

# Science Education for All



Facilitators today:

Amy Gingell, Suzi Mast, & Shelly Pollnow

Welcome and Introductions

Name, School, District/Charter

Table Discussion- What does Science Education for All mean for you at your site?

# Science Think Tank Session Agenda

- Where are we now? NAEP 2015 Science Results
- Where do we want to go? Table Discussions
- How do we get there? Framework/New Arizona Science Standards

- **NAEP 2015 Science**

**Arizona Leads the Nation in 4<sup>th</sup> Grade Growth**

- **NAEP 2015 Math, Reading, and Science**

**Arizona is the only state to have statistically significant increases in Grade 4 and 8 for Math, Reading, and Science from 2009-2015.**

- **ADE Press Release**

# Arizona Headlines NAEP 2015

“Consistent improvement year after year, test after test, grade after grade, across the whole state indicates that this is something more than random variation in scores or the luck. It is the result of the increased learning that is going on in the classrooms across Arizona. It is a pattern we need to recognize, celebrate with our teachers and students, and build upon. Getting to where we want our students achievement to be will take time and effort. We are making progress. Let's stop and celebrate our successes along the way.”

–Joe O'Reilly, Executive Director for Student Achievement Mesa Public Schools

Retrieved 10/28/2016, <http://www.care-az.org/> *Arizona Research on Education*



# NAEP 2015 Science Results

Shelly Pollnow, Ed.D

AZ Director of NAEP Program



# Science Assessment Design

## Science Content Areas

Physical science



Earth and space sciences

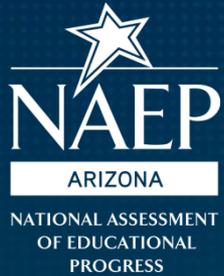


Life science



# Science Assessment Design

## Percentage distribution of assessment time in 2015 NAEP science, by content area

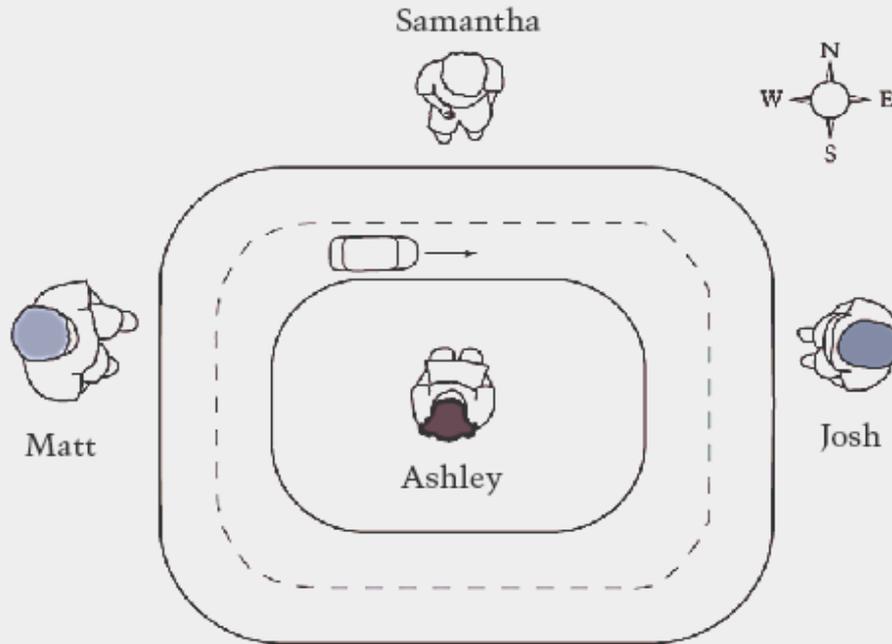


Content area	Grade 4	Grade 8	Grade 12
Physical science	33%	29%	38%
Earth and space sciences	33%	40%	25%
Life science	34%	31%	37%



## Sample Question: Physical Science

The diagram below shows the top of a toy car as it travels on a curved track. Four students, Matt, Samantha, Josh, and Ashley stand in the positions shown and watch the toy car move.

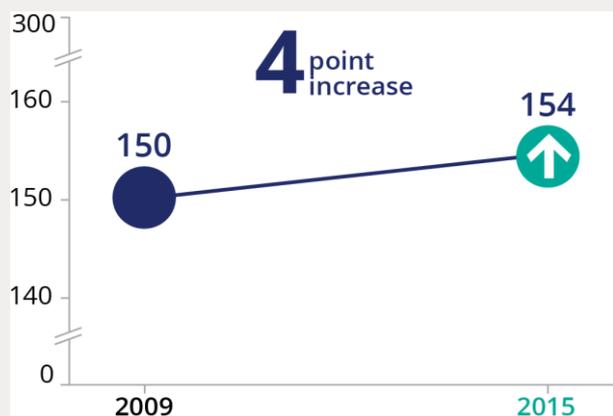


When the toy car is in the position shown in the diagram, which student sees the car as moving away from him or her?

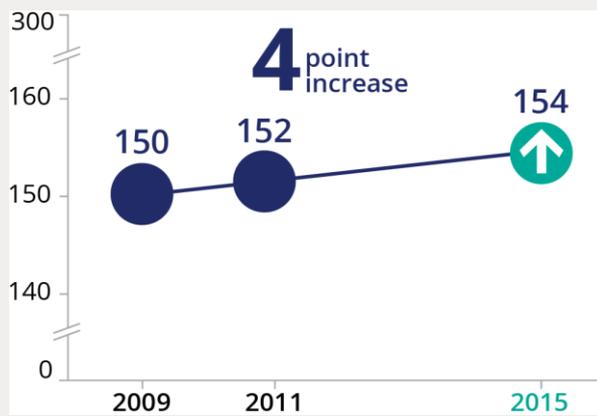
- (A) Ashley
- (B) Josh
- (C) Matt
- (D) Samantha

## National score changes between 2009 and 2015

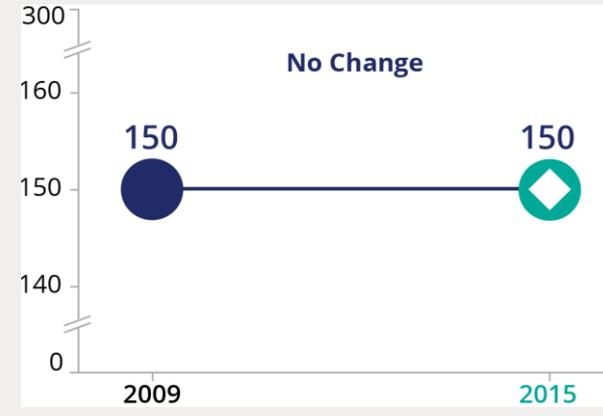
### Grade 4



### Grade 8



### Grade 12

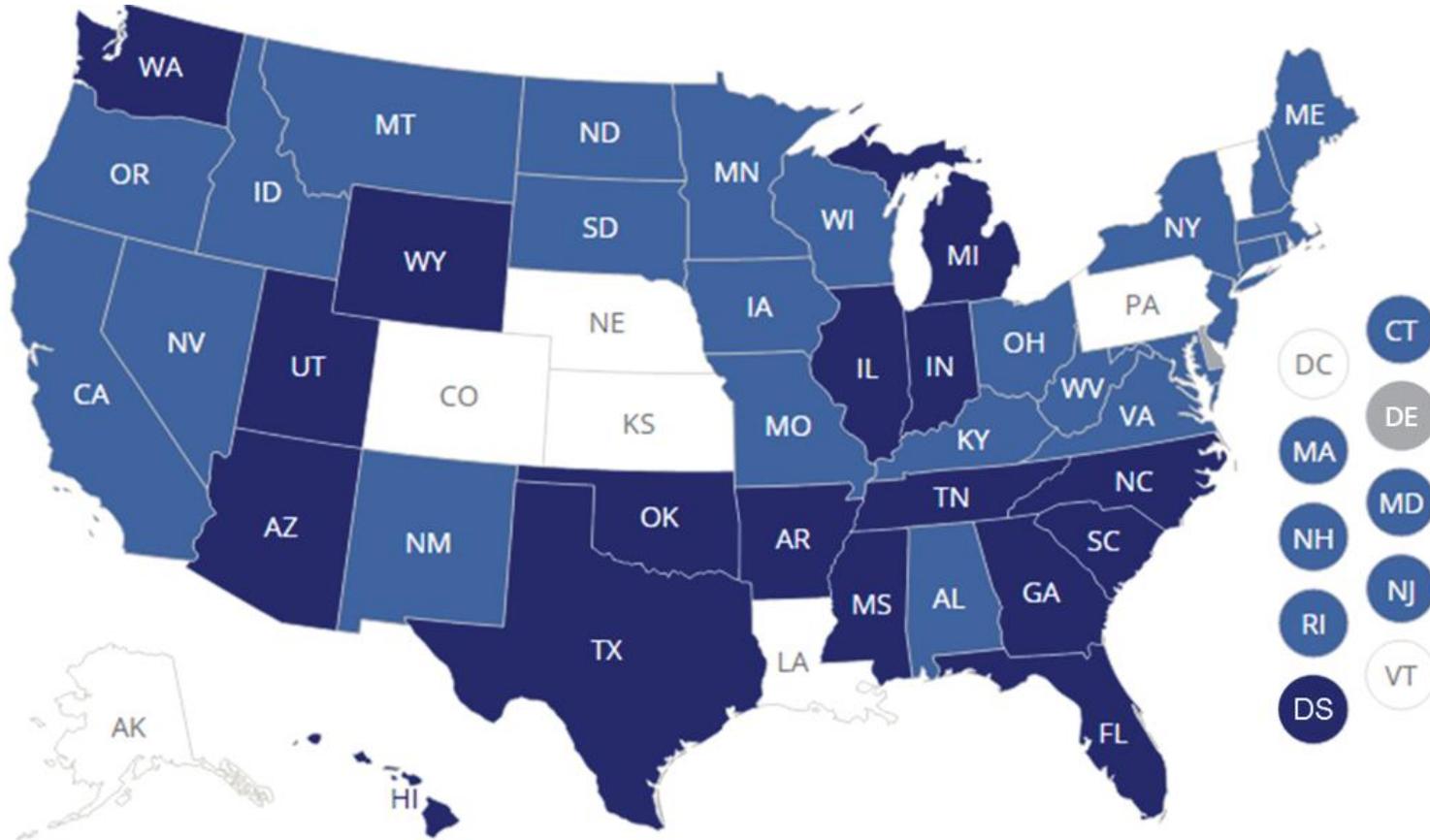


 Score increase from previous assessment years

 No significant change from previous assessment year

NOTE: Trend data available at grades 4 and 12 from 2009 and at grade 8 from 2009 and 2011.

