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University of Zurich[UZH]

# Educational Technologies

Guilherme Lichand
University of Zurich

Symposium on the results and next steps of the UNICEF-UZH Partnership

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NEXT TRAIN
EXPRESS
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FLUSHING EXP


Leapfrogging

# Leapfrogging

- Being the follower – instead of the leader – can be good: leapfrogging opportunity!
- But can also be bad… worse, even, than if the technology had not been invented.
  - Why?

# Investments in children - leaders

- Investments in Education (and Health) are an **optimal response** to innovations and their effects on the returns to human capital.

# Investments in children - followers

- Investments in Education are an **optimal response** to **leaders' innovations** and their effects on children's human capital.
- Investments in Education are a **response to external pressure by leaders**.

# Investments as Leapfrogging: Consequences

- Technology may not be **appropriate**
- Technology may not be **institutional**

# Inappropriate Technology

- Evidence that **education linked to supply-side needs** can generate **very high social returns**:
  - Green Revolution in India
  - Primary school in Kenya
  - Vocational school in Brazil
- **No evidence** that **education decoupled from supply-side needs** has positive **social returns**:
  - High school in Indonesia
  - Vocational school in Brazil in France

# Conrad Wolfram: “80% of what is learnt in Math class is worthless”

Physicist, well known for a viral TED talk and for changing the way Math is taught, bets on the end of computing by hand.

ANA TORRES MENÁRGUEZ

3 NOV 2017 - 15:50 CET

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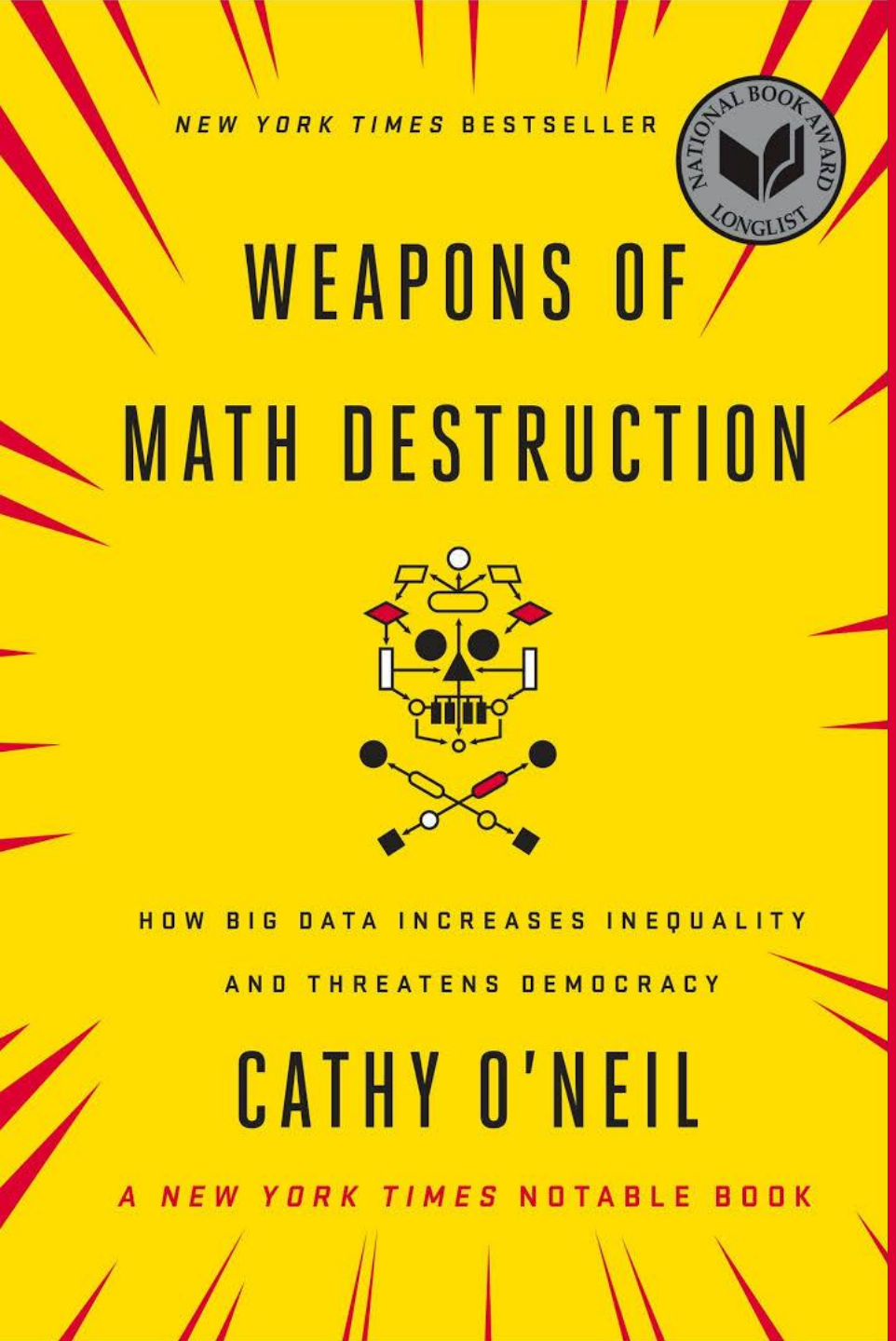
# Inappropriate Technology

- Artificial Intelligence has **negative social returns** when poorly utilized!




# Inappropriate Technology

# Inappropriate Technology

- Machine learning to predict bad teachers:
  - Insufficient frequency of data to fine-tune algorithm
  - **Inequality increases!**

# Non-institutional Technology

A pin prick on the heel of a newborn baby 48 to 72 hours after birth can be life changing.

**ANALYSIS OF A FEW DROPS** of blood can make all the difference between healthy thriving and debilitating ill health caused by an inherited metabolic disorder that might otherwise go undetected until it is too late.

"Newborn screening is probably the pinnacle of preventative medicine, and international practice recommends testing for all newborns," says Dr Chris Vorster, head of the Centre for Human Metabonomics at the Potchefstroom Campus.

This is so even in developing countries such as Thailand and Brazil, where an estimated 97% and 80% of newborns, respectively, are screened shortly after birth.

The situation is starkly different in South Africa: in 2012 fewer than 1% of newborns were screened. "Newborn screening is not a health priority in South Africa and no legislation or even recommendations exist for testing," says Dr Vorster, a chemical pathologist by profession.

body's ability to process certain nutrients – are perceived as being extremely rare in South Africa. Hence, the thinking is that newborn screening would divert funds from more pressing health priorities.

"There is little evidence to suggest that South Africa is spared from inherited metabolic diseases," says Dr Vorster. "Based on the experience obtained from our own screening programme, it appears that some of these disorders are quite common."

Examples are isovaleric acidemia, propionic acidemia and glutaric acidemia type 1, which impair the body's ability to process certain proteins. This can be lethal. It causes the build-up of harmful substances in the blood and urine, which can lead to mental retardation and early death.

The sheer number of inherited metabolic defects that can be passed on by parents unaware that they are carriers is daunting. To date, as many as 2 000 different defects

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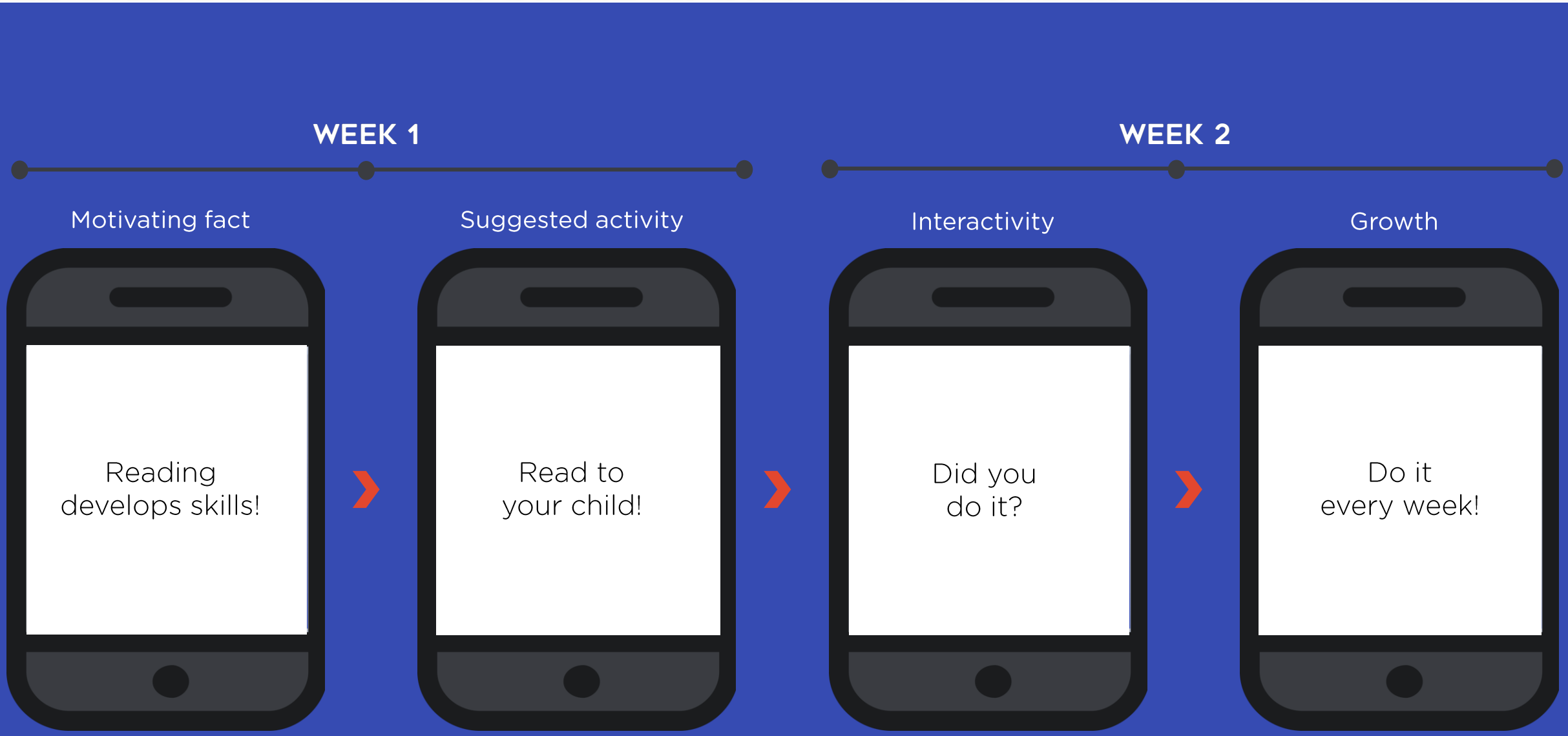
# Non-institutional Technology

- Decisions are not automatic:
  - Investments in Education are not mandatory
- More decisions to be made:
  - How to take my child to school?
  - How to monitor school quality?

