



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

Elizabeth Randolph, CIES 2022



Conventional Research: Focus on Individuals and Group Comparisons

Assess Individuals



Compare Groups



Malawi

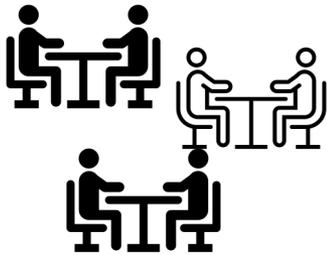


Philippines

Learn About



Deep Dive FGDs



Treatment Schools



Control Schools



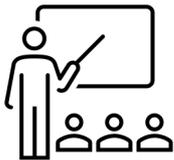
Preschool



No Preschool



Observe Classrooms



High Self-Efficacy Low Self-Efficacy





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.



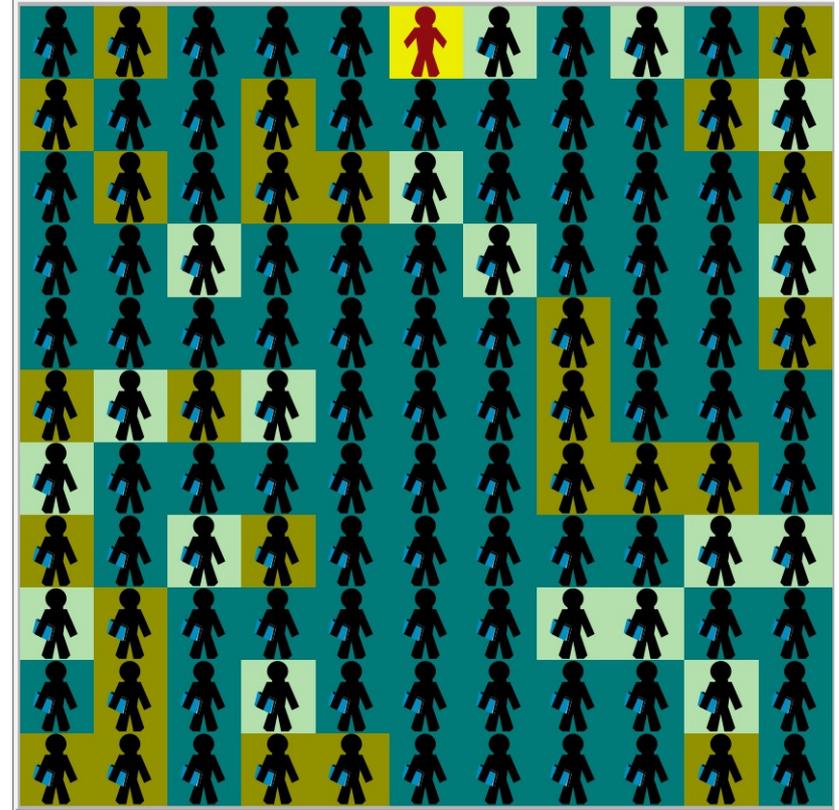
Photo: Katie Nelson, RTI International



Photo: Elizabeth Randolph, RTI International

Modeling impact of teacher feedback on student participation, retention, equity

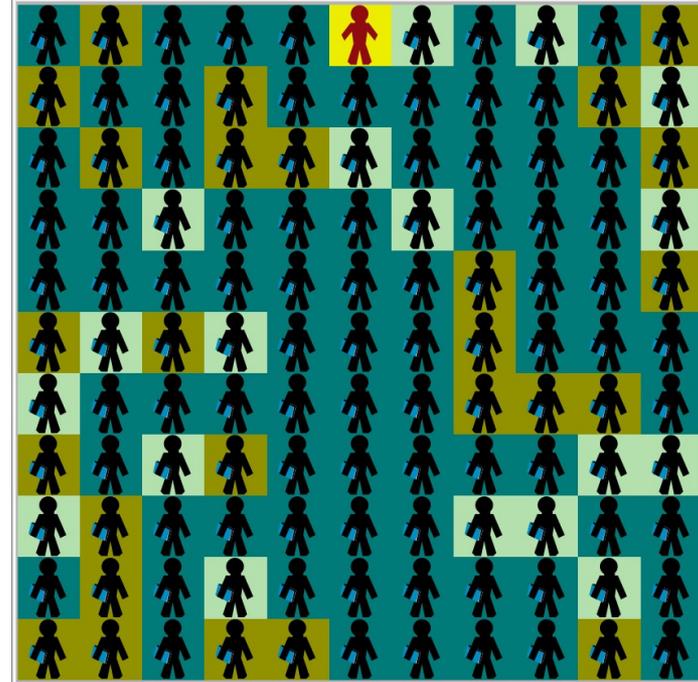
- **Hypothesis:** When teachers punish or give negative feedback to students, willingness to participate decreases - the reverse being true for positive feedback.
- **Elements of the Model**
 - **Agents and Properties**
 - Teacher – Probability of giving positive feedback (1% - 99%)
 - Students – Average, 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