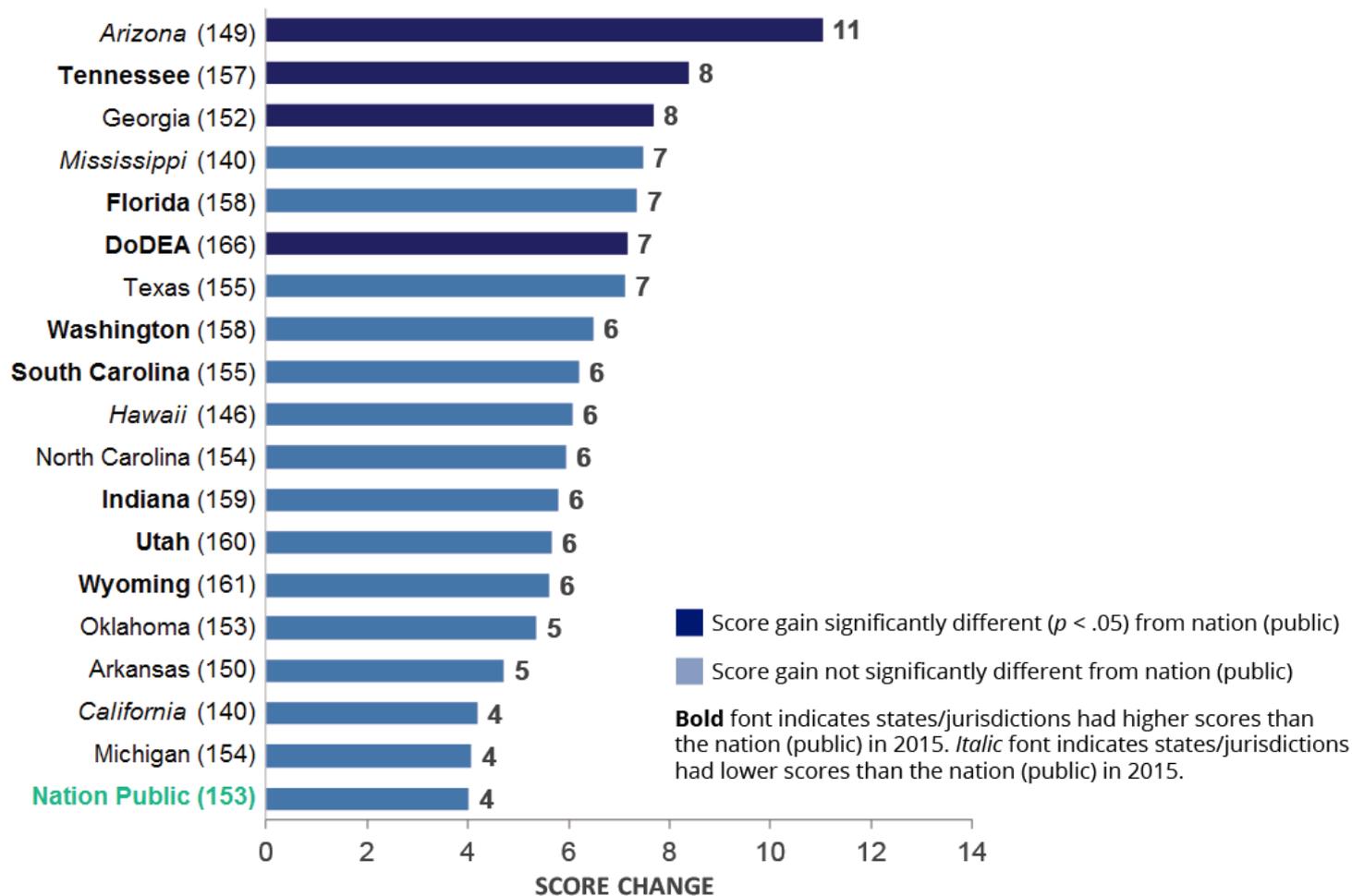
## Science scores increased in 18 states/jurisdictions and decreased in 1 state compared to 2009



Score gain
  No significant score change
  Score loss
  No data/not applicable

NOTE: DS = Department of Defense Education Activity (DoDEA).

## Four states/jurisdictions had greater score gains than the nation since 2009

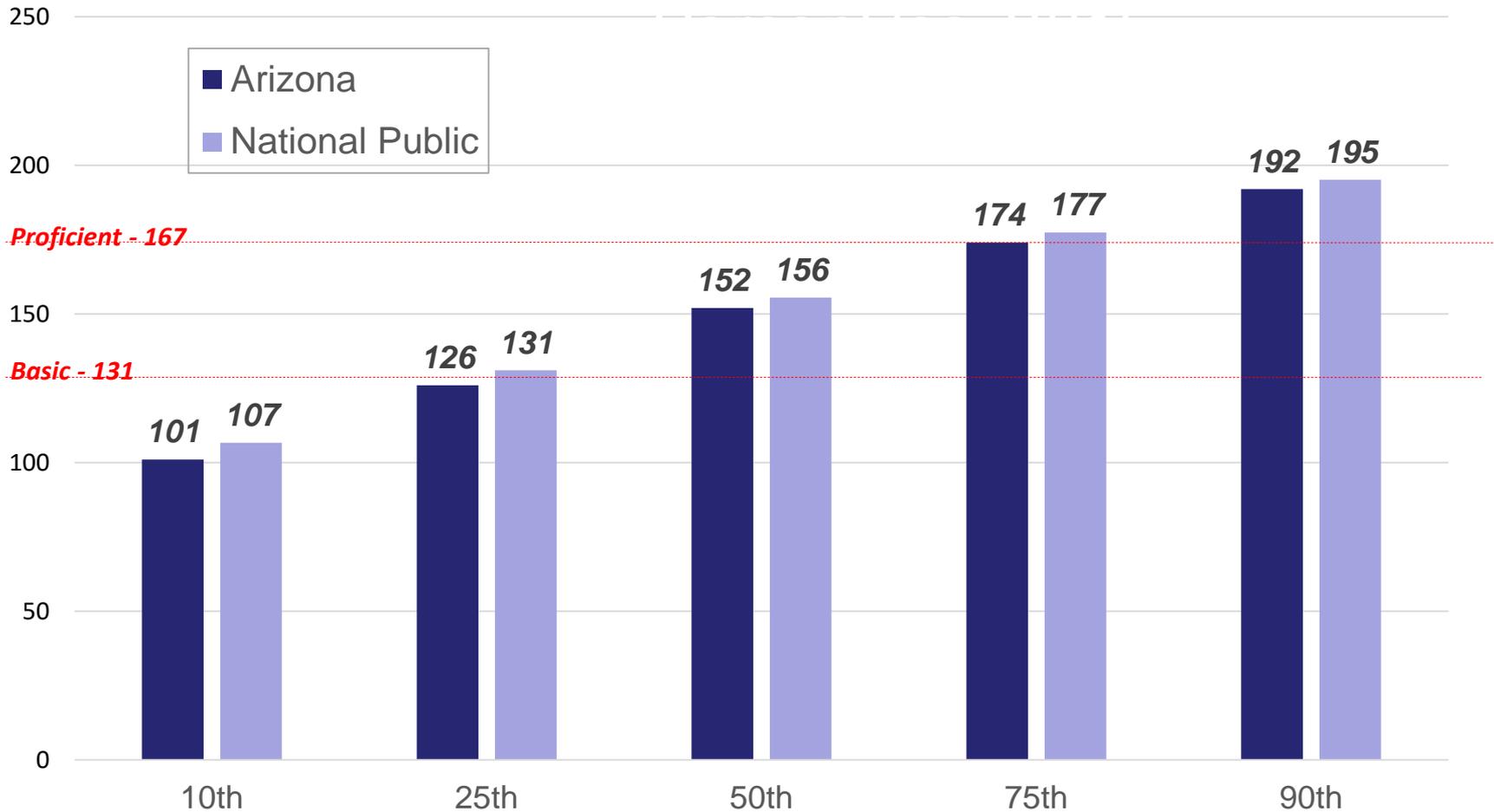


# Grade 4 Science Overall Growth 2009-2015

**NAEP Science Grade 4 – Overall**  
*Growth Score points 2009 to 2015*

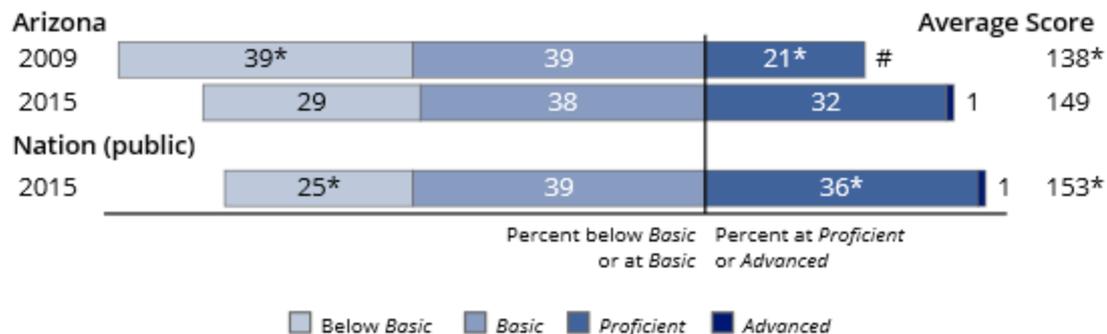


# Grade 4 Science Percentile Scores 2015



# Grade 4 Science Achievement Level Percentages 2009-2015

## Achievement-Level Percentages and Average Score Results



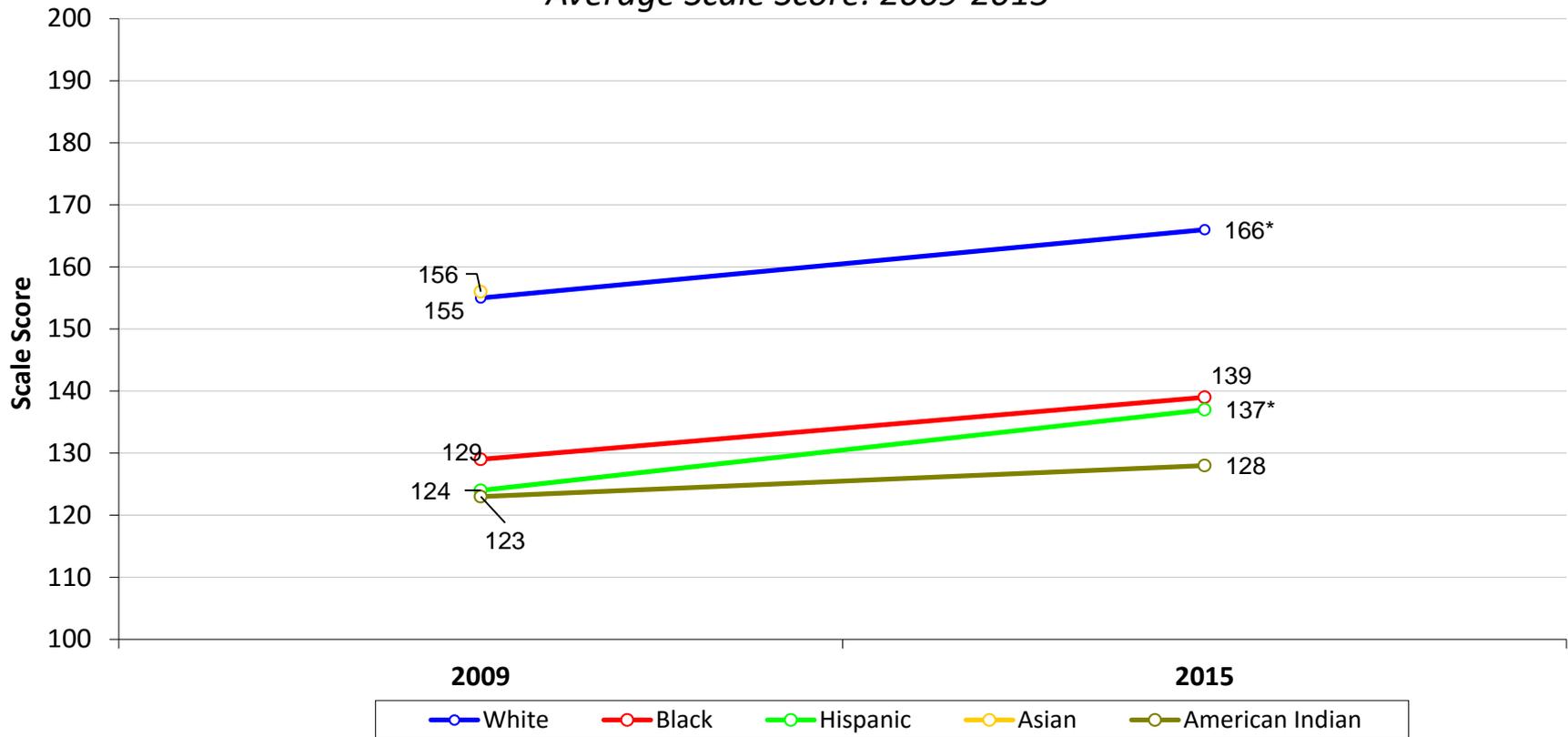
# Rounds to zero.

\* Significantly different ( $p < .05$ ) from state's results in 2015. Significance tests were performed using unrounded numbers.

NOTE: Detail may not sum to totals because of rounding.

