M.E.M.O.R.A.N.D.U.M

From: Bert Stoneberg, Ph.D.
Date: September 10, 2014
RE: Idaho K-12 Achievement and Spending, 2000-2013

The current election season in Idaho has considerable discussion/debate about the adequacy of K-12 public school achievement and state spending. This memorandum examines Idaho vs. national NAEP results for 2003-2013, and Idaho vs. national per–pupil spending for 2000-2011 that should contribute to 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

- **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

- **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

- **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

- **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**

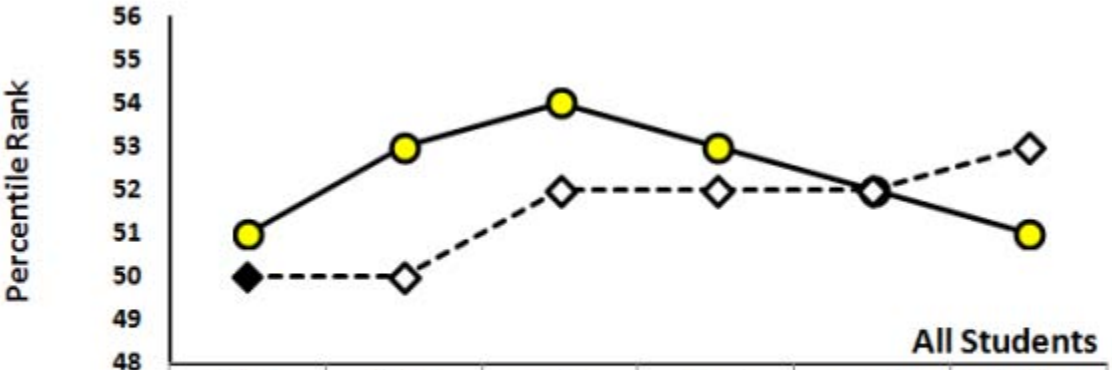
Simpson's Paradox

Bracey[1] 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?

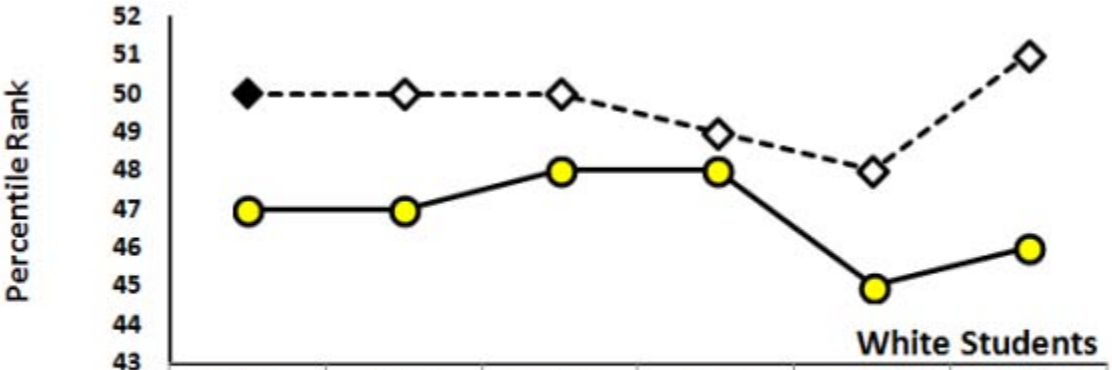
One must note from the above data narratives and graphs that Simpson's Paradox runs rampant among Idaho's NAEP results. Idaho's achievement results for All Students {the only NAEP results typically reported to the public) have been more positive than those for our White Students or Hispanic Students.

[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

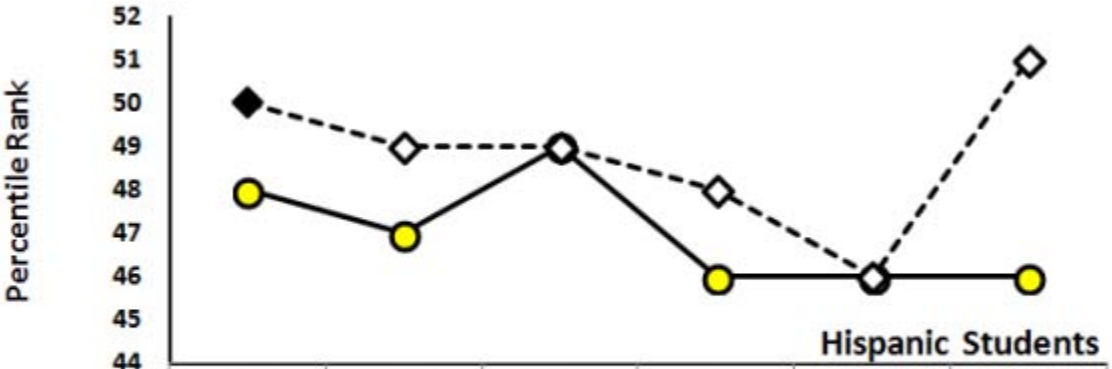
Exhibit 1. NAEP Reading, Grade 4, 2003-2013. Percentile ranks for three Idaho student groups vs. their peers in the nation's public schools: All Students, White Students and Hispanic Students.