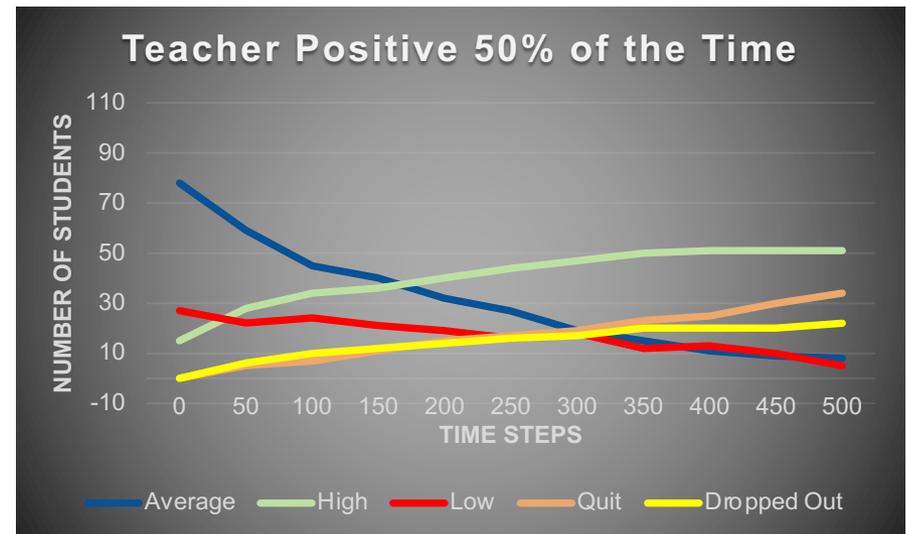
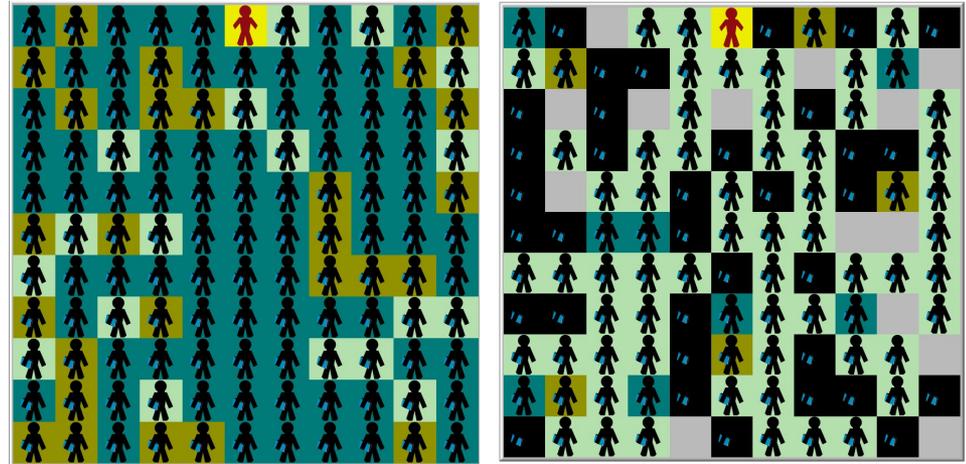
- **Manipulation of Model**

- Probability of positive teacher feedback: from 1% - 90%
- Choose the type of learning environment: Punitive, Average, Positive



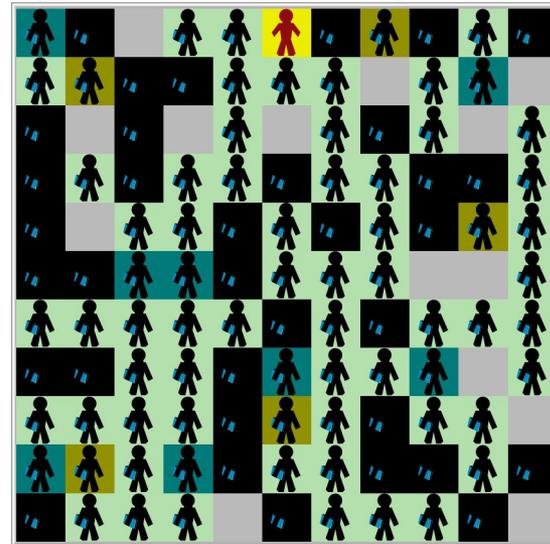
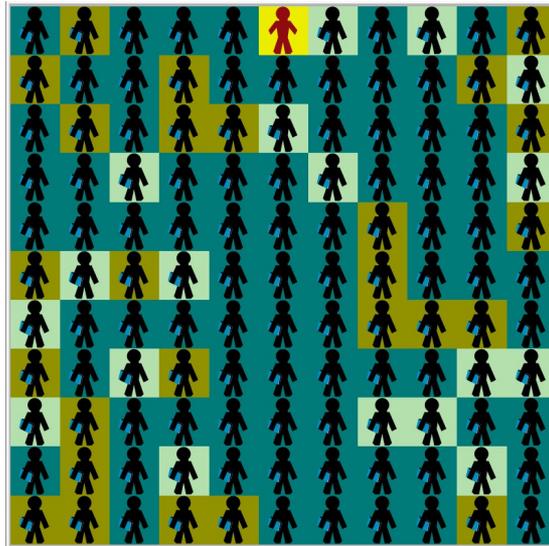
Modeling impact of teacher feedback on student participation, retention, equity