# Grade 4 Scores by Race Ethnicity 2009-2015

**NAEP Science Grade 4 – Race/Ethnicity**  
*Average Scale Score: 2009-2015*

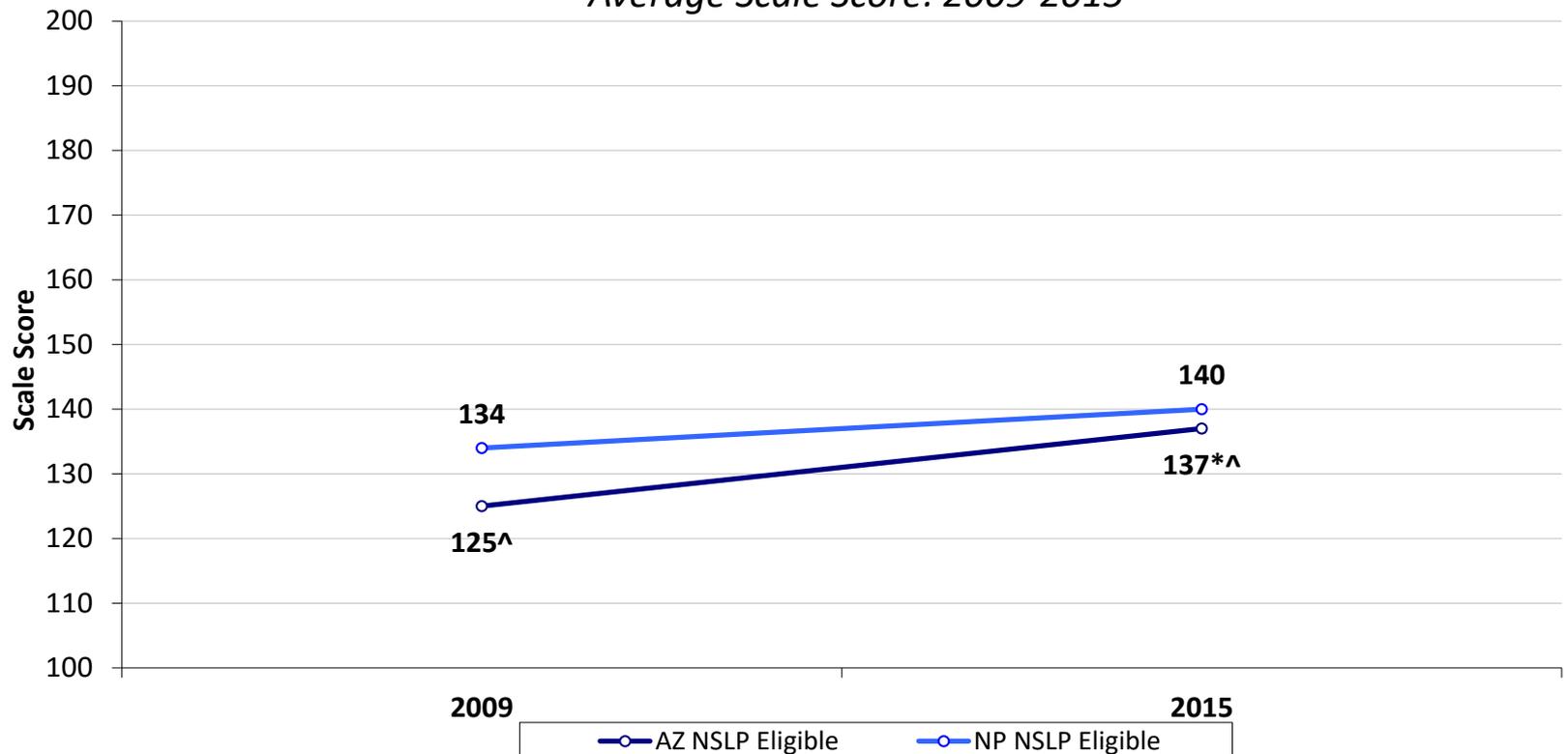


NOTE: The NAEP Science scale ranges from 0 to 300. \* Observed differences are statistically significant at  $p < .05$  from 2009.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP).

# Grade 4 Science Eligible School Lunch

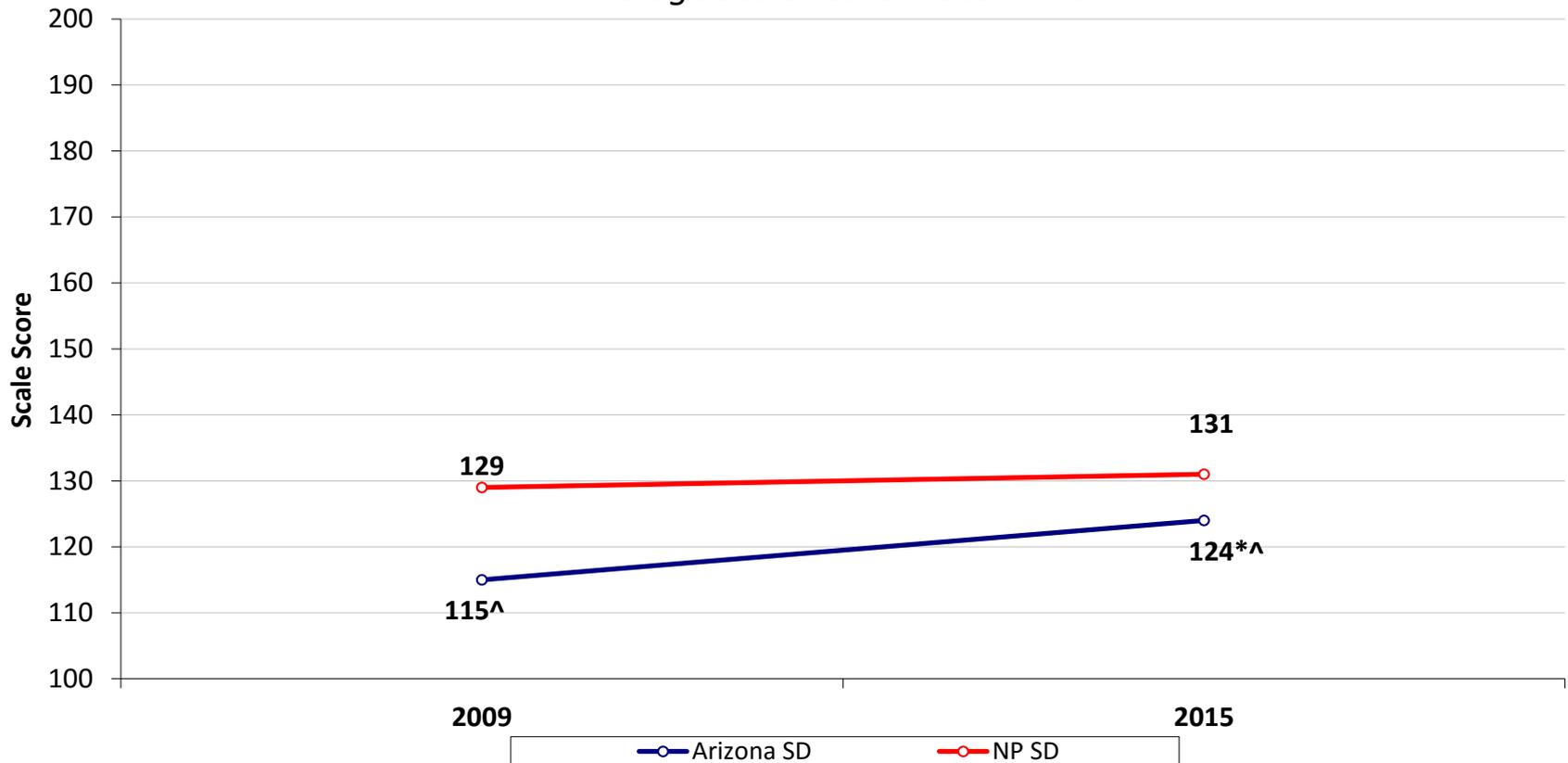
**NAEP Science Grade 4 – National School Lunch Program Eligible**  
*Average Scale Score: 2009-2015*



NOTE: The NAEP Science scale ranges from 0 to 300. \* Observed differences are statistically significant from Arizona 2009 at  $p < .05$ . <sup>^</sup> Observed differences are statistically significant from National Public NP for the same year at  $p < .05$ .

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress

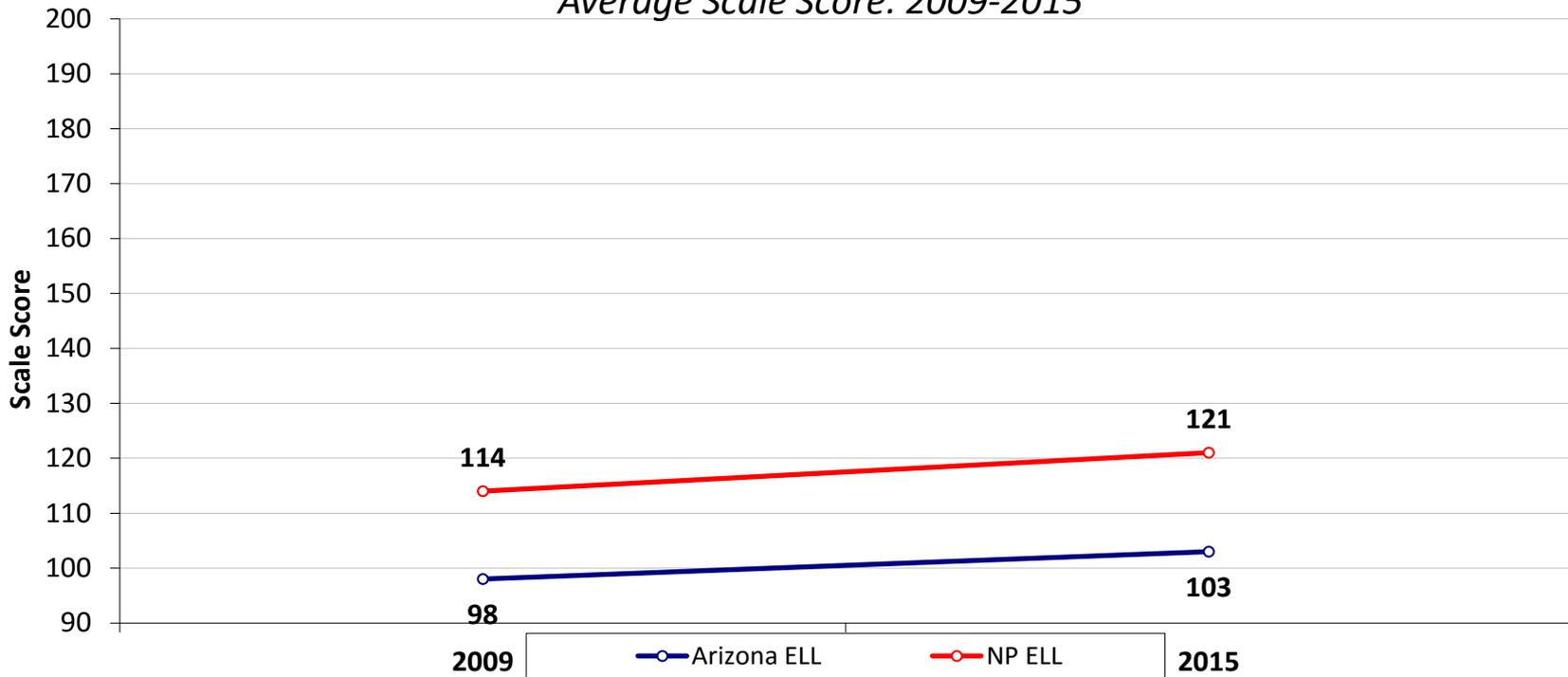
## NAEP Science Grade 4 – Students with Disabilities Average Scale Score: 2009-2015



NOTE: The NAEP Science scale ranges from 0 to 300SOURCE: U.S. Department of Education, Institute of Ed. \*Observed differences are statistically significant from AZ 2009. ^Observed difference are statistically different from National Public NP for the same year. Source US Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP).

# Science Grade 4 ELL

**NAEP Science Grade 4 – English Language Learners**  
*Average Scale Score: 2009-2015*

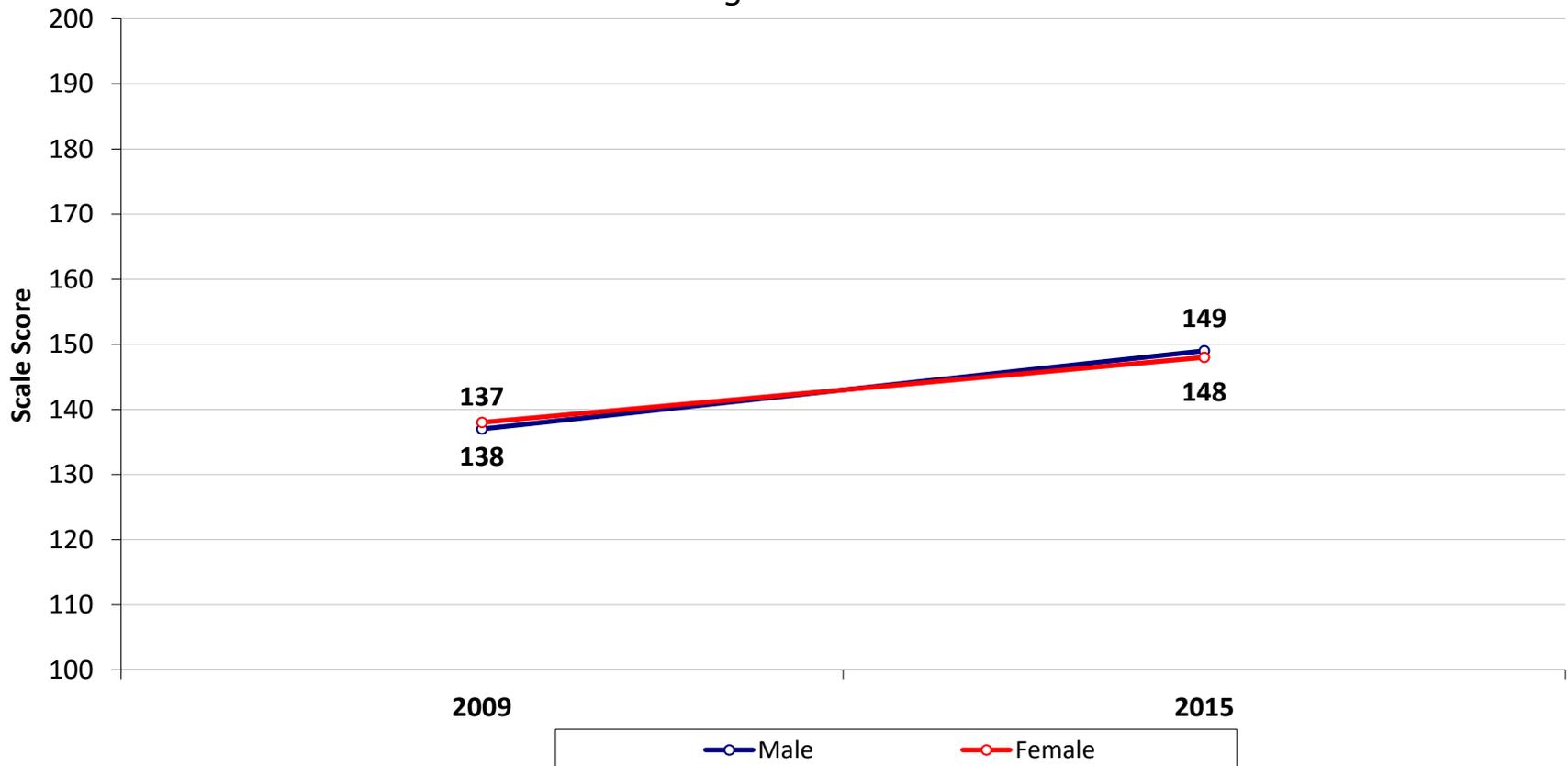


NOTE: The NAEP Science scale ranges from 0 to 300. Observed differences are not statistically significant at  $p < .05$ .

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP).

# Arizona Grade 4 Scores by Gender 2009-2015

**Arizona NAEP Science Grade 4 – Gender**  
*Average Scale Score: 2009-2015*



NOTE: The NAEP Science scale ranges from 0 to 300. Observed differences are not statistically different at  $p < .05$ .

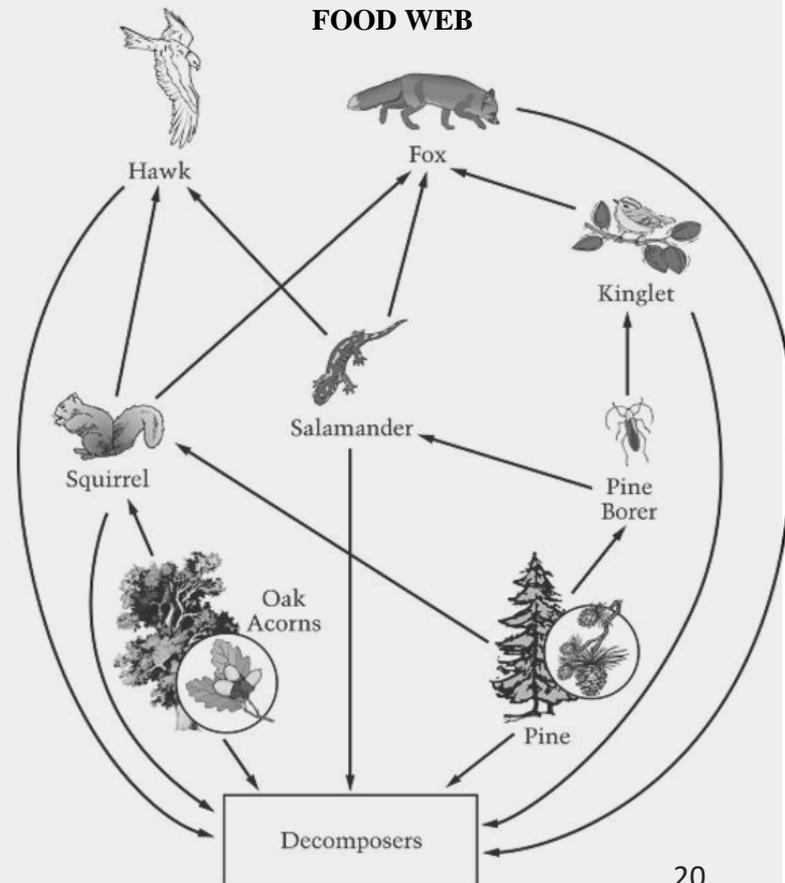
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP).

## Sample Question: Life Science

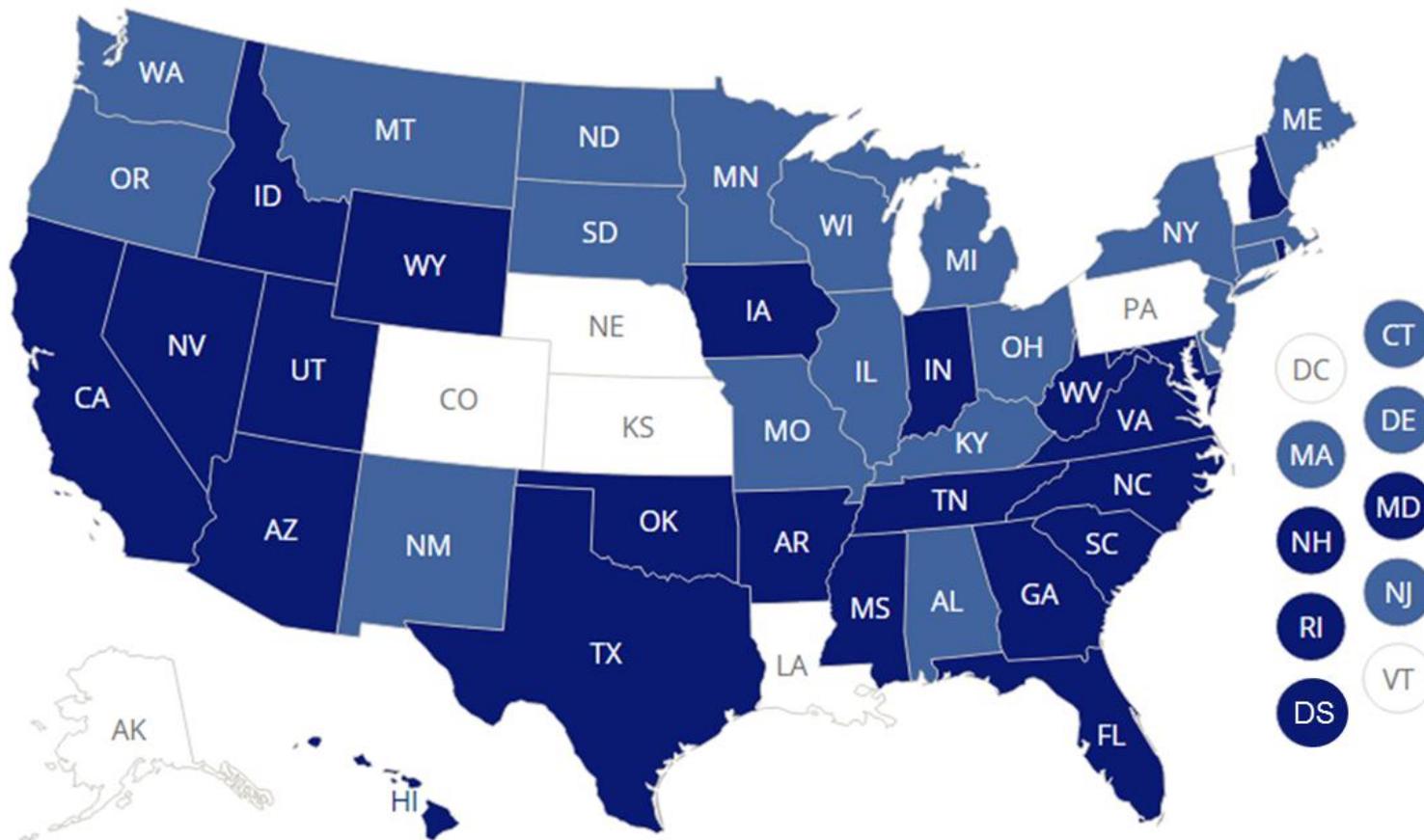
The diagram shows a food web. The arrows show the direction of energy flow. Each arrow points from the organism that is consumed to the organism that consumes it. Use the information in the food web to answer the question that follows.

Which statement best explains why decomposers are an important part of this food web?

- (A) They use sunlight to make their own food.
- (B) They give off oxygen for animals to breathe.
- (C) They provide camouflage for small animals.
- (D) They make nutrients available to plants.



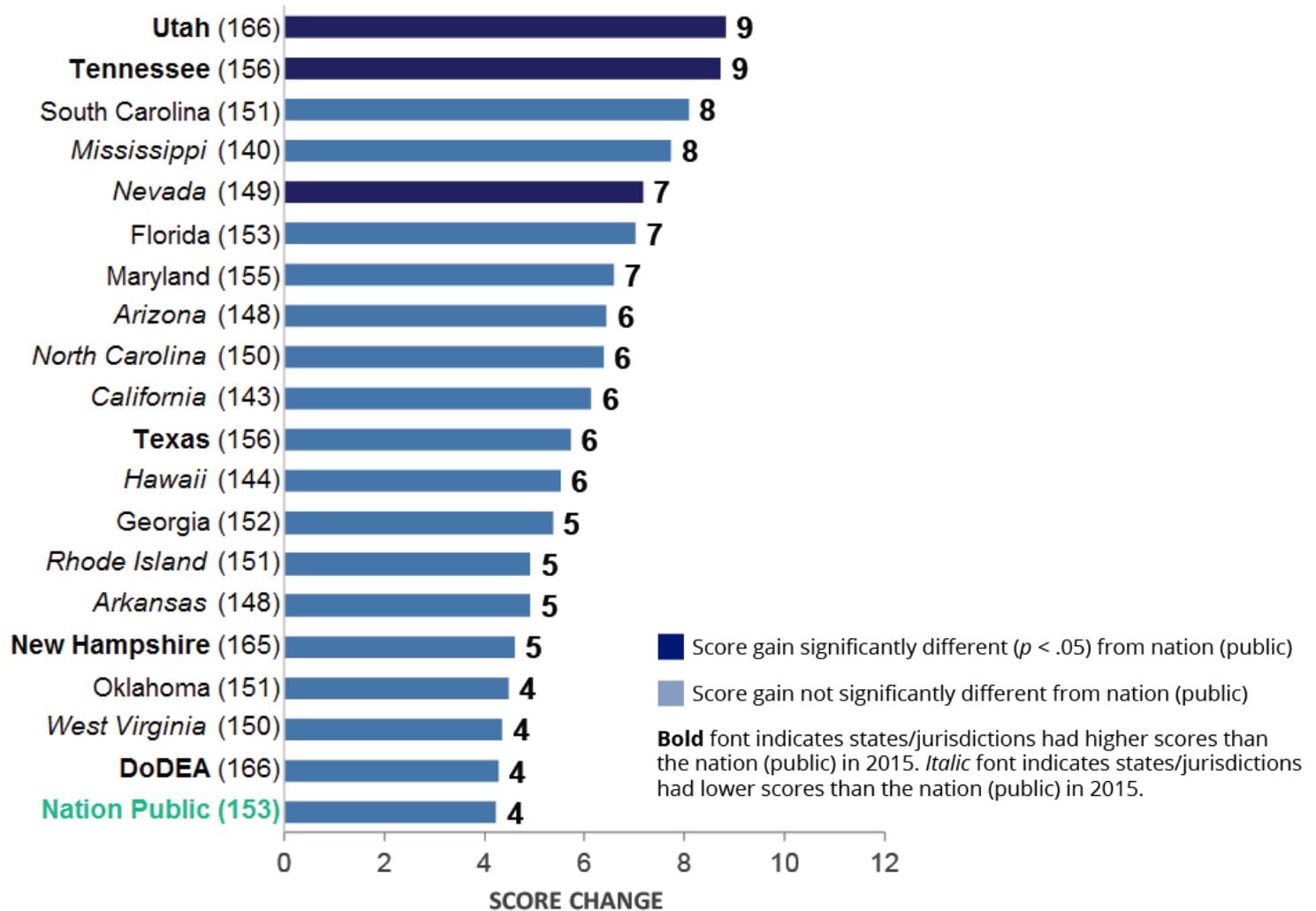
## Science scores increased in 24 states/jurisdictions and decreased in none compared to 2009



Score gain
  No significant score change
  No data/not applicable

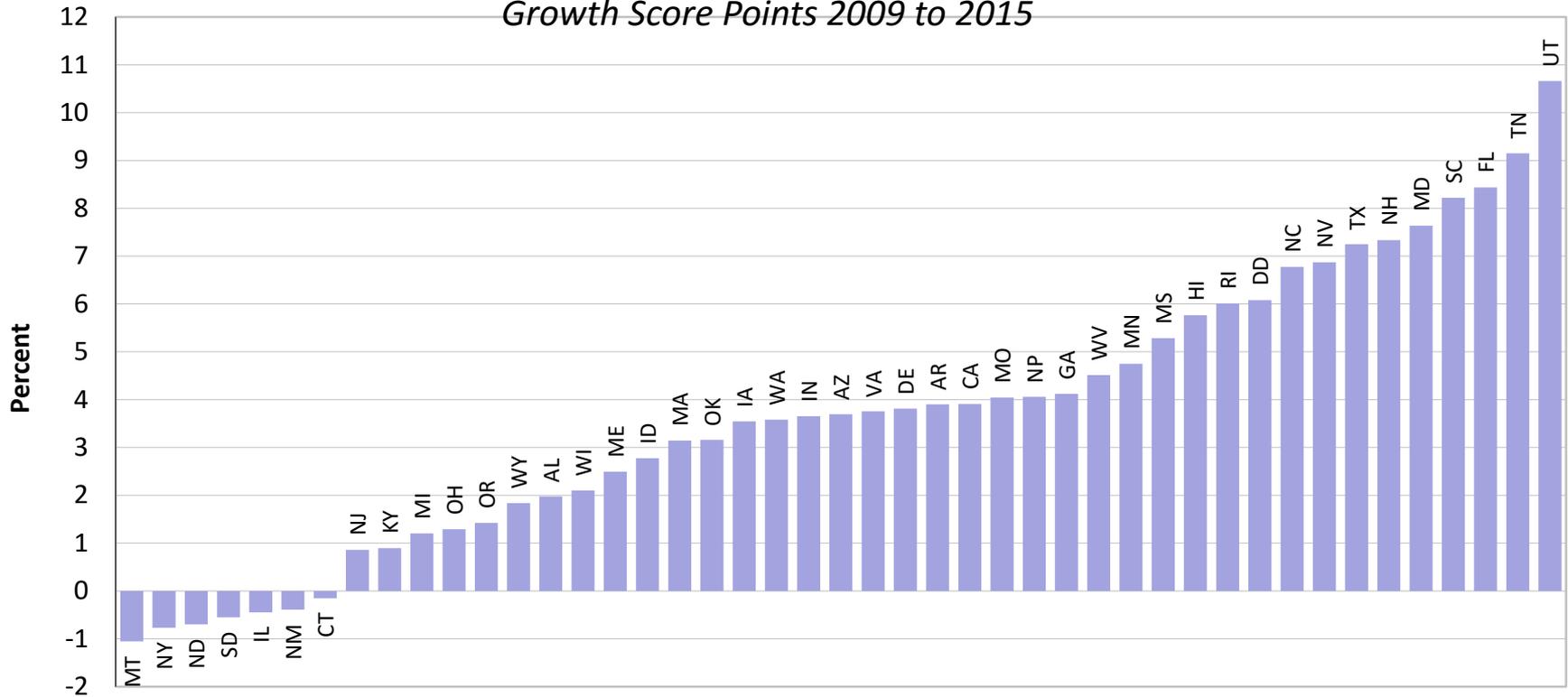
NOTE: DS = Department of Defense Education Activity (DoDEA).

## Three states had greater score gains than the nation since 2009

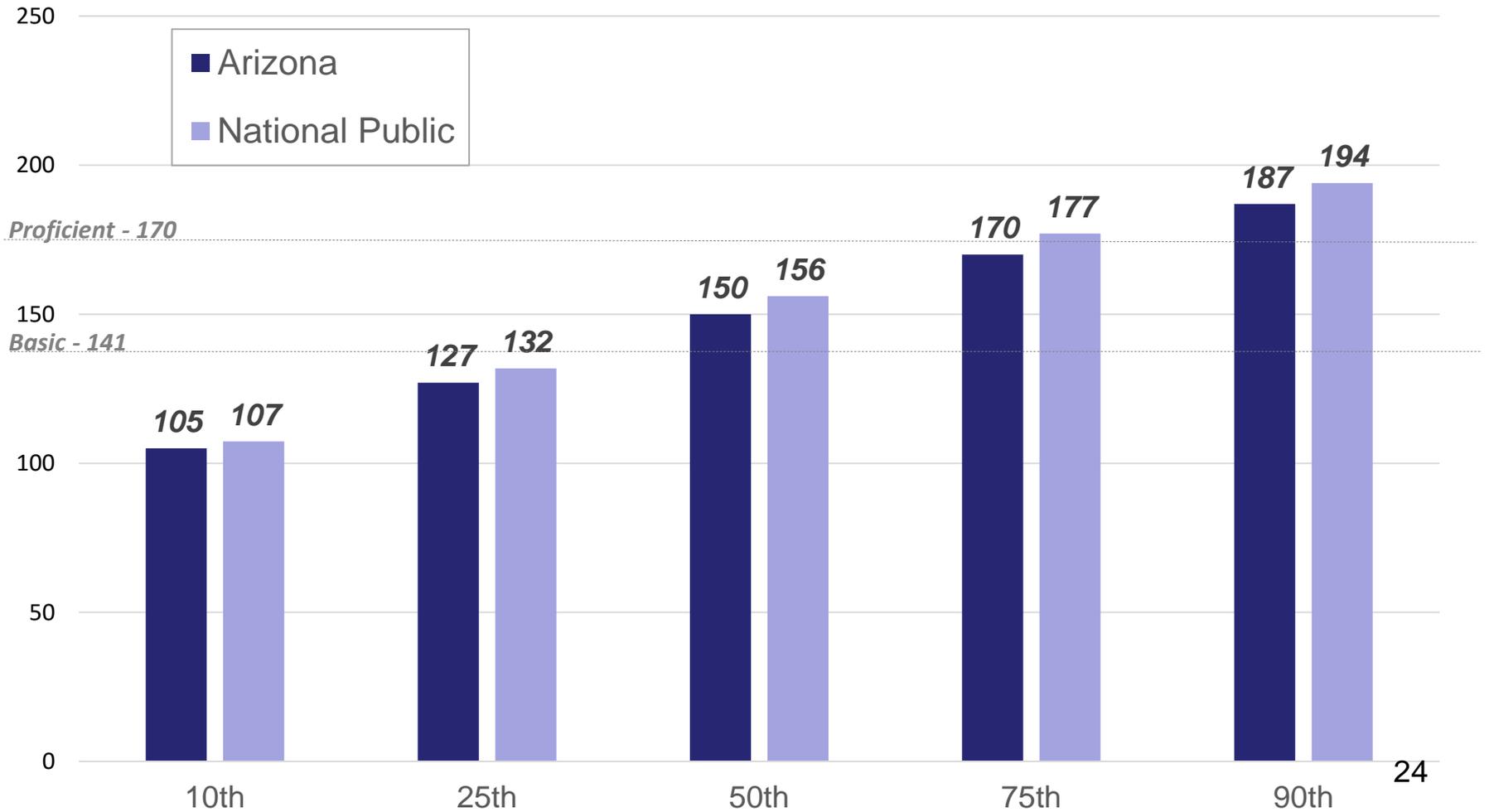


# Grade 8 Science Overall Growth 2009-2015

**NAEP Science Grade 8 – Overall**  
*Growth Score Points 2009 to 2015*

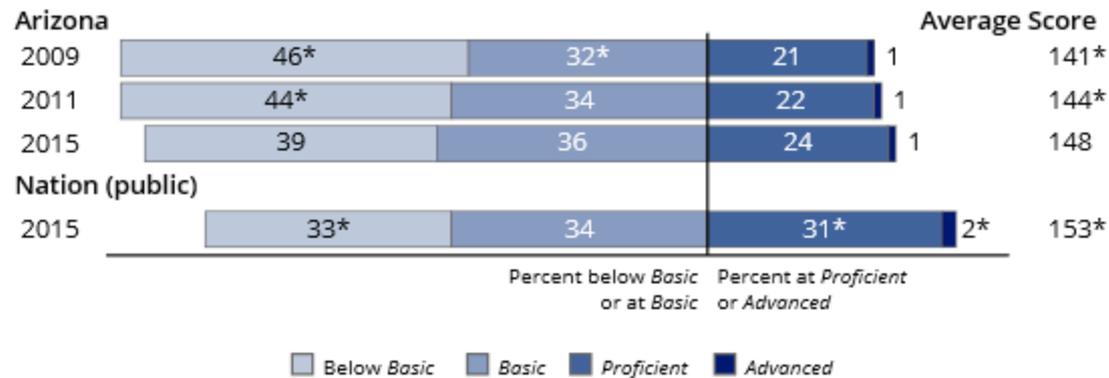


# Science - Grade 8 Percentiles: 2015



# Grade 8 Science Achievement Level Percentages 2009-2015

## Achievement-Level Percentages and Average Score Results

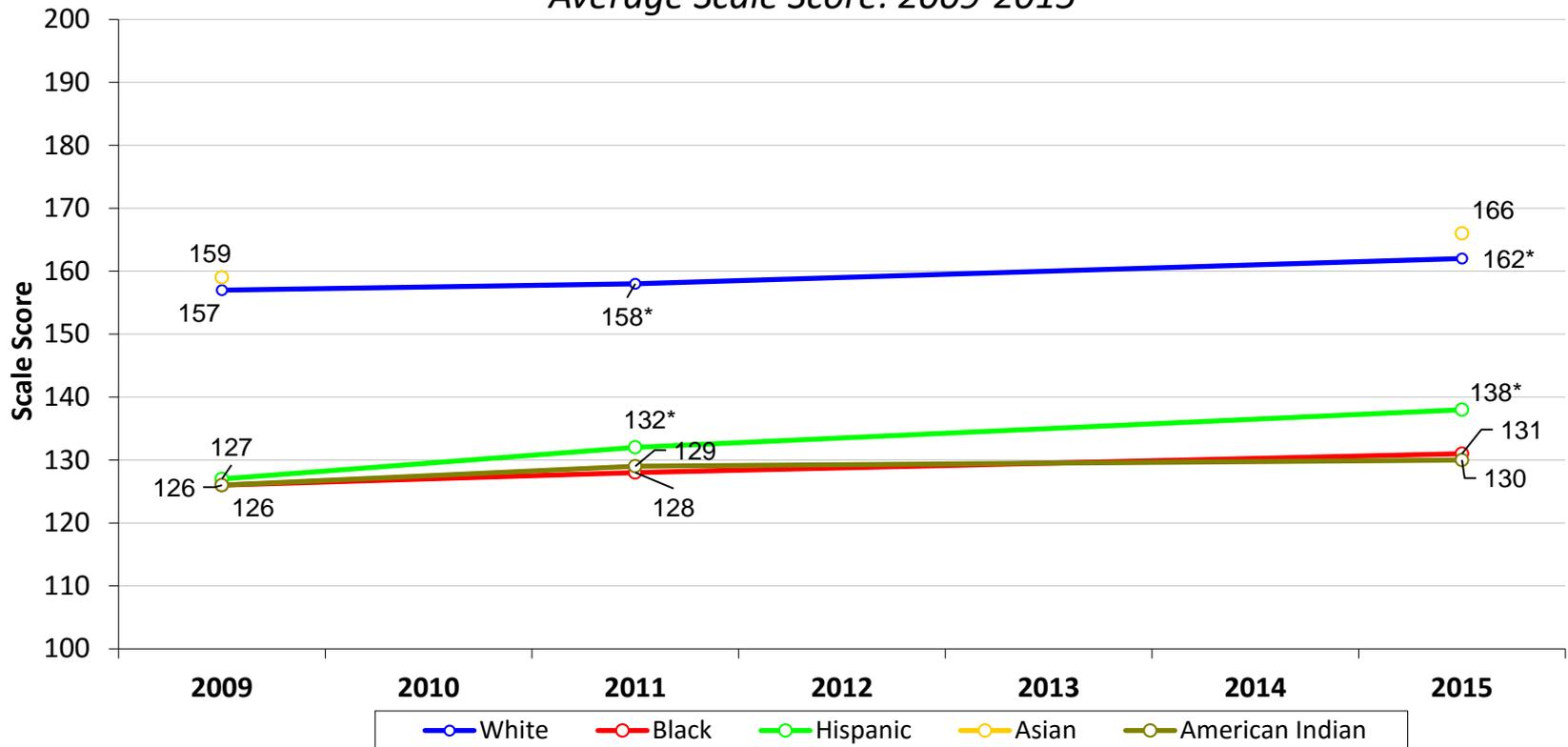


\* Significantly different ( $p < .05$ ) from state's results in 2015. Significance tests were performed using unrounded numbers.

NOTE: Detail may not sum to totals because of rounding.

# Grade 8 Scores by Race Ethnicity 2009-2015

**NAEP Science Grade 8 – Race/Ethnicity**  
*Average Scale Score: 2009-2015*

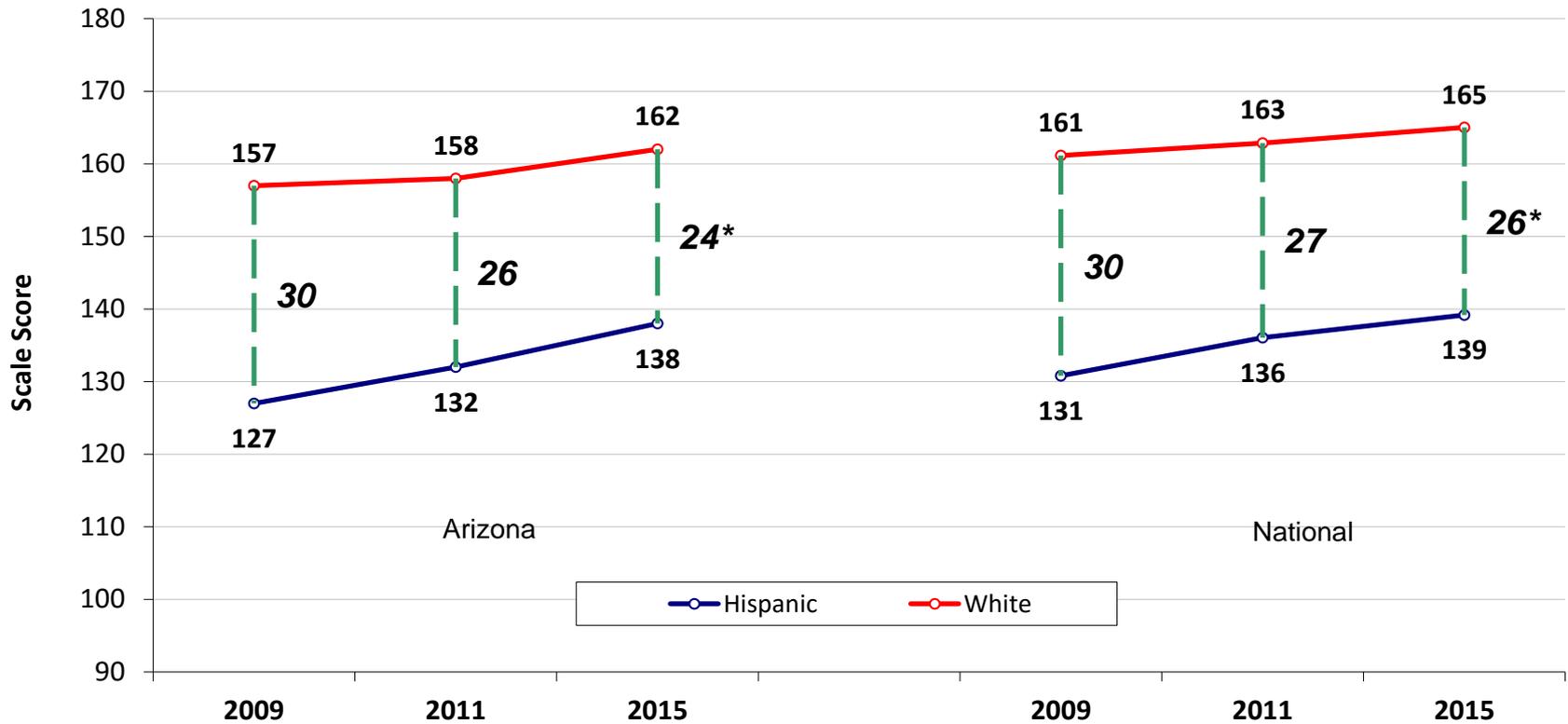


NOTE: The NAEP Science scale ranges from 0 to 300. \*Observed differences statistically significant at  $p < .05$ .

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress

# Closing of the White/Hispanic Gap Grade 8

**NAEP Science Grade 8 – White - Hispanic**  
*Gap - Average Scale Score: 2009-2015*



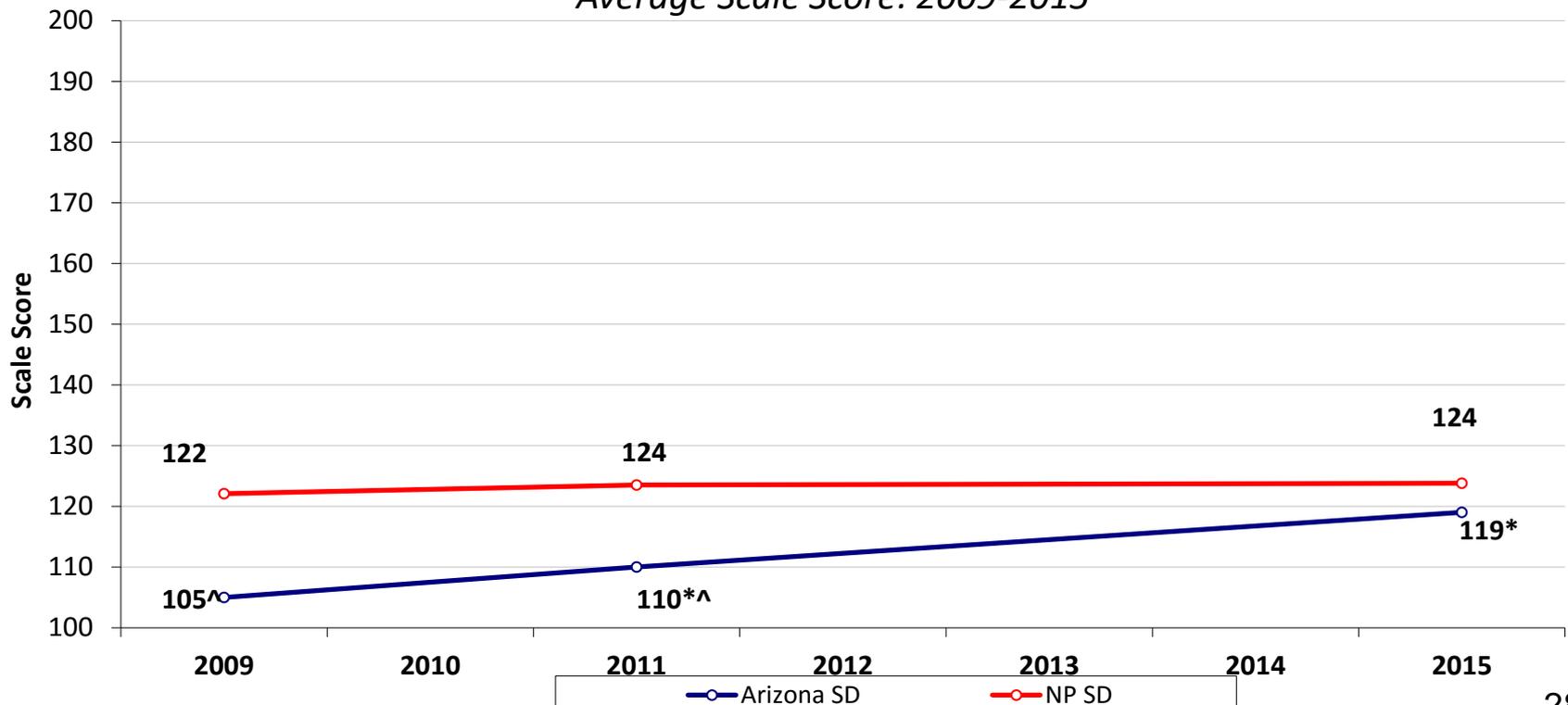
NOTE: The NAEP Science scale ranges from 0 to 300. \*Observed differences are statistically significant from 2009 at  $p < .05$ .

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP).

# Science Grade 8 Students with Disabilities

## NAEP Science Grade 8 – Students with Disabilities

*Average Scale Score: 2009-2015*

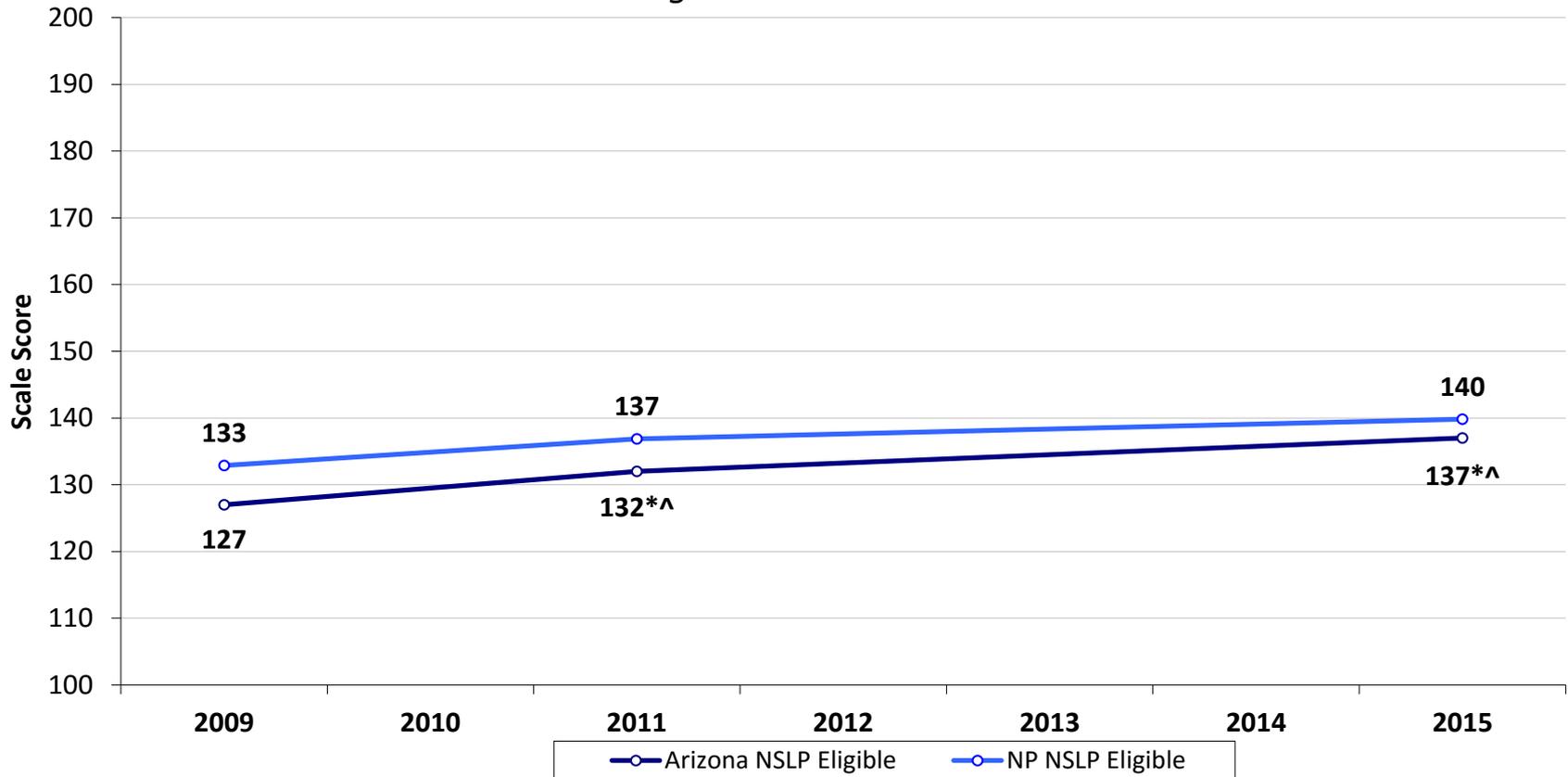


NOTE: The NAEP Science scale ranges from 0 to 300. \*Observed differences are statistically significant from AZ 2009. ^Observed differences are statistically different from National Public NP for the same year at P<.05

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP).

# Grade 8 Science Eligible School Lunch

**NAEP Science Grade 8 – National School Lunch Program Eligible**  
*Average Scale Score: 2009-2015*

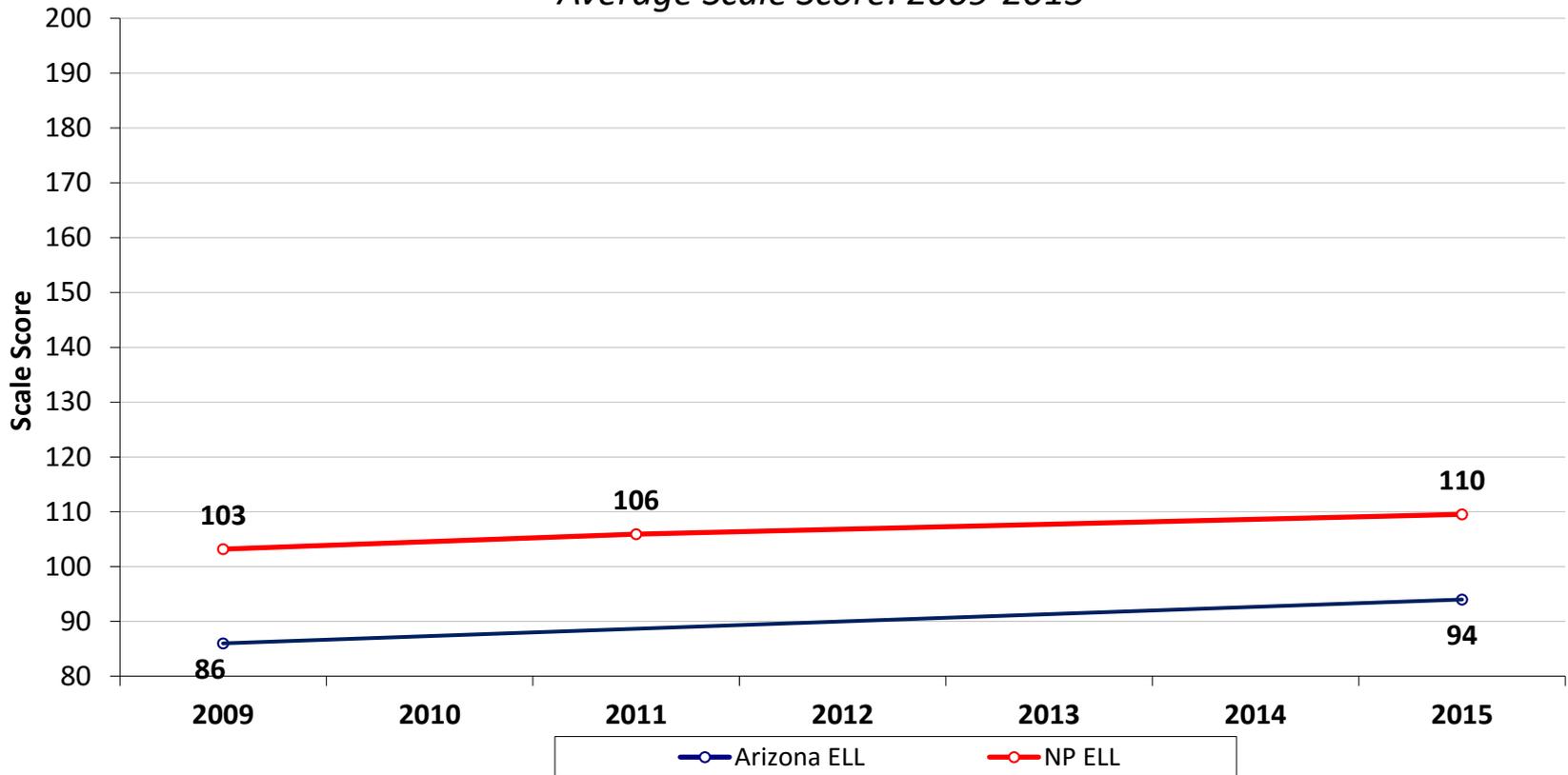


NOTE: The NAEP Science scale ranges from 0 to 300. \* Observed differences are statistically significant from AZ 2009. ^Observed difference are statistically significant from National Public NP for the same year at p<.05

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP)

# Grade 8 Science ELL

**NAEP Science Grade 8 – English Language Learners**  
*Average Scale Score: 2009-2015*

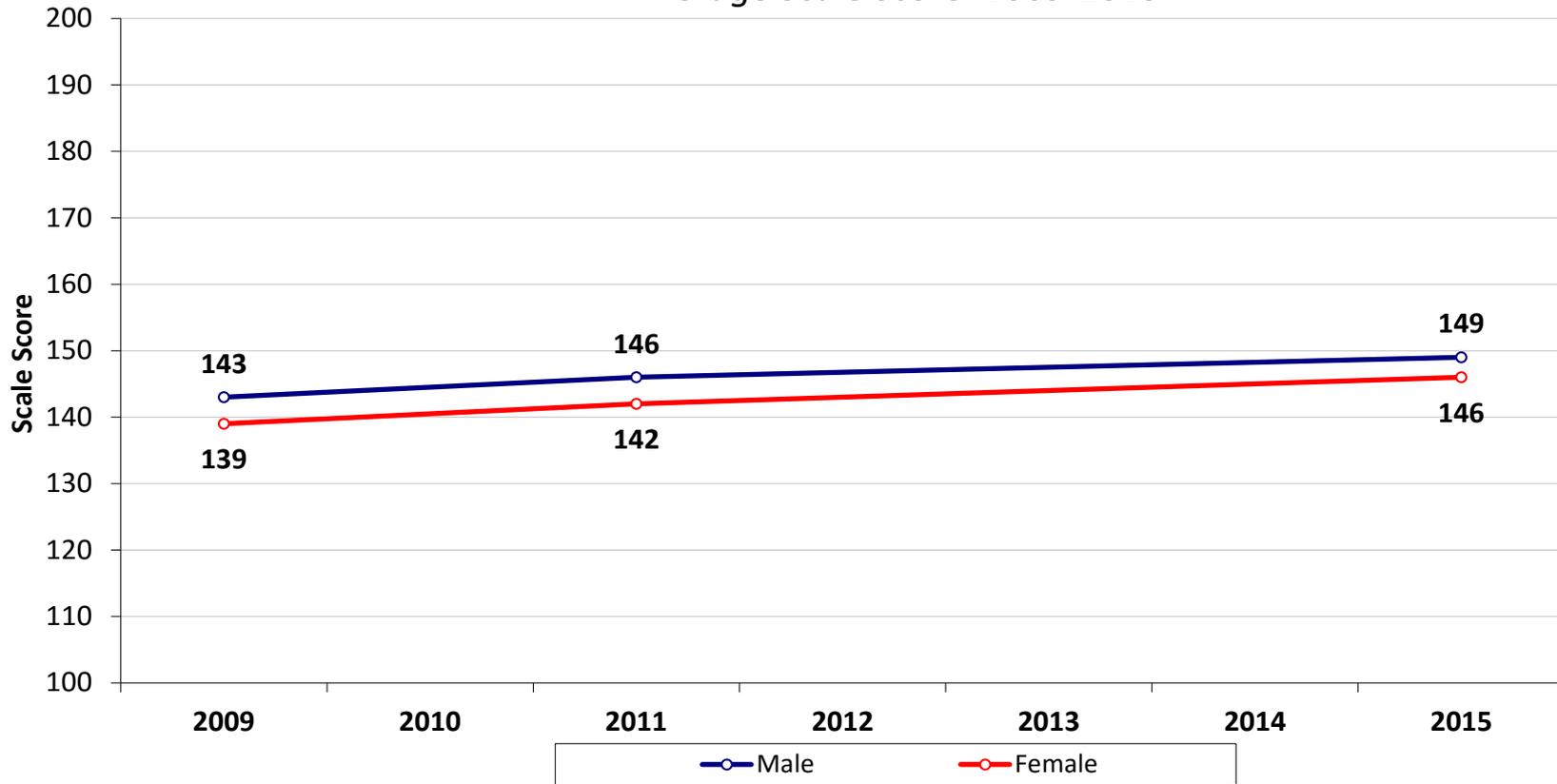


NOTE: The NAEP Science scale ranges from 0 to 300. Observed differences are not statistically significant at  $p < .05$ .

