

Idaho K-12 Achievement and Spending, 2000-2013

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The 2014 election season in Idaho enjoyed considerable discussion and debate about the adequacy of K-12 public school achievement and state education spending. This paper reported Idaho vs. national NAEP results for 2003-2013, and Idaho vs. national per-pupil spending for 2000-2011 to help inform the discussion.

[1]. Idaho K-12 Achievement 2003-2013

Six years of Idaho and national NAEP reading and mathematics results from grades 4 and 8 for three student groups (i.e., All Students, White Students and Hispanic Students) were analyzed. These data, expressed as percentile ranks, provided 24 Idaho vs. national snapshots of achievement for each of the three groups.

Results (Narratives and Exhibits)

Idaho's All Students group had a percentile rank that was higher than the All Students group in the nation's public schools 83 percent of the time. By contrast, Idaho's White Students had a percentile rank higher than White Students in the nation's public schools zero (0) percent of the time, while Idaho Hispanic Students had a higher percentile rank higher than their Hispanic peers in the nation's public schools eight (8) percent of the time.

NAEP Reading, Grade 4 [Exhibit 1]

- Idaho's All Students group in grade 4 scored *higher* in reading than their national peers in 2003 through 2009, but not in 2011 or 2013.
- Idaho's White Students in grade 4 scored *lower* in reading than their national peers all six years, 2003-2013.
- Idaho's Hispanic Students in grade 4 scored *lower* in reading than their national peers all six years, 2003-2013.

NAEP Reading, Grade 8 [Exhibit 2]

- Idaho's All Students group in grade 8 scored *higher* in reading than their national peers all six years, 2003-2013.
- Idaho's White Students in grade 8 scored *lower* in reading than their nation peers all six years, 2003-2013.
- Idaho's Hispanic Students in grade 8 scored *higher* in reading than their national peers in 2005 and 2011, but not in 2003, 2007, 2009, or 2013.

NAEP Mathematics, Grade 4 [Exhibit 3]

- Idaho's All Students group in grade 4 scored *higher* in mathematics than their national peers in 2003 through 2009, but not in 2011 or 2013.
- Idaho's White Students in grade 4 scored *lower* in mathematics than their national peers all six years, 2003-2013.
- Idaho's Hispanic Students in grade 4 scored *lower* in mathematics than their national peers each year except 2005, when Idaho Hispanics matched their national peers.

NAEP Mathematics, Grade 8 [Exhibit 4]

- Idaho's All Students group in grade 8 scored *higher* in mathematics than their national peers all six years, 2003-2013.
- Idaho's White Students in grade 8 scored *lower* in mathematics than their nation peers all six years, 2003-2013.
- Idaho's Hispanic Students in grade 8 scored *lower* in mathematics than their national all six years.

Graphs displaying the percentile ranks for the three student groups' by NAEP reading and mathematics at grades 4 and 8 are presented in Exhibits 1 through 4:

- Exhibit 1 displays NAEP reading, grade 4, for 2003 through 2013.
- Exhibit 2 displays NAEP reading, grade 8, for 2003 through 2013.
- Exhibit 3 displays NAEP mathematics, grade 4, for 2003 through 2013.
- Exhibit 4 displays NAEP mathematics, grade 8, for 2003 thorough 2013.O

Simpson's Paradox

Bracey¹ has pointed out how statements about student achievement that might begin with "Statistics show . . ." need to be carefully examined. Simpson's Paradox is a phenomenon in which subgroups show one trend and the aggregate of all subgroups show another. In other words, what is true for the parts (i.e., White or Hispanic students) is not necessarily true for the whole (i.e., All students); hence the paradox. In standardized testing, the paradox frequently crops up when one tries to calculate "national average" scores or "state average" scores. Statistics ... is a tricky business, and as Simpson's Paradox suggests, things are not always as straightforward as them seem. Paradoxical, isn't it?

One must note from the above data narratives and graphs that Simpson's Paradox runs rampant among Idaho's NAEP results. Idaho's achievement results for All Students (the only NAEP results typically reported to the public) have been more positive than those for our White Students or Hispanic Students.

¹ Bracey, G.W. (2004, February). Simpson's paradox and other statistical mysteries. *American School Board Journal*. Available online at <http://www.asbj.com/MainMenuCategory/Archive/2004/February>

Exhibit 1. NAEP Reading, Grade 4, 2003-2013. Percentile ranks for three Idaho student groups vs. their peers in the nation's public schools: All Students, White Students and Hispanic Students.

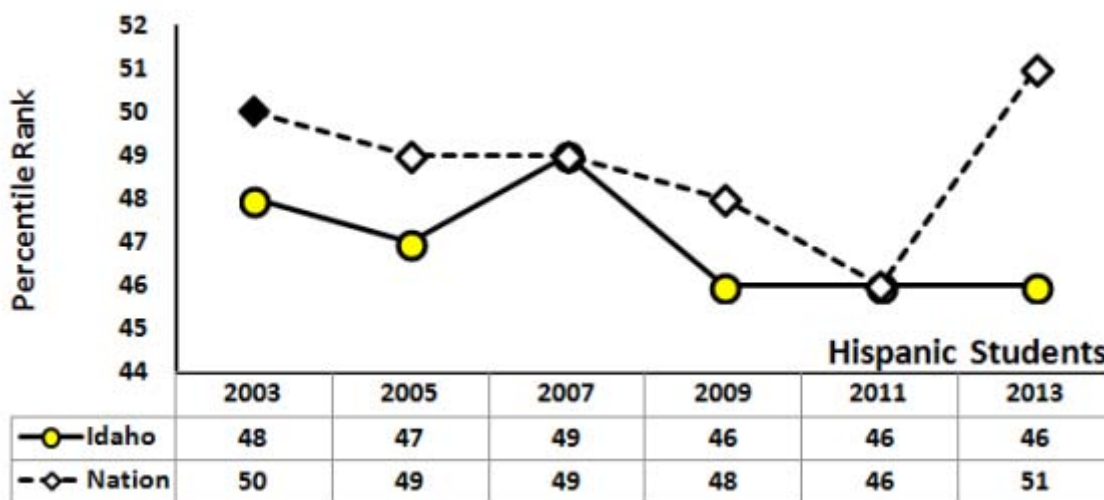
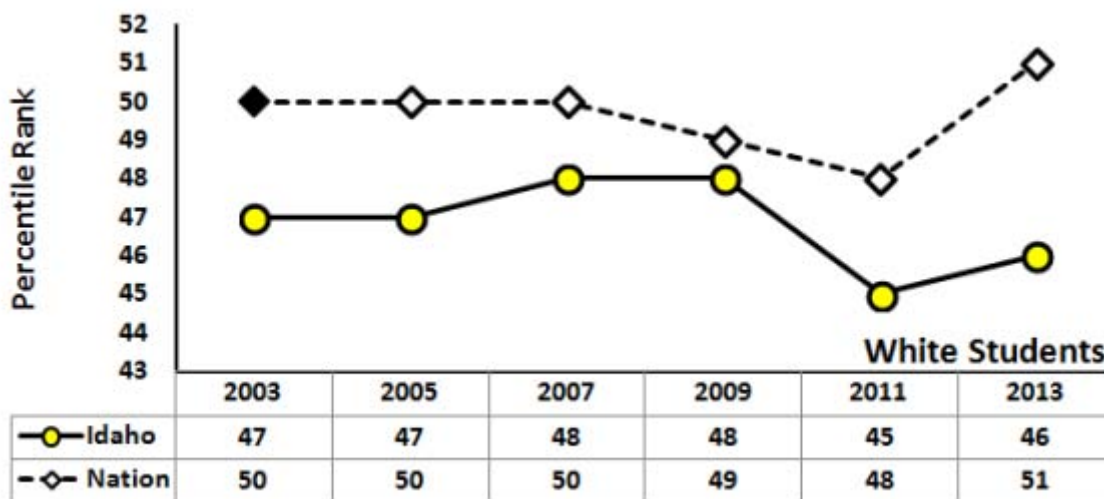
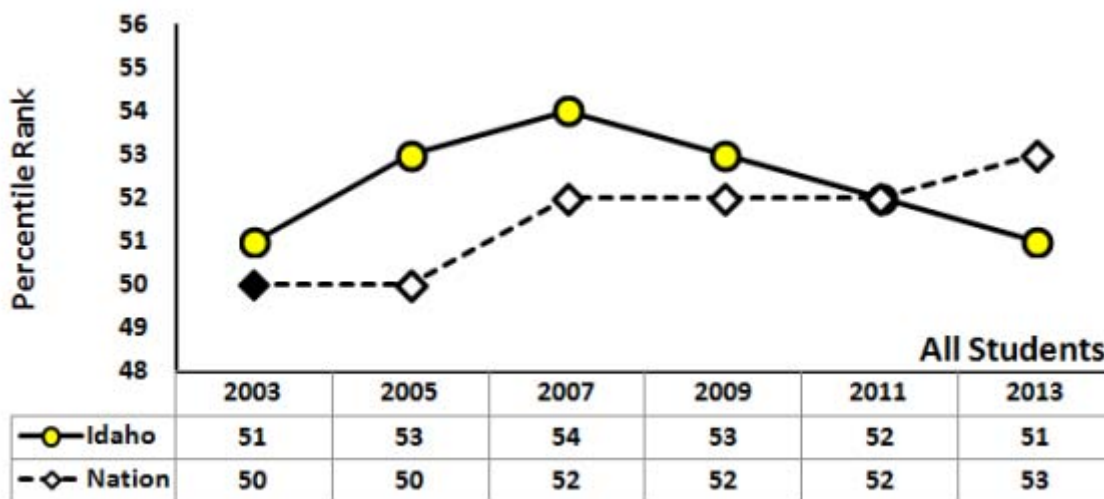


