

Personalized Learning at Scale:

Challenges and Opportunities

Philip Oreopoulos
University of Toronto
Abdul Latif Jameel Poverty Action Lab

Motivation

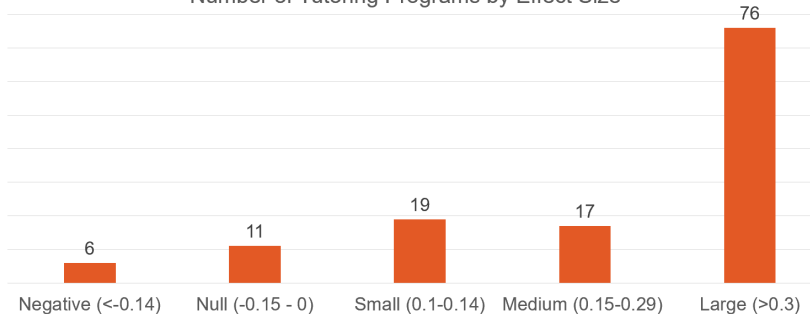
- Fundamental challenge of education is that children learn differently
- Students don't arrive at the start of a grade at the same level, and they don't progress at the same level
- Teachers cannot easily provide individualized attention
- Result is that many students fail to master material before moving on to new topics
- This is bad - student with weak foundations in math, reading, and other topics never catch up, become disengaged, discouraged, and resolved at being poor students, in a labor market that emphasizes more and more the importance of high end and creative skill
- COVID-19 pandemic has exacerbated problem (e.g. Goldhaber et al., 2022, Engzell et al. 2021, Hanuchek, 2020)

Pedagogical solution is personalized instruction

- One-to-one teacher-to-student ratio allows students to progress at their own pace and teacher to provide continuous feedback, respond to students' needs
- E.g. Oxford Advisor/student setup 500 years ago
- E.g. Howard Bloom's 2 Sigma Problem
 - Conventional instruction: 30 students per teacher vs.
 - Individualized instruction: each student with individual instructor
 - Gr 4-8 math, 11 periods of instruction over 3 weeks, 2 sigma difference
- [A review of 96 randomized trials](#) found consistent and substantial positive impacts on learning outcomes, with an average effects size of 0.37 standard deviation increase in test scores (usually english or math)

Across 96 RCTS of K12 tutoring in last 40 years, pooled average effects size 0.37SD (Nickow, Oreopoulos, and Quan, 2020)

Number of Tutoring Programs by Effect Size



Avg. impact larger for programs 1) during school; 2) with teacher or paraprofessional as tutor; 3) 1:1; 4) 3-5 days a week

But even with 1:3 tutors, 1-2 days a week, after school and volunteer tutors, avg. effect size >0.2SD

- Incoming Grade 9 Chicago Public School students randomized into different elective courses or tutoring
- Treatment: 1 hour each day, during class
 - 5min warm-up problems
 - 40 min 2-1 or 3-1 tutoring with trained full-time professionals
 - 10-15min problems to check understanding
- 0.37 SD TOT in year 1, 0.22 SD TOT in year 2
- equivalent of 10 months of additional learning

Servicio País en Educación RCT

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Challenges to make tutoring scale

- 1 Expensive!
- