PISA SIB Draft

**Fifteen-Year-Old Students’ Science Career Perceptions in PISA 2015**

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**Introduction**

The presence of skilled workers in scientific fields is closely linked to global competitiveness (Traurig and Rich, 2008). But according to the U.S. Department of Education, comparatively few American students pursue expertise in science, technology, engineering, and math (STEM) – with the number of high school students interested in pursuing science-related careers failing to catch up to increasing needs (U.S. Department of Education, 2014). Additionally, there is a lack of gender and ethnic diversity of students entering STEM educational programs and career fields (Crisp, Nora, and Taggart, 2008).

Students’ career expectations have been found to be highly predictive of students’ actual career choices and outcomes later in life (Aschbacher, Ing, & Tsai, 2014). Young adolescents who expected to have a career in science were more likely to graduate from college with a science degree, emphasizing the importance of early encouragement (Tai, Liu, Maltese, and Fan, 2006).

Race or ethnicity does not seem to contribute much to differences in career aspirations or decision-making attitudes (Fouad and Byars-Winston, 2005; Byars and McCubbin, 2001; Fouad & Brown, 2000). And yet, there are differences among racial and ethnic groups in perceptions of career opportunities and barriers. These significant differences are consistent with the sociopolitical context within which many visible racial/ethnic minorities work and live (Fouad and Byars-Winston, 2005, 230).

This Statistics in Brief examines the results from the 2015 PISA science literacy assessment, with a focus on students’ science career expectations and the context behind these expectations. Specifically, it investigates selected demographic characteristics of students expecting careers in science, and the relationship between students’ science career expectations and their science performance.

**Data, Measures, and Methods**

This analysis uses data for U.S. 15-year-old students from the 2015 Program for International Student Assessment (PISA).

The primary measure of this Statistics in Brief concerns career expectations: students who took the 2015 PISA assessment answered, “what kind of job [they] expect to have when they are about 30 years old,” for which open-ended responses were recoded into ISCO-08 codes. Broadly, science-related career expectations are defined as those career expectations whose realization requires further engagement with the study of science beyond compulsory education, typically in formal tertiary education settings.

The ISCO-08 codes were used to define science careers (for the purposes of deriving science career expectations) in the following manner, which is the same way that the OECD has defined science careers.

All science and engineering professionals except for product and garment designers, graphic and multimedia designers were coded as science careers. Likewise, all health professionals apart from traditional and complementary medicine professionals as well as all information and communications technology professionals were coded as science careers. Science technicians and associate professionals (physical and engineering science technicians, life science technicians and related associate professionals, air traffic safety electronic technicians, medical and pharmaceutical technicians except medical and dental prosthetic technicians, and telecommunications engineering technicians) were the final group of careers considered to be science careers.

The science careers were further disaggregated into engineering and technology careers, as well as medicine careers. There are careers that ostensibly could be called science careers that do not fit into either of these two categories, but following the practice of the OECD, and the definition of science careers concerning the requirement further engagement with the study of science beyond compulsory education, these are counted as “non-science” careers in our analysis.

The same methodology was used to code responses for mother and father’s occupation. The questions come from the student background questionnaire and ask about both the jobs of the student’s mother and father. For each parent, the student is asked to type a job title and a sentence describing the kind of work involved in the job. If a parent is not working, the questionnaire instructs the student to fill in the respective parent’s last job title and job duties.

All the analyses in this Statistics in Brief were carried out using a combination of STATA and the *repest* module, and the IEA IDB Analyzer, which creates scripts for use in SPSS for complex survey designs such as PISA. Score-point differences presented in the text were computed from unrounded numbers, and these may differ from computations made using the rounded whole numbers that appear in the tables. Percentage point differences were computed from rounded numbers.

Estimates were produced from cross-tabulations of the data, and *t* tests were performed to test for differences between estimates. All the estimates and comparisons that are discussed in this brief are statistically significant at the *p* < .05 level to ensure that they are larger than what might be expected due to sampling variation. No adjustments were made for multiple comparisons. Readers are cautioned not to make causal inferences about the data presented here. For more information, see the Technical Notes at the end of the report.

**Study Questions**

1. What percentage of U.S. 15-year-olds is interested in pursuing a career in science by student background variables and a school level variable (school location)?
2. Are the careers of students’ parents associated with the careers students expect to have themselves? For example, if a parent has a career in science, is a student more likely to express interest in a science career?

**Key Findings**

**Find Out More**

**Technical Notes**

The estimates provided in this Statistics in Brief come from the 2015 administration of the Program for International Student Assessment (PISA). PISA is a cross-national study that measures 15-year-old students’ reading, mathematics, and science literacy. Science was the focal subject of the 2015 data collection. The 2015 assessment also included optional assessments of collaborative problem solving and financial literacy. In the U.S., 15-year-old students participated in both option assessments. PISA is coordinated by the Organization for Economic Cooperation and Development (OECD), with governmental sponsors in each participating country. More than 70 countries and education systems participated in the 2015 data collection of PISA. In the United States, PISA is sponsored by the National Center for Education Statistics (NCES).

To ensure comparability of the data across participating countries and education systems, OECD provided detailed international requirements on the various aspects of data collection and implemented quality control procedures. Participating countries and education systems were obliged to follow these requirements. These requirements—regarding the target population, sampling design, sample size, exclusions, and defining participation rates—are briefly described below. For more detailed information, please see OECD (2017).

*Target Population and Exclusions*

This Statistics in Brief only used data from PISA’s science assessment. PISA’s international desired population is 15-year-olds attending both publicly and privately controlled schools in grade 7 and higher. More specifically, the technical standards required that students in the sample be 15 years and 3 months to 16 years and 2 months at the beginning of the testing period.

PISA 2015 was designed to be as inclusive as possible, though it did provide guidelines for allowable exclusions. These guidelines allowed schools to be excluded for approved reasons (for example, schools in remote regions, very small schools, or special education schools) and students to be excluded in certain circumstances, including:

* **Students with functional disabilities:** students with a moderate to severe permanent physical disability such that they cannot perform in the PISA testing environment.
* **Students with intellectual disabilities:** students with a mental or emotional disability and who have been tested as cognitively delayed or who are considered in the professional opinion of qualified staff to be cognitively delayed such that they cannot perform in the PISA testing environment.
* **Students with insufficient language experience:** students who meet the three criteria of not being native speakers in the assessment language, having limited proficiency in the assessment language, and having less than 1 year of instruction in the assessment language.

Overall estimated exclusions (including both school and student exclusions) were to be under 5 percent of the PISA target population.

Across 72participating countries and education systems, around 540,000 students completed the PISA 2015 science assessment, representing approximately 29 million 15-year-old students.

*Sampling Design and Sample Sizes*

Though it is not possible to assess every single 15-year-old student, samples can provide representative values for education systems. As such, a representative sample of students was selected from a representative sample of schools, a two-stage stratified systematic sample. The sampling probabilities in said sample are proportional to the estimated number of 15-year-old students in the school based on grade enrollments. The first stage refers to a sample of schools, while the second stage refers to a sample of students within schools. The PISA international contractors (hereby referred to as the PISA consortium), who are responsible for the design and implementation of PISA internationally, drew the sample of schools for each participating country and education system.

A minimum of 4,500 students from a minimum of 150 schools were required in each participating country and education system. Following the PISA consortium;, replacement schools were identified at the same time as the PISA sample was selected by assigning the two schools neighboring the sampled school in the frame as replacements. The international guidelines specified that within schools, a sample of 35 students age 15 were available (in which case all 15-year-old students selected).

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