Exhibit 2. NAEP Reading, Grade 8, 2003-2013. Percentile ranks for three Idaho student groups vs. their peers in the nation's public schools: All Students, White Students and Hispanic Students.

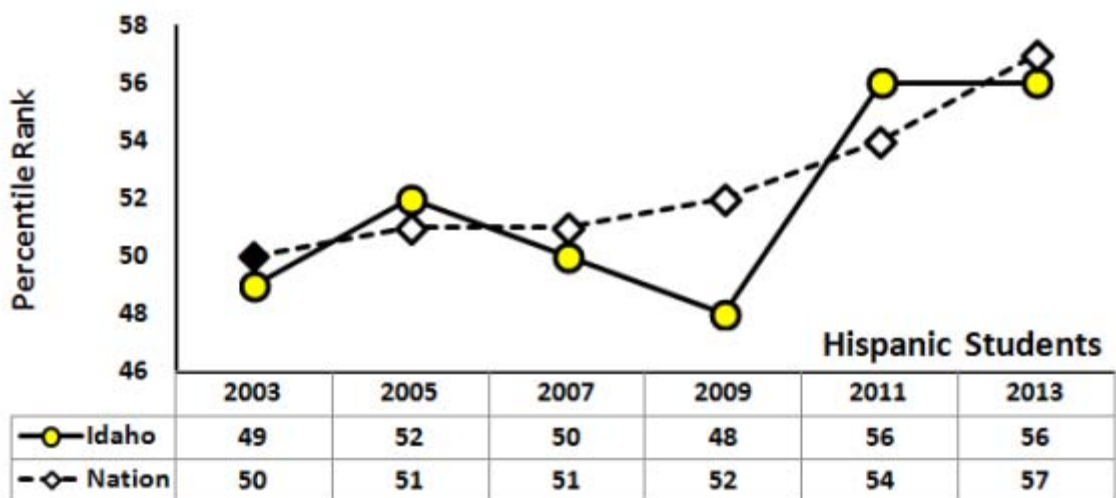
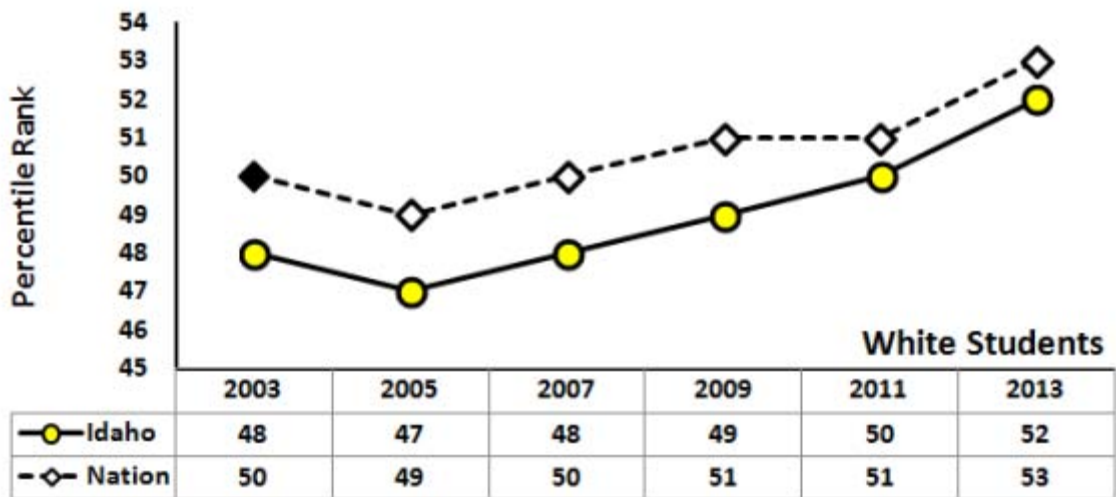
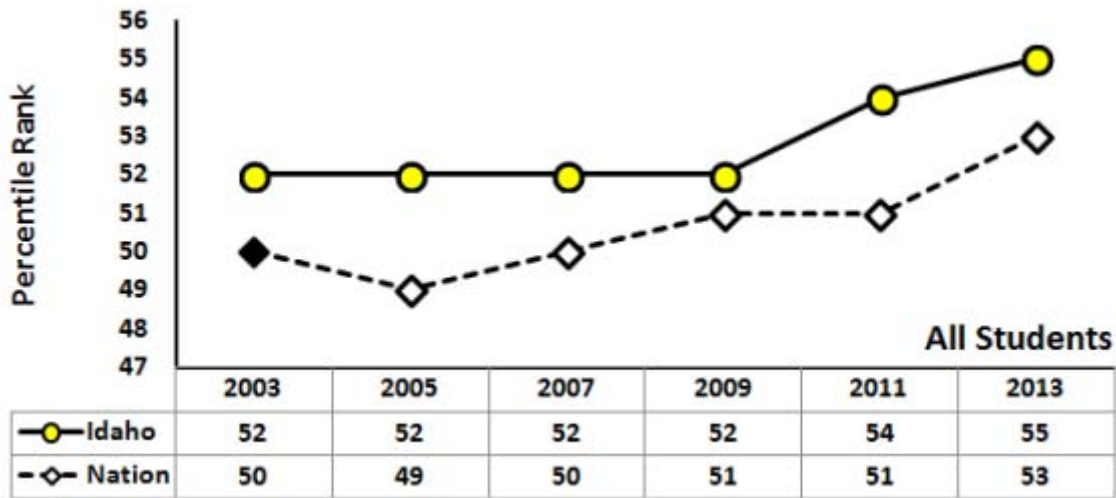


Exhibit 3. NAEP Mathematics, Grade 4, 2003-2013. Percentile ranks for three Idaho student groups vs. their peers in the nation's public schools: All Students, White Students and Hispanic Students.

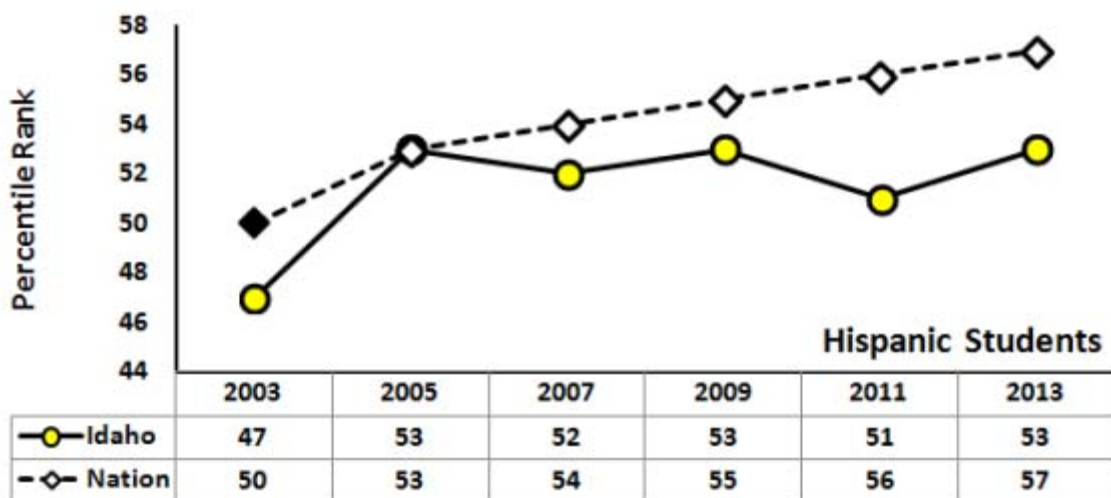
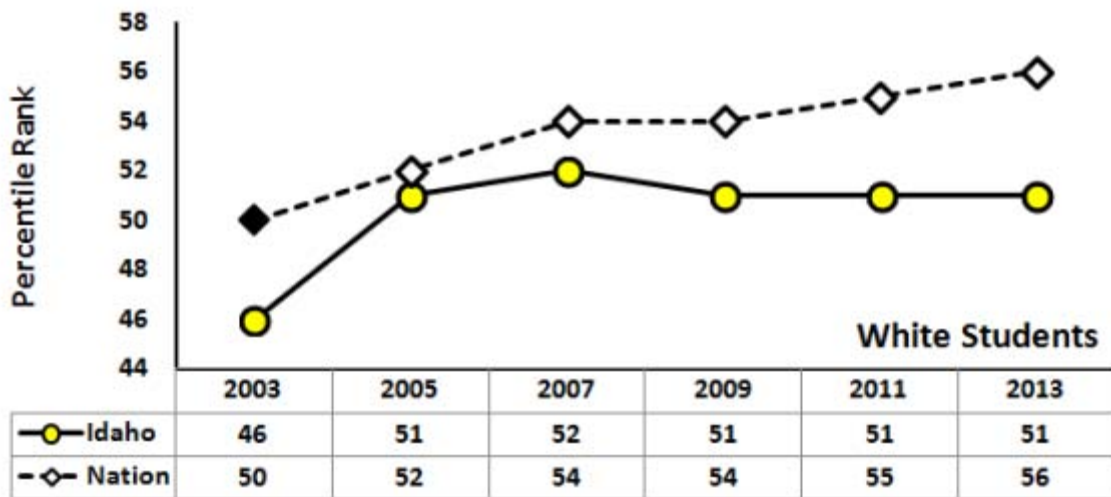
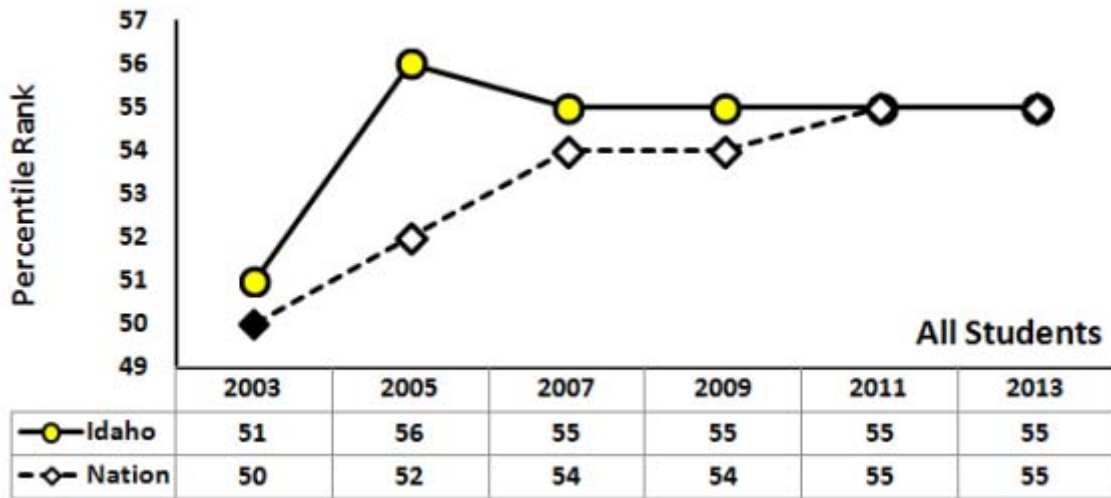
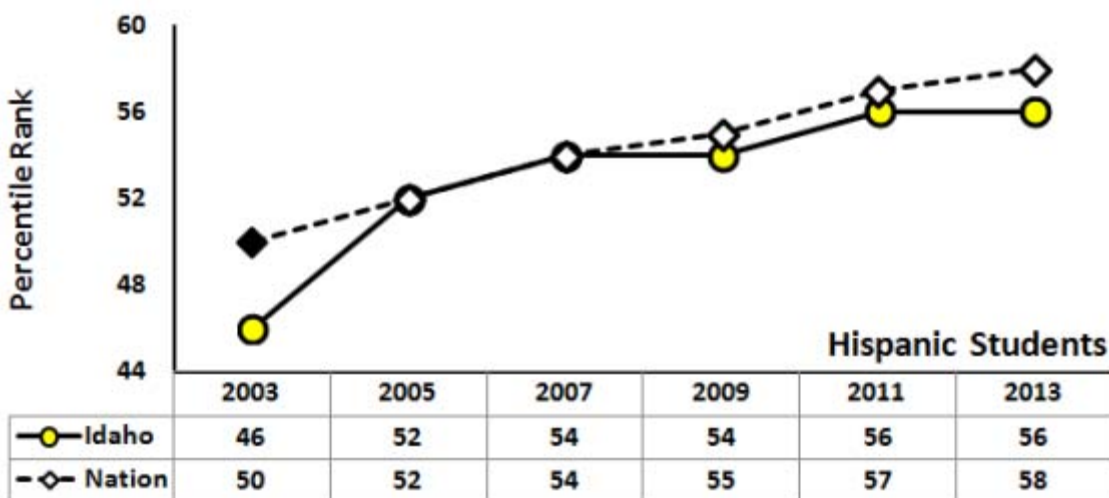
