Analysing the large scale international comparative data from the student assessments PISA and TIMSS
What PISA actually measures?

A short interactive introduction to analysing PISA 2018 data?

Showing an analysis which reveal the nature of PISA and TIMSS and what kind of classroom activities provide good PISA results.

Graphical presentations of multilevel modelling results

An experience how to build a research around LINCAS Studies

Examples of thesis
What PISA actually measures?
The Quality of Education system or something else?

- The PISA mathematical and scientific literacy test asks students to apply their knowledge to solve problems set in real-world contexts. To solve the problems students must activate a number of mathematical competencies as well as a broad range of mathematical content knowledge. TIMSS, on the other hand, measures more traditional classroom content such as an understanding of fractions and decimals and the relationship between them (curriculum attainment). PISA claims to measure education's application to real-life problems and lifelong learning (workforce knowledge).

- A mathematically literate student recognises the role that mathematics plays in the world in order to make well-founded judgments and decisions needed by constructive, engaged and reflective citizens.

- … key knowledge and skills that are essential for full participation in modern societies.

- … can apply that knowledge in unfamiliar settings, both in and outside of school.
Learning time and science performance

- Intended learning time at school (hours)
- Study time after school (hours)
- Score points in science per hour of total learning time

Countries included:
- Finland
- Germany
- Japan
- Estonia
- Sweden
- New Zealand
- Australia
- Czech Republic
- Macao (China)
- United Kingdom
- Canada
- Norway
- Iceland
- Luxembourg
- Latvia
- Hong Kong (China)
- OECD average
- Chinese Taipei
- Austria
- Portugal
- Uruguay
- Lithuania
- Singapore
- Denmark
- Sweden
- Poland
- Spain
- Croatia
- United States
- Israel
- Korea
- Italy
- Greece
- France
- Russia
- Mexico
- Brazil
- Costa Rica
- Turkey
- Montenegro
- Peru
- Qatar
- Thailand
- United Arab Emirates
- Tunisia
- Dominican Republic
You as an analyst!

- http://gpseducation.oecd.org/
Showing a basic analysis which reveal the nature of PISA and TIMSS and what kind of classroom activities provide good PISA results.
Comparison of TIMSS and PISA Results

How well are students prepared for the future with their skills?

- Very well
- Not that well
- Not much

What have students learned within the different subject domains?

- Many things
Science scores in TIMSS 1999 vs PISA 2000 +
Iterative K-Mean Cluster Analysis of Science Classroom Activities Based on Teacher Questionaire

%
Clusterization of the countries

- Cluster 1
- Cluster 2
- Cluster 3
- Cluster 4
Graphical presentation of multilevel modelling results

https://jyx.jyu.fi/bitstream/handle/123456789/37745/T022.pdf?sequence=1&isAllowed=y
### Finland

#### Explanatory variables of science achievement in Finland, TIMSS 1999

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parents Educational Background</td>
<td></td>
<td></td>
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<tr>
<td>Reading Habit</td>
<td></td>
<td></td>
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<tr>
<td>Frequency of Watching News or Documents on TV</td>
<td></td>
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<tr>
<td>Daily Time Spent Watching TV or Videos</td>
<td></td>
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<tr>
<td>Frequency of Watching Nature, Wildlife or History on TV</td>
<td></td>
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<tr>
<td>Internet or E-mail in Math/Science</td>
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<tr>
<td>Experimental Approach in Physics/Chemistry</td>
<td></td>
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<tr>
<td>Frequency of Tests and Quizzes</td>
<td></td>
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<tr>
<td>Gramming Math or Science</td>
<td></td>
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<tr>
<td>Student's Own Educational Expectations</td>
<td></td>
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<tr>
<td>Believe: Science Can Solve Environmental Problems</td>
<td></td>
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<tr>
<td>Self-Evaluation: Math Skills and Likes</td>
<td></td>
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<tr>
<td>Evaluation of Own Sci-Skills Vs. Peers</td>
<td></td>
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<tr>
<td>Normally Does Well in Science</td>
<td></td>
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</tbody>
</table>

#### Home Background

- (51%) Don't Know
- (49%) Know

#### Free-time

- (15%) Not at All
- (22%) >1h Daily
- (34%) Daily
- (62%) 0–2h
- (26%) > Once a Week

#### Schooltime

- (22%) > Monthly
- (50%) Rarely
- (19%) Often

#### Motivation

- (68%) Secondary
- (14%) University
- (20%) Weak
- (20%) Strong

#### Affection

- (24%) No
- (10%) High
- (20%) Strongest
- (25%) Weakest
- (21%) Yes
Explanatory variables of science achievement in Finland, TIMSS 1999

- **Gender**
  - (49%) Girl
  - (51%) Boy

- **Number of Books at Home**
  - (19%) ≤ 25
  - > 200 (26%)

- **Mother Appreciates Sports**
  - (22%) Strongly Agree
  - ≥ Disagree (26%)

- **Lives with Father**
  - (26%) No
  - Yes (74%)

- **Number of People Living at Home**
  - (44%) ≥ 5
  - ≤ 3 (18%)

- **Daily Free-Time Spend With Friends**
  - (13%) > 5h
  - Never (13%)

- **For Friends it's Important to be Good in English**
  - (33%) Strongly Agree
  - ≥ Disagree (10%)

- **Student and Friends Think It's Important to Have Fun**
  - (36%) ≤ Agree
  - Strongly Agree (64%)

- **Absence Rate in School**
  - (12%) ≥ 10%
  - ≤ 4% (20%)

- **School Admittance by Entrance Examination**
  - (90%) No
  - Yes (10%)

- **Students Tend to Neglect Their Work in Math Class**
  - (34%) ≥ Agree
  - Strongly Disagree (14%)

- **Frequency of Tests and Quizzes in Mathematics**
  - (14%) Almost Always
  - ≤ Once in a While (40%)

- **Use of Internet & E-mails in Math / Sci Projects**
  - (23%) ≥ Monthly
  - ≤ Rarely (77%)

- **Success by Hard Work and Memorization**
  - (20%) Strongly Agree
  - Strongly Disagree (16%)

- **It Takes Good Luck to Do Well**
  - (20%) Strongly Agree
  - Strongly Disagree (24%)

- **Self-Esteem in Science**
  - (19%) Low
  - High (19%)

- **Does Usually Well in Math & Science**
  - (13%) ≤ Disagree
  - Strongly Agree (23%)

- **Science score**
  - 510
  - 520
  - 530
  - 540
  - 550
  - 560
  - 570
  - 580
  - 590
  - 600