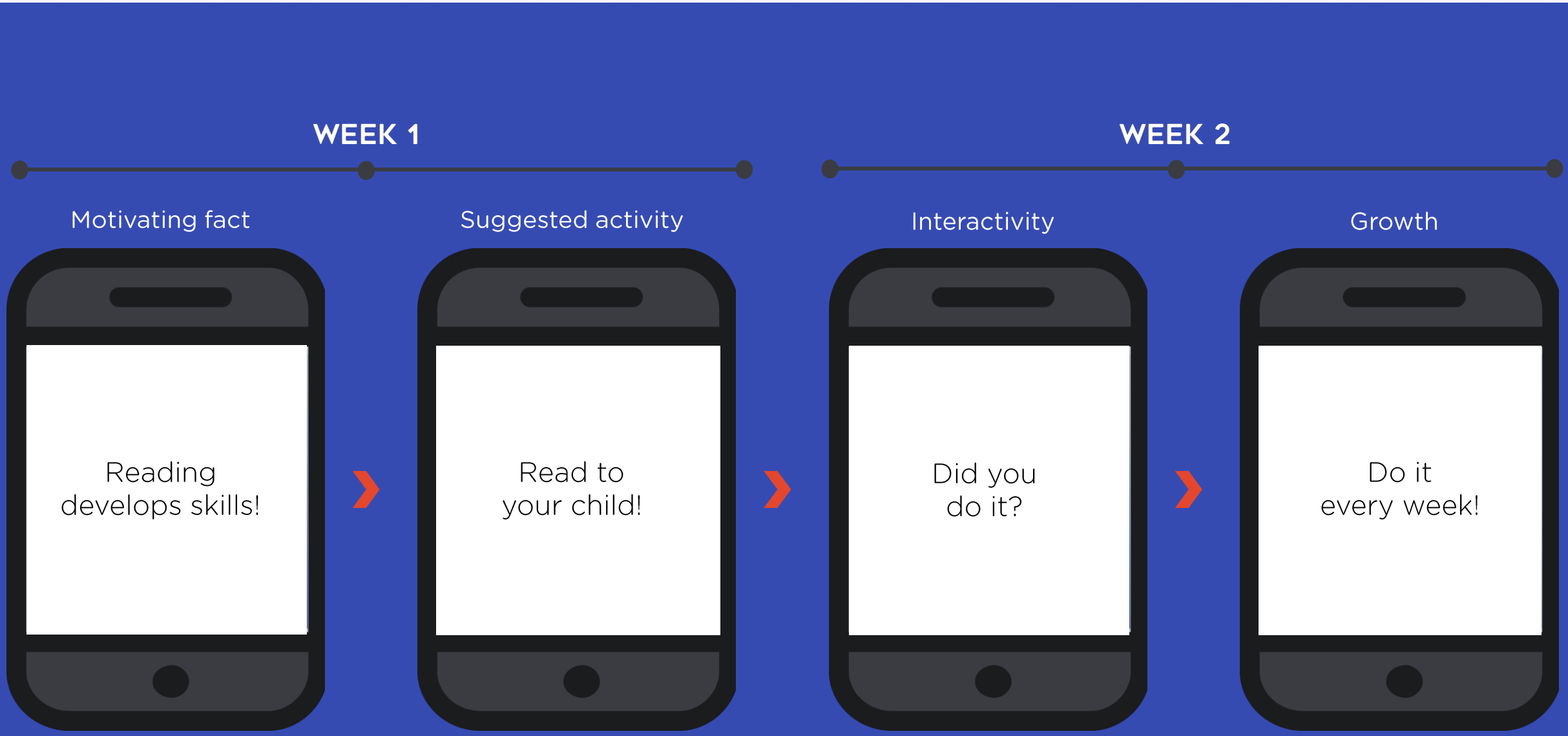
# Non-institutional Technology

- Problem: decisions are complex to everyone, but even more for the poor

# AN SMS EDUCATIONAL PROGRAM

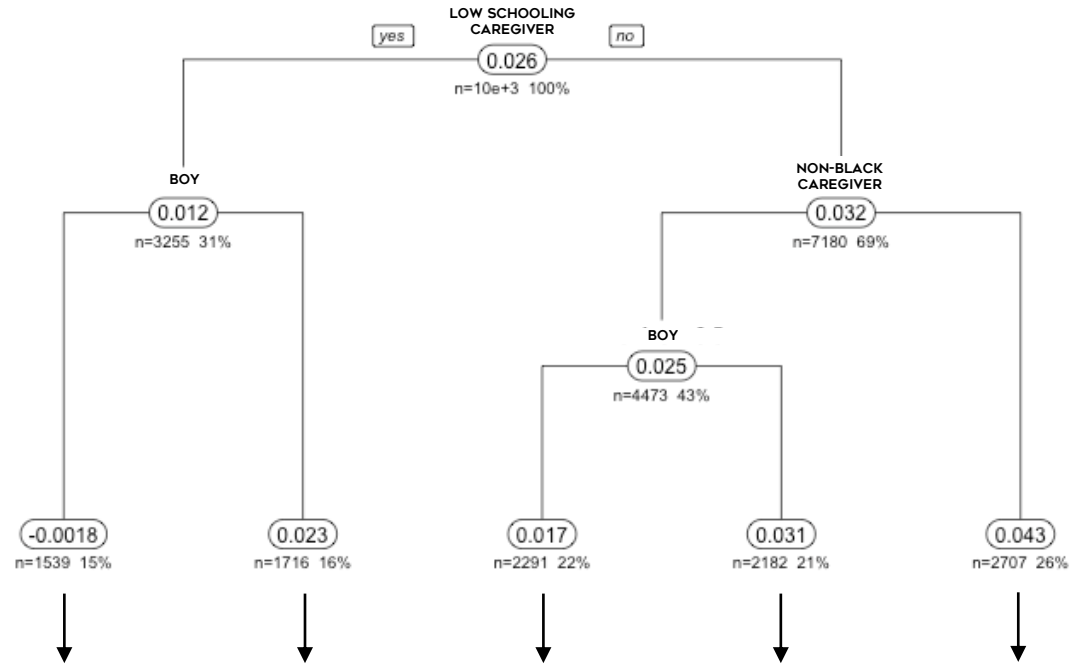


# DO YOU WANT TO BUY IT?



# PREDICTED RETURNS

On the likelihood of **advancing to high school**:




Predicted ROI: 0% 2% 2% 3% 4%

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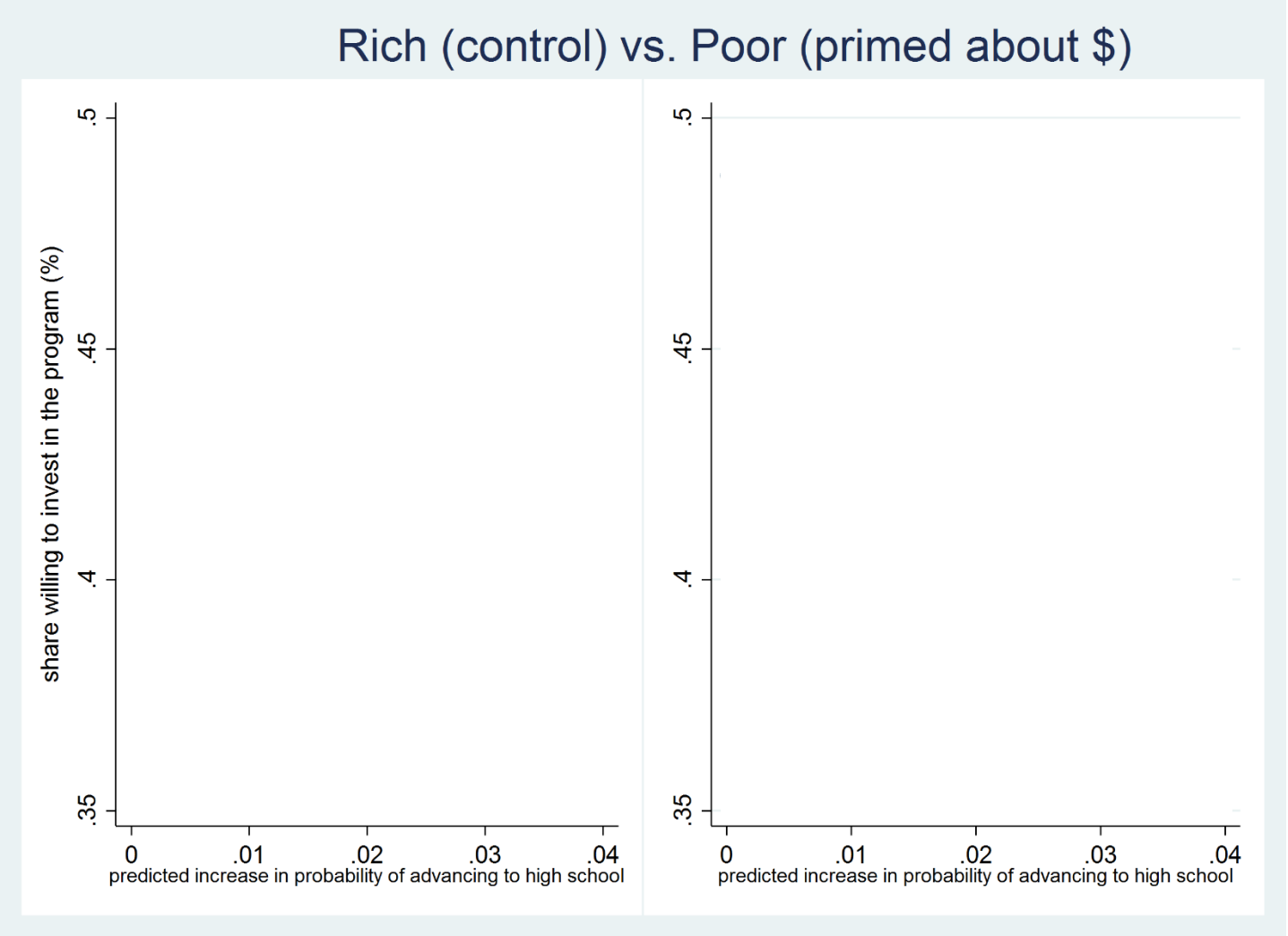
# INVESTMENT IN CHILDREN'S HK

**Investment decision:** "You already earned R$10 in airtime credit by answering this call until the end. Would you rather exchange those R$10 for 6 months of weekly text messages about your child's school life? If you would like to exchange airtime by the text messages, press 1; if you would like to keep the airtime, press 2; or to listen again, press 9."

