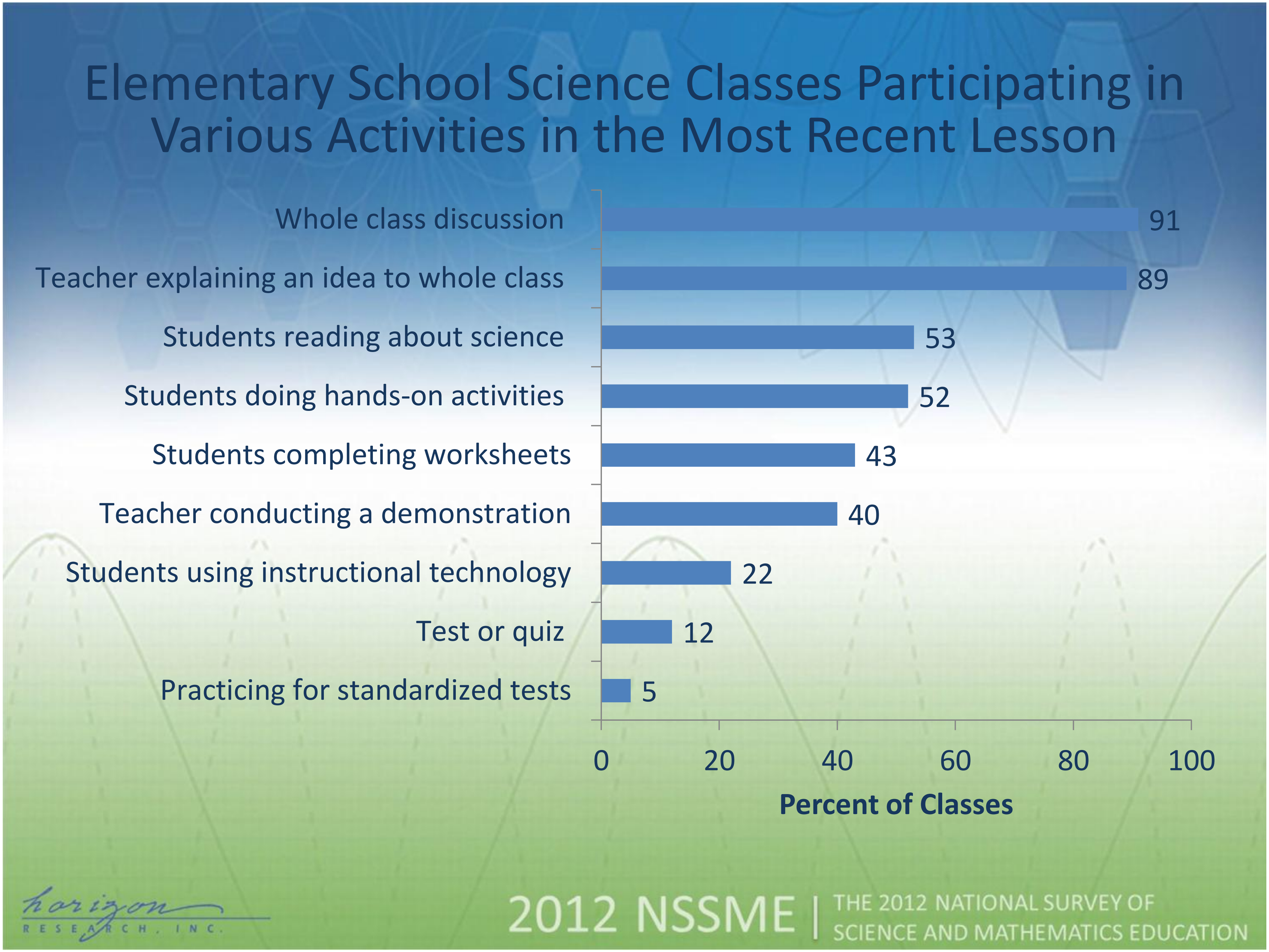


Middle School Science Classes Using Various Activities at Least Once a Week

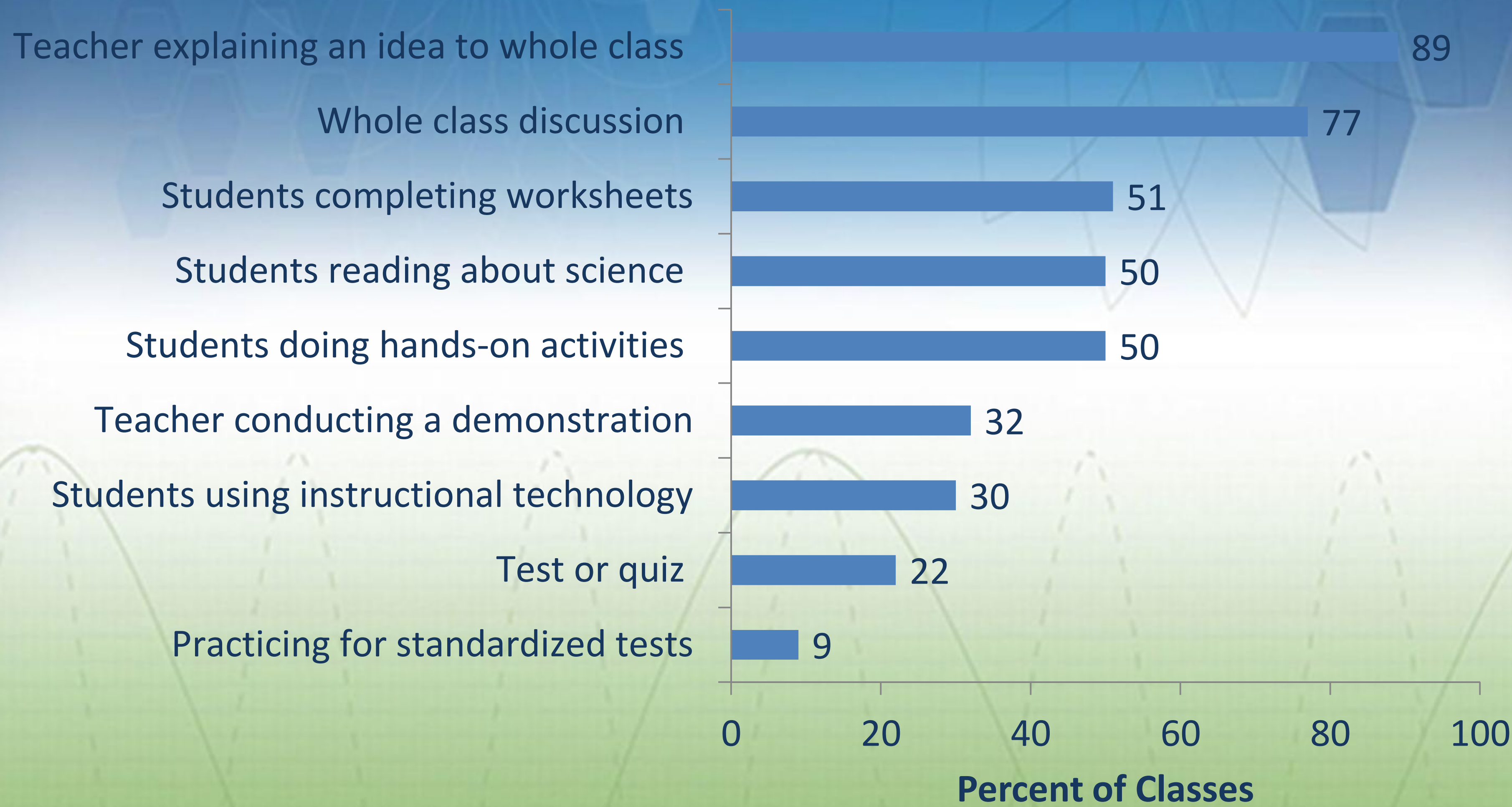


High School Science Classes Using Various Activities at Least Once a Week

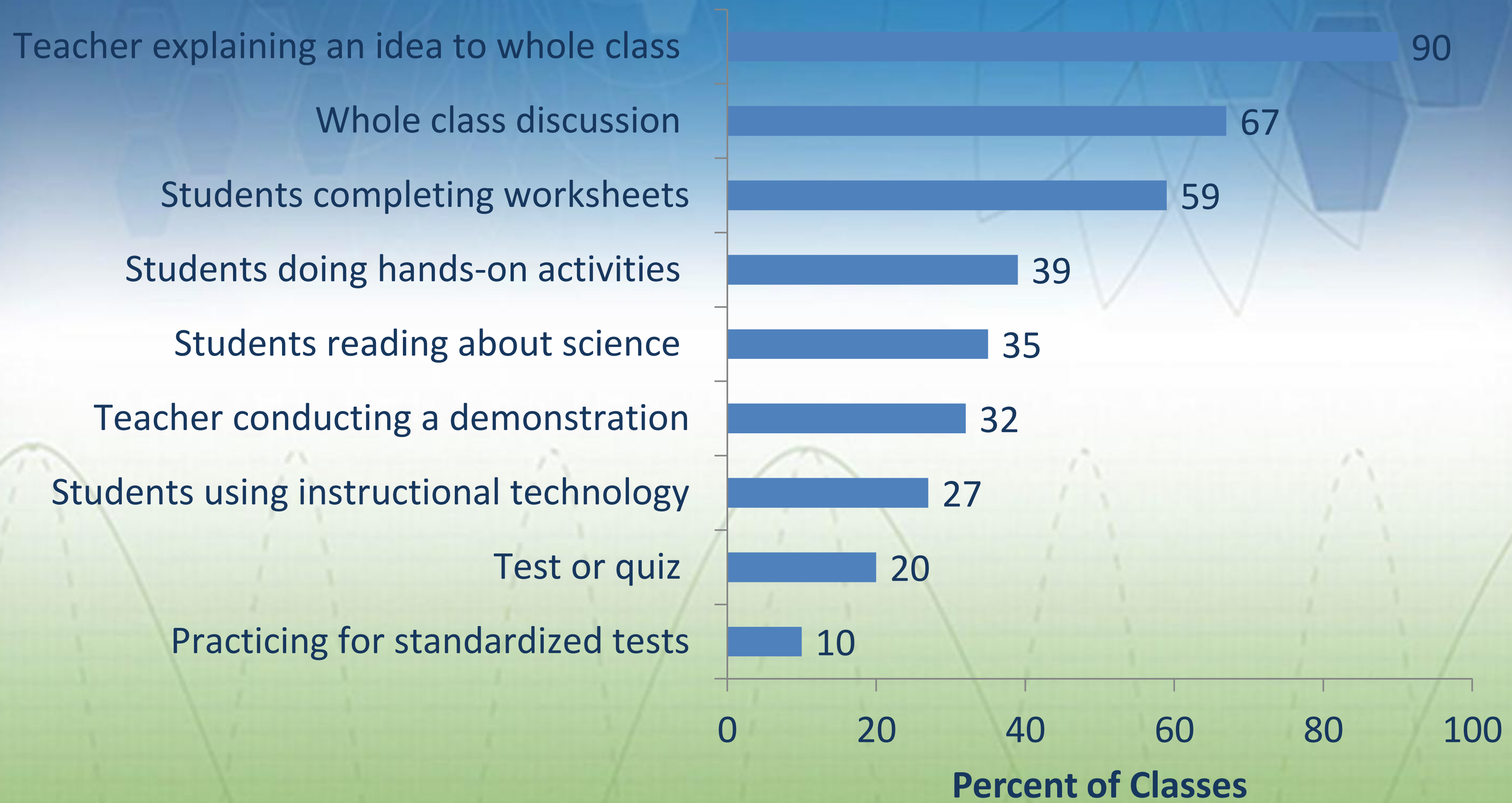



Elementary School Science Classes Participating in Various Activities in the Most Recent Lesson
Whole class discussion
Teacher explaining an idea to whole class
Students reading about science
Students doing hands-on activities
Students completing worksheets
Teacher conducting a demonstration
Students using instructional technology
Test or quiz
Practicing for standardized tests
91
89
53
52
43
40
22
12
5
0
20
40
60
80
100
Percent of Classes
horizon RESEARCH, INC.
2012 NSSME | THE 2012 NATIONAL SURVEY OF SCIENCE AND MATHEMATICS EDUCATION

Middle School Science Classes Participating in Various Activities in the Most Recent Lesson



High School Science Classes Participating in Various Activities in the Most Recent Lesson