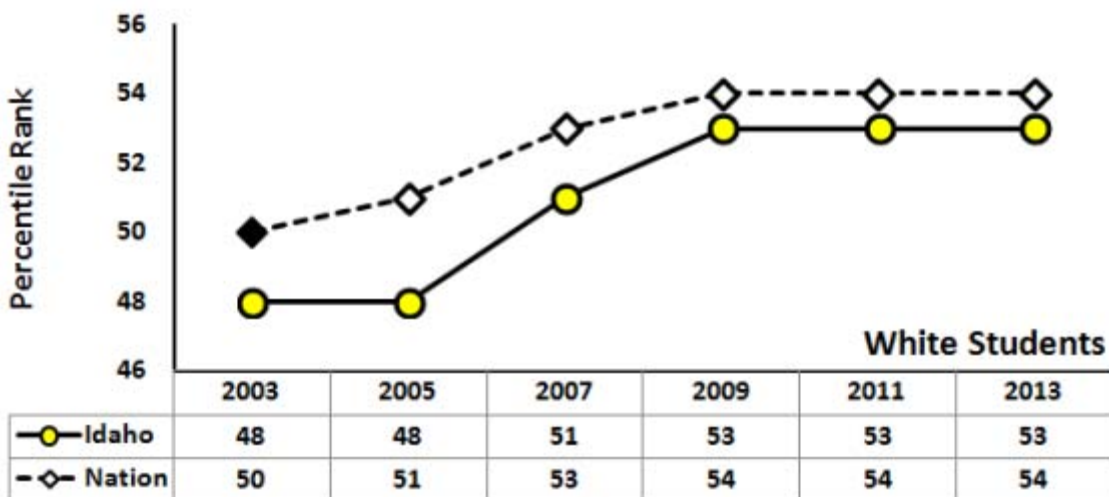
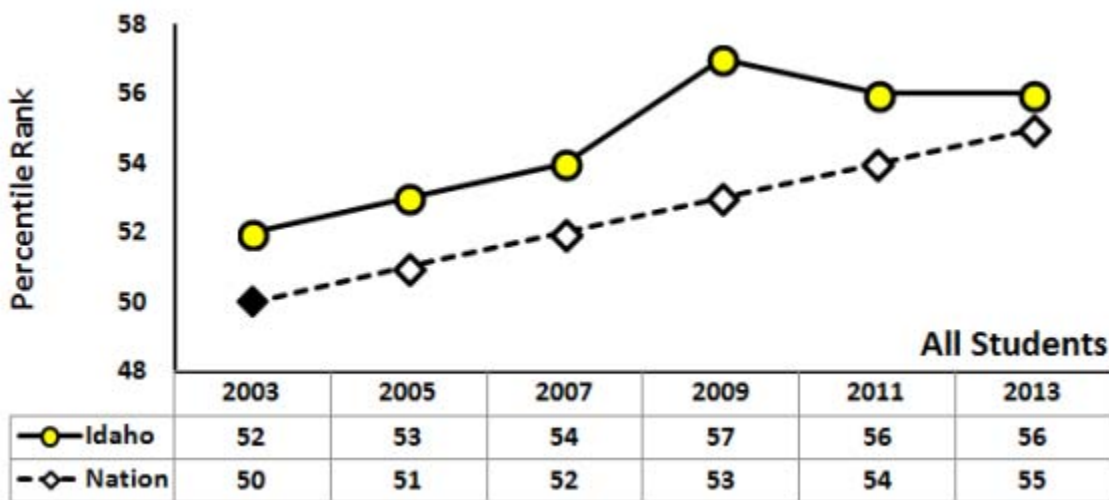