- **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

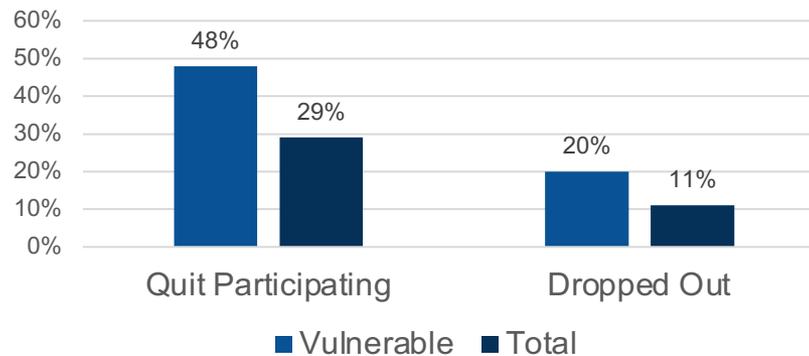


Differential Impact of Teacher Feedback on Low Participators/Most Vulnerable

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

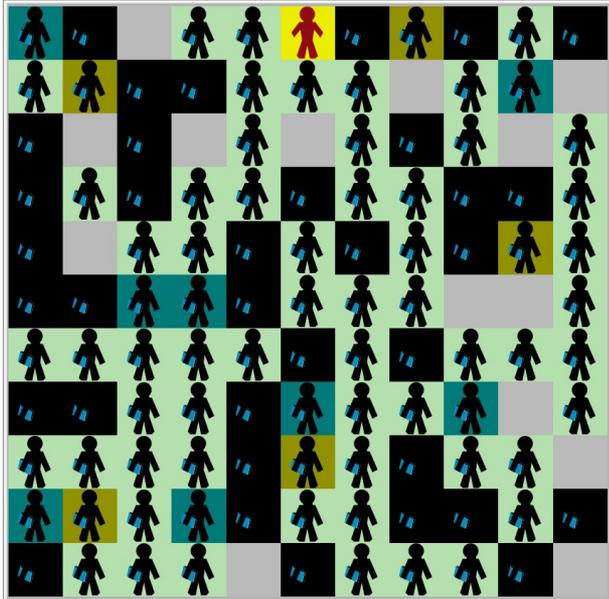


Differential Impact on Vulnerable

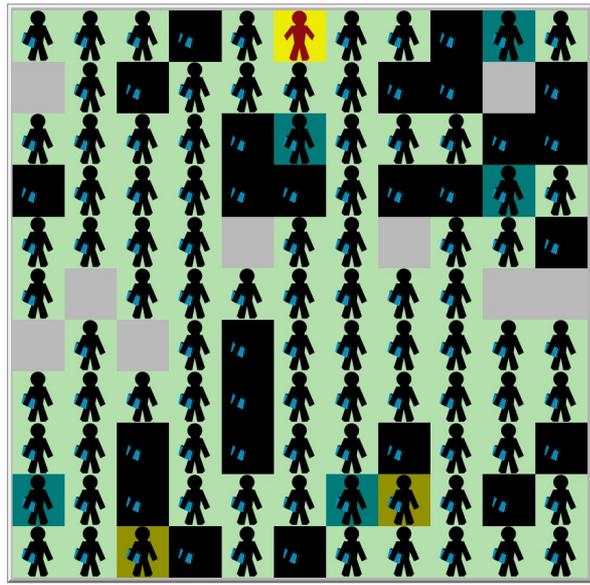


A small increase in positive feedback can make a difference.