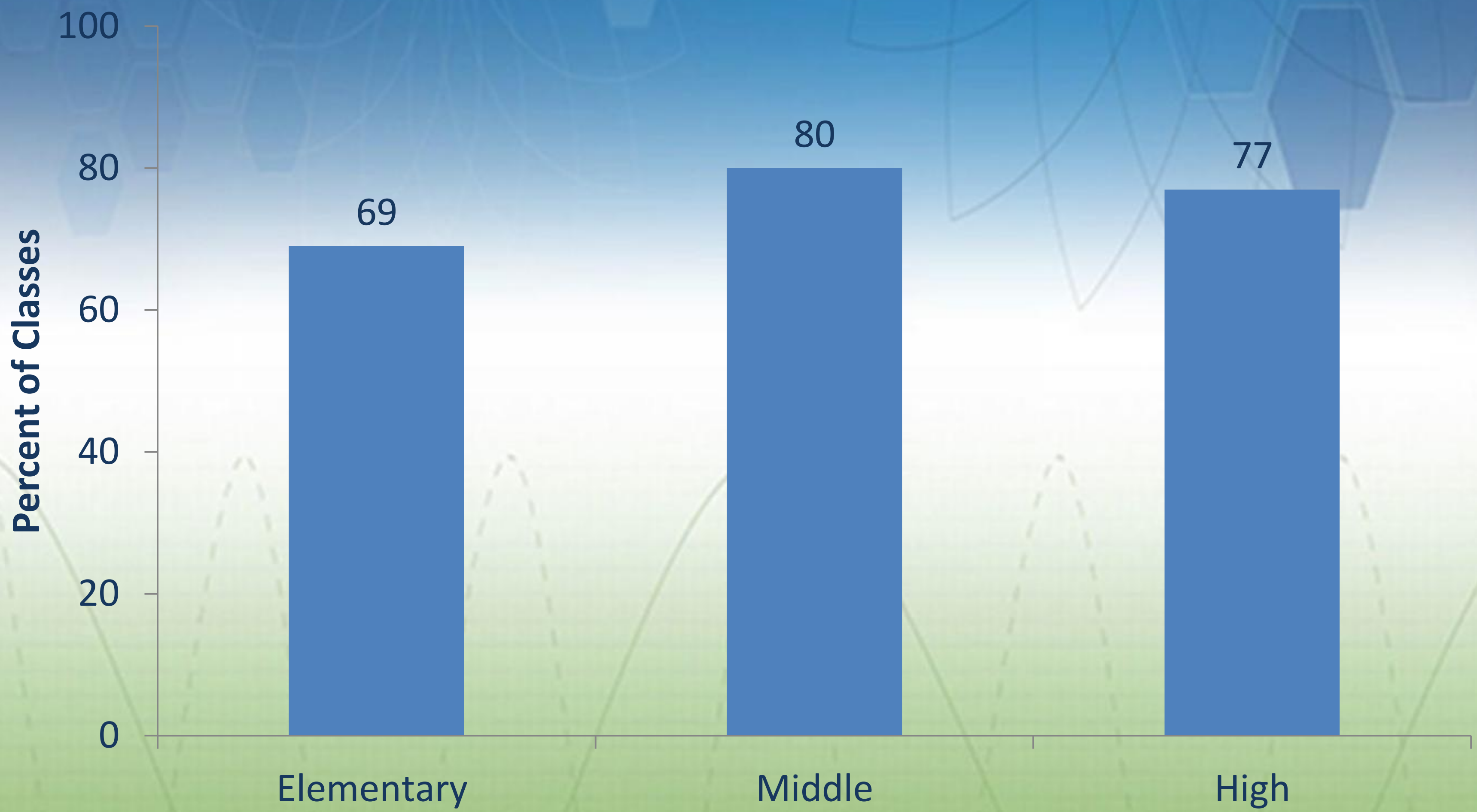


Discussion Question

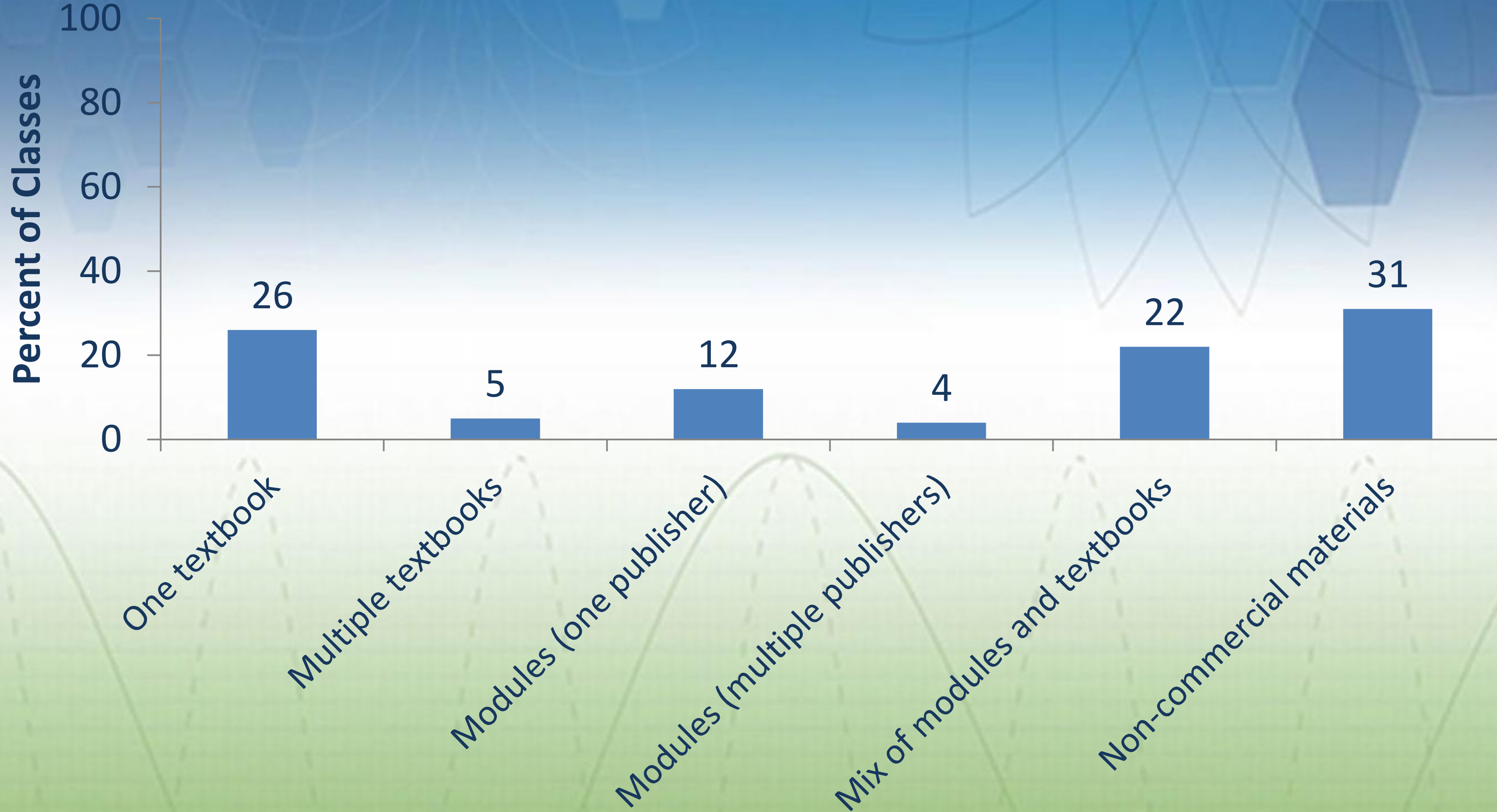
The NGSS do not make specific recommendations about instructional strategies; however, by integrating DCIs, cross-cutting concepts, and practices, they signal that some instructional approaches are better aligned to the standards than others. What areas of alignment and misalignment do you see in these data on science instruction?