Exhibit 4. NAEP Mathematics, Grade 8, 2003-2013. Percentile ranks for three Idaho student groups vs. their peers in the nation's public schools: All Students, White Students and Hispanic Students.



Percentile Ranks

A percentile rank of 56 for Idaho, for example, would mean that the average student in Idaho scored higher than 56 percent of the students in the nation's public schools on "that test" at "that grade level" in 2003, i.e., the national norm group.

The percentile rank is an "effect size" statistic, so no claims about statistical significance were made in this memorandum. Whether an effect size is meaningful is in the eye of the beholder. Some might consider a difference of one point between two percentile ranks (e.g., 47 vs. 48) to be trivial, of no consequence. Others might consider that one point represents one percent of the students in the nation's public schools at that grade in 2003, a meaningful difference.

Narratives describing NAEP percentile rank results should identify the jurisdiction (nation or Idaho), the grade (4 or 8), the subject (reading or mathematics), the year (2003 to 2013), and the student demographic group (All Students, White Students, or Hispanic Students).

Norm Groups

Students in the nation's public schools in 2003 were selected at the norm group for each grade, subject, and student group. For example, three national norm groups were identified for fourth grade reading: one for All Students, one for White Students, and one for Hispanic Students. In total, there were 12 norm groups for this analysis. National and Idaho percentile ranks related to each norm group were plotted on a separate graph in Exhibits 1-4.

In Exhibits 1-4, the norm group percentile rank is a solid black diamond. It serves as a "standard" against which all other percentile ranks may be compared. Thus, achievement trends for the nation and for Idaho may be observed from 2003 to 2013.

Calculating a Percentile Rank

The percentile rank is a complex transformation of the standard score (i.e., z-score). The Excel spreadsheet was used to calculate percentile ranks in a two steps. First, the z-score is the difference between the focus group and norm group averages divided by the standard deviation of the norm group:

$$z\text{-score} = \frac{\textit{Average}_{\textit{Focus Group}} - \textit{Average}_{\textit{Norm Group}}}{\textit{Standard Deviation}_{\textit{Norm Group}}}$$

Then this Excel equation converted the z-score into a percentile rank:

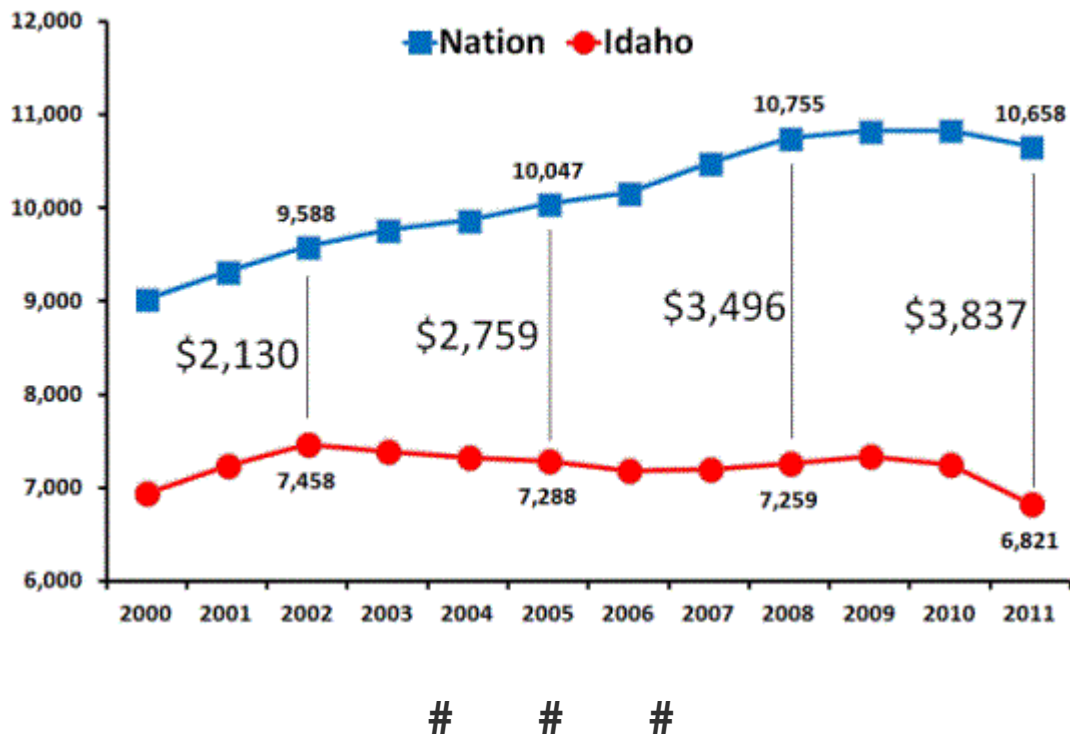
$$\textit{Percentile Rank} = \textit{TRUNC}(100 * \textit{NORMSDIST}(z\text{-score}))$$

[2]. Idaho K-12 Spending 2000-2011

Exhibit 5 shows in constant 2011 dollars (i.e., inflation-adjusted dollars):

- The recession that hit Idaho and the nation in 2008, actually hit the Idaho K-12 public education community in 2002.
- Idaho's average K-12 per pupil expenditure was \$2,130 below the national average in 2002, \$2,759 below in 2005, \$3,496 below in 2008, and \$3,837 below in 2011. The deficit increased over 80% between 2002 and 2011.
- Nationwide schools spent \$10,658 per K-12 pupil in 2011, which was \$97 less than in 2008, but \$1,070 more than in 2002.
- Idaho schools spent \$6,821 per K-12 pupil in 2011, which was \$438 less than in 2008, and \$637 less than in 2002.

Exhibit 5.² Idaho vs. national inflation-adjusted current per pupil spending for public K-12 education for fiscal years 2000 to 2011.



² Cornman, S.Q. (2013). *Revenues and Expenditures for Public Elementary and Secondary Education: School Year 2010–11 (Fiscal Year 2011) (NCES 2013-342)*. Washington, D.C.: National Center for Education Statistics, U.S. Department of Education. Available online at <http://nces.ed.gov/pubs2013/2013342.pdf>

Author's Notes



Bert Stoneberg was Idaho's NAEP State Coordinator from 2002 to 2012. He is retired, but continues research and independent consulting in issues related to K-12 measurement and evaluation, and school reform in Idaho.

He maintains <http://k12researchidaho.com/> to share his work with interested persons. The site is not glitzy, but it does have information about NAEP and other test results and education issues of interest to Idahoans not available elsewhere.

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