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP)

# Arizona Grade 8 Scores by Gender 2009-2015

**Arizona NAEP Science Grade 8 – Gender**  
*Average Scale Score: 2009-2015*

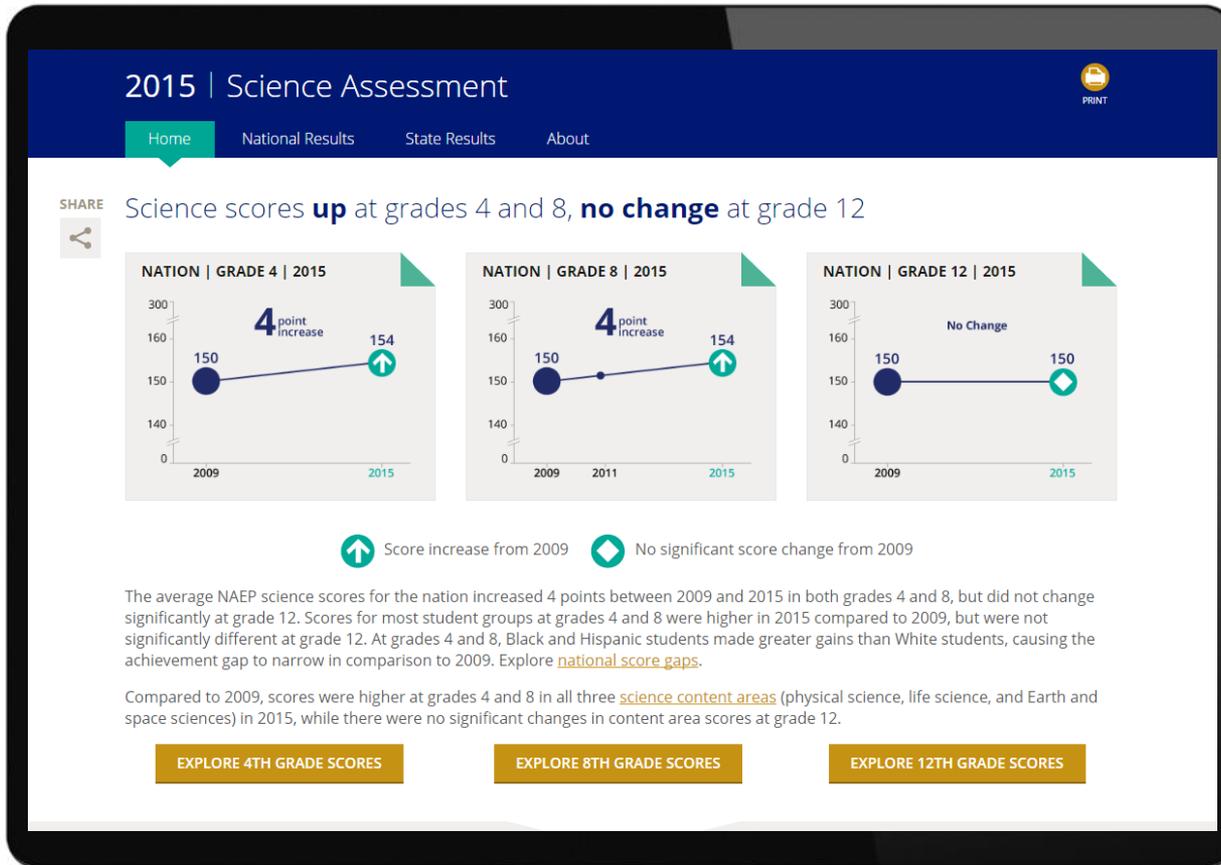


NOTE: The NAEP Science scale ranges from 0 to 300. Observed differences are not statistically different at  $p < .05$ .

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP).

- Grade 4 made the greatest score gains (11 pts) in the nation
- Score gains made at Grade 8 (6 pts) since 2009;
- National results only- no change at Grade 12
- Score gain also made at Grade 8 since 2011
- Percentages at or above *Proficient* higher at Grade 4 2009
- White–Hispanic achievement gap narrowed at Grade 8 compared to 2009
- There is no gender score gap in AZ at Grades 4 or 8

## Explore the results online <http://nationsreportcard.gov>



## Where do we want to go?

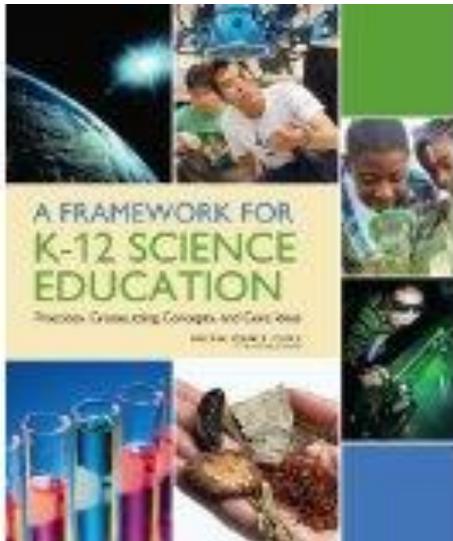
# What does this data tell us about science education in Arizona?

- Talk at your table:
  - What does the data indicate about the science at 4<sup>th</sup> grade?
  - Do you think this data is representative of what you would find in your school/district in elementary school?
  
  - What does the data indicate about the science at 8<sup>th</sup> grade?
  - Do you think this data is representative of what you would find in your school/district in middle school/ junior high?

## Continued Improvement

- Switch to a different table and talk about these questions.
  - How do Arizona schools continue to improve science education in their classrooms?
  - What strategies or instructional practices would have the greatest impact on science education in your schools?

## A Framework For K-12 Science Education



- Science instruction is for all students, K-12.
- Science instruction begins at the early grades and progresses to more sophisticated understandings at the higher grades.
- Students should engage in the three dimensions of science science and engineering practices, crosscutting concepts and disciplinary core ideas.

# How do we get there?

## 3-Dimensional Science Instruction

### A Framework for K-12 Science Education

#### Scientific and Engineering Practices

1. Asking questions and defining problems
2. Developing and Using Models
3. Planning and Carrying Out Investigations
4. Analyzing and Interpreting Data
5. Using Mathematics and Computational Thinking
6. Constructing Explanations and Designing Solutions
7. Engaging in Argument from Evidence
8. Obtaining, Evaluating, and Communicating Information

## Crosscutting Concepts

## Science and Engineering Practices

### A Framework for K-12 Science Education

#### Crosscutting Concepts

1. Patterns
2. Cause and effect
3. Scale, proportion and quantity
4. Systems and system models
5. Energy and matter
6. Structure and function
7. Stability and change

## A Framework for K-12 Science Education

### Disciplinary Core Ideas

#### Life Science

- LS1: From Molecules to Organisms: Structures and Processes
- LS2: Ecosystems: Interactions, Energy, and Dynamics
- LS3: Heredity: Inheritance and Variation of Traits
- LS4: Biological Evolution: Unity and Diversity

#### Physical Science

- PS1: Matter and Its Interactions
- PS2: Motion and Stability: Forces and Interactions
- PS3: Energy
- PS4: Waves and Their Applications in Technologies for Information Transfer

# Disciplinary Core Ideas

## A Framework for K-12 Science Education

### Disciplinary Core Ideas

#### Earth Science

- ESS1: From Molecules to Organisms: Structures and Processes
- ESS2: Ecosystems: Interactions, Energy, and Dynamics
- ESS3: Heredity: Inheritance and Variation of Traits
- ESS4: Biological Evolution: Unity and Diversity

#### Engineering , Technology and Applications of Science

- ETS1: Engineering Design
- ETS2: Links Among Engineering, Technology, Science and Society



# K-12 ACADEMIC STANDARDS

[Home](#) | [Standards](#) ▼ | [Content Area Resource Pages](#) ▼ | [Instructional Support](#) ▼ | [Webinars](#) | [About Us](#) | [Contact Us](#) |

## Three-Dimensional Science Instruction

The following documents provide guidance or examples for how to bundle objectives within Arizona's Science Standard for three-dimensional science instruction.

### Overview

- [FAQ – Implementing Arizona's Science Standard](#)
- [Comparison of Arizona's Science Standard to the vision of \*A Framework for K-12 Science Education\*](#)
- [Comparison of Arizona's Science Standard to the Science and Engineering Practices](#)
- [Comparison of Arizona's Science Standard to the Crosscutting Concepts](#)
- [Comparison of Arizona's Science Standard to the Disciplinary Core Ideas](#)

### Learning Progressions Documents

- [Learning Progressions for K-5 Science](#)
- [Learning Progressions for 6-12 Science](#)

### Three-Dimensional Science – Concept Organizer Template and Lessons

- [3-D Science Concept Organizer Template](#)
- [Grade K Example – Heredity](#)
- [Grade 3 Example: Light](#)
- [High School Earth Science Example: Climate Patterns](#)

### Three-Dimensional Science – Curriculum Analysis Template and Lessons

- [K-5 Science Curriculum Analysis Template](#)
- [6-12 Science Curriculum Analysis Template](#)
- [Kindergarten Example: Life Cycles \(Heredity\)](#)
- [Grade 3 Example: Light](#)
- [Grade 4 Example: Earth's Processes](#)
- [Grade 8 Example: Chemical Reactions](#)
- [HS Chemistry Example: Rate of Reactions](#)
- [HS Biology Example: Adaptations](#)
- [HS PS Example: Energy of Pendulums](#)
- [HS ES Example: Climate Patterns](#)

<http://www.azed.gov/standards-practices/academic-standards/science/>

# Science Standards Review Process

- Public feedback on the current Science Standard is open until December 3, 2016.
- ADE is accepting application for K-12 educators as well as higher education faculty in science education and science to participate in the science standard review process.
- Review committee work will begin in early spring of 2017 and go through the fall of 2017. We estimate the draft of the standards could go to the State Board of Education by spring of 2018.
- Science is most likely looking at 2 year transition with full implementation and new assessment during year 3, which would be the 2020/21 school year (assessment spring 2021).



## K-12 Standards Section

### Arizona Science and Social Studies Standards Review

The State Board of Education and the Arizona Department of Education have opened the process of collecting public comments on Arizona’s Science Standard (approved 2004) and Arizona’s Social Studies Standard (approved 2005). We invite you to review these two standards and submit comments by completing a survey in each content area. This survey is designed to obtain the comments of educators, parents, students, businesses, policy makers, and the public to help inform Arizona educators during the upcoming revision of Arizona’s Science Standard and Arizona’s Social Studies Standard so the revised standards represent the best standards for Arizona students, teachers, and families.

Standards outline what a student needs to know, understand, and be able to do by the end of each grade. Standards build across grade levels in a progression of increasing understanding and through a range of cognitive demand levels. Standards are adopted at the state level by the State Board of Education (A.R.S. §§15-701 and 15-701.01). Arizona retains authority to approve and modify academic standards; there is no federal law requiring the adoption of specific standards.

Curriculum includes all the resources used for teaching and learning the standards (textbooks, reading material, lesson plans). Curriculum is adopted at a local level by districts and schools. Neither the State Board nor the Arizona Department of Education (ADE) has the authority to adopt or mandate school curriculum. Under A.R.S. §§15-721 and 15-722, local governing boards (both district and charter) have the sole authority to adopt curriculum via public meetings, allowing for community input regarding what instructional materials are used in classrooms.

Each survey is to provide feedback on the existing Science or Social Studies Standard; it does not ask about locally adopted curriculum. Each survey asks for feedback in 3 major areas: respondent demographics, depth and breadth of the grade level standards, and content and rigor of K-12 learning progressions. After this 60 day public review period closes on December 3, 2016, a state-wide committee of educators from each content area will review your responses and consider this feedback during the development of the revised standards.

▶ Science Standard and Survey

▶ Social Studies Standard and Survey

#### Science Survey Responses and Comments

▶ Depth and Breadth of the Science Standard By Grade Level

▶ Content and Rigor of K-12 Learning Progressions

#### Social Studies Survey Responses and Comments

▶ Depth and Breadth of the Social Studies Standard By Grade Level

▶ Content and Rigor of K-12 Learning Progressions

K-12 Application

Higher Ed Application

# ADE Science/STEM PD Sessions



Scan the QR code or  
click the link below for a  
full list of available  
Science/STEM PD from  
the ADE!

<https://ems.azed.gov//home/SearchResults?SearchString=k12-as-sci>

# Science Think Tank Session Agenda

- Where are we now? NAEP 2015 Science Results
- Where do we want to go? Table Discussions
- How do we get there? Framework/New Arizona Science Standards

# Questions? Thoughts?

## Contact Information

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