# RICH VS. POOR

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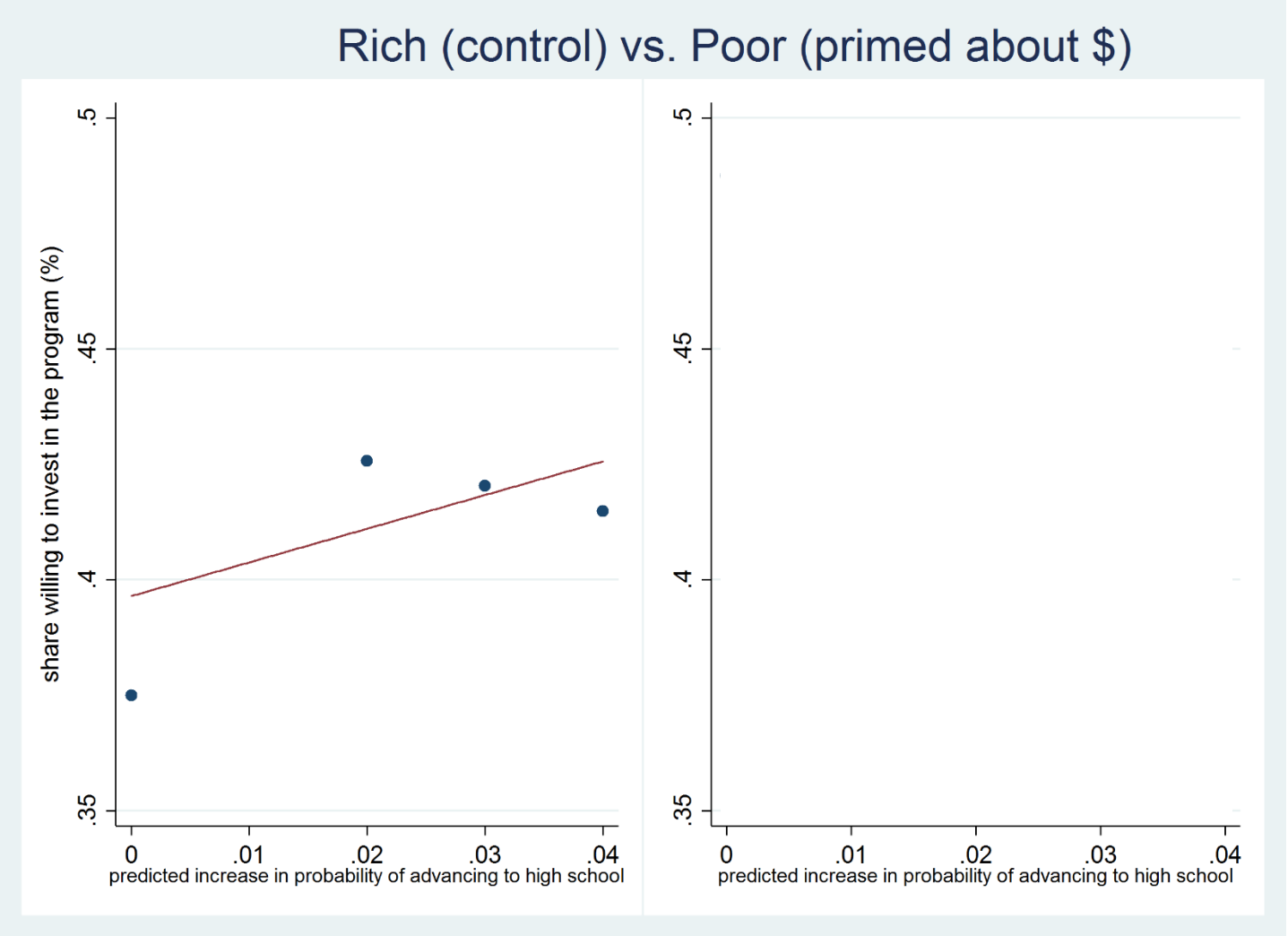


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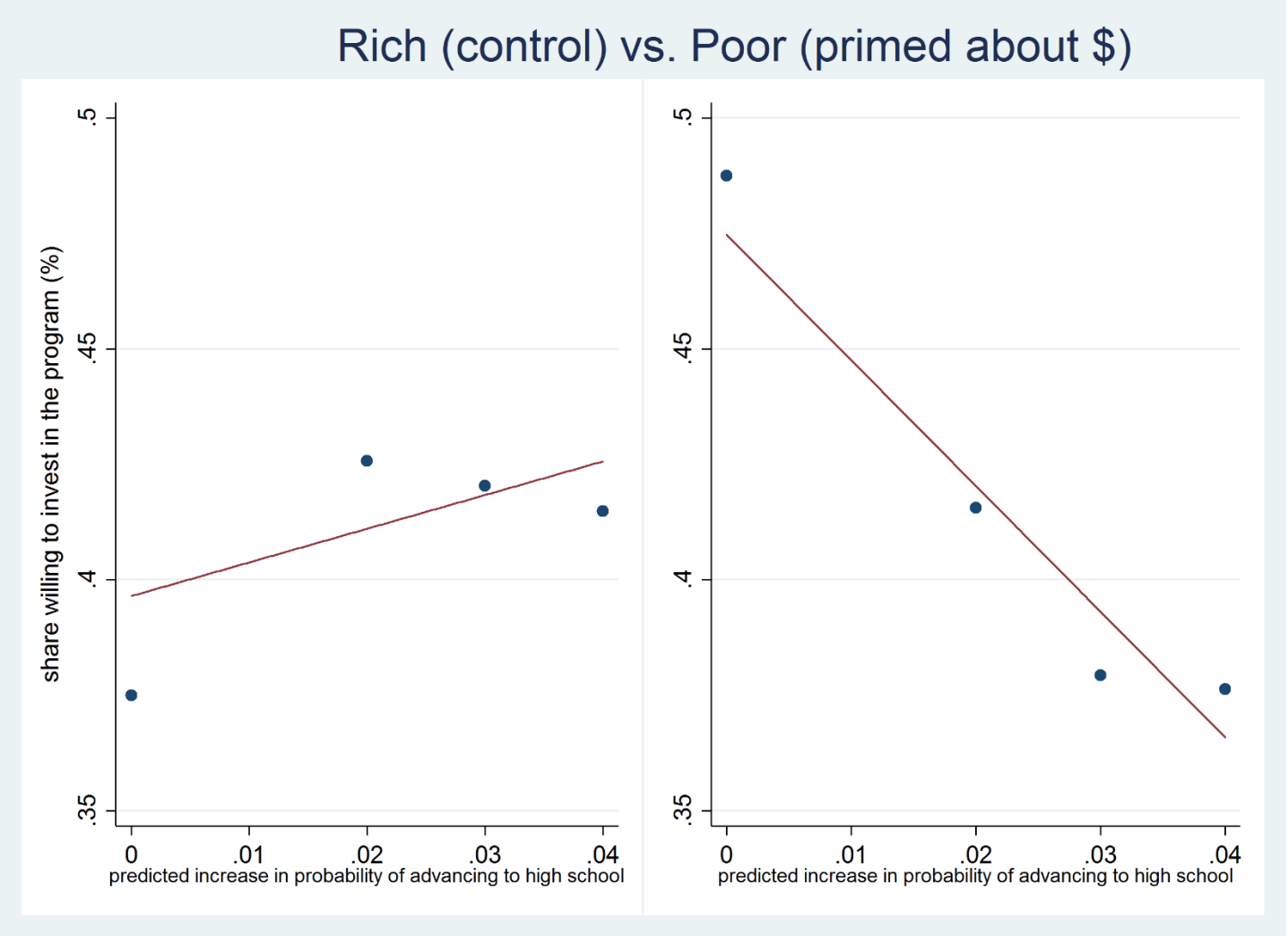


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# The RIGHT Technology

- What is the **right technology** to ensure investments in children's human capital? It must take into consideration that, in developing countries:
  - ➢ Decisions are **not automatic**
  - ➢ **Making decisions is harder**, and that there are **more decisisions to be made**
  - ➢ Available technologies may be **inappropriate to generate social returns**

# A concrete application

- Children have to attend school in order to learn
- But it is hard to ensure that children attend
- Can technology help?
  - ➢If so, what is the **right technology?**

BBC NEWS

# Brazilian schools microchip T-shirts to cut truancy

23 March 2012 | Latin America & Caribbean

**Schools in Brazil have started to place computer chips in school uniforms to keep track of pupils and reduce truancy.**

The chips are placed underneath the badge of a school uniform, or on a sleeve

Some 20,000 pupils in the north-eastern city of Vitoria da Conquista will have microchips embedded in their school T-shirts.

The parents will get a text message when their children arrive at school, or if they are late for classes.

The authorities say the measure will help teacher-parent relations.

## SMS alerts

The authorities in Vitoria da Conquista, Bahia state, call the microchipped T-shirts "intelligent uniforms".

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The local government has invested about $700,000 (£442, 531) to set up the system.

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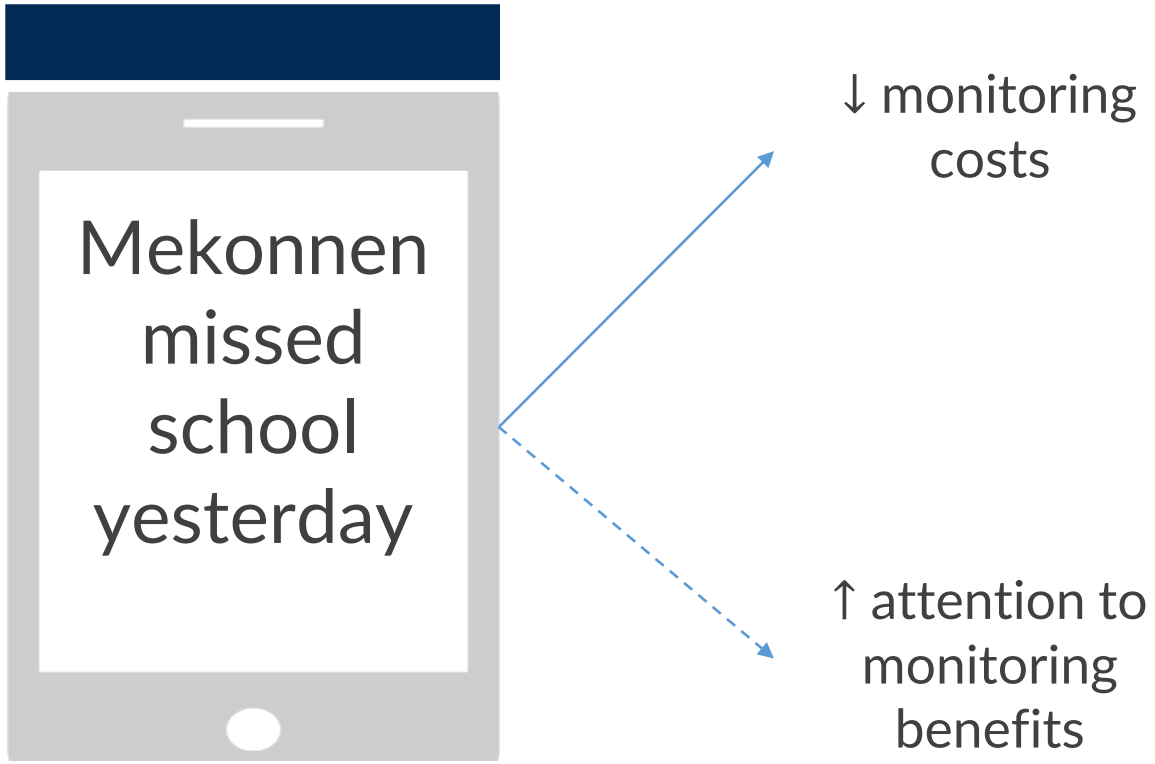
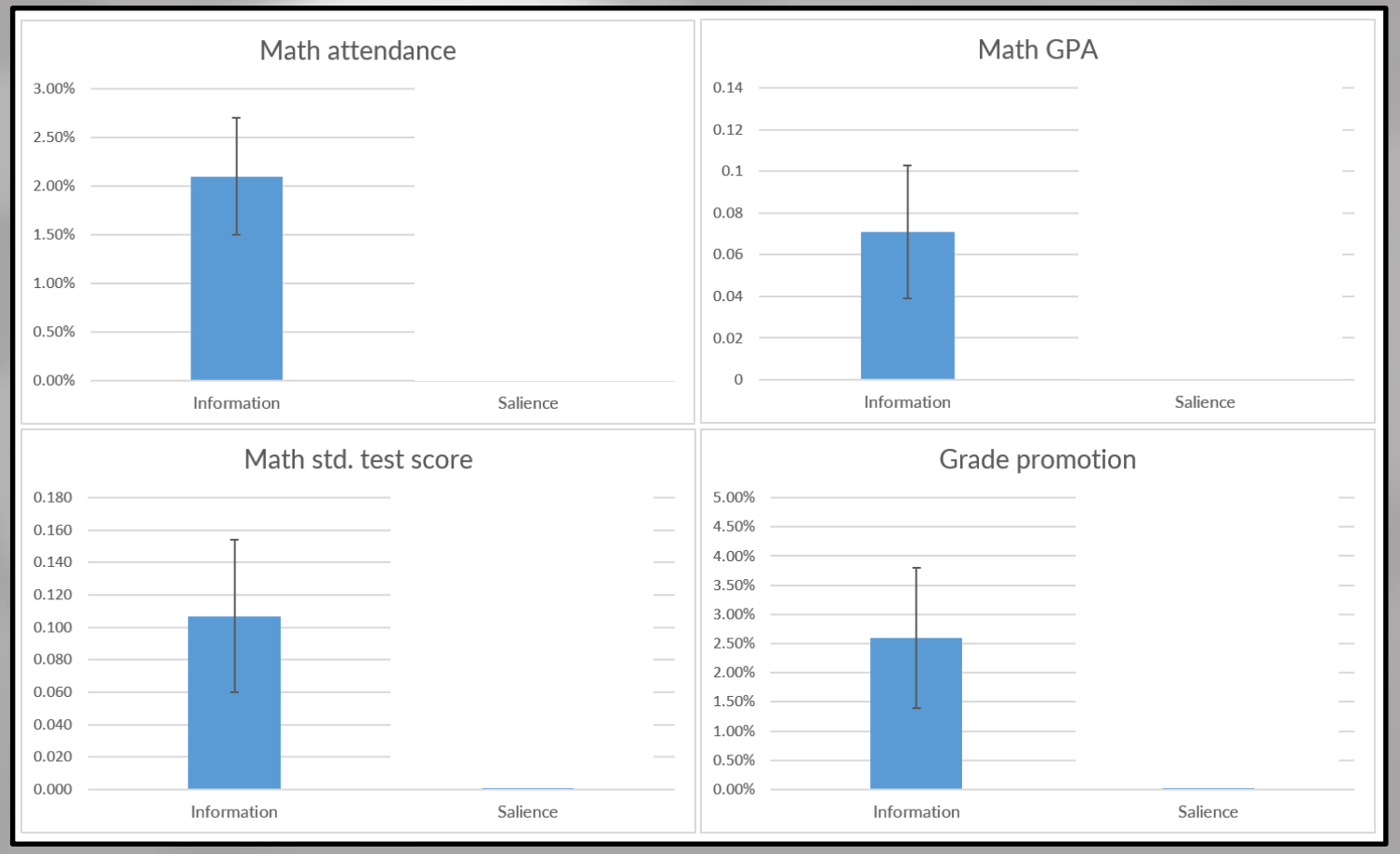


# IS IT ENOUGH TO DRAW ATTENTION?

Cunha, Lichand, Madeira and Bettinger (2018) “What Is It About Communicating With Parents?”


| CONTROL | ATTENTION | INFORMATION |
|---|---|---|
| | Attending classes every day is important for Johannes’s grades. | Mekonnen was absent less than 3 times in the previous 3 weeks |

# Cunha, Lichand, Madeira e Bettinger (2018)



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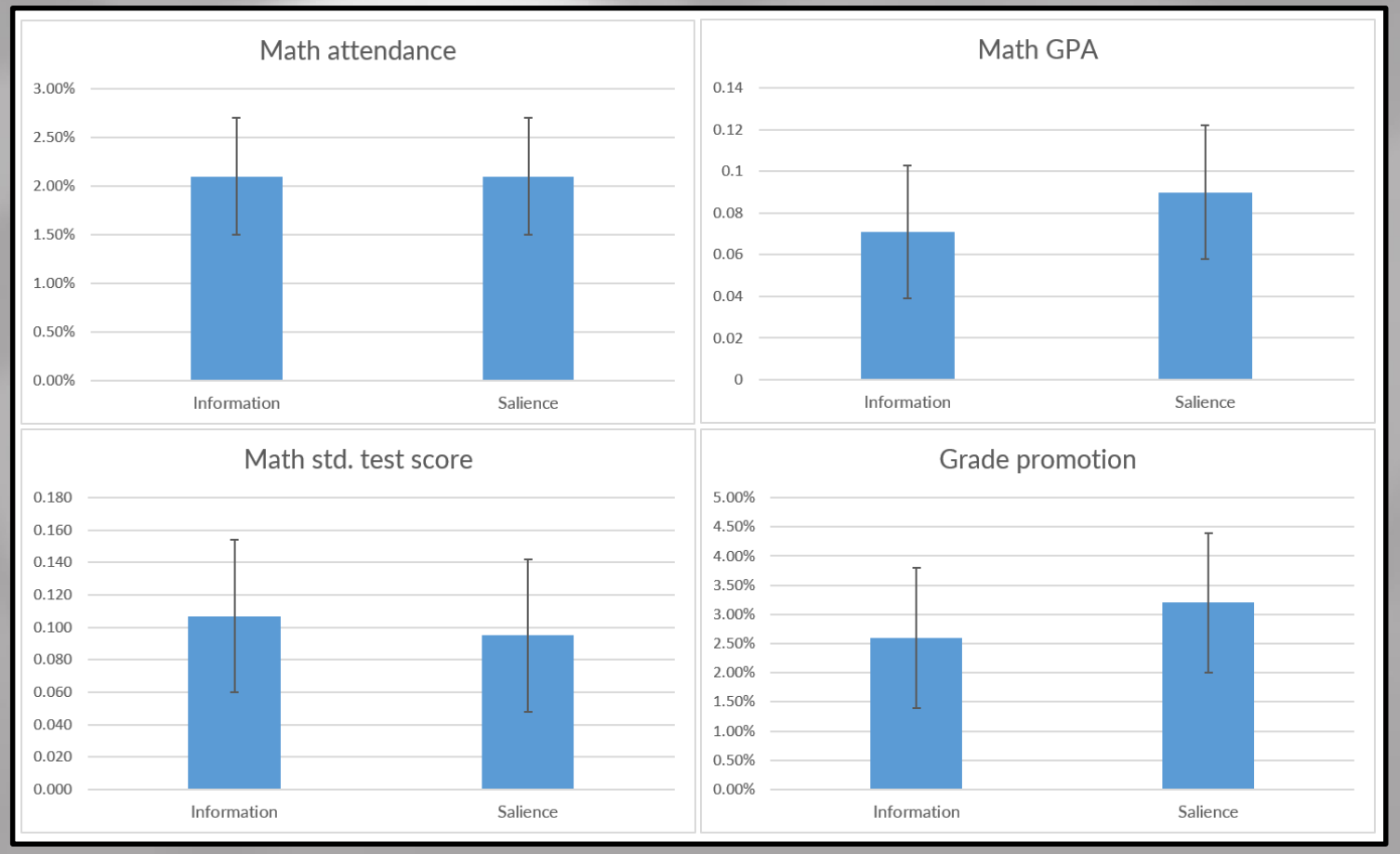
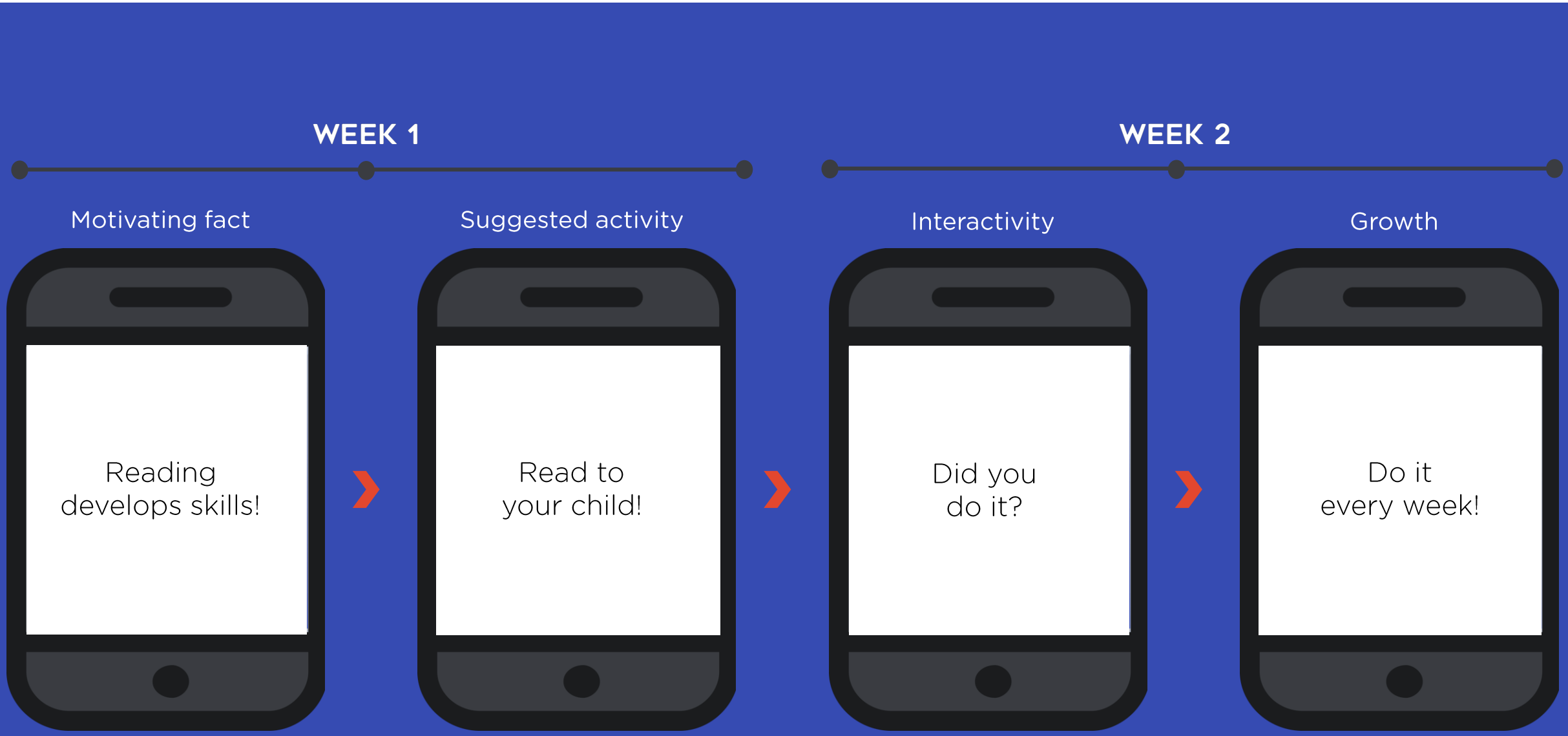