Instructional Resources

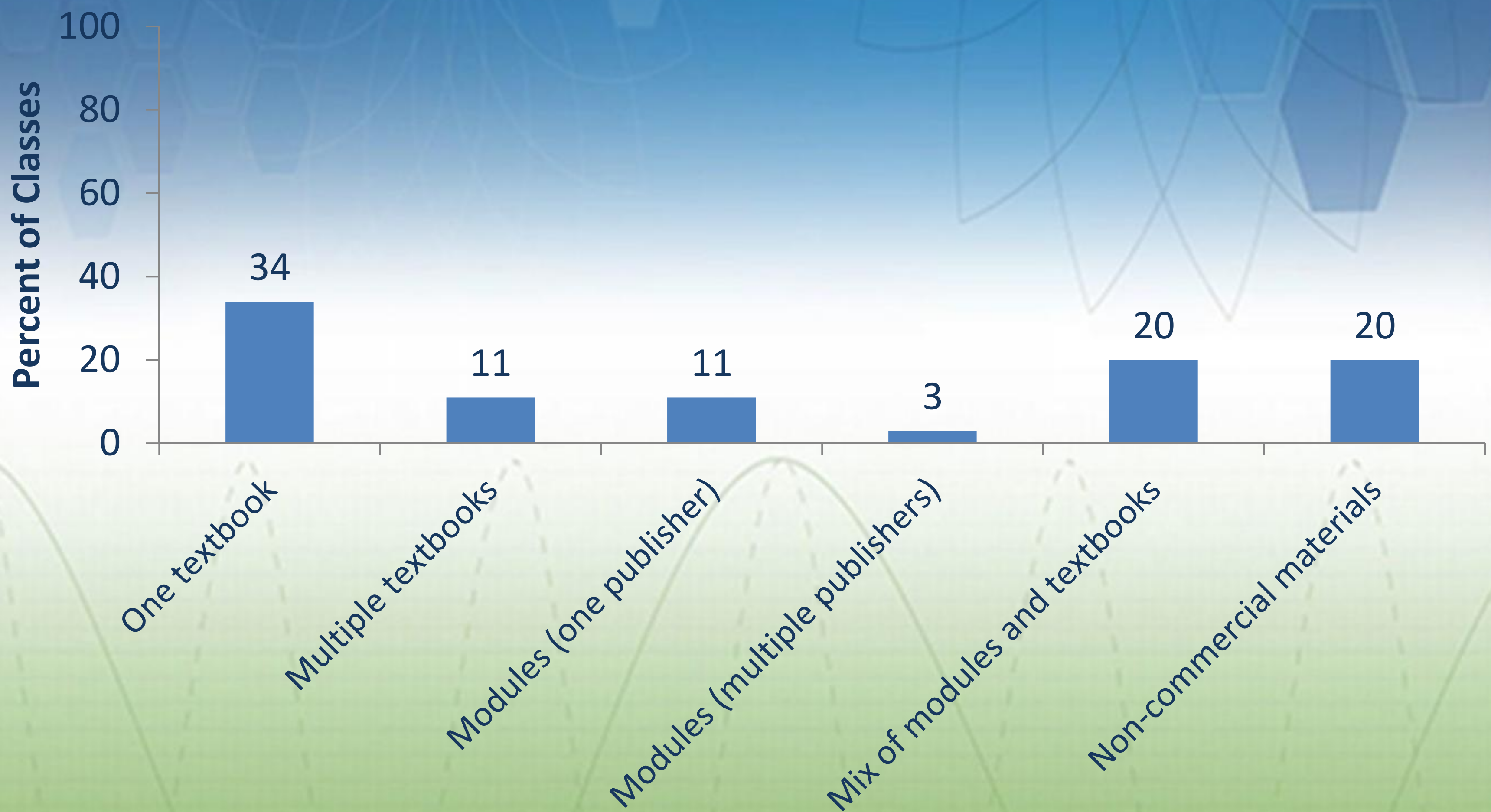
Science Classes Using Commercially Published Textbooks/Programs, by Grade Range