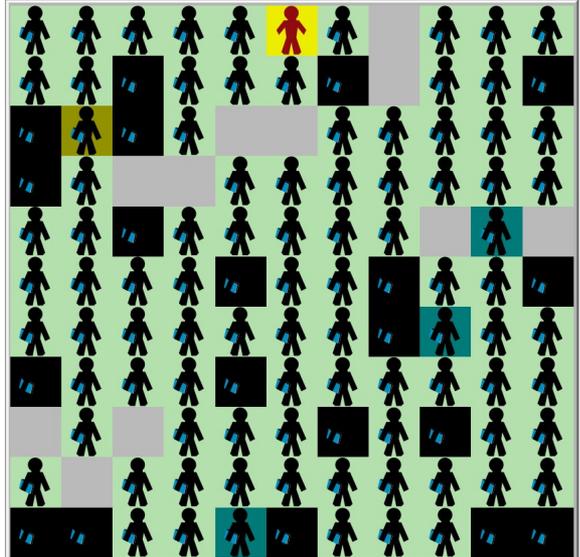
50%
Positive



70%
Positive

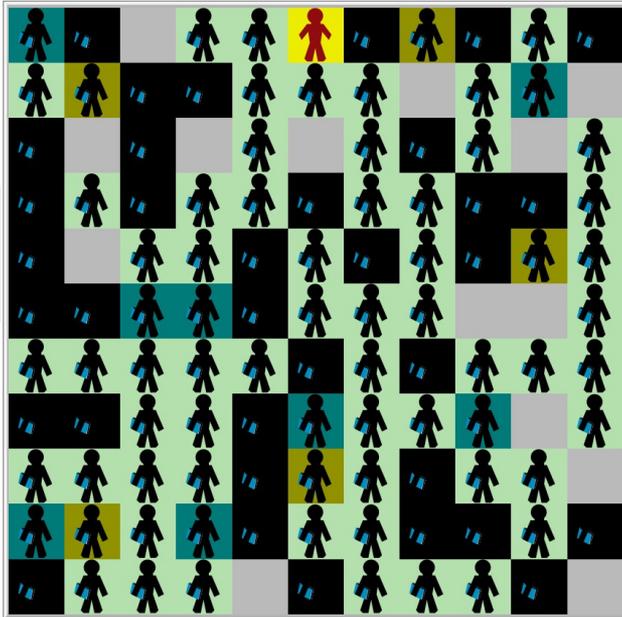


90%
Positive

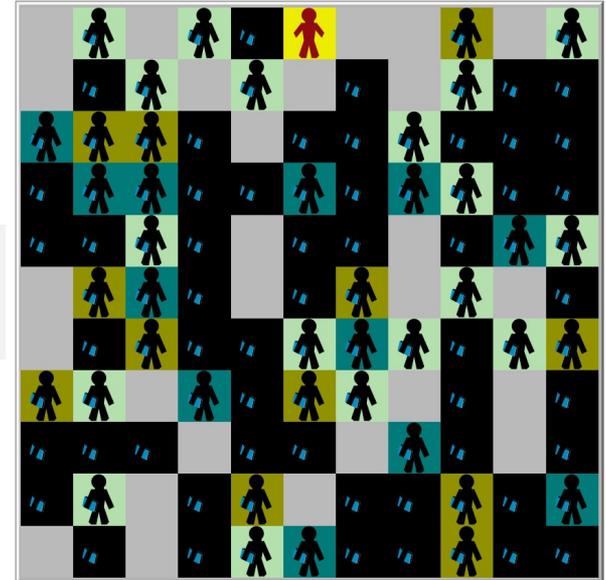


A small reduction in positive feedback can make a difference.

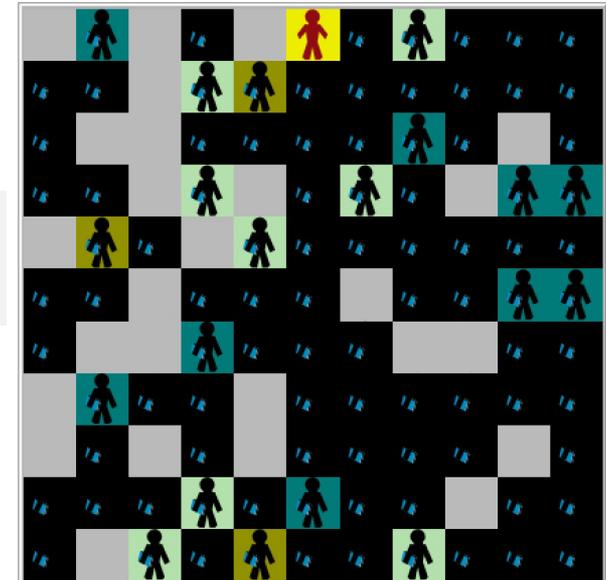
50%
Positive



30%
Positive



10%
Positive



“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