# A concrete application (2)

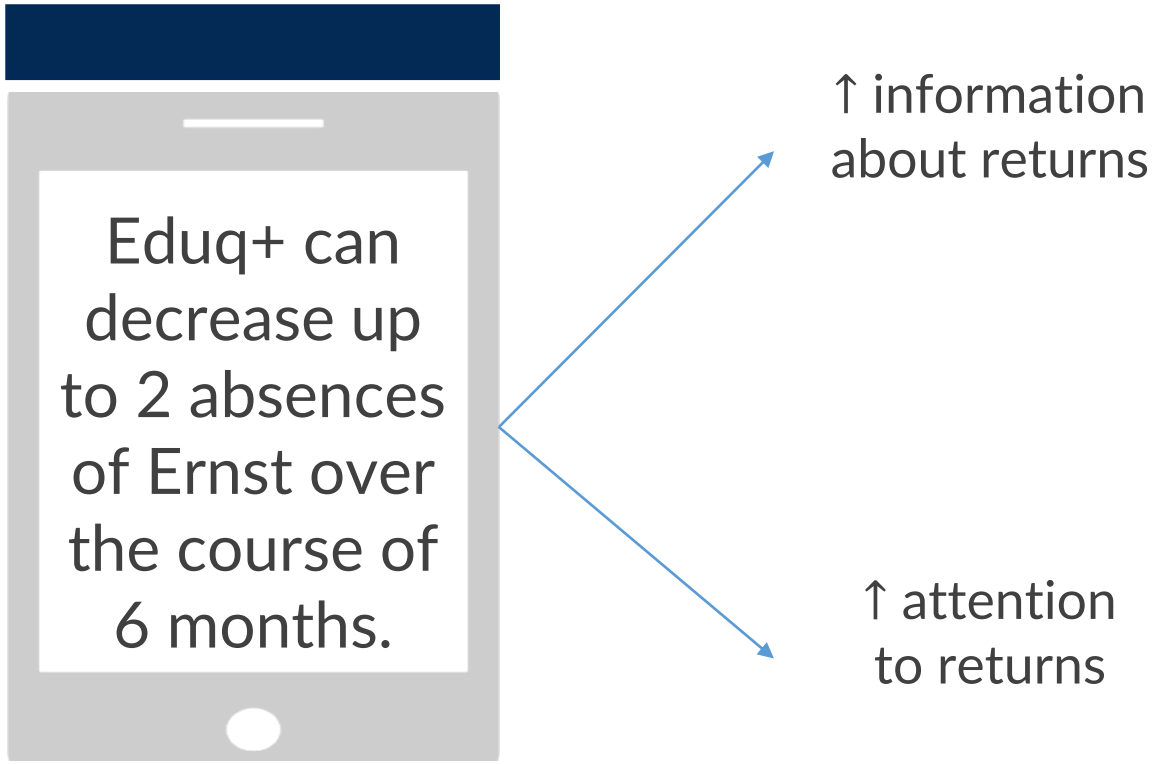
- Poverty leads parents to mess up the evaluation of returns on investments in children
- Can technology help?
  - If so, what is the **right technology?**

# DO YOU WANT TO BUY IT?



# MAKING DECISIONS EASIER

2 days before the decision had to be made:



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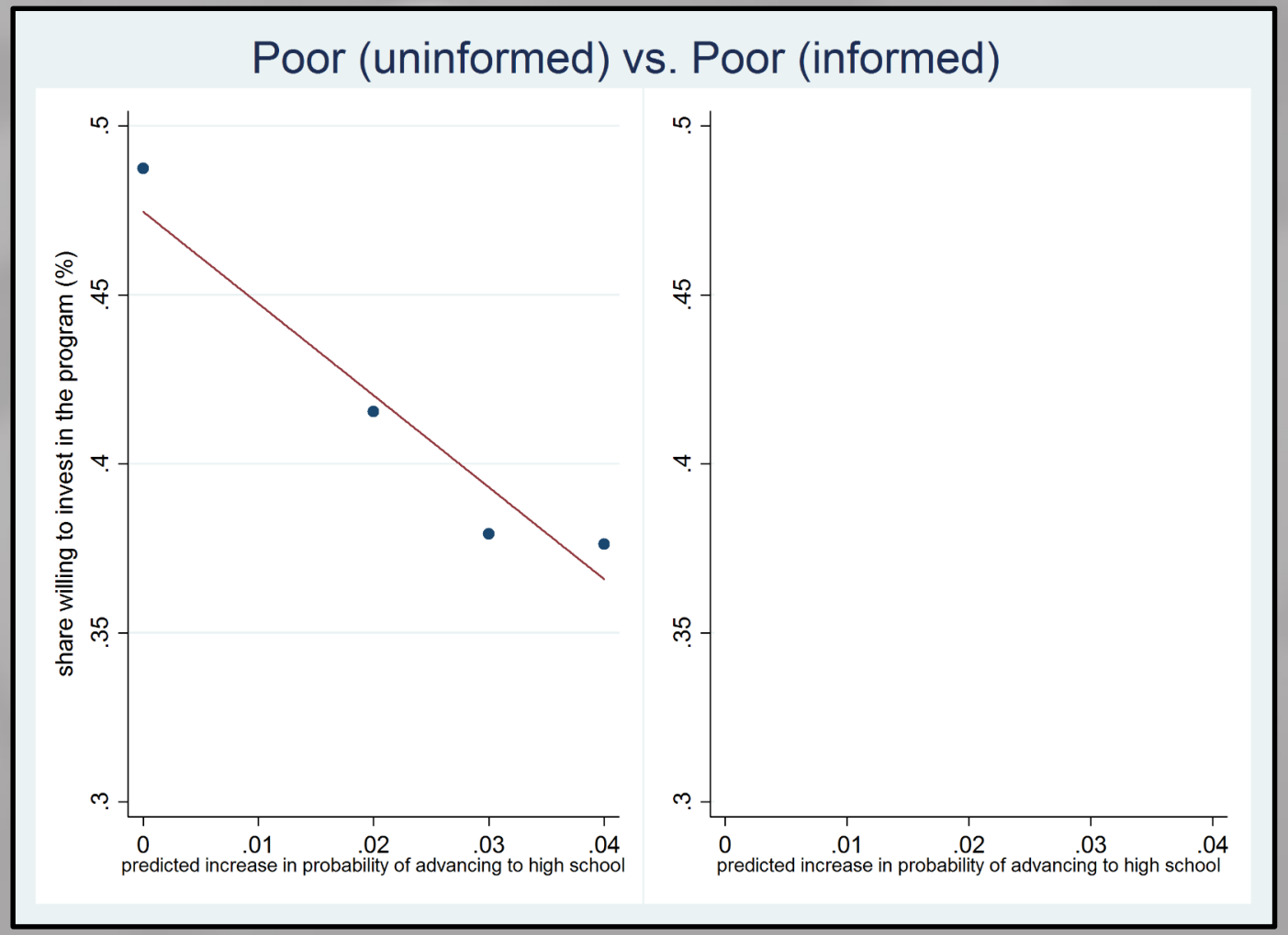

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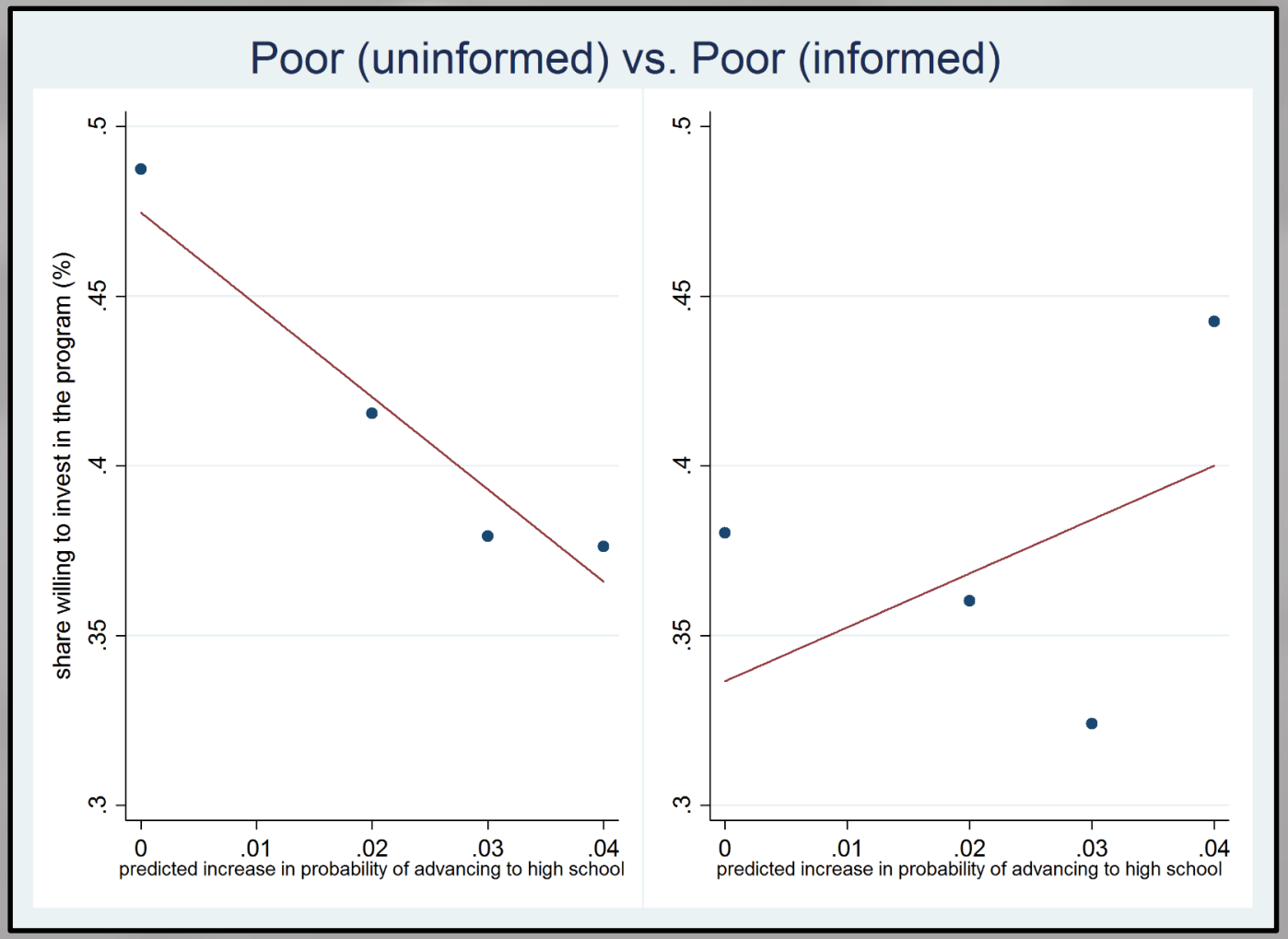

# The RIGHT Technology

- **Removes restrictions** to decisions-making
  - Simplification
  - Nudges and reminders
- Makes decisions **automatic**
  - Change rules and institutions
- Offers **mechanisms for participation and voice**
  - Maximal reach
  - Incentive compatible

# LEAPFROGGING INEQUALITY

## Remaking Education to Help Young People Thrive

**Rebecca Winthrop**

with

**Adam Barton and Eileen McGivney**



FIGURE 5-1 The Leapfrog Pathway for Education

### CORE ELEMENTS

**Teaching and Learning:** Increasingly Student-centered

| TEACHING | POTENTIAL TO LEAPFROG | LEARNING |
|---|---|---|
| **Playful** + Interactive + Lecture-based | LEAP | **Evaluate and Create** + Apply and Analyze + Remember and Understand |
| **Interactive** + Lecture-based | SKIP | **Apply and Analyze** + Remember and Understand |
| **Lecture-based** | HOP | **Remember and Understand** |

**Recognition of Learning:** Increasingly Individualized

| PROGRESSION | POTENTIAL TO LEAPFROG | VERIFICATION |
|---|---|---|
| **Individual-based** + Group-based + Predetermined | LEAP | **Industry-led** + Hybrid-led + Education-led |
| **Group-based** + Predetermined | SKIP | **Hybrid-led** + Education-led |
| **Predetermined** | HOP | **Education-led** |

### SUPPORT ELEMENTS

**People and Places:** Increasingly Diverse

| PEOPLE | POTENTIAL TO LEAPFROG | PLACES |
|---|---|---|
| **Everyone** + Teachers team with others + Licensed teachers | LEAP | **In a diversity of contexts** + Connected to outside school + In-school |
| **Teachers team with others** + Licensed teachers | SKIP | **Connected to outside school** + In-school |
| **Licensed teachers** | HOP | **In-school** |

**Technology and Data:** Increasingly Results Oriented

| TECHNOLOGY | POTENTIAL TO LEAPFROG | DATA |
|---|---|---|
| **Modification and redefinition** + Augmentation + Substitution | LEAP | **Data for transforming learning experiences** + Data for program improvement + Data for compliance |
| **Augmentation** + Substitution | SKIP | **Data for program improvement** + Data for compliance |
| **Substitution** | HOP | **Data for compliance** |

# LEAPFROGGING INEQUALITY

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| **Lecture-based** | HOP | |

Rec

| | | |
|---|---|---|
| | | **Hybrid-led** + Education-led |
| | HOP | **Education-led** |

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| **Substitution** | HOP | **Data for compliance** |

THROUGH THE RIGHT TECHNOLOGY

of

# APPLYING THE FRAMEWORK

1. Technologies inside the classroom
   - 1.1 Computers
   - 1.2 Internet
   - 1.3 Tablets
2. Remote learning technologies
   - 2.1 Video lectures
   - 2.2 Cell-phones
   - 2.3 Digital television
3. Technologies to support management
   - 3.1 Comunicating with students and parents
   - 3.2 Monitoring teachers
   - 3.3 Generalizing best practices

# TECHNOLOGIES INSIDE THE CLASSROOM

- Computers
- Internet
- Videos or tablets (scripted teaching)

Education Technology: An Evidence-Based Review
Maya Escueta, Vincent Quan, Andre Joshua Nickow, Philip Oreopoulos
NBER Working Paper No. 23744, Issued in August 2017

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# TECHNOLOGIES INSIDE THE CLASSROOM

Make **decisions automatic**

Remove **restrictions to decisions making**

Offers **mechanisms for participatoin and voice**

# TECHNOLOGIES INSIDE THE CLASSROOM

- Computers:
  - ➢ No systematic impacts on learning…
  - ➢ Nuance: for what use?

# TECHNOLOGIES INSIDE THE CLASSROOM

- Internet:
  - ➢ No systematic impacts on learning…

# EDUCATIONAL TECHNOLOGIES CAN MAKE OPPORTUNITIES LESS UNEQUAL


A NEW DOCUMENTARY FROM ACADEMY AWARD® NOMINATED DIRECTOR RORY KENNEDY
WITHOUT A NET
THE DIGITAL DIVIDE IN AMERICA
WATCH TRAILER
PREMIERES 9.26.17 10/9C
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EDUCATIONAL TECHNOLOGIES CAN MAKE OPPORTUNITIES EVEN MORE UNEQUAL
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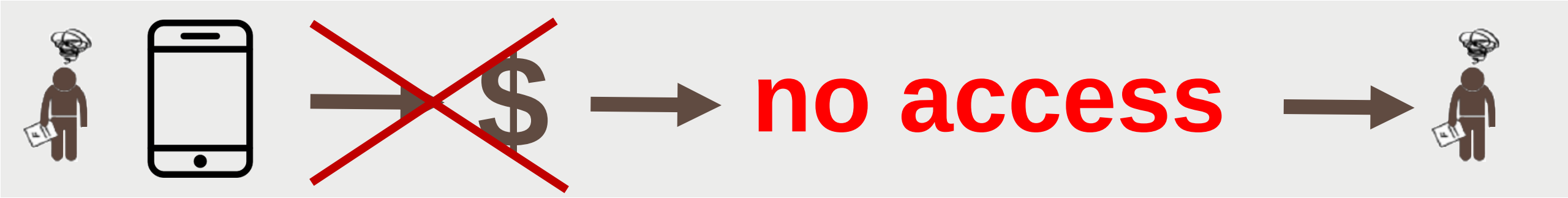
# **UNEQUAL** OPPORTUNITIES

## Today

# TECHNOLOGIES INSIDE THE CLASSROOM

- Internet:
  - No systematic impacts on learning…
  - Tripod technology + connectivity + teach training is hard to achieve even in developed countries like the US.
  - As a result, inequality potentially increases!

# TECHNOLOGIES INSIDE THE CLASSROOM

- Internet:
  - No systematic impacts on learning…
  - Tripod technology + connectivity … hard to achieve even in developed … s.
  - As a result, inequalit… …es!

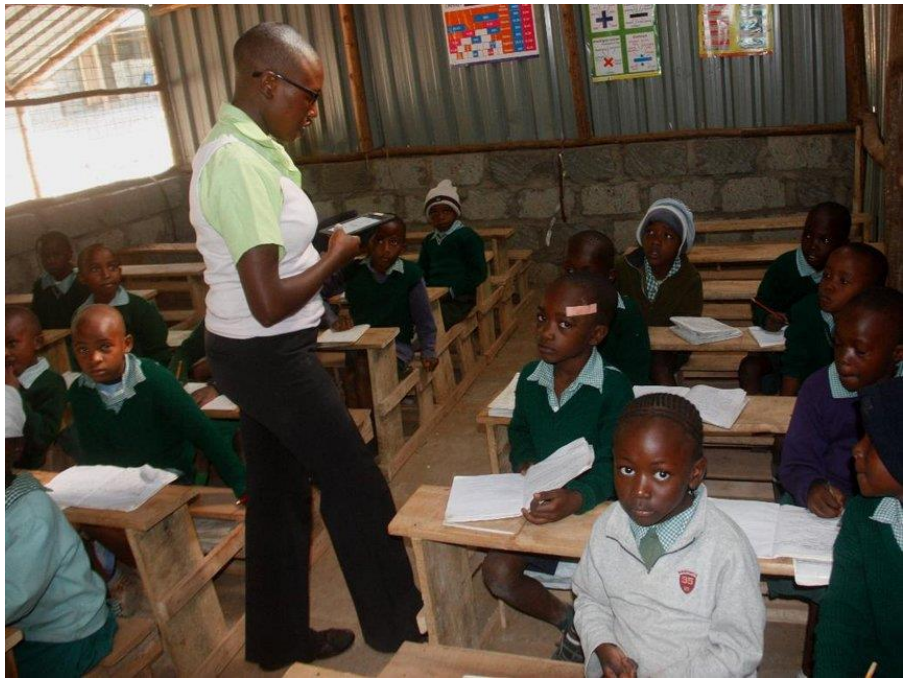
INAPPROPRIATE TECHNOLOGY

# TECHNOLOGIES INSIDE THE CLASSROOM

- Videos or tablets (scripted teaching):
  - ➢ It works!
  - ➢ Succesfull experiences both in fragile school systems (such sa Kenya and Liberia) and in consolidated school systems (such as Hong Kong).

# TECHNOLOGIES INSIDE THE CLASSROOM

- Videos or tablets (scripted teaching):

# REMOTE LEARNING TECHNOLOGIES

- Video lectures
- Cell-phones
- Digital TV

# REMOTE LEARNING TECHNOLOGIES

Make **decisions automatic**

Remove **restrictions to decisions making**

Offers **mechanisms for participatoin and voice**

# REMOTE LEARNING TECHNOLOGIES

- Video lectures:
  - Scripted learning works!
  - Experiences in North of Brazil is considered amongst the best in the world: https://www.youtube.com/watch?v=maO6bXYwcBc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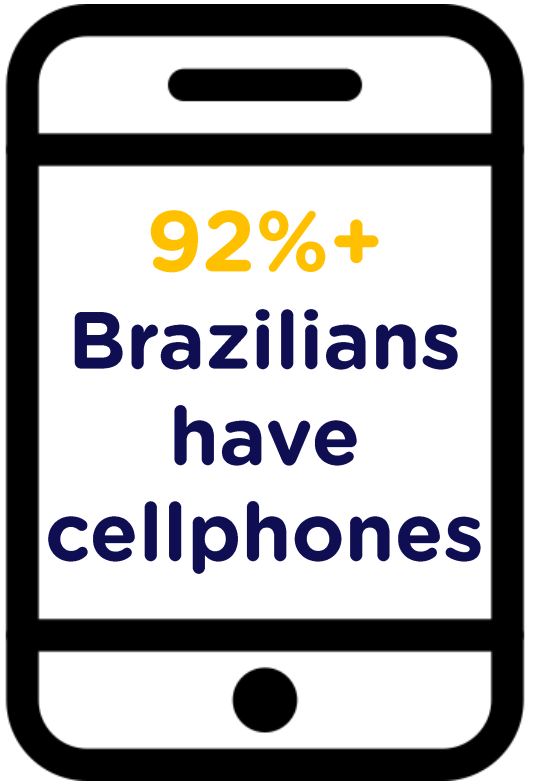
# REMOTE LEARNING TECHNOLOGIES

- Cell-phones:
  - ➢ It is already possible to allow students to learn directly through their cell-phones (with or without teacher mediation)
  - ➢ Opportunities and challenges..