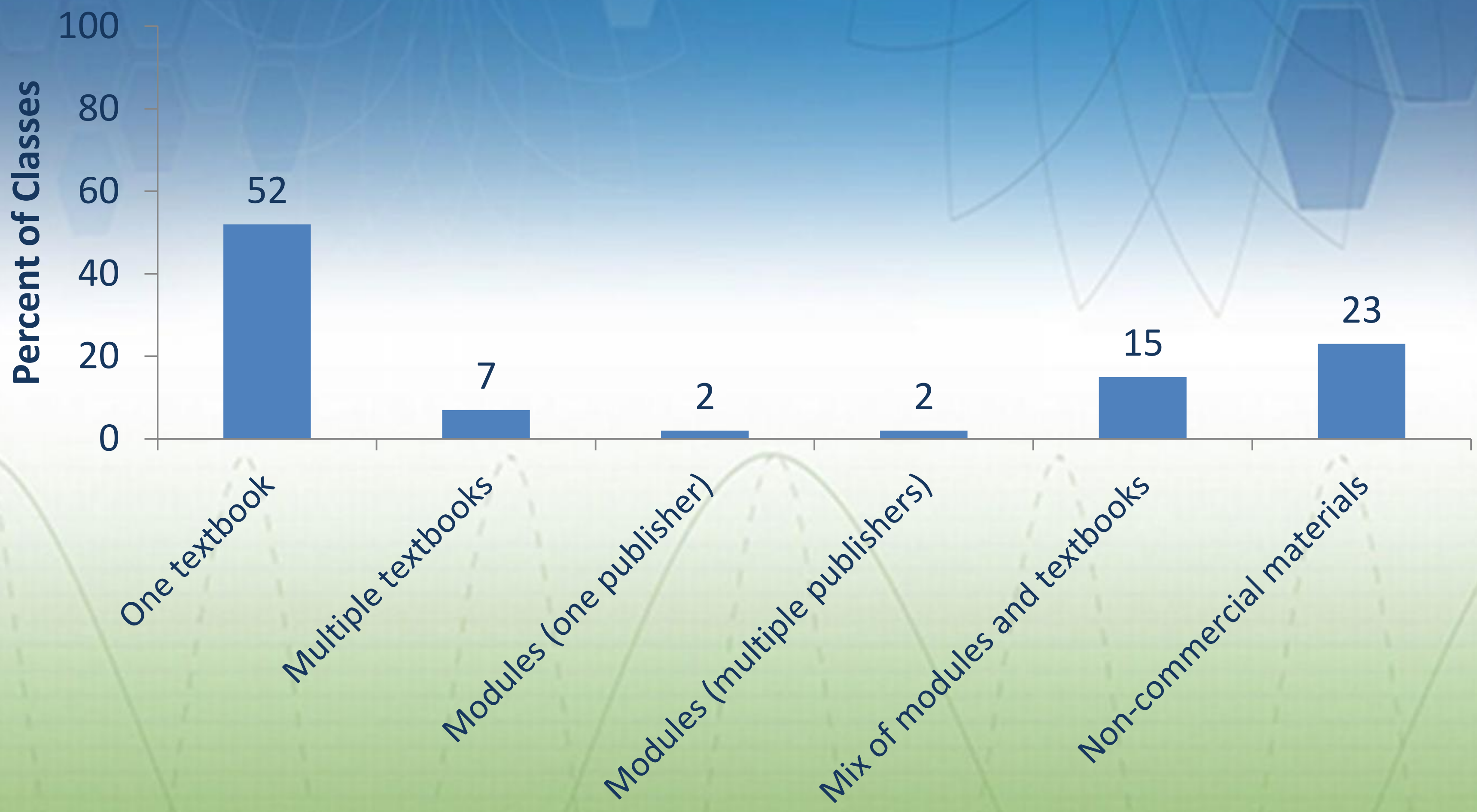
Instructional Materials Used in Elementary School Science Classes



