What can PISA 2015 time results tell us?

Paulina Popiołek
Agnieszka Pszczółkowska

Faculty of Mathematics and Information Science, Warsaw University of Technology

What is PISA?

The Programme for International Students Assessment (PISA) is the triennial survey of 15-year-old students around the world. Its aim is to evaluate education systems worldwide by testing the skills and knowledge that are essential for full participation in modern societies. The assessment does not just ascertain whether students can reproduce knowledge; it also examines how well students can extrapolate from what they have learned and can apply that knowledge in unfamiliar settings, both in and outside of school. The PISA 2015 survey focused on science, with reading, mathematics and collaborative problem solving as minor areas of assessment. The survey is sponsored, governed, and coordinated by the Organisation for Economic Co-operation and Development (OECD).

PISA 2015

Approximately 540 000 students completed the assessment in 2015, representing about 29 million 15-year-olds in the schools of the 72 participating countries and economies. Computer-based tests were used, with assessments lasting a total of two hours for each student. Test items were a mixture of multiple choice questions and questions requiring students to construct their own responses. The items were organised in groups based on a passage setting out a real-life situation. The results of the 2015 assessment were published on 6th December 2016.

Analyzed data

We downloaded two datasets from PISA[1] website: student-questionnaire data file and the cognitive item data file. These files had some missing values which were removed. We prepared data set with information about questions: the time spent on solving them, their results, number of actions, types (mathematics / reading / science), position in booklets and about students: their sex, school id and country. This data set was the starting point for further analysis.
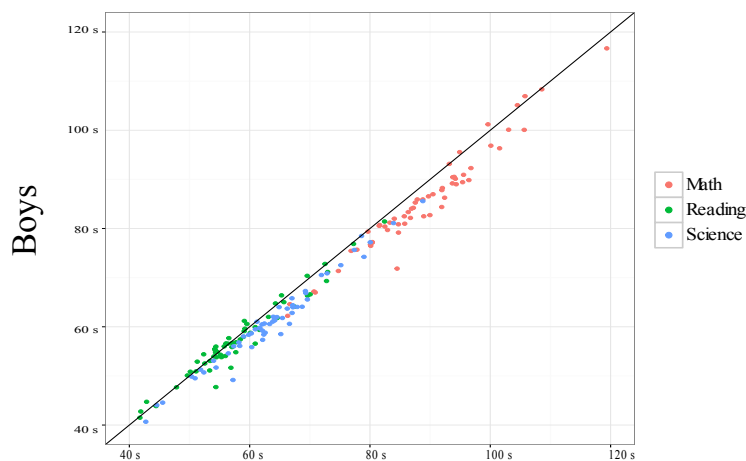
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[1] *http://www.oecd.org/pisa/*

Girl and Boy Power

For every country and gender - boys and girls - we calculated mean time which they spent on solving one question.

According to official PISA 2015[2] results, boys get higher scores both in Mathematics and Science, whereas girls are better at Reading.

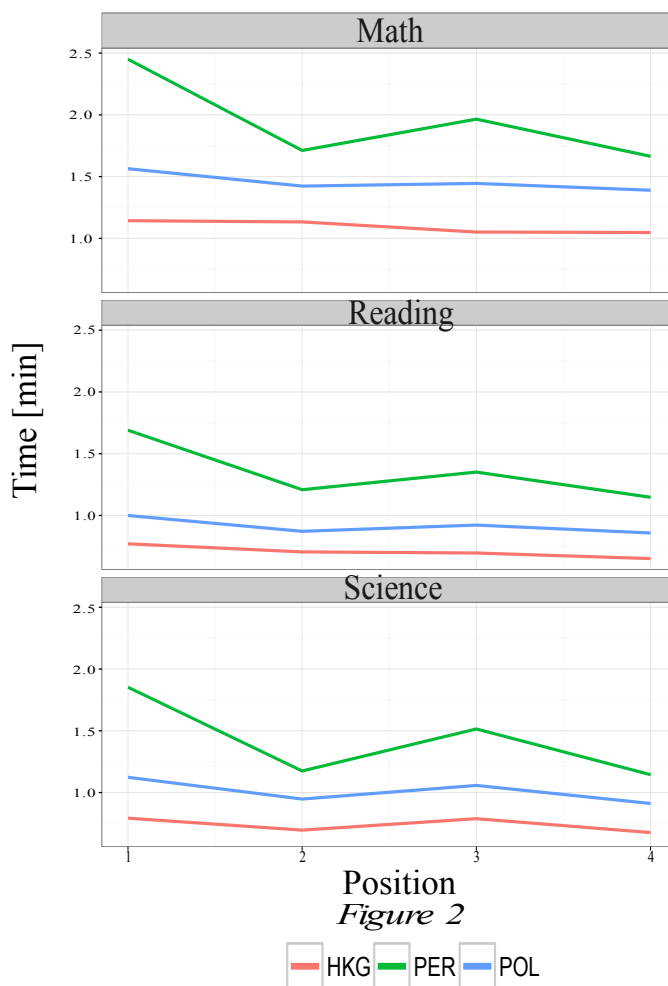**Mean time spent on solving one question**
Boys vs. Girls

Figure 1

If we look at *Figure 1*, we can see that in most countries boys are faster at doing Mathematics and Science. Surprisingly, when we look at Reading time, the differences are not so evident and seem almost equal. It is also clear that both girls and boys spend more time on Math than on other subjects.

Super-position?

During the test, students got questions in four sets. Depending on booklet, each set contains only one category - Mathematics, Science or Reading. During our analysis, we found out that countries differ not only with mean time spent on one question, but also with mean time spent on one question at different position. Depending on position, it may be caused by stress, underestimating the time left or it is a result of test-taking strategy on which we will focus later. For example, *Figure 2* shows three countries - Poland, Hong Kong and Peru. We choose them to indicate how huge differences it can be.

Mean Time vs. different subject and position

Figure 2

Hong Kong represents countries which solve questions very quickly - Hong Kong, Korea, Japan, Singapore. Regardless of position and subject, they spend about one minute on average. Moreover, they are high-ranking in the PISA 2015.

Poland is an example of country which needs more time. The time vary between position and it's the highest at the beginning and the shortest at the end. It is also not placed high in rankings. Among other lands similar to Poland we can find European countries like Germany, Denmark, Belgium, Great Britain but also USA and Canada.

Our last choice - Peru, represents the weakest countries like Brazil, Colombia, Mexico. They start the test really slow and during the next set of questions they speed up a little. Because the third part takes again more time, they have to hurry at the end. Maybe their low scores are caused by the lack of time.

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[2] *http://www.ibe.edu.pl/pl/projekty-miedzynarodowe/pisa*

Young strategists

From our previous analysis it is noticeable that main differences in taking test follows from time spent at the beginning and at the end. In the following part we want to focus on them and define possible strategies which student might take.

First, we calculate average time for the first and the last position. Then, for each student, we calculate the same averages. Comparing student time to corresponding position time, we divide participants into four different strategies.

Strategy 1 - Quick-Quick

This group consists of students who start and finish test Quickly. Below, in *Figure 3*, we have proportion in selected countries between pupils included in this strategy and total amount of students who participate in test.

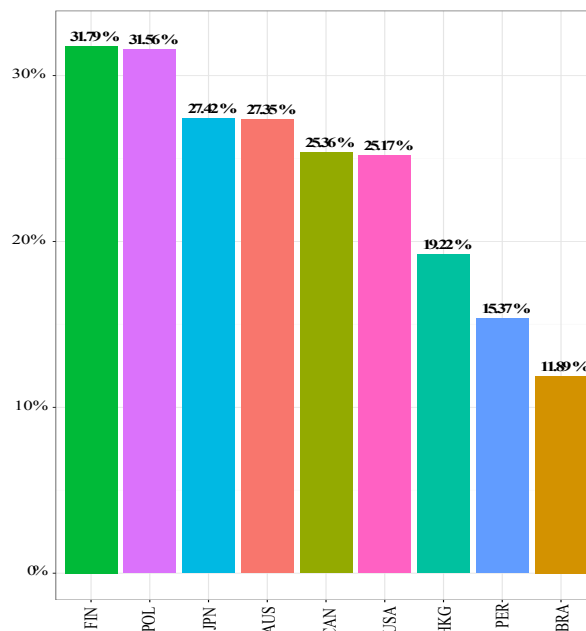**Percentage of students applying Strategy 1**
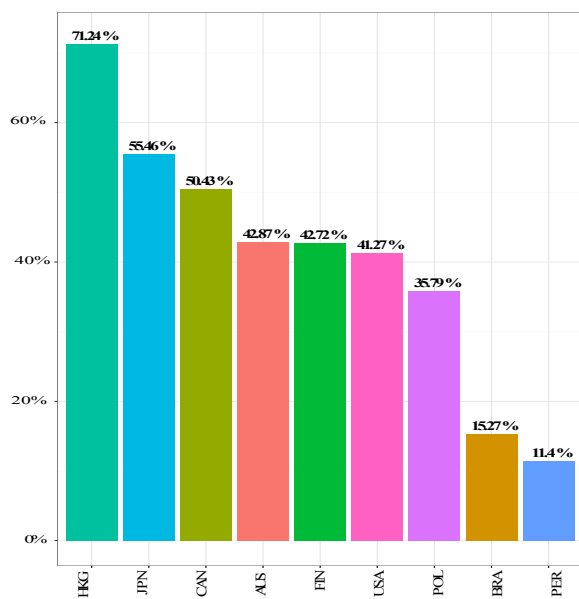
Figure 3

Strategy 2 - Quick-Slow

To this strategy we include students who solved questions quickly at the beginning but needs more time to finish the test. In *Figure 4* we present analogous chart as in *Figure 3* but connected with Strategy 2.

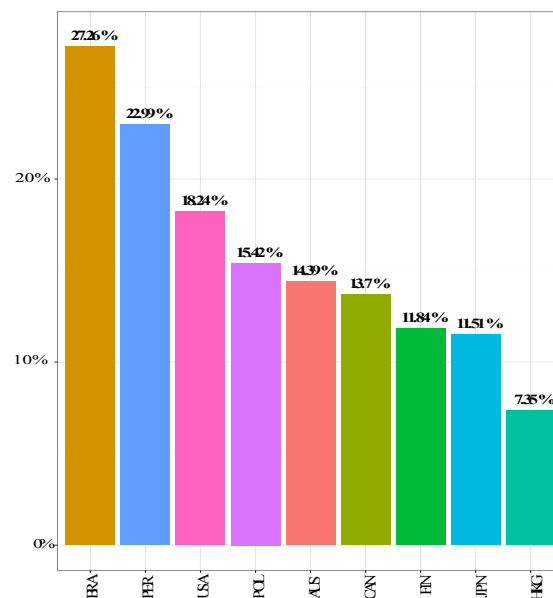**Percentage of students applying Strategy 2**

Figure 4

Strategy 3 - Slow-Quick

This group consist of student who need more time at the beginning but finish test really quickly. *Figure 5* presents proportion for this strategy.

Percentage of students applying Strategy 3

Figure 5

Strategy 4 - Slow-Slow

The last group consist of student who (regardless of position) spent more time than position averages. *Figure 6* presents proportion for this strategy and complete data from previous figures to 100%.
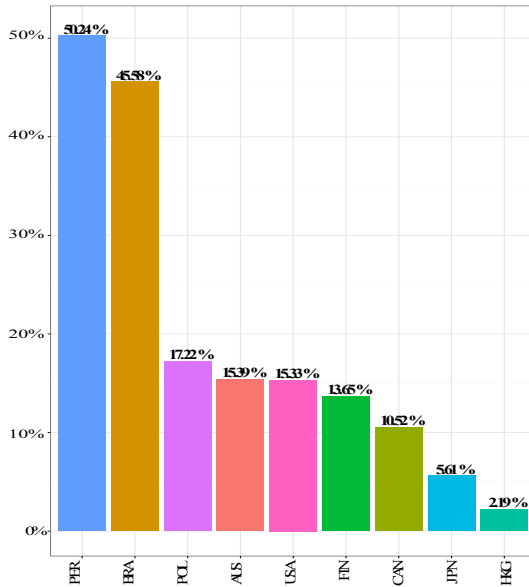
## Percentage of students applying Strategy 4

Figure 6

It is typical for students from Asian countries (Hong Kong, Japan, Korea, Singapore) to take Strategy 1. It is possible that good plan and being well-prepared is a key to success in PISA.

On the other hand, South America's student (Peru, Brazil, Mexico) mostly undertake Strategy 4. Spending much time at the beginning seems to cause lack of time at the end. Because of that, they have not much time to complete test. Unluckily - more haste, less speed - so their scores are affected by rush.

What about schools ?

To be more specific, we could analyze the same strategies among schools, but we don't have any information about them. What is more interesting, the division of students from one school into strategies does not have to go along with country result. Below, in *Figure 7*, we present results for two schools in Poland with different dominating plans.

Dominating strategy Quick-Quick
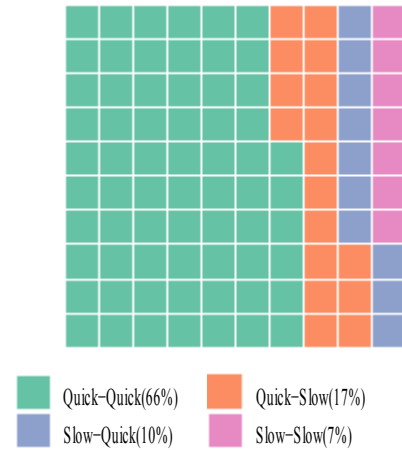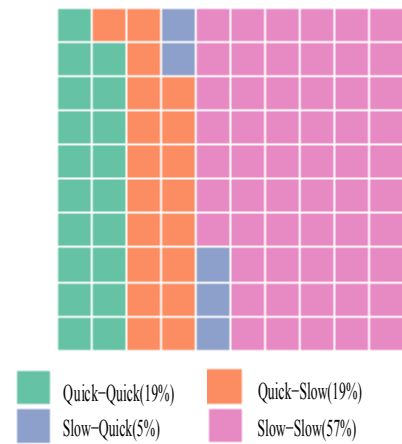

Dominating strategy Slow-Slow

Figure 7

Summary

To sum up, we defined four different strategies for solving problems in PISA 2015 test. The division of students from countries around the world into strategies shows that communities differ from each other. Students from countries that are at the top of the ranking PISA 2015 answer questions faster than pupils from the South America which gained worse results in test. However, it cannot be stated that the strategies in schools correspond to the general trends in their respective countries.

Full analysis and used data sets can be found on GitHub: http://bit.ly/2oDkrrA