Cellphones are

# everywhere




**40%+** of stock are already smartphones

**+**

Rapid **growth** through low-cost Androids

But not everyone is

# connected

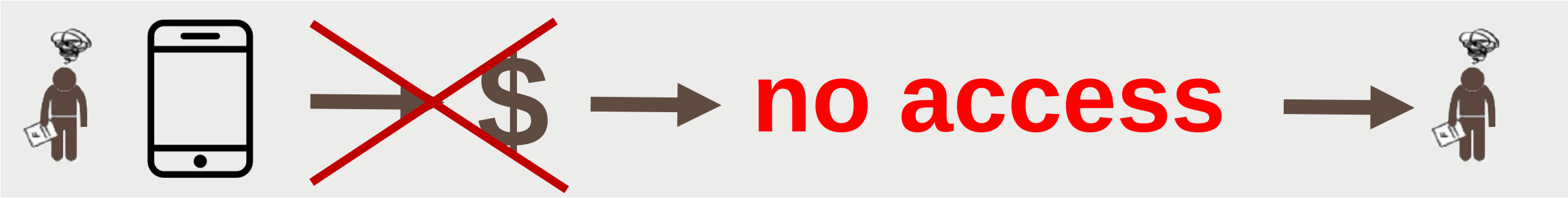

Brazil has the **most expensive phone costs** in the world

**+**

Cheapest data plan is about **10 CHF/month**

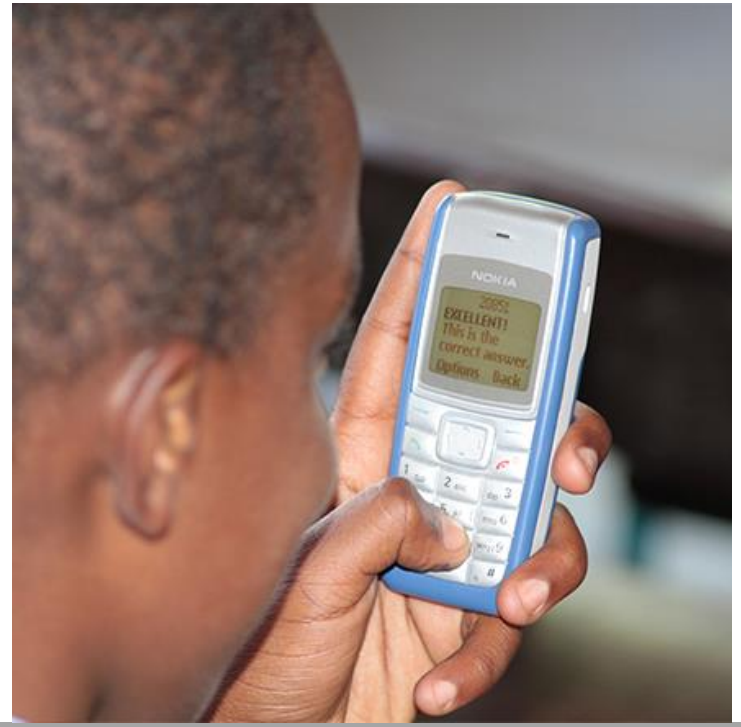
# **UNEQUAL** OPPORTUNITIES

## Today

# REMOTE LEARNING TECHNOLOGIES

- Cell-phones:
  - ➢ It is already possible to allow students to learn directly through their cell-phones (with or without teacher mediation)
  - ➢ Offline model: ENEZA

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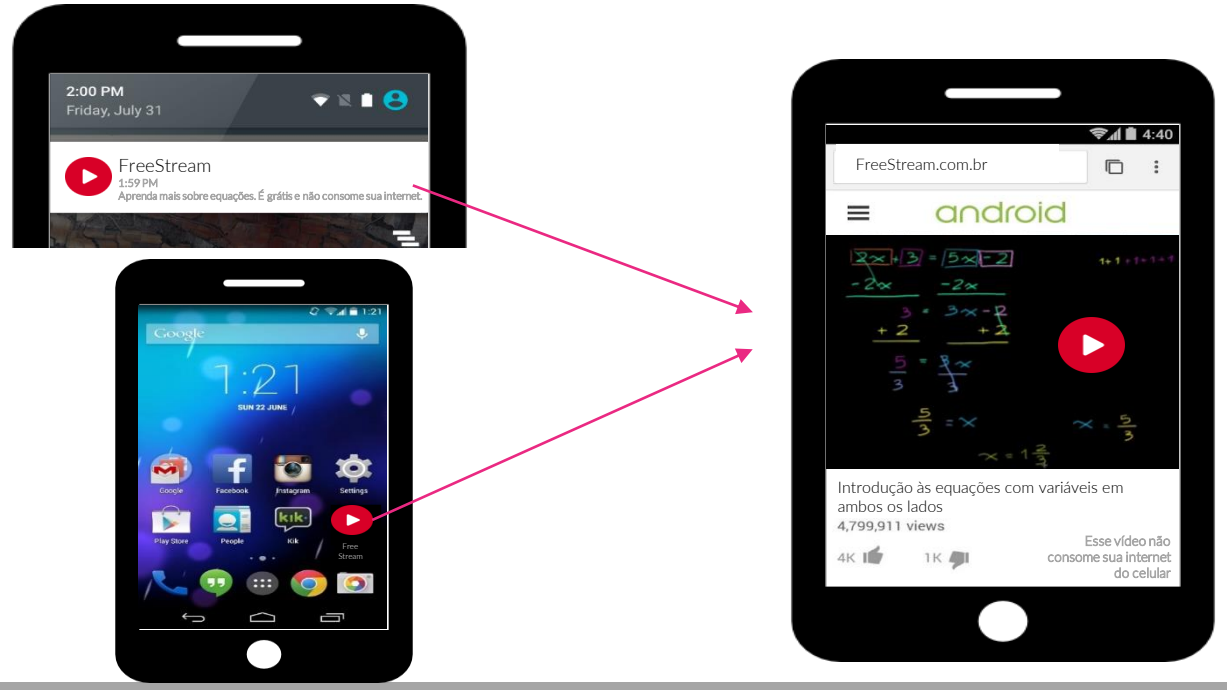
# REMOTE LEARNING TECHNOLOGIES

- Cell-phones:
  - ➢ It is already possible to allow students to learn directly through their cell-phones (with or without teacher mediation)
  - ➢ Online model (zero rating): needs testing

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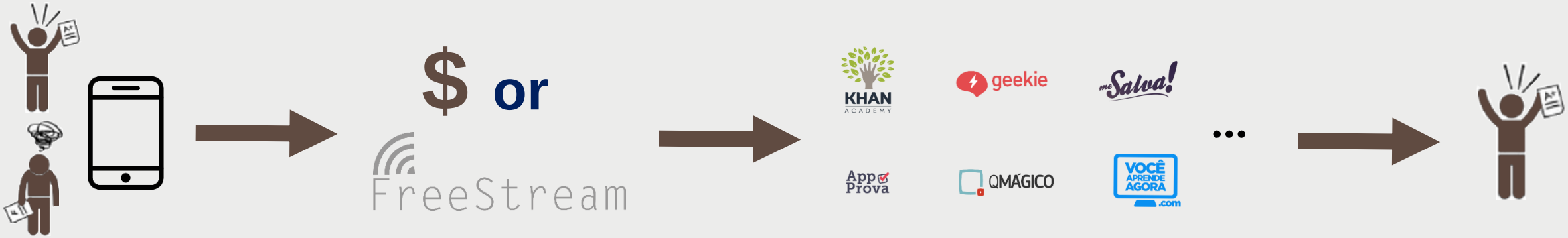
# A **DISRUPTIVE** SOLUTION

## The future




**FREE CONNECTIVITY** EARMARKED TO ACCESS CONTENT **MADE AVAILABLE** THROUGH **FREESTREAM**

LIKE **AIRPORT WI-FI... BUT** NO SPECIFIC LOCATIONS OR VENDORS; RATHER, A SPECIFIC **TARGET AUDIENCE**

# REMOTE LEARNING TECHNOLOGIES

- Digital TV:
  - ➢ In Brazil, every household has a digital conversor!

# REMOTE LEARNING TECHNOLOGIES

- Digital TV:
  - Unique media to send information and survey, directly inside the household.
  - Hardware is available… software needs testing

# TECHNOLOGIES TO SUPPORT MANAGEMENT

- Communication with students and parents
- Monitoring teachers
- Generalizing best practices

# TECHNOLOGIES TO SUPPORT MANAGEMENT

Make **decisions automatic**

Remove **restrictions to decisions making**

Offers **mechanisms for participatoin and voice**

# TECHNOLOGIES TO SUPPORT MANAGEMENT

- Communication with students and parents:
  - About **aspirations and mindset**

# MINDSET MATTERS

- Growth mindset: agreement with statements about whether intelligence can be changed.
- Strong correlation between performance and mindset.
- Interventions that manipulate mindset also have important effects on challenge seeking, math performance and grade progression (Yeager et al., 2017).

# RESULTS FROM SMS PILOT WITH PARENTS

Parents of 6-15 year-old children in public schools across Petrolina (PE) and Jacareí (SP) randomly assigned to 2 SMS/week over 3 months, focused on either parental engagement messages (Cunha et al., 2018) or growth mindset messages.

SMS endline survey (no differential response rates):

| | **Disagrees with:** | | | | | |
|---|---|---|---|---|---|---|
| | "Your intelligence is something about you that you can't change very much" | | "Being a 'math person' or not is something that you really can't change. Some people are good at math and other people aren't" | | "When your child has to try really hard in a subject in school, it means s/he can't be good at that subject" | |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Growth mindset SMS | 0.0363 | 0.0334 | 0.0202 | 0.0294 | 0.0767* | 0.0739* |
| | [0.0456] | [0.0457] | [0.0453] | [0.0451] | [0.0414] | [0.0400] |
| Constant | 0.521*** | 0.522*** | 0.433*** | 0.429*** | 0.652*** | 0.653*** |
| | [0.0321] | [0.0319] | [0.0317] | [0.0314] | [0.0292] | [0.0282] |
| Municipality-age fixed effect | No | Yes | No | Yes | No | Yes |
| Observations | 479 | 479 | 483 | 483 | 497 | 497 |
| R-squared | 0.001 | 0.044 | 0.000 | 0.039 | 0.007 | 0.093 |

0.67 s.d. 0.59 s.d. 0.16 s.d.

