



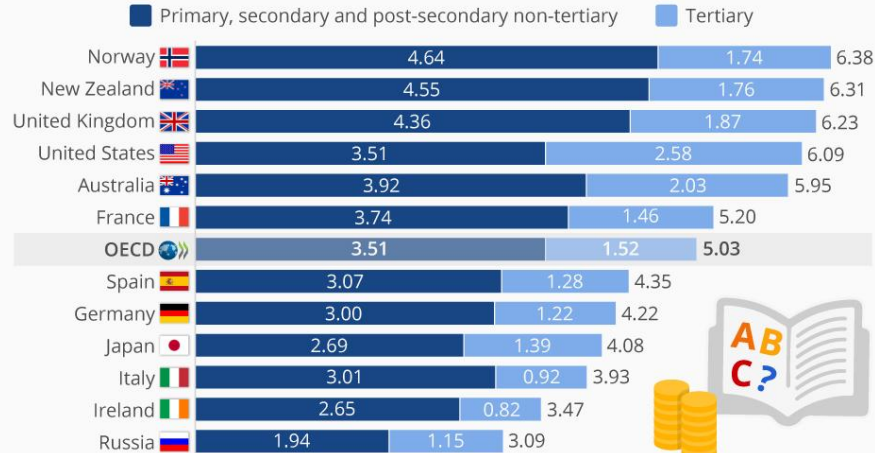
Worldwide Education Quality Analysis

Questions:

Which countries have the best overall education quality?
Which factors of education best predict overall quality?


How Much Do Countries Spend on Education

Education spending as a share of gross domestic product in selected countries in 2015 (%)



@StatistaCharts Source: OECD

statista

- 
- School Climate
 - School Resources
 - Learning Outcomes

* Inspired by Our World In Data post by Max Roser titled *Measuring Education*



School Climate

Data:

- ★ UNESCO UIS - Education Statistics
 - United Nations Educational, Scientific and Cultural Organization
 - UNESCO Institute for Statistics

Features:

Enrollment Rate, Intake Rate, Mean Years of Schooling, School Life Expectancy, Transition Ratio, Graduation Ratio

Inverse Drop-Out Rate, Out-of-School Rate, Repetition Rate, Percentage of Repeaters

- Net & Gross for Primary & Secondary

School Resources

Data:

- ★ The World Bank - Education Statistics
 - IBRD & IDA
 - International Bank for Reconstruction and Development
 - International Development Association

Features:

Government Expenditure on Education:

- Percent of Country GDP, Government Expenditure, & Expenditure on P.I.
 - Primary, Secondary, & Tertiary
- Government Expenditure per Student
 - Primary, Secondary, & Tertiary

Learning Outcomes

Data:

- ★ PISA USA - International Assessment
 - Program for International Student Assessment
- ★ The World Bank - Education Statistics
 - Literacy Rates

Features:

PISA Math, Reading, & Science Averages

- By country from 2000-2015
 - Every three years

World Bank Literacy Rates


- Youth and Adult Percentages



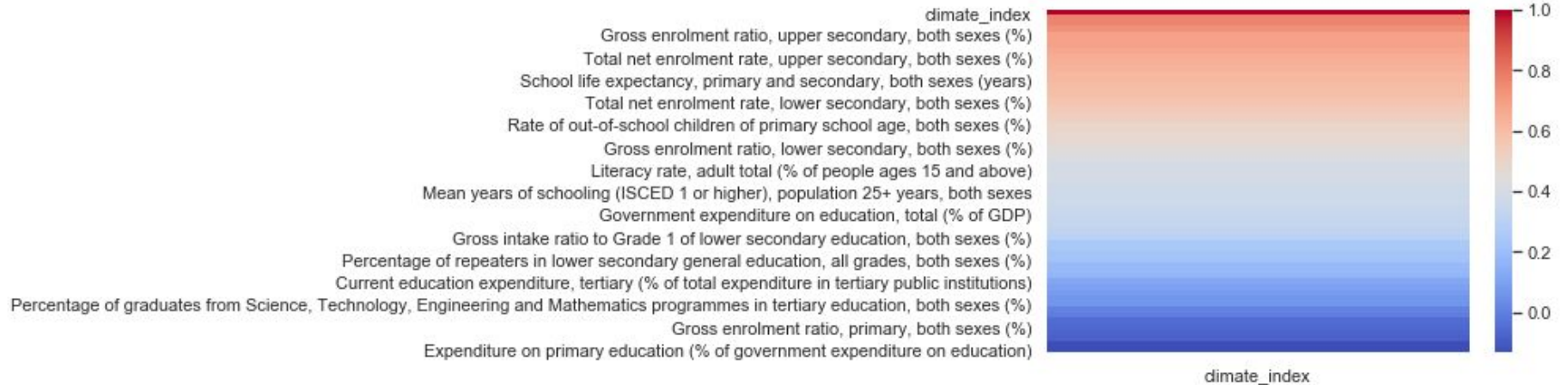
Features Scaled and Combined
By Type to Create Three Indexes:

- Climate Index
- Resources Index
- Learning Index

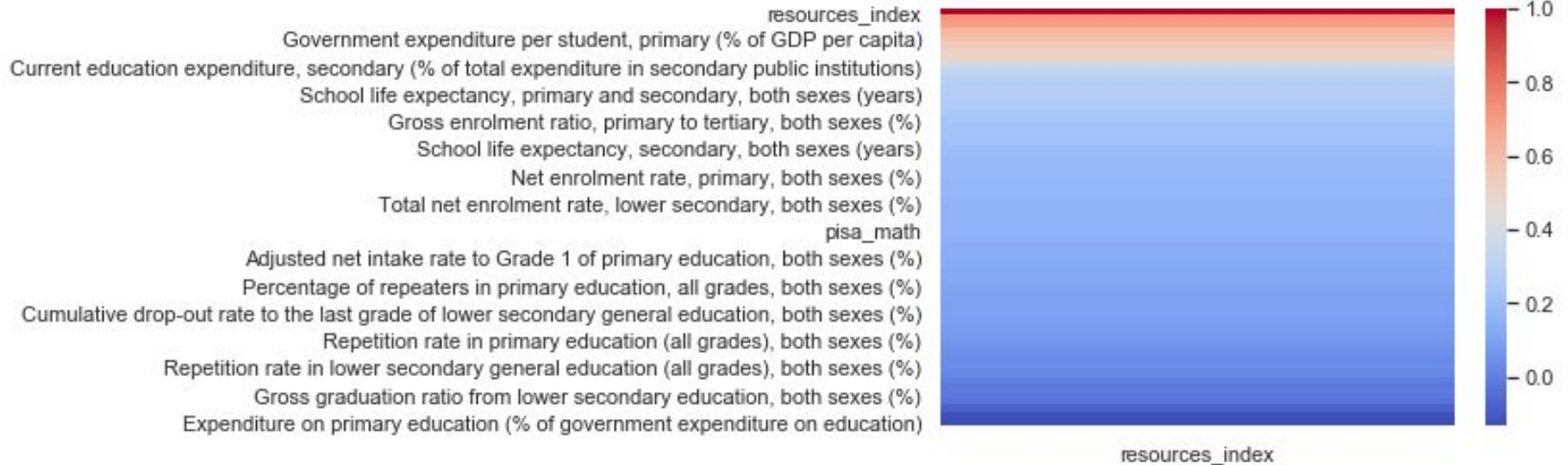
Cube Root of Product = Education Quality Index



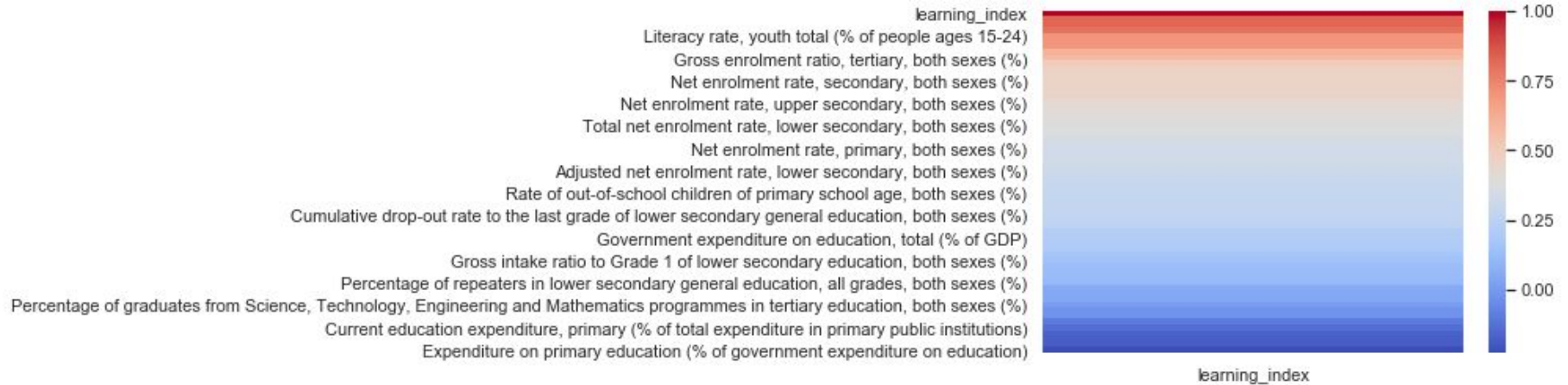
Features Correlated with School Climate Index



