A Hierarchical Linear Modelling of Gender Differentials in Mathematics in the Kenya Certificate of Primary Education Examination

EE4A

Evidence-based Education Reforms for Sustainable National Transformation

---

Epari Ejakait, PhD
Masinde Muliro University of Science and Technology

Presentation Layout

- Introduction
- Objective
- Purpose
- Methodology
- Results
- Policy Implications

Introduction

- Single level models (OLS) are inappropriate
  - Not sensitive to the hierarchical nature of the data
  - Aggregates student-level data to school-level (introduces bias)
  - Disaggregate school-level data to student-level (under-estimates standard errors)
  - Both approaches miss the nature of school effects
  - Not adept at measuring interrelationships among independent variables
  - HLM

Objective

- Model the drivers of gender differentials in Mathematics in the Kenya Certificate of Primary Education (KCPE) examination
- We do this through comparative Hierarchical Linear Models (HLM) for male and female students.

Purpose

- To Contribute to SDG Target 4.5:
  - By 2030, eliminate gender disparities in education and ensure equal access to all levels of education and vocational training for the vulnerable, including persons with disabilities, indigenous peoples and children in vulnerable situations
- There is a long standing achievement gap: Boys were better in Math in the 2019 KCPE results

Methodology

- Mumias sub county from the top 5% sub counties for the period 2010-2012
- Kuria East sub county from the bottom 5% sub counties for the same period
- $n = \left(\frac{z x \sigma}{E}\right)^2$ = 1824 Class 8 Candidates 2014, ±2.34% margin of error
- Population Proportion to Size; Mumias, 1068 (58.55%); Kuria East, 758 (41.45%)
- Multi-stage sampling techniques

Methodology_2

- Outcome Variable: Math raw scores transformed to standardized scores, $z = (\frac{x-\mu}{\sigma})$ with M=0 & SD=1
- Eplanatory Variables (Student Level-1 Variables; School Level-2 Variables)
- $yij = \beta_0 + \beta_1 X_{ij} + u_j + e_{ij}$
- Random effects and residual errors are assumed independent of one another and normally distributed with zero means and constant variances $u_j \sim N(0, \sigma_u^2)$; $e_{ij} \sim N(0, \sigma_e^2)$

Key Results

- Female students scored 0.33 (p<.001) standard deviation units below the boys Maths
- Schools encouraged to allow unlimited access to T/books
- Both boys and girls in the low SES scored lower than their counterparts in the high SES
- Parental education positively affects boys Math scores
- Bad company more detrimental to boys Maths scores
- Kuria East negatively affects Math scores compared with Mumias
- epari_maths_tables_ee4a_conference_2019.xlsx

Policy Implications

- Mentorship in math for female students
  - Female mathematics teachers, with a positive attitude
  - ‘talks’ from females who have excelled in math and the sciences
  - Rewards for student positive deviation in math, among others.
- Low SES households: Policy interventions at micro and macro levels
- Grade repetition is a waste, stakeholder fora for education
- Bad and/or negative company worse for boys.

Policy Implications_2

- Schools should be encouraged to lend books and other materials to students for their private study away from official school time.
- The puzzle of Kuria East. Most input variables appear same as for Mumias (Teachers, textbooks). Is it attitude? Multisectoral approach for all stakeholders to isolate variables of concern

Thank you


Evidence
Action


WUSC EUMC


KENYATTA
UNIVERSITY


APHRC
African Population and
Health Research Center


RTI
INTERNATIONAL


KICD


HARAMBEE


Twaweza
ni sisi


ipa
INNOVATIONS FOR
POVERTY ACTION