	2003	2005	2007	2009	2011	2013
Idaho	51	53	54	53	52	51
Nation	50	50	52	52	52	53



	2003	2005	2007	2009	2011	2013
Idaho	47	47	48	48	45	46
Nation	50	50	50	49	48	51



	2003	2005	2007	2009	2011	2013
Idaho	48	47	49	46	46	46
Nation	50	49	49	48	46	51

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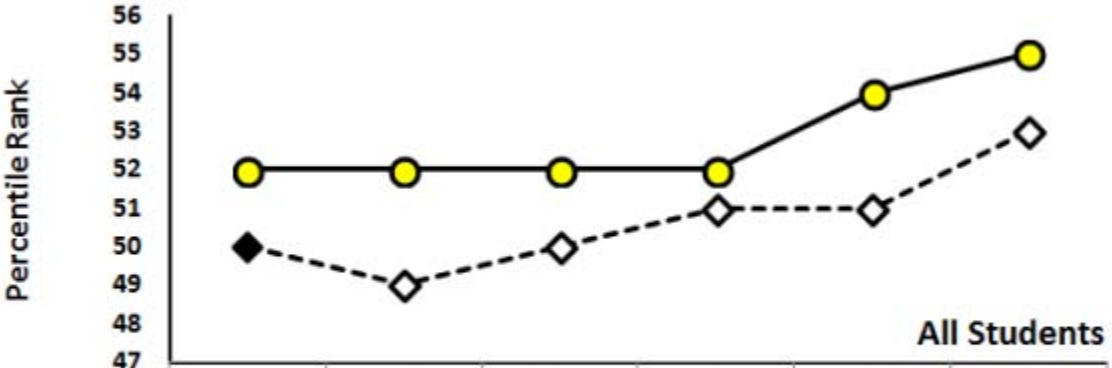
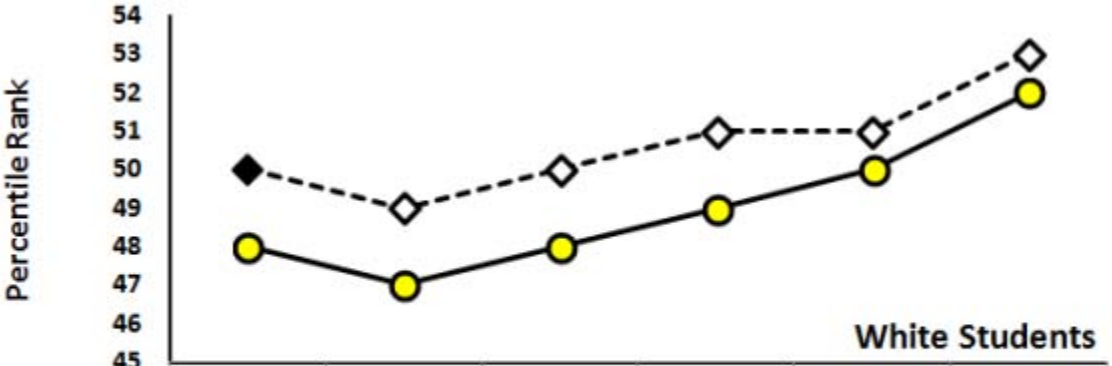
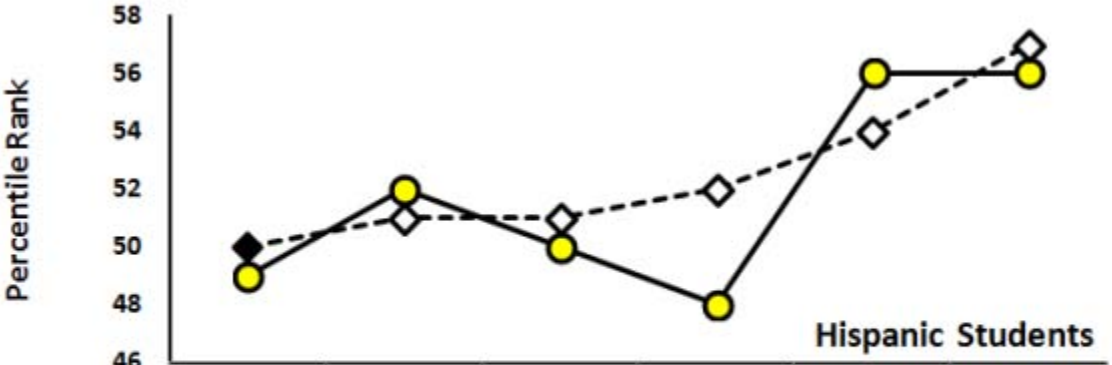
Exhibit 2. NAEP Reading, Grade 8, 2003-2013. Percentile ranks for three Idaho student groups vs. their peers in the nation's public schools: All Students, White Students and Hispanic Students.