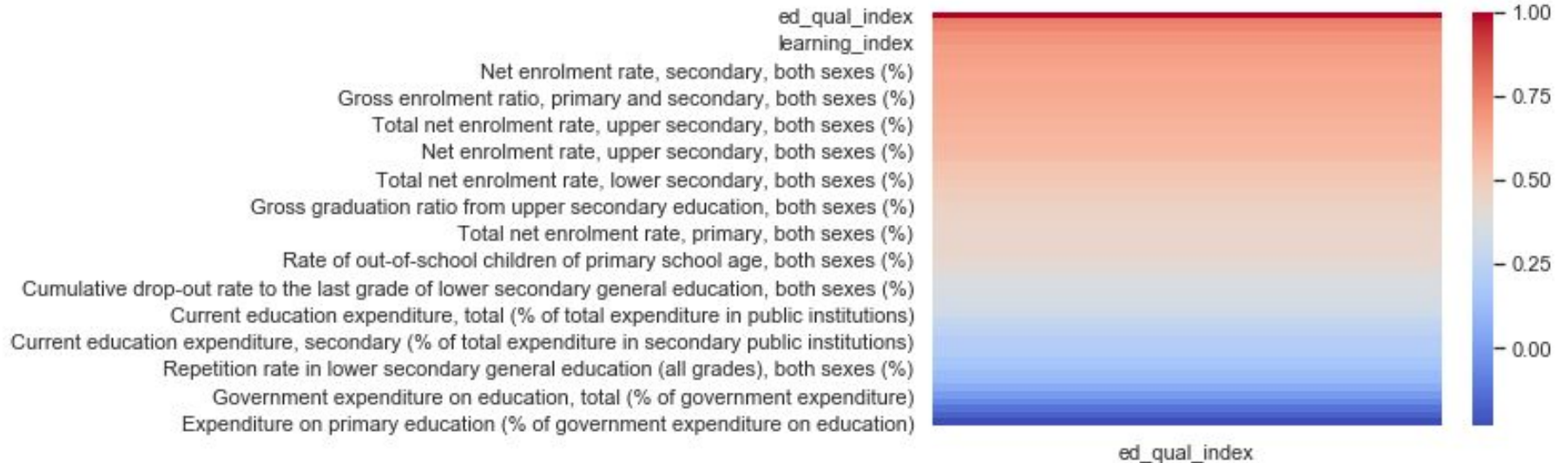
Features Correlated with School Resources Index



Features Correlated with Learning Outcomes Index



Features Correlated with Education Quality Index



Top Countries by Index

```
Year_Country
2012_Singapore      1.100000
2015_Singapore      1.094854
2015_Spain          1.062294
2006_Finland        1.061270
2012_Spain          1.060064
2009_Spain          1.051692
2009_Finland        1.051049
2012_Republic of Korea 1.046899
2012_Japan          1.046642
2009_Republic of Korea 1.045438
Name: learning_index, dtype: float64
```

```
Year_Country
2015_Finland      1.100000
2015_Denmark      1.045439
2015_Ireland      1.044536
2015_Lithuania    1.042688
2015_Belgium      1.038566
2015_Slovenia     1.031495
2006_Belgium      1.028028
2012_Belgium      1.024209
2015_Spain        1.018522
2015_Sweden       1.017748
Name: climate_index, dtype: float64
```

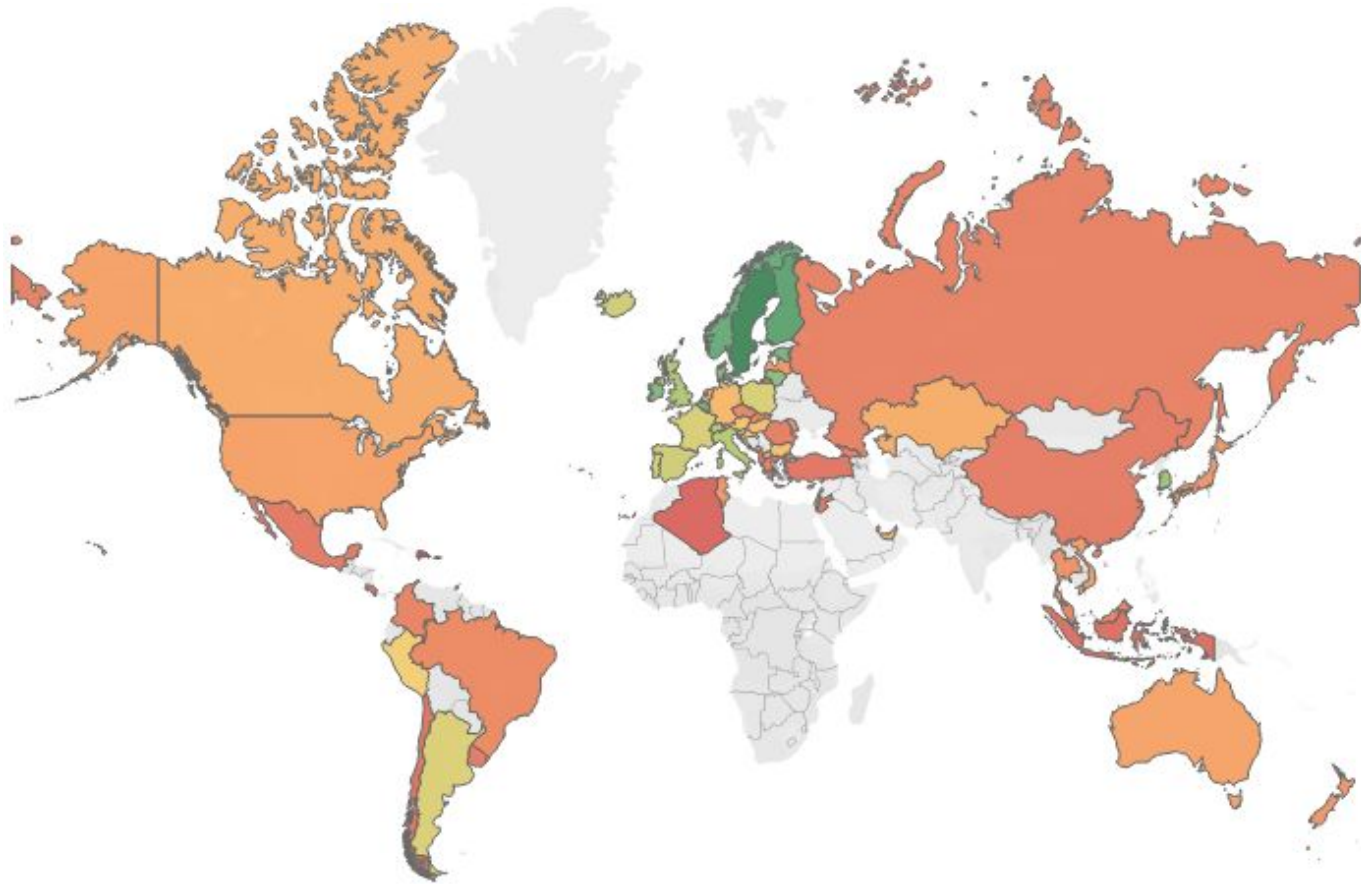
```
Year_Country
2009_Republic of Moldova 1.100000
2015_Republic of Moldova 1.080842
2012_Republic of Moldova 1.078640
2015_Cyprus              1.073287
2000_Sweden              1.072440
2003_Denmark             1.067790
2000_Denmark             1.065954
2006_Denmark             1.064698
2015_Tunisia            1.063200
2015_Uruguay            1.060781
Name: resources_index, dtype: float64
```

