U.S. Scores in 2006 PISA Show NCLB Not Performing Internationally

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Purpose

We sought to confirm the findings in *Science Competencies for Tomorrow's World* published by the OECD (Organization for Economic Co-operation and Development) on its 2006 PISA (Program for International Student Assessment) science literacy assessment. The 2006 PISA assessed over 200,000 students at age 15 across all genders, ethnicities, and nationalities; we compared the total scores for over 16,000 15-year-old students that were randomly selected in Germany, Japan, and the United States. Furthermore, we combined established research and the results of our analysis to develop a deeper understanding of any possible educational systematic trends in student achievement due to reform movements, such as No Child Left Behind (NCLB) in the US.

Theoretical Framework

Since the passing of NCLB in 2002, standardized testing has been pushed to the forefront of the educational agenda. As a result, a multitude of international assessments has been conducted in the past decade comparing the performance of students from industrialized nations in math and science. Two of the most predominant tests are the TIMSS (Trends in International Mathematics and Science Study) and the PISA. Both report that students in the US perform near or below the international average in math and science, and both found that the US had significantly lower performance than Japan and Germany (Ferrini-Mundy & Schmidt, 2005).

There are major differences in both of these international assessments, especially in what they test. The TIMSS, administered since the early 1990s, focuses on testing students on a common set of curriculum standards based on what is prevalent in all of the countries. The PISA, first administered in 2000, focuses on testing students on 4 skills and 3 competencies as indicators of literacy (i.e., an “ability to apply knowledge and skills gaining in school or elsewhere to a broad range of situations” (Plisko, 2005)). Thus, the TIMSS could be considered more as an ability test and the PISA could be considered more as an aptitude test.

The most recent literature reports on the 2003 TIMSS math and science assessment and the 2003 PISA math assessment, which included components on science. Ferrini-Mundy and Schmidt (2005) found that, although they performed above the international average on the TIMSS, U.S. students showed little annual improvement in mathematics. In regards to the PISA, Lemke et al. (2005) found that when student performance is analyzed under 6 levels of competencies, which are based on a separate categorization of each problem with increasing levels of cognitive demand (1 being the

lowest level), the U.S. had a larger proportion of students at levels 1 and 2 and a lower proportion at levels 4, 5, and 6 than the international average. This evidence might lead one to conclude that U.S. students fail on the international stage. However, Boe and Shin (2005) illustrate that U.S. achievement is actually above average, not poor, in comparison to other countries when all four subjects, reading, science, math, and social studies, are weighted equally. There are only 19% of other nations scoring significantly higher and 38% significantly lower than the US.

At the time of our article there were no peer-reviewed, journal-published findings on the 2006 PISA assessment, the most recent international administered test. Even as an assessment primarily focused on science literacy, the 2006 PISA had considerable portions also focused on math. An analysis of this most recent assessment could provide a more accurate analysis of U.S. student performance, especially as standardized testing is now fully implemented and vetted after four years of existence under NCLB.

Therefore, we examined the question: What country's students (Germany, Japan, or U.S.) are most proficient in math or science according to the 2006 PISA? We predict the analysis will show that Japanese students perform highest in math and science and U.S. students score lowest in both subjects. We feel that these results are plausible due to recent low scores of U.S. students in math and science assessments when compared to other industrialized countries (Ferrini-Mundy & Schmidt, 2005; Lemke et al., 2005; Plisko, 2005).

Methods

Data

The PISA dataset for *2006 Science Competencies for Tomorrow's World* is used to answer our research question. The 2006 PISA tested the science literacy (including a math component) of 15-year-old students in 57 countries (OECD, 2007). The scores from one representative country in each industrialized continent, Asia (Japan), Europe (Germany), and North America (US) were used. This assessment was administered to a representative sample of students within each country: 5,952 Japanese, 5,611 U.S., and 4,891 German students.

Analysis

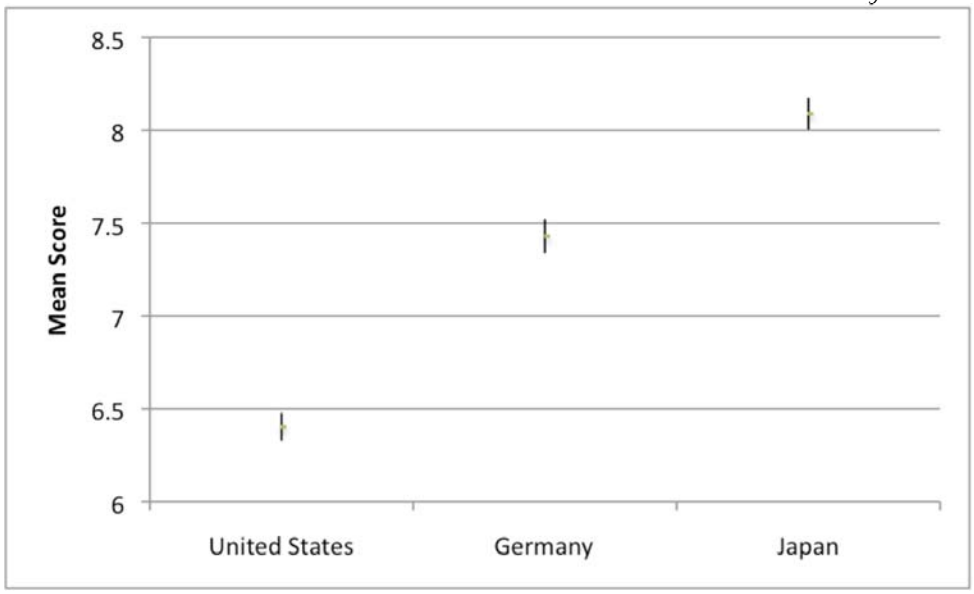
The individual math and science scores of each student from the 2006 PISA dataset were combined to obtain total math and total science scores. To analyze whether or not the data supports our predictions, an *F* test (one-way ANOVA) for three independent sample means (i.e., by country) was used on two different levels (i.e., by subject).