**Home Background**

**Free-time**

**School's Background**

**Schooltime**

**Belives & Motivation**

**Affection**
<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
<th>Yes (21%)</th>
<th>No (%)</th>
<th>Science score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>(50%) Girl</td>
<td></td>
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<td>520 - 600</td>
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<tr>
<td></td>
<td>Boy (50%)</td>
<td></td>
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<tr>
<td>Parents Educational Level</td>
<td>(12%) Some Secondary or Less</td>
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<td></td>
<td>Have Finished University (28%)</td>
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<tr>
<td>Mother: Important to be Good in Sports</td>
<td>(13%) Strongly Agree</td>
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<td></td>
<td>Strongly Disagree (9 %)</td>
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<tr>
<td>Reading Habit</td>
<td>(22%) Rarely</td>
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<td></td>
<td>≥ Daily (39%)</td>
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<tr>
<td>Free-time: Plays with Friends, Does Jobs at Home</td>
<td>(22 %) ≥ 3h /d</td>
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<tr>
<td></td>
<td>≤ 1h / d (24%)</td>
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<tr>
<td>School Admittance by Entrance Examination</td>
<td>(79%) No</td>
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<td></td>
<td>Yes (21%)</td>
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<tr>
<td>Working in Pairs or Small Groups in Science</td>
<td>(20%) Quite Often</td>
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<td></td>
<td>Novor (20%)</td>
<td></td>
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<tr>
<td>Working Independently in Practical Projects</td>
<td>(21%) Almost Always</td>
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<td></td>
<td>Rarely (19%)</td>
<td></td>
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<tr>
<td>Extra Lessons (Cramming) in Math</td>
<td>(20 %) ≥ 1h / Week</td>
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<tr>
<td></td>
<td>No Time (64%)</td>
<td></td>
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<tr>
<td>Own Educational Goals</td>
<td>(5%) Not Clear</td>
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<td></td>
<td>University (64%)</td>
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<tr>
<td>Subjective Evaluation of Mathematics</td>
<td>(20%) Low</td>
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<td></td>
<td>High (20%)</td>
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<tr>
<td>Subjective Evaluation of Biology</td>
<td>(21%) Low</td>
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<tr>
<td></td>
<td>High (20%)</td>
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<tr>
<td>Science score</td>
<td>520 - 600</td>
<td></td>
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</tr>
<tr>
<td>Category</td>
<td>Response Options</td>
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<tr>
<td>---------------------------------------------------</td>
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<tr>
<td><strong>Home Background</strong></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Number of Books at Home</td>
<td>(14%) ≤ 10, &gt; 200 (18%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mother Appreciates Sports</td>
<td>(24%) Strongly Agree, ≥ Disagree (18%)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Home Posses Computer &amp; Internet</td>
<td>(61%) No, Yes (39%)</td>
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<tr>
<td><strong>Free-time</strong></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Frequency of Watching Music on TV</td>
<td>(34%) Rarely, About Every Day (33%)</td>
<td></td>
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</tr>
<tr>
<td>Daily Free-Time Spend Playing or Being With Friends</td>
<td>(25%) ≥ 3 h, No Time (16%)</td>
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</tr>
<tr>
<td>Frequency of Watching nature, Wildlife or History on TV</td>
<td>(63%) Rarely, &gt; Once a Month (37%)</td>
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</tr>
<tr>
<td>Frequency of Reading Books</td>
<td>(45%) ≤ Once a Week, Daily (55%)</td>
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</tr>
<tr>
<td><strong>School Background</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>School Has an Entrance Examination</td>
<td>(98%) No, Yes (2%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students are Grouped by Their Ability in Mathematics</td>
<td>(41%) ≥ Very Imp., ≤ Somewhat Imp. (29%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student Has Skipped Classes in Last Month</td>
<td>(9%) Yes, No (91%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solve Problems with Every Day Life Things</td>
<td>(26%) Never, ≤ Pretty Often (21%)</td>
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</tr>
<tr>
<td><strong>Schooltime</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science Can Solve Environmental Hazards</td>
<td>(21%) Not at All, Greatly (20%)</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Own Educational Expectations</td>
<td>(25%) Don't Know or Some Secondary, Finnish University (38%)</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Does Usually Well in Science and Math</td>
<td>(45%) ≤ Disagree, ≥ Agree (34%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student's Self Esteem in Science and Math</td>
<td>(19%) Low, High (20%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attitude Toward Science</td>
<td>(17%) Low, High (21%)</td>
<td></td>
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</tr>
</tbody>
</table>

**Science score**

520 530 540 550 560 570 580 590 600
An experience how to build a research around LINCAS Studies
LINKS to Finnish thesis of PISA, TIMSS and PIRLS

PISA:
https://www.finna.fi/Search/Results?sort=main_date_str+desc&view=condensed&filter%5B%5D=%7Eformat%3A%220%22Thesis%2F%22&join=AND&bool%5B%5D=AND&lookfor%5B%5D=pisa&type%5B%5D=Subject&limit=100

TIMSS:
https://www.finna.fi/Search/Results?limit=100&view=condensed&filter%5B%5D=%7Eformat%3A%220%22Thesis%2F%22&join=AND&bool%5B%5D=AND&lookfor%5B%5D=timss&type%5B%5D=AllFields

PIRLS:
https://www.finna.fi/Search/Results?sort=relevance&bool%5B%5D=AND&lookfor%5B%5D=pirls&type%5B%5D=AllFields&join=AND&filter%5B%5D=%7Eformat%3A%220%22Thesis%2F%22&limit=100
Kiitos! Дякую!

Pasi Reinikainen
pasi.reinikainen@fcg.fi