Instructional Coherence A/B Testing



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Context

NewGlobe is a social enterprise which began in Kenya in 2007.

□Operates (pre-)primary schools in Kenya, Nigeria, Uganda, Liberia, and India and supports public schools in government partnerships (e.g. Edo in Nigeria).

□Structured pedagogical approach: teacher guides via tablet, textbooks, teacher training and ongoing support.

Learning Collaborative with academics, scholars, educators, and institutions, incl. A/B experiments.



Instructional Coherence A/B Testing

- NewGlobe collaboration on several A/B experimental evaluations
- Several interventions seek to align instruction to student learning *levels* and/or *how* pupils learn more effectively:
 - 1. Provide teacher with greater autonomy to respond to student needs thru shorter teacher guides .
 - 2. Provide pupils with rapid feedback through daily quizzes.
 - 3. Provide pupils with rapid feedback through interleaved problem sets.
 - 4. Teach to the right level by assigning different problem sets in math.
 - 5. Support student to work towards goals.
- Instructional coherence matters, but the devil is in the details



Data available across interventions

• School/classroom level:

- County
- Demographic location: Rural/Urban
- Lesson completion,
- Pupil attendance
- Gender balance
- Teacher attendance
- Pupil-teacher ratio

• Pupil level:

- Mid- and Endterm scores,
- Pre- and posttests,
- Primary leaving exam scores,
- Date of birth (age),
- Years enrolled in NewGlobe school

Limitation: limited information to identify mechanisms at play

Shorter Teacher Guides

Detailed lesson guides have been shown to be an effective strategy to enhance teacher skills and improve student outcomes (Piper et al., 2018).

Motivation

Guthrie Gray-Lobe (Un. Chicago) Michael Kremer (Un. Chicago) Joost de Laat (Utrecht Un.) Detailed guides can provide teachers with valuable scaffolding, especially if knowledge of subject matter and effective pedagogy is low (Bold et al., 2017).

Concerns that teacher guides may reduce teacher autonomy and impede a teacher's ability to use their own judgment and adapt to the needs of the classroom (Dresser, 2012; Valencia et al., 2006).

Shorter Teacher Guides

Kenyan NewGlobe schools using technology-assisted teacher guides

137 academies, 1 academic year (2018-2019)

Standard 2 mathematics

Treatment: Length teacher guides reduced by approx. 50%. Material and concepts the same.

Control: Regular teacher guide length

Treatment assignment balanced on covariates

Duration: 1 year

Empirical Setting

Shorter Teacher Guides

Significantly **increase** pupil test scores in math by 0.23 standard deviations.

The effects appear to be concentrated among lower performing students

The effect is largest for more crowded classrooms

QUIZZING

Quizzing is a simple, low-cost intervention that may support long term retention of class material

Tests, homework, and workbooks are used in nearly all educational environments

But quizzing may have negative effects if it replaces teacher-led instruction

Little is known about effects of increasing time spent quizzing at scale, especially how it interacts with other classroom inputs

Motivation

Ronak Jain (Harvard Un.) Guthrie Gray-Lobe (Un. Chicago) Becky Scurlock (Un. Chicago) Joost de Laat (Utrecht Un.) Michael Kremer (Un. Chicago)

QUIZZING

Kenyan NewGlobe schools using technology-assisted teacher guides

199 Academies (94 Treatment, 105 Control)

Grade 7 classrooms (2018); Grade 8 classrooms (2019)

Treatment: Daily quizzes with 12 items aligned to KCPE content in Math, English, and Social Studies

Control: Regular afternoon lessons

Treatment assignment balanced on covariates

Duration: 1 year

Empirical Setting

QUIZZING

No significant treatment effect on average

No significant interaction between treatment and individual baseline score

Significant, positive interaction between treatment and academy mean baseline/VA

Interpretation: quizzing may act as a complement to instructional quality

Interleaved math strategy

There is an extensive literature showing that repetition and spacing can have large impacts on memory

Motivation

Lotte van der Haar (Utrecht Un.) Guthrie Gray-Lobe (Un. Chicago) Joost de Laat (Utrecht Un.) Michael Kremer (Un. Chicago) Therefore, improvements in sequencing of practice and repetition can potentially be a low-cost tool to increase math knowledge in low- and middle-income countries

Previous studies show promising effects of interleaved problem sets in lab experiments and classrooms (e.g. Rau et al. (2010), Rohrer et al (2015), Nemeth et al. (2021)).