Top Education Quality Index Values

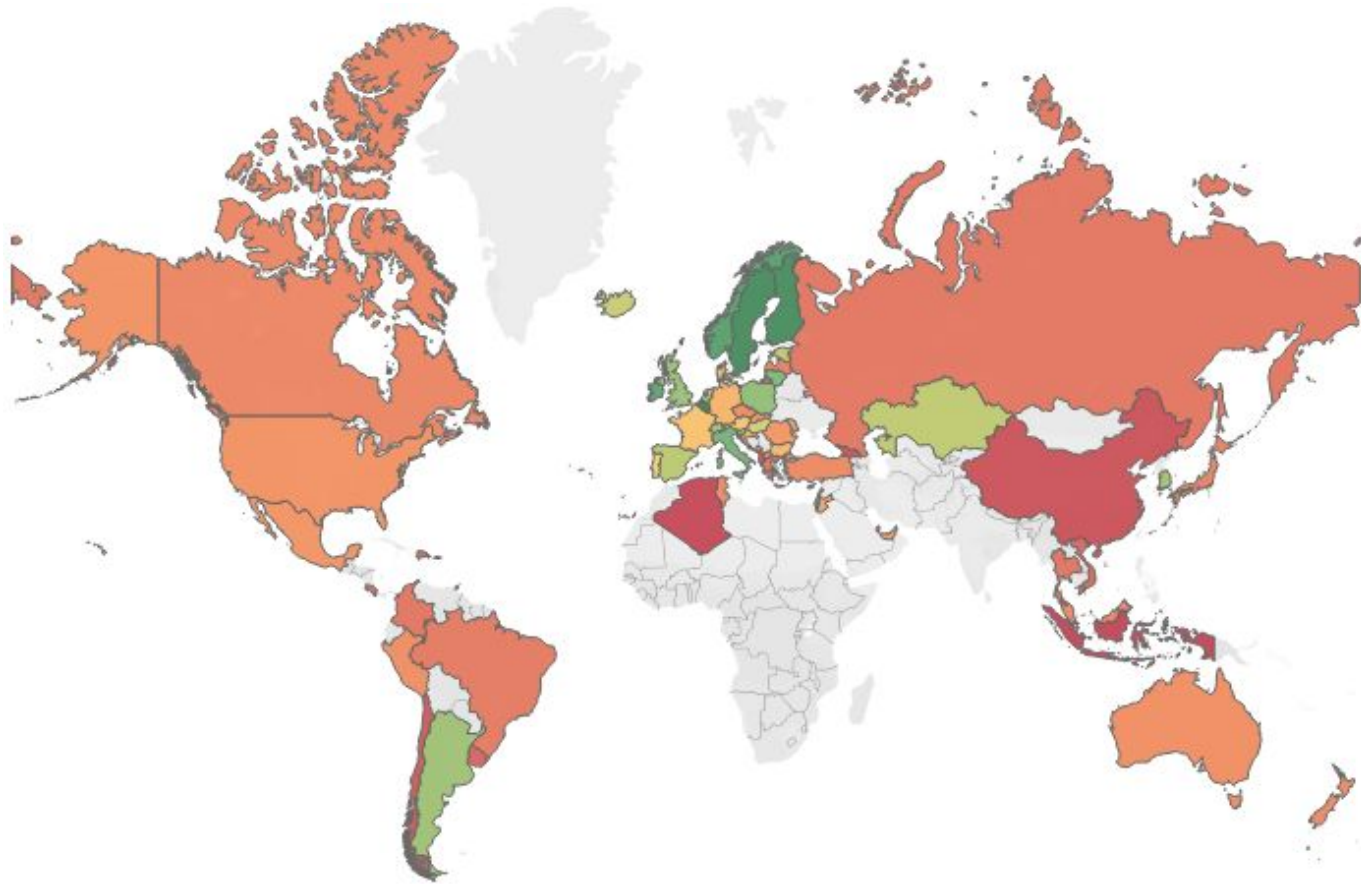
Year_Country	
2015_Finland	1.131133
2009_Finland	1.076251
2012_Finland	1.065708
2015_Spain	1.059025
2015_Belgium	1.049086
2012_Denmark	1.044720
2000_Sweden	1.042887
2015_Sweden	1.041655
2009_Belgium	1.038473
2006_Finland	1.030511
2015_Denmark	1.030226
2009_Denmark	1.028663
2015_Slovenia	1.026433
2015_Ireland	1.026188
2006_Belgium	1.019769