Results

Analysis of the 2006 PISA dataset indicates there is a significant difference in the performances of the students between all three countries on the math assessment ($F(2,$

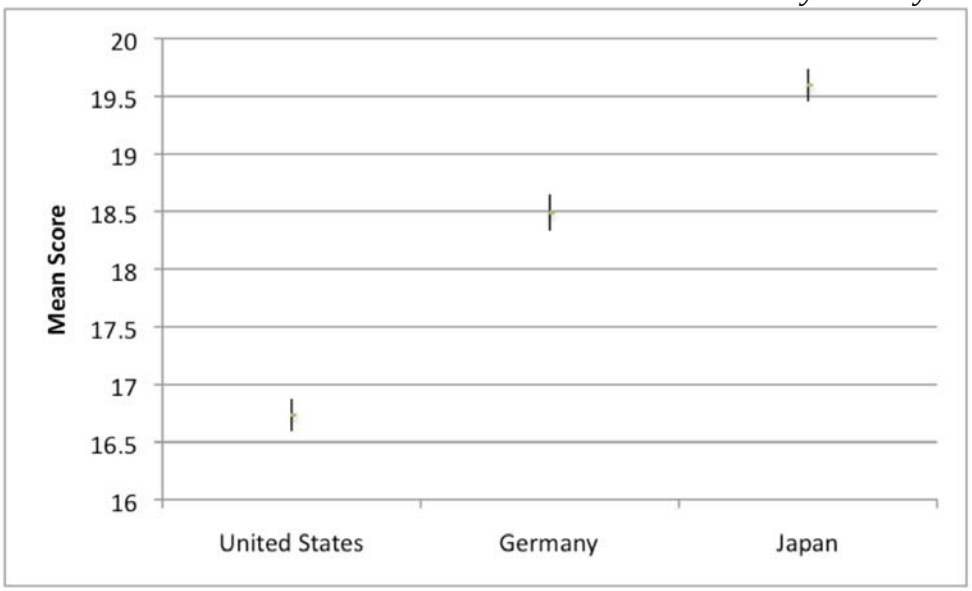
16451) = 106.508, p < .001) (see Figure 1). In particular, the data indicates that U.S. students had a lower performance (*M* = 6.4035, *SE* = .07588) in math literacy than German students (*M* = 7.4304, *SE* = .09163) and Japanese students (*M* = 8.0892, *SE* = .08543).

Figure 1. *2006 PISA International Mathematics Assessment Mean Scores by Country.*



Analysis of the science assessment yielded a similar result; there is a significant difference in the performances of the students between all three countries (*F*(2, 16451) = 101.847, p < .001). Again, U.S. students have a lower proficiency (*M* = 16.7361, *SE* = .14108) in science literacy, according to the PISA data, than German students (*M* = 18.4913, *SE* = .15662) and Japanese students (*M* = 19.5954, *SE* = .14220).

Figure 2. *2006 PISA International Science Assessment Mean Scores by Country.*



Conclusions

The analyses of the 2006 PISA dataset confirmed our prediction that U.S. students had lower performances in math and science when compared to Japanese and German students. These results parallel the findings published by the OECD regarding the 2006 PISA. Detailed in its report, Japanese students ranked highest in science and math (8th and 10th, respectively) and German students ranked above U.S. students (15th and 20th, respectively); U.S. students ranked 36th internationally in science and 35th in math.

However, as Boe and Shin eluded, the US may not be the only nation showing poor performance. For instance, even though U.S. students ranked much lower than Japanese and German students and lower than the international average in science literacy on the 2006 PISA, 58.1% of Japanese students scored at or below a level 3 competency compared to 64.7% of German students and 72.6% of U.S. students (OCED, 2007). This could be an indicator that students worldwide have difficulty solving science and math problems in an authentic context, and that all educational systems could use curricular reform so that students are engaged in more critical thinking.

Future research may include data analysis from other international assessments to confirm results from our article. In addition, as tests like the TIMSS and the PISA continue, data over several years could be analyzed to find trends between and within industrialized nations in science and math achievement. Only until a similar study to our article is completed can we make more accurate inferences about the effectiveness of NCLB and its effect on U.S. student proficiency in the global, educational race.

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