In *interleaved* problem sets, different types of problems are interspersed

Blocked problem sets are composed of the same type of items (the status quo in most classrooms (Rohrer et al. (2020))

Interleaved math strategy

NewGlobe Nigeria schools using technology-assisted teacher guides

62 schools, grade 5 classes (avg. pupil aged 10 years) for a full academic year

Treatment: pupils in treatment schools worked on *interleaved* problem sets. They received the same math instructions as control schools.

Empirical Setting

Control: pupils in control schools worked on **blocked** problem sets in class

Treatment assignment balanced on covariates

Interleaved math strategy

Raised performance on short-term tests directly related to the problem set material by 0.34 standard deviations (se 0.10, p-value <0.01).

Most effective for lower performing pupils at baseline. This is consistent with previous findings, e.g. Ostrow et al (2015).

Effects on a longer-term test (1-year) suggest some effects on cumulative development of skills, at least for pupils in the lower bottom of the distribution

An analysis of scores on tests measuring general math ability suggests that the positive interleaving effect is limited to performance on the intervention-specific tests.

Levelled Math Problem Sets

Increasingly available evidence about the existence of a gap between instructional levels and students' actual competence level, especially in LMIC. E.g. Filmer et al. (2006); World Bank (2018)

Evidence of the positive effects of various ways to tailor the teaching process to the actual students' level

- Tutoring programs: Banerjee et al. (2017), Banerji and Chavan (2016)
- Ability grouping: Duflo et al. (2011), Hong et al. (2012)
- Computer-assisted learning (CAL): Lai et al. (2015), Muralidharan et al. (2019)

However, scaling up those interventions is often difficult due to various reasons:

- Tutoring programs \rightarrow ensuring fidelity of implementation quality
- Ability grouping ightarrow bureaucracy
- Computer-assisted learning (CAL) \rightarrow high costs

Motivation

Guthrie Gray-Lobe (Un. Chicago) Enric Vila-Villasante (Utrecht Un.) Joseph Kassim (Utrecht Un.) Joost de Laat (Utrecht Un.) Michael Kremer (Un. Chicago)

Levelled Math Problem Sets

Kenyan NewGlobe schools using technology-assisted teacher guides

201 Academies, 3,297 class 4 pupils

Same cohort was followed between term 3 2018 and term 2 2019; three academic terms.

Treatment: During 2nd half of each Mathematics lesson, teachers assigned pupils to two groups: one was asked to carry out problem set A (more basic) or problem set B (more challenging). Assignment was based on the teacher's perception of pupil ability.

Control: regular (i.e. no grouping) math's lessons

Treatment assignment balanced on covariates

Empirical Setting

Levelled Math Problem Sets

Treatment point estimates are negative and statistically **insignificant** across time

Quantiles level treatment effect: instances of positive treatment effect on low quantiles

Gender effects: statistically significant negative interaction between females and treatment by end line

Adaptive replication study in 2021-2022 using workbooks and so-called exit tickets

Goal Setting

Growing evidence on the importance of soft skills in labor market and educational outcomes [Beattie et al., 2018; Cunha et al., 2010; Heckman & Kautz, 2012; Heckman & Rubinstein, 2001].

Motivation

Anaya Dam (Utrecht Un.) Guthrie Gray-Lobe (Un. Chicago) Joost de Laat (Utrecht Un.) Michael Kremer (Un. Chicago) Karlijn Morsink (Utrecht Un.) We focus on the soft-skill of goal setting, or the act of:

- identifying future outcomes that an individual would like to achieve;
- breaking them down into SMART shorter-term goals;
- evaluating progress and adjusting these goals

Potentially addresses behavioral constraints to learning: e.g., selfcontrol, time inconsistencies, inaccurate beliefs, and salience of goals.

Goal Setting

NewGlobe Uganda schools using technology-assisted teacher guides

39 NewGlobe schools, 327 students in final year of primary school for one academic year

Treatment:

Goal setting curriculum; 17 weeks, 2 x 45 minutes per week "star of the week";

SMS reminder outreach to parents.

Empirical Setting

Control: receives standard revision class for primary leaving exam (PLE)

Treatment assignment balanced on covariates

Goal Setting

Suggestive positive average treatment effect on Primary Leaving Exam, not statistically sig. at 90% CI

Large learning gains for females in **Math (0.376SD)** and **Science (0.369SD).** Null or potentially negative effects on English for males.

Limitations:

Small sample size (power).

Lack of data for testing mechanisms

Replication study in Kenya (July 2021-2022)

Thank you!



PS. Instructional coherence matters, but the devil is in the details