

# Educational feature extraction across nations using UNdata



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## 1. Introduction

### Education Sector Analysis (ESA)

a way of a rational policy analysis which helps to suggest an efficient and strategic solution in education for developing countries. (John C. Weidman, 2011)

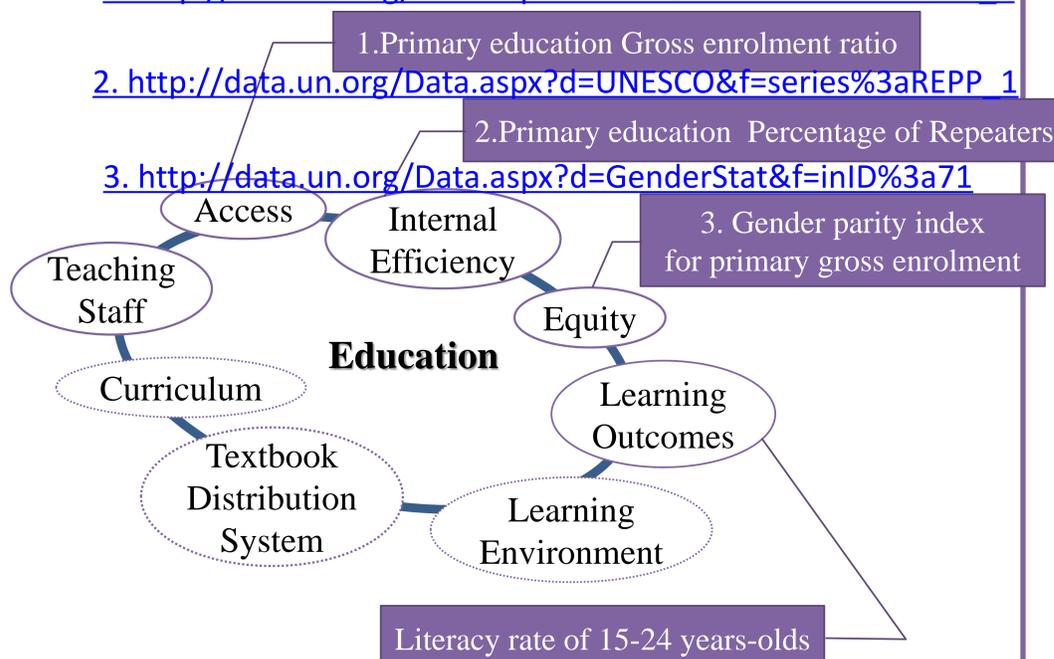
In our study, we make a plot showing clear relationship between each country and the two kinds of contents; educational items that are critical on education in each country and external items that harm the education.

### Educational items (4 variables)

1. [http://data.un.org/Data.aspx?d=UNESCO&f=series%3aGER\\_1](http://data.un.org/Data.aspx?d=UNESCO&f=series%3aGER_1)

2. [http://data.un.org/Data.aspx?d=UNESCO&f=series%3aREPP\\_1](http://data.un.org/Data.aspx?d=UNESCO&f=series%3aREPP_1)

3. <http://data.un.org/Data.aspx?d=GenderStat&f=inID%3a71>



4. <http://data.un.org/Data.aspx?d=SOWC&f=inID%3a10>

### External items (4 variables)

• GNI, PPP (current international \$)

<http://data.un.org/Data.aspx?q=GNI&d=SNAAMA&f=grID%3a103%3bcurrID%3aUSD%3bpcFlag%3a0>

• HIV/AIDS rate among population 15-24

<http://data.un.org/Data.aspx?q=HIV%2fAIDS+rate+among&d=GenderStat&f=inID%3a25>

• Intentional homicide, number and rate per 100,000 population

<http://data.un.org/Data.aspx?q=homicide&d=UNODC&f=tableCode%3a1>

• Percentage of individuals using the Internet

<http://data.un.org/Data.aspx?q=internet&d=ITU&f=ind1Code%3aI99H>

The purpose of this study is, therefore, by presenting which the problem in education should be tackled the most, we can seize the educational features on each country.

## 2. Method

Unfolding is visualizing method for the relations between two kinds of objects, from two-way two-mode dissimilarity data (Borg and Groenen, 2005). Here, new unfolding which can deal with three kinds of objects with considering geographical locations is introduced to reveal the relations among countries, educational items, and external items.

The model is described as Figure 1 and the objective function is shown.