	2003	2005	2007	2009	2011	2013
Idaho	52	52	52	52	54	55
Nation	50	49	50	51	51	53

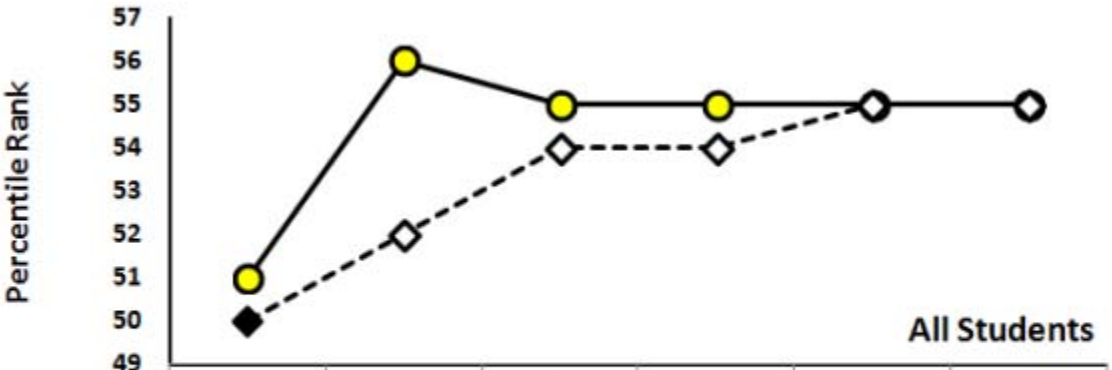


	2003	2005	2007	2009	2011	2013
Idaho	48	47	48	49	50	52
Nation	50	49	50	51	51	53

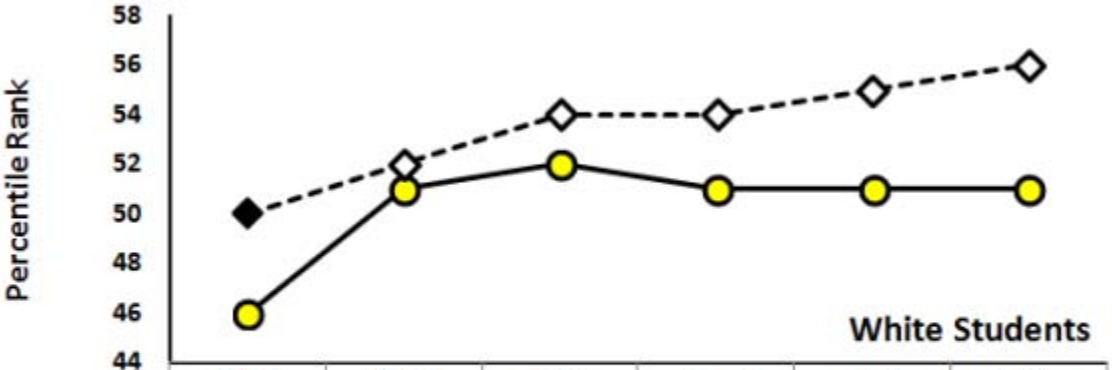


	2003	2005	2007	2009	2011	2013
Idaho	49	52	50	48	56	56
Nation	50	51	51	52	54	57

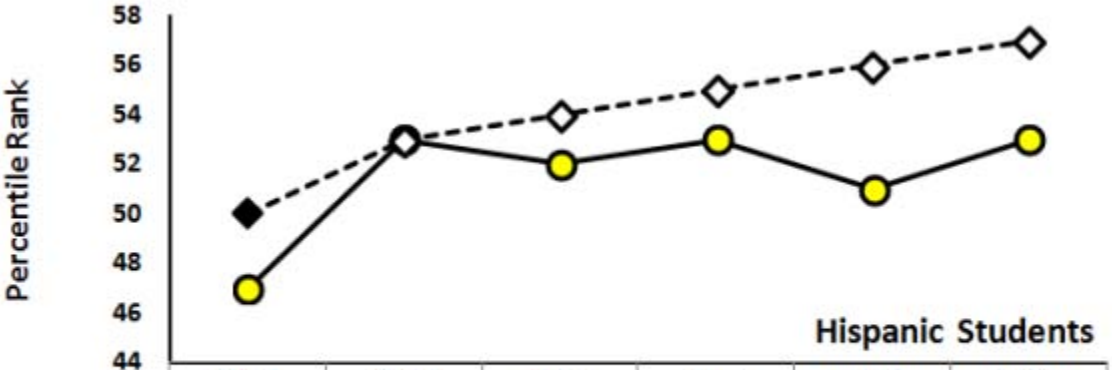
Exhibit 3. NAEP Mathematics, Grade 4, 2003-2013. Percentile ranks for three Idaho student groups vs. their peers in the nation's public schools: All Students, White Students and Hispanic Students.