Name: ed_qual_index, dtype: float64

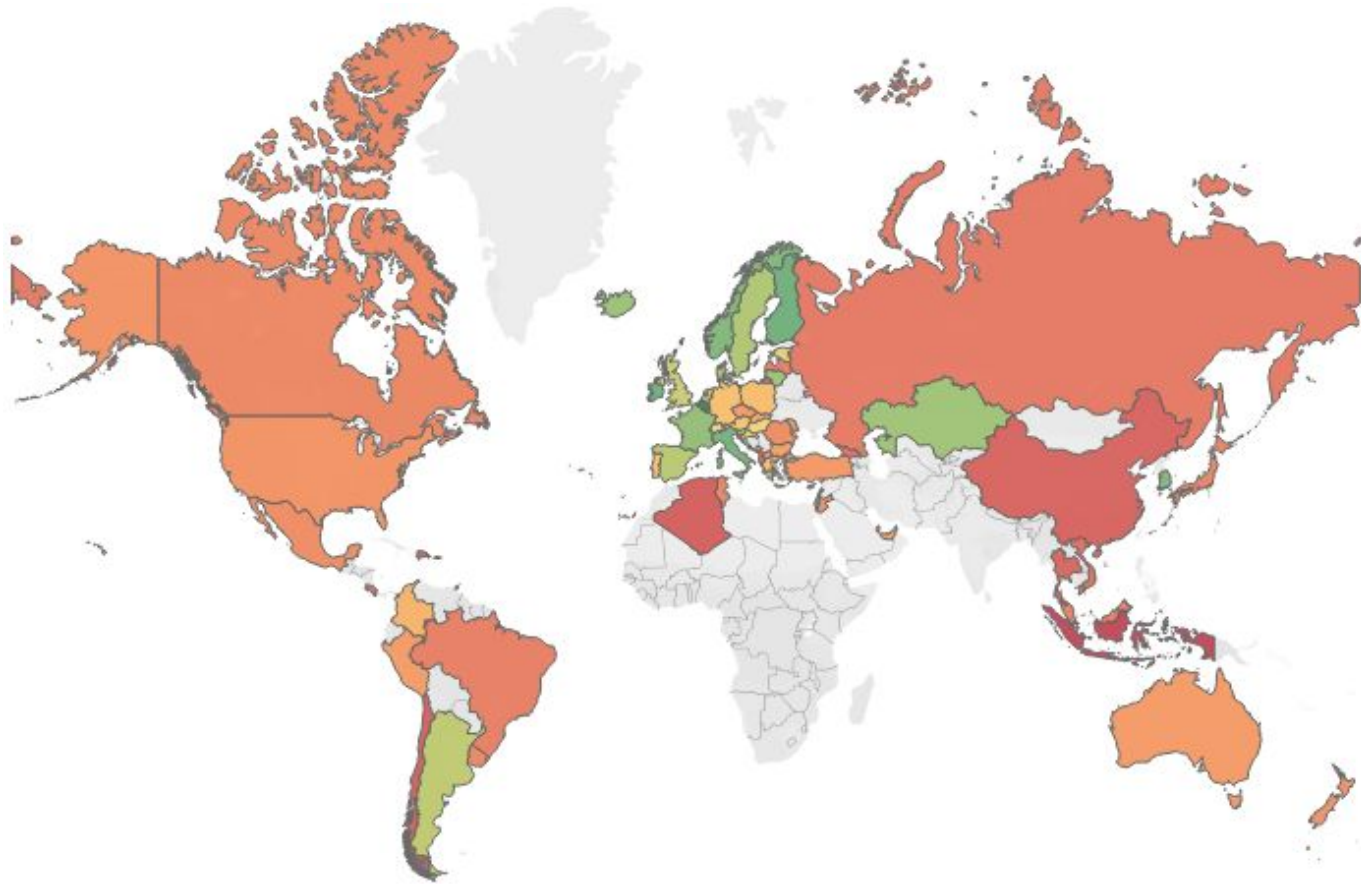
2000



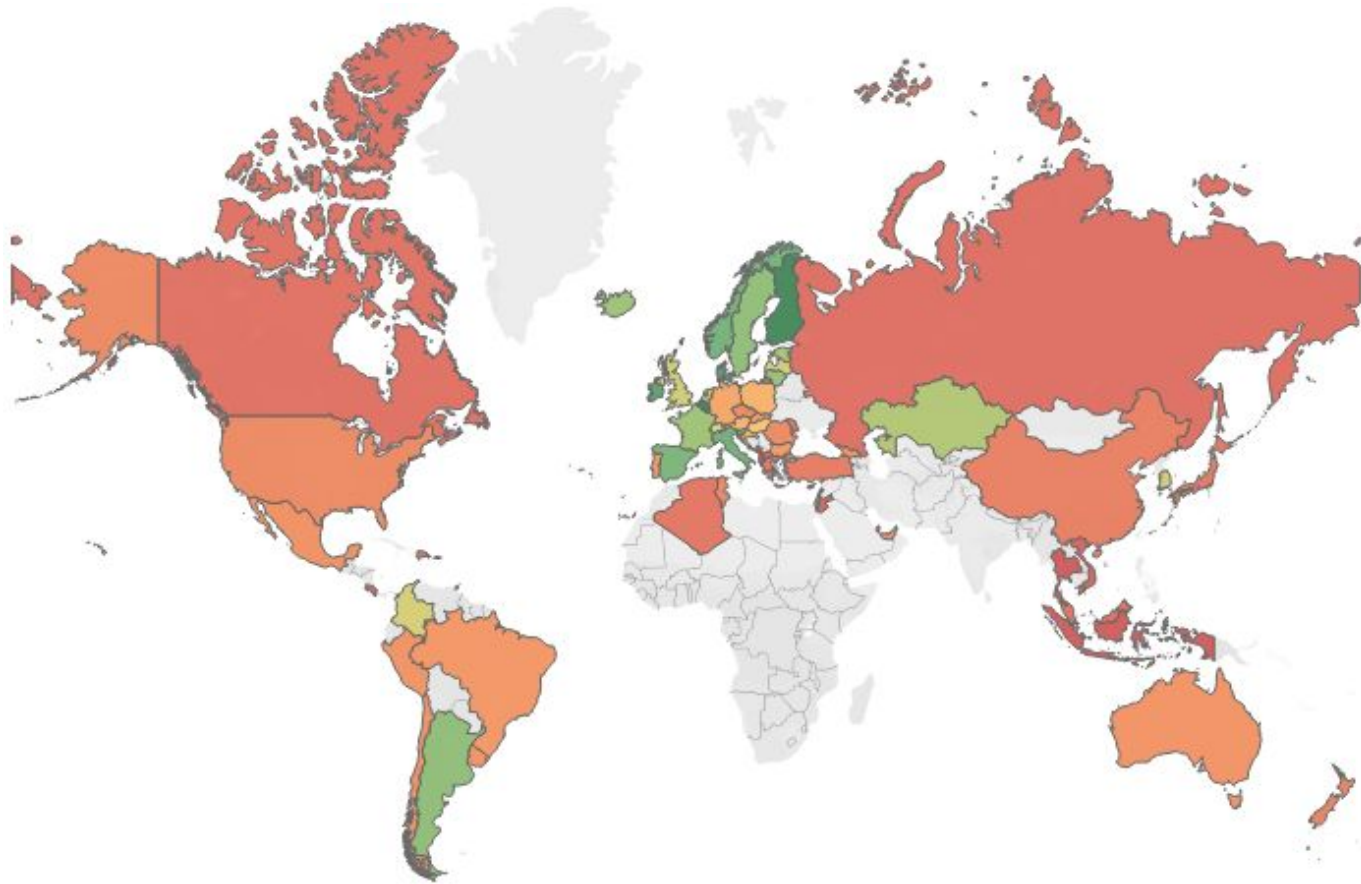
2003



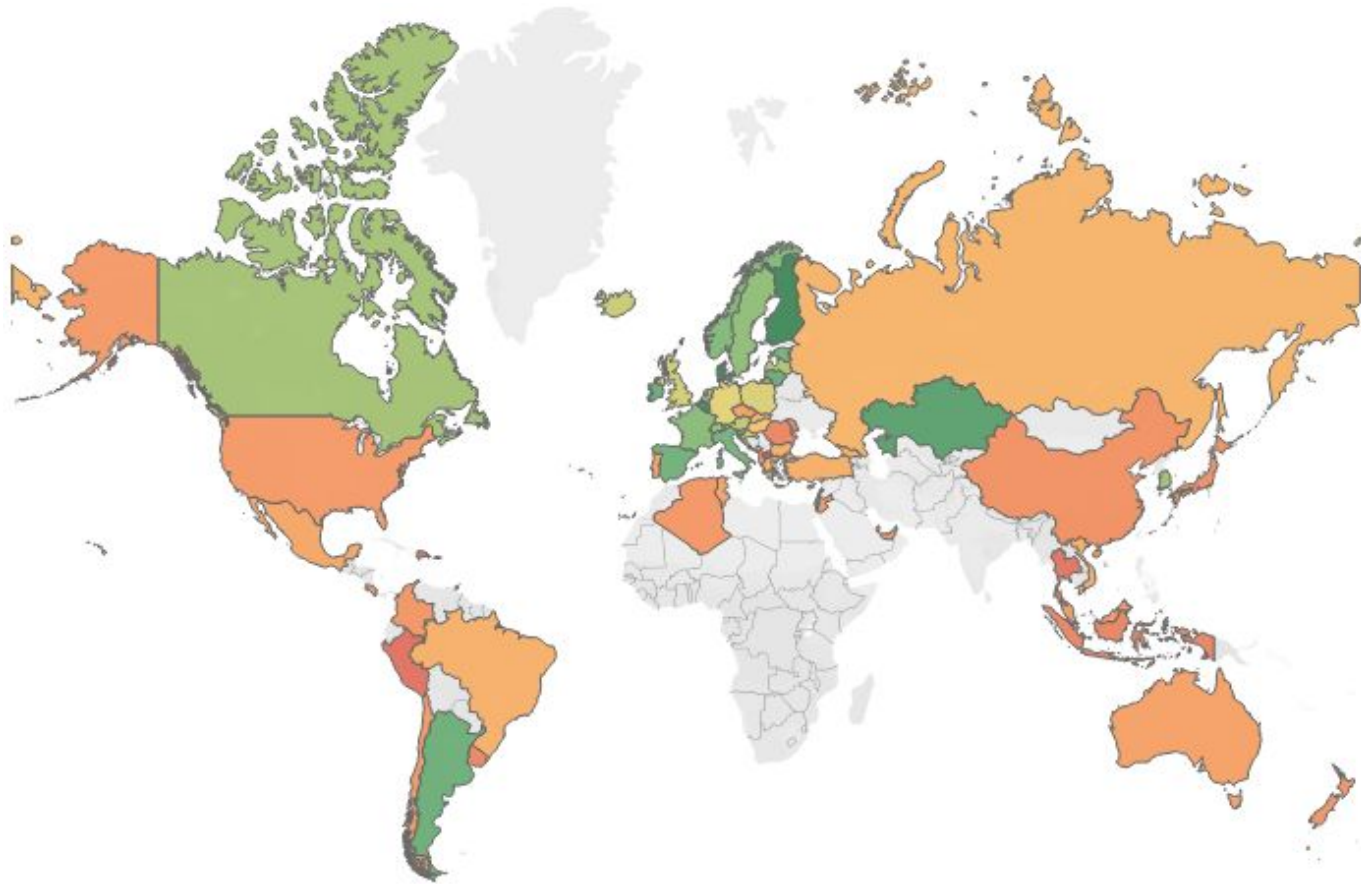
2006



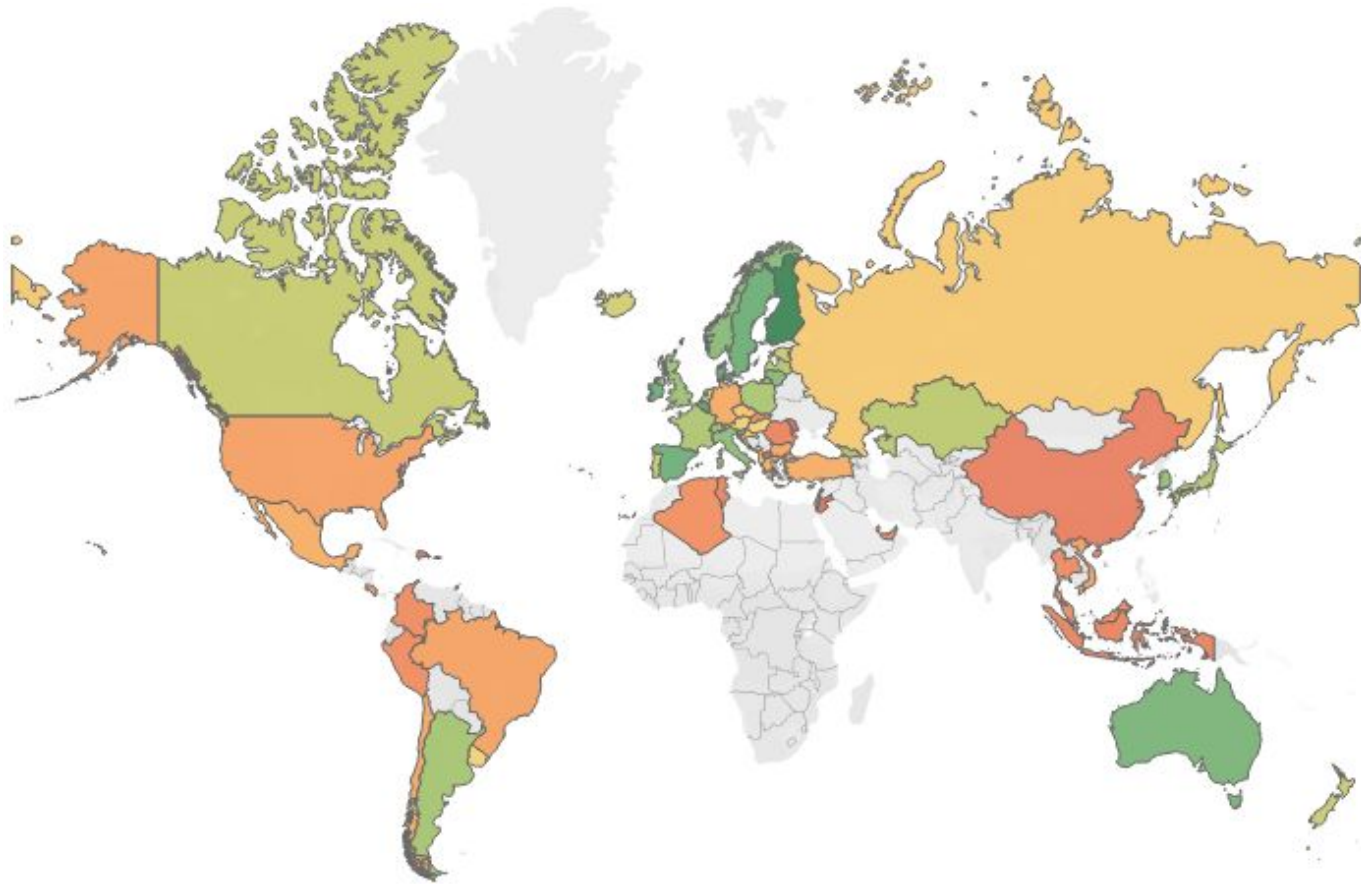
2009



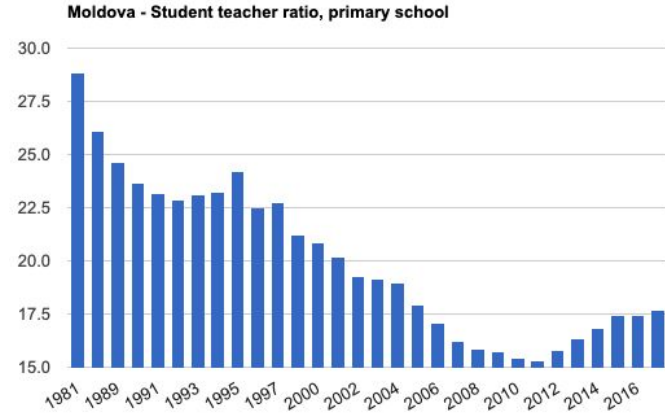
2012



2015



The Case of Moldova



- Why does Moldova have the highest resource index in the world?
- *Improving the Efficiency and Equity of Public Education Spending*
 - Staff wages account for the majority of educational system total cost
 - Moldova has the highest student-per-teacher ratio (15.32 in 2011)

Conclusions

- The top education systems in the world exist in Europe
 - Finland, Belgium, & Denmark top the list