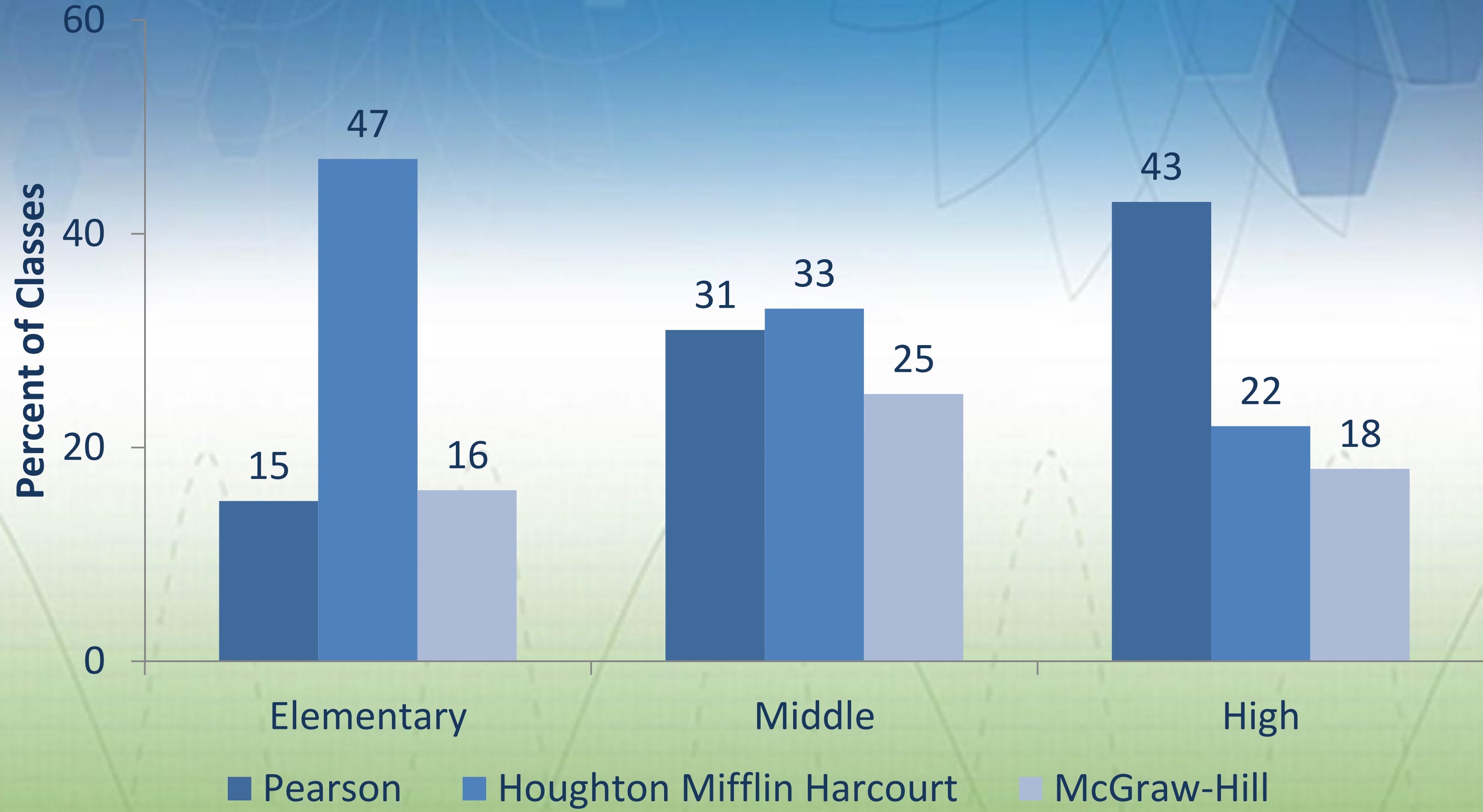
Instructional Materials Used in Middle School Science Classes



