An Agent Based Model to Understand the Impact of Teacher Feedback on Children’s Participation and Equity in Learning

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Conventional Research: Focus on Individuals and Group Comparisons

- Assess Individuals
  
  Deep Dive FGDs

- Observe Classrooms

- Compare Groups
  
  Malawi
  
  Philippines
  
  Treatment Schools
  
  Control Schools

- Learn About
  
  Preschool
  
  No Preschool

  High Self-Efficacy
  
  Low Self-Efficacy
Also focuses on the intersection of learning and the learning environment.
Learn Something About

Many Unanswered Questions

Why do education systems perform differently?

What is the basis for variance in impact and persisting inequity?

What defines a safe and supportive school?

What drives teacher uptake of an intervention?
Social agents interact with each other through connections and navigate their world by the adaptive processes they apply – making decisions, learning, changing – as they encounter and interact with other social agents.

- J Miller & S Page, 2007, p.10

- Diversity of individuals, institutional departments, sub-systems (communities, classrooms)
- Path dependence
- Sensitive to local context and social eco-system
- Subject to self-organization without central control
- Impact system changes in often unpredictable ways
Agent Based Modeling

Core Assumption: “Many if not most phenomenon in the world can be modeled with agents, an environment, and a description of agent-agent interactions and agent-environment interactions.”

In an ABM ....

- **Agents interact** with each other and their environment, based on rules or strategies.
- **Agents update** their individual properties or behaviors and the strategies of interaction based on the information that is exchanged in these interactions.

**Interactions** are constituted by exchange of information.
Why did I choose Agent Based Modeling

- **School climate** research and programming to establish **safe and supportive schools** must capture relational dynamics and conventional aggregate measures can miss this.

- ABM modeling offers a way to capture the relational dynamics in schools and classrooms such as the impact of teacher feedback on students’ participation.
**Hypothesis:** When teachers punish or give negative feedback to students, willingness to participate decreases - the reverse being true for positive feedback.

**Elements of the Model**

- **Agents and Properties**
  - Teacher – Probability of giving positive feedback (1% - 99%)
  - Students – Average, High, Low Participators

- **Environment**
  - Classroom of 120 students
  - School Climate: Punitive, Average, Positive
Modeling impact of teacher feedback on student participation, retention, equity

• What Happens in Each Time Step as Model Runs?
  – Teacher calls on a pupil
  – Child responds
  – Teacher provides positive or negative feedback
  – Child impacted by and changes participation behavior depending on feedback

• Manipulation of Model
  – Probability of positive teacher feedback: from 1% - 90%
  – Choose the type of learning environment: Punitive, Average, Positive
What are the Outputs?

- Observation of a changing classroom dynamic
- Change in student participant levels in different conditions of the model
- Change in the participation levels of students over a period of time or "time steps"
  - Average
  - High
  - Low
  - Quit Participating
  - Dropped Out
Differential Impact of Teacher Feedback on Low Participators/Most Vulnerable

Teacher provides Positive Feedback 50% time (500 teacher-child exchanges/Time steps)

Differential Impact on Vulnerable

- Quit Participating: Vulnerable 48%, Total 29%
- Dropped Out: Vulnerable 20%, Total 11%
A small increase in positive feedback can make a difference.
A small reduction in positive feedback can make a difference.
“All models are wrong, but some models are useful”
- George Box, (1979)

- We started with a minimalist model, to nudge more narrative about the impact of teacher feedback.

- Rules in model only verified in a cursory way with qualitative interviews with primary school children. More extensive data collection in process to inform the rules in this model

- Need to learn more about the balance of positive and negative teacher feedback in targeted classrooms.

- The distribution of individual vulnerability and participation based on real data from rural schools in Uganda, but this must be adjusted for other contexts.

- What other elements should be introduced, keeping in mind these are useful only if they change the story.
Thank You!

For questions, please contact me at erandolph@rti.org