	2003	2005	2007	2009	2011	2013
Idaho	51	56	55	55	55	55
Nation	50	52	54	54	55	55

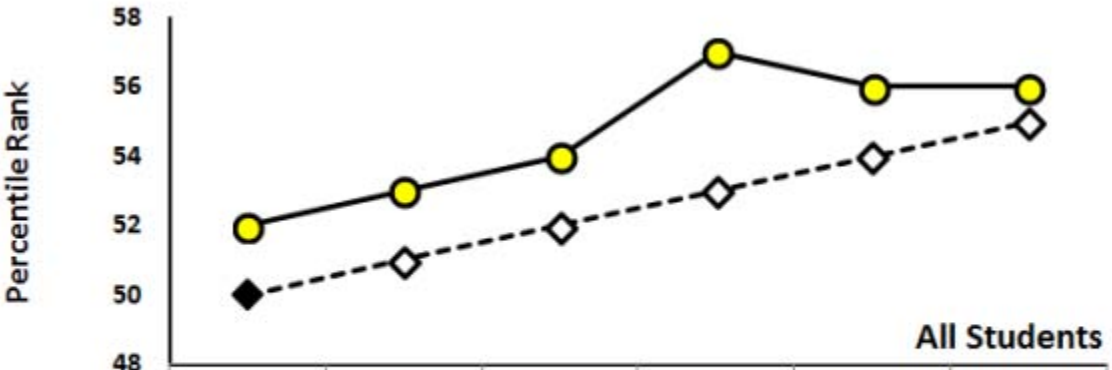


	2003	2005	2007	2009	2011	2013
Idaho	46	51	52	51	51	51
Nation	50	52	54	54	55	56

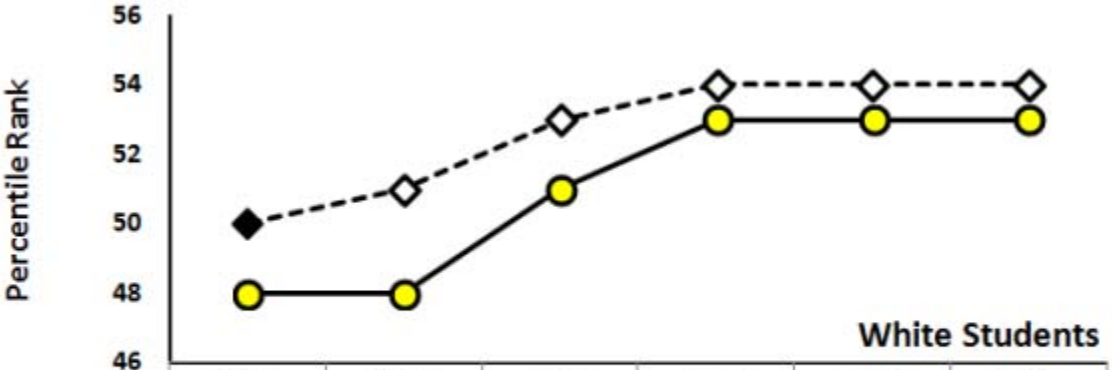


	2003	2005	2007	2009	2011	2013
Idaho	47	53	52	53	51	53
Nation	50	53	54	55	56	57

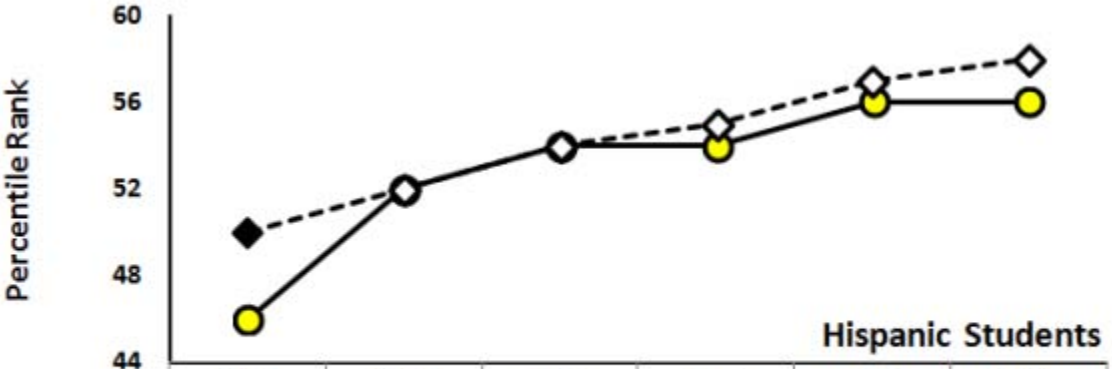
Exhibit 4. NAEP Mathematics, Grade 8, 2003-2013. Percentile ranks for three Idaho student groups vs. their peers in the nation's public schools: All Students, White Students and Hispanic Students.



	2003	2005	2007	2009	2011	2013
Idaho	52	53	54	57	56	56
Nation	50	51	52	53	54	55



	2003	2005	2007	2009	2011	2013
Idaho	48	48	51	53	53	53
Nation	50	51	53	54	54	54



	2003	2005	2007	2009	2011	2013
Idaho	46	52	54	54	56	56
Nation	50	52	54	55	57	58

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:

$$z\text{–}score = \frac{Average_{Focus\ Group} - Average_{Norm\ Group}}{Standard\ Deviation_{Norm\ Group}}$$

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

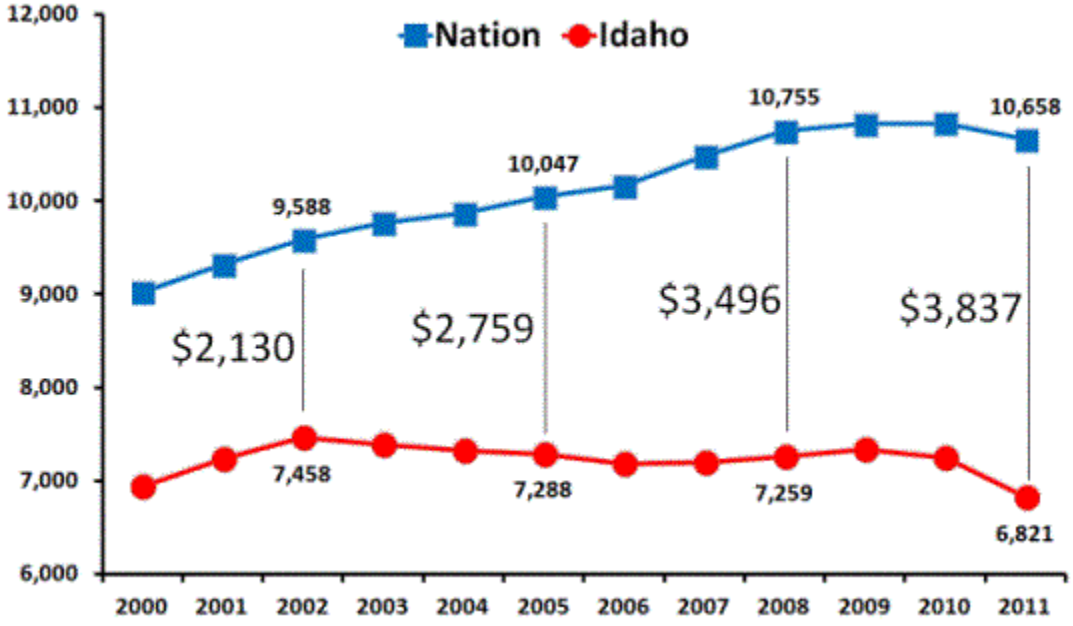
*Percentile Rank =TRUNC(100*NORMSDIST(z-score))*

[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.



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[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 doing independent research and consulting in educational assessment, evaluation and research. He maintains http://bdsphd.tripod.com to share his work with interested persons. The size it not glitzy, but it does have a much information about NAEP results for Idaho not available elsewhere. Sorry, but it is a "free to me" website plastered with ads that I have maintained since the mid-1980's.

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