### Geographical coordinates of Countries

$$\mathbf{X} \in \mathbb{R}^{|I| \times 2}$$

### Coordinates of educational items

$$\mathbf{Y} \in \mathbb{R}^{|J| \times 2}$$

### Coordinates of external items

$$\mathbf{Z} \in \mathbb{R}^{|K| \times 2}$$

### Proposed objective function

$$L(\mathbf{X}, \mathbf{A}, \mathbf{W}, \mathbf{V}, \mathbf{Y}, \mathbf{Z}) =$$

$$\sum_{i \in I^*} \sum_{j \in J^*} \left( {}^{(IJ)}\delta_{ij} - d_{ij}(\mathbf{V}, \mathbf{Y}) \right)^2 + \sum_{j \in J} \sum_{k \in K} \left( {}^{(JK)}\delta_{jk} - d_{jk}(\mathbf{Y}, \mathbf{Z}) \right)^2 \rightarrow \text{Min}$$

subject to

$$\mathbf{A}^t \mathbf{A} = \mathbf{I}, \quad \mathbf{W} = \text{diag}(w_{11}, w_{22}, \dots, w_{pp}), \quad \prod_{h=1}^2 w_{hh} = 1,$$

$$\| \mathbf{v}_i - \mathbf{x}_i^t \mathbf{A} \mathbf{W} \| = 1 \quad (i \in I), \quad \| \mathbf{y}_j - \bar{\mathbf{x}}(\mathbf{A}, \mathbf{W}) \| = \max_i (\mathbf{x}_i \mathbf{A} \mathbf{W}) \quad (j \in J)$$

$$\text{where} \quad d_{ij}(\mathbf{V}, \mathbf{Y}) = \| \mathbf{v}_i - \mathbf{y}_j \| \quad d_{jk}(\mathbf{Y}, \mathbf{Z}) = \| \mathbf{y}_j - \mathbf{z}_k \|^2$$

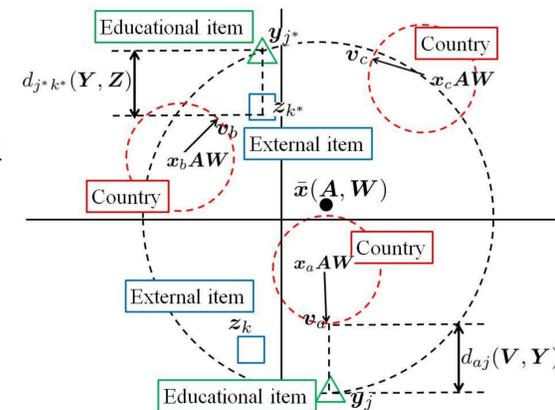


Figure 1 the proposed model

## 3. Application

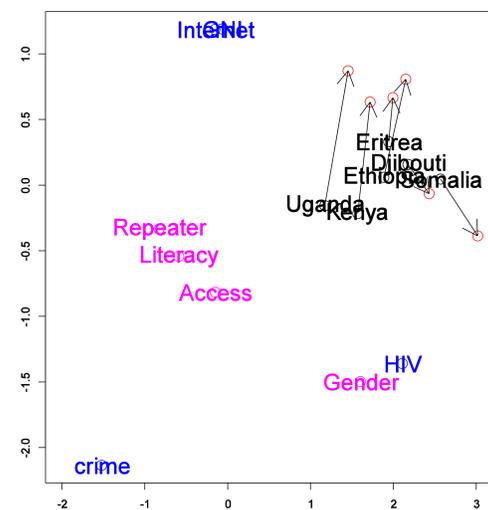


Figure 2 the result of the Unfolding of the middle area of Africa

## 4. Conclusion

What we found out from the result is:

1) Each of educational items has the similar value on each country.

-> a financial support for those countries should be distributed over all educational items.

2) Among external items, only HIV has the high correlation with the Internal efficiency.

This means: the spread of HIV infections deprives people of equal educational opportunities.

-> to give people knowledge on HIV may result in equally providing both men and women with education, which eventually leads to better educational standards.

## References

- [1] I. Borg and P. Groenen (2005): *Modern Multidimensional Scaling, Theory and Applications*. Springer-Verlag, New York.
- [2] John C. Weidman (2011) : *Education Sector Analysis: An Introduction*, [http://www.gsid.nagoya-u.ac.jp/syamada/Dr.%20Weidman\\_PPT2.pdf](http://www.gsid.nagoya-u.ac.jp/syamada/Dr.%20Weidman_PPT2.pdf)