

Program for International Student Assessment (PISA) 2018 Revisited

Shuai Shao | Department of Psychology | UC San Diego | Documents are available at <https://github.com/shaoshuai95/POLI271>

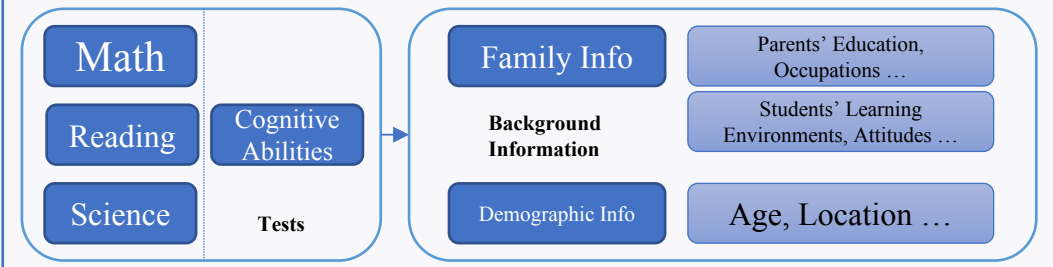
Abstract

First launched in 1997, Program for International Student Assessment (PISA), a large-scale, policy-oriented, and international project that measures 15-year-old students' mathematical, cognitive, and reading abilities, has a profound impact on international education research. Understanding PISA test data and results have promoted education reform in several countries and will contribute to a more efficient and advanced education system. In this project, I will 1) apply Linear Regression model to understanding how reading-related cognitive abilities have an impact on reading scores, 2) apply Logit model to estimating how learning environments predict education expectation, and 3) apply Ordered Probit model to evaluating participants' feeling about the reading test.

Measurement

Dataset The current project uses PISA 2018 dataset retrieved from [PISA website](#), conducted by *Organisation for Economic Co-operation and Development (OECD)*. In this project, data are from the United States sub-dataset.

Procedure



Three dimensions of ability were evaluated, namely math, reading, and science. Additionally, several cognitive abilities related to reading (i.e., understanding, locating information, evaluation and reflection, single text structure comprehension, and multiple text structure comprehension) as well as background information were assessed or collected.

Findings

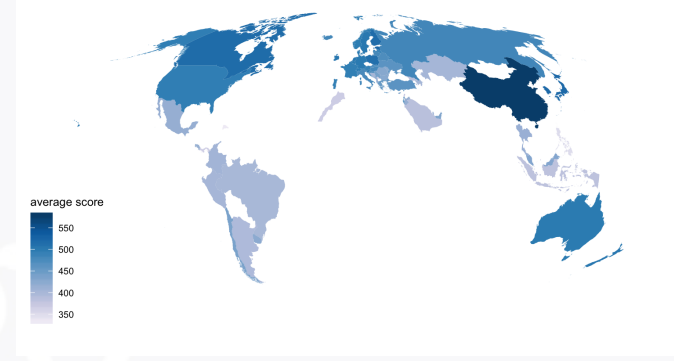
Model 1. Cognitive Abilities and Reading Scores

Modeling the relationship between cognitive abilities and reading scores

$$Y_i \sim f_N(\mu_i, \sigma^2)$$
$$\mu_i = \beta_0 + x_{1i}\beta_{\text{understanding}} + x_{2i}\beta_{\text{locating information}} + x_{3i}\beta_{\text{evaluation and reflection}} + x_{4i}\beta_{\text{single text}} + x_{5i}\beta_{\text{multiple text}}$$
$$\ln L(\beta, \sigma | y) = \sum \left(-\frac{1}{2} \ln \sigma^2 - \frac{(y_i - X_i \beta)^2}{\sigma^2} \right)$$

	Estimate	Std. Error
Intercept	13.20	1.13
Understand	0.32	0.02
Locating Information	0.09	0.01
Evaluation & Reflection	0.06	0.01
Single Text	0.21	0.01
Multiple Text	0.30	0.02

PISA Test Average Total Scores, 2018
data sources: OECD



Model 2. Learning Environments and Expectations

Modeling the relationship between learning environments and future expectations

- Learning Environments (Independent Variables):
 - Having a desk or not
 - Having a book of own or not
 - Having a quiet place or not
 - Having a computer or not
 - Having Internet access or not
- Expectations (Dependent variable):
 - Expect to complete post-secondary education or not

$$Y_i \sim \text{Bernoulli}(\pi_i)$$
$$\pi_i = \frac{1}{1 + e^{-X_i \beta}}$$

	Estimate	Std. Error
Intercept	0.72	0.24
Desk	0.40	0.13
Private Room	0.23	0.16
Quiet Place	0.19	0.17
Computer	0.74	0.14
Internet Access	0.53	0.22

- Simulations:
 - Probability of expecting to complete post-secondary education: 92.28%
 - All set to mean but with no Internet access: 88.46%
 - All set to mean but with Internet access: 92.80%

Model 3. Test Evaluations

- Self-reported Reading Abilities (Independent Variables):
 - "I am a good reader."
 - "I am able to understand difficult texts."
 - "I read fluently."
 - "I have always had difficulty with reading."
 - "I have to read a text several times before completely understanding it."
 - "I find it difficult to answer questions about a text."(All six dimensions above were rated on a 4-point scale)
- Reading Section Evaluation (Dependent Variable):

In the PISA test, how do you feel about the reading tasks:
Many texts were too difficult for me. (Rated on a 4-point scale)

	Estimate	Std. Error
Good Reader	-0.08	0.04
Understanding	-0.20	0.03
Difficulty-Texts	0.27	0.03
Fluency	-0.30	0.03
Repeat	0.18	0.03
Understanding-Questions	0.37	0.03