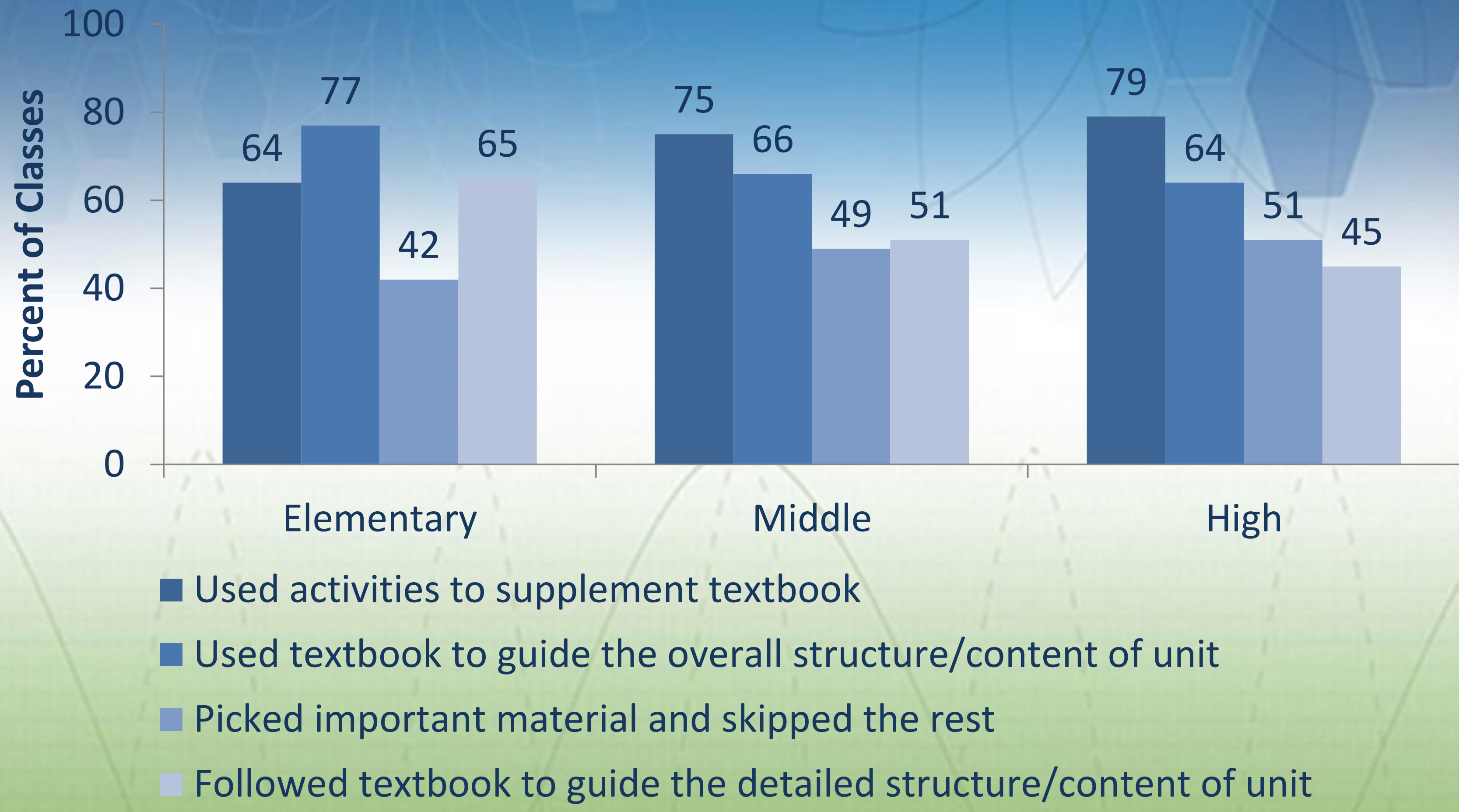
Instructional Materials Used in High School Science Classes



Market Share of Commercial Textbook Publishers in Science Classes, by Grade Range



Ways Science Teachers Substantially Used Their Textbook in the Most Recent Unit, by Grade Range



Discussion Question

Clearly, commercially published instructional materials exert substantial influence on science instruction. What are the components of a message we should deliver to publishers as they create the next generation of instructional materials?

Briefing Book

www.horizon-research.com/2012nssme

The following presentation slides are available in PowerPoint format and require Microsoft PowerPoint for use.

Study Overview

Teacher Background and Beliefs	Science	Mathematics
Professional Development	Science	Mathematics
Science and Mathematics Courses	Science	Mathematics
Instruction	Science	Mathematics
Instructional Resources	Science	Mathematics
Factors Affecting Instruction	Science	Mathematics

Wrap-up and Transition to Panel Discussion