Standard errors in brackets

*** p<0.01, ** p<0.05, * p<0.1

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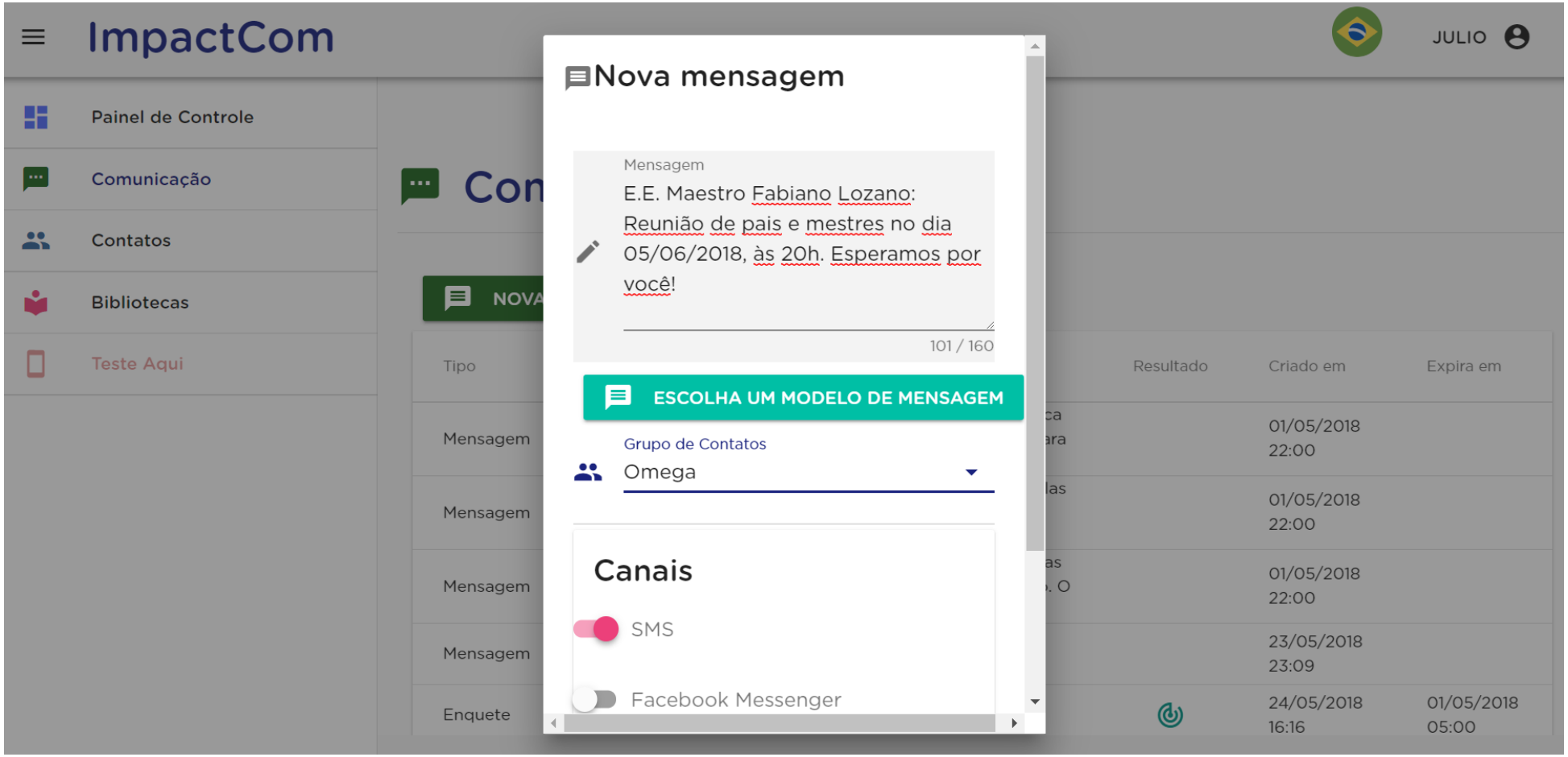
# TECHNOLOGIES TO SUPPORT MANAGEMENT

- Communication with students and parents:
  - Information about **attendance and school behavior**: increases attendance by 15%, learning by at least one additional quarter in school, and decreases grade repetition rates by 1/3
  - Nudges for **making children's school life top-of-mind**: increases attendance by 15%, learning by up to three additional quarters in school, and drecreaes grade repetition rates by 1/3

# TECHNOLOGIES TO SUPPORT MANAGEMENT

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# TECHNOLOGIES TO SUPPORT MANAGEMENT

- Communication with students and parents:
  - Caveat 1: Parents may be illiterate, or not understand the official language
    - In Cote d'Ivoire, ongoing study testing voice messages, and dialects
  - Caveat 2: In Ghana, communication with parents has proven to be harmful – **increased demand for teachers to physically punish students**, reversing the positive effects of a teacher training intervention
    - In Cote d'Ivoire, ongoing study trying to engage parents while dispelling such negative effects

# TECHNOLOGIES TO SUPPORT MANAGEMENT

- Communication with students and parents:
  - Caveat 3: When teachers are so often not in classroom (60% of the time, in Ghana), maybe engaging parents is not enough to boost learning

# TECHNOLOGIES TO SUPPORT MANAGEMENT

- Monitoring teachers:
  - Class pictures
  - Proven impacts on attendance and learning in Kenya

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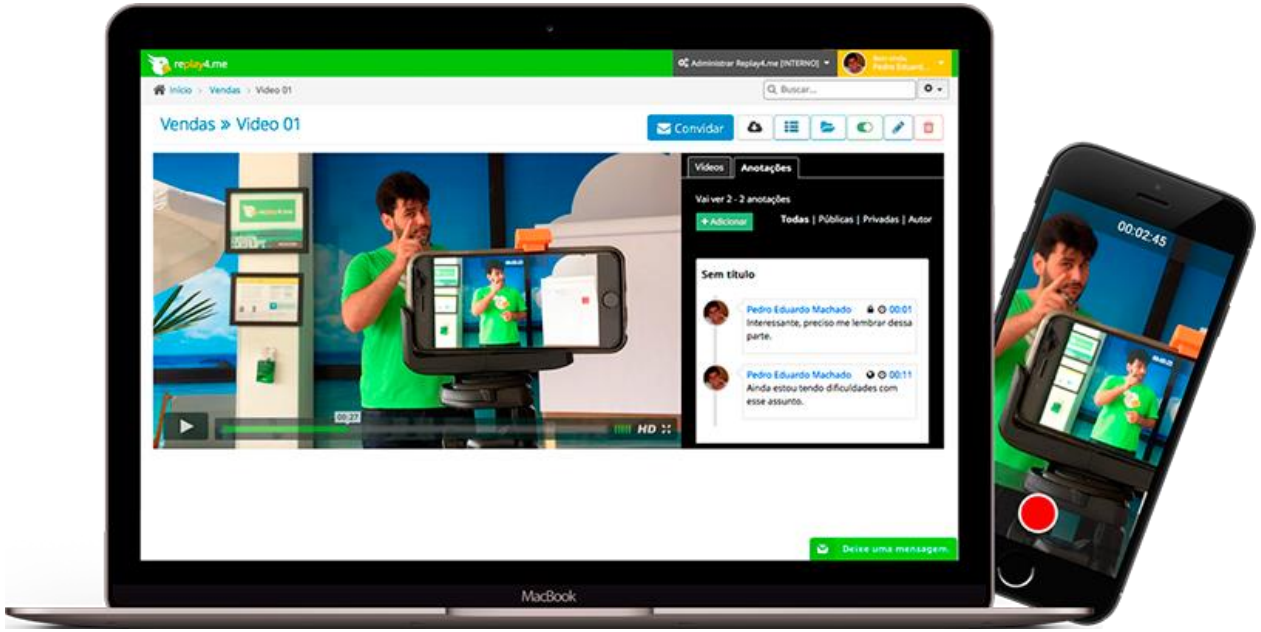
# TECHNOLOGIES TO SUPPORT MANAGEMENT

- Monitoring teachers:
  - ➢ Teacher training
  - ➢ Proven impacts on teacher attendance, burnout and quality in Ghana

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# TECHNOLOGIES TO SUPPORT MANAGEMENT

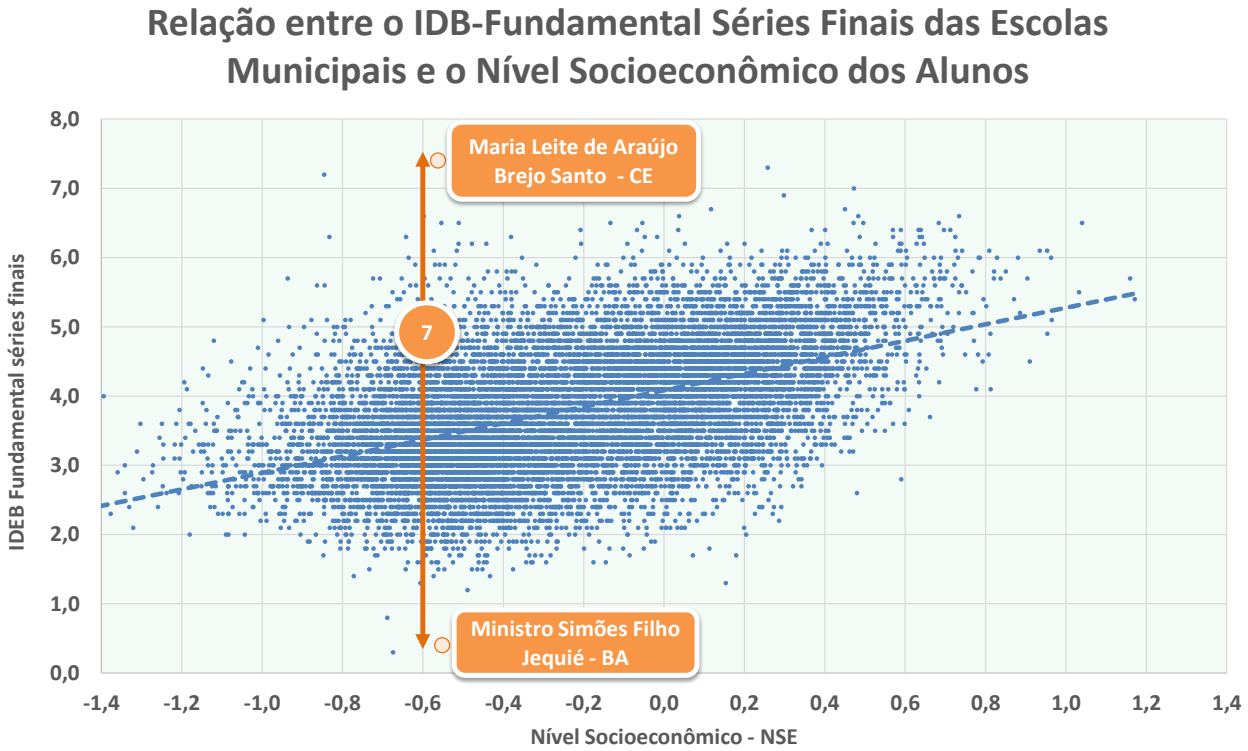
- Generalizing best practices:
  - Learning from what works systematically elsewhere
    - Teacher training
    - Scripted learning
    - Tracking: Teaching at the Right Level

# TECHNOLOGIES TO SUPPORT MANAGEMENT

- Generalizing best practices:
  - ➢ Learning from what works systematically in Malawi

# TECHNOLOGIES TO SUPPORT MANAGEMENT

- Generalizing best practices:

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# TECHNOLOGIES TO SUPPORT MANAGEMENT

- Generalizing best practices:
  - ➢ Learning from what works systematically in Malawi
    - ➢ Collect **systematic high-quality data on school outcomes**
    - ➢ Algorithm can find clusters of schools, and match schools within clusters for sharing best practices

# Thank you!

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