- Resource factors play a relatively small role in determining quality
 - Best predictive factors include enrollment & inverse drop-out
- Worldwide quality has improved
 - US education has not

2000	Education Quality Index Mean:	0.8822
2003	Education Quality Index Mean:	0.8897
2006	Education Quality Index Mean:	0.8988
2009	Education Quality Index Mean:	0.9132
2012	Education Quality Index Mean:	0.9167
2015	Education Quality Index Mean:	0.9332

Limitations

- How to handle missing values: the problem with imputing 1
 - Imputing 1 does not explicitly alter indexes but does negate the gain / loss potential
- Multicollinearity amongst features (i.e. Ed. Expenditures: % of GDP & % of Govt Expenditure & ...)
 - This problem mentioned in article titled *Can we measure education quality in global rankings?*
- Difficult to measure learning outcomes imparted solely from educational systems
 - That is, learning outcomes always reflect prior experience / learning aptitude

References

- The 11 Best School Systems in the World (November 2016)
 - INDEPENDENT Report by Oscar Williams-Grut
 - <https://www.independent.co.uk/news/education/11-best-school-systems-in-the-world-a7425391.html>
- Measuring education: What data is available? (February 2018)
 - Our World in Data Report by Max Roser
 - <https://ourworldindata.org/measuring-education-what-data-is-available>
- Improving the Efficiency and Equity of Public Education Spending: The Case of Moldova (February 2019)
 - IMF Working Paper by Hui Jin, La-Bhus Fah Jirasavetakul, and Baoping Shang
 - <https://www.imf.org/~media/Files/Publications/WP/2019/WPIEA2019042.ashx>
- Can we measure education quality in global rankings? (August 2018)
 - University World News: The Global Window on Higher Education Report by Philip G Altbach and Ellen Hazelkorn
 - <https://www.universityworldnews.com/post.php?story=20180814184535721>
- Data Resources:
 - UNESCO UIS (February 2019)
 - <http://data.uis.unesco.org/#>
 - PISA (February 2017)
 - <https://pisadataexplorer.oecd.org/ide/idepisa/>
 - World Bank (June 2017)
 - <https://datacatalog.worldbank.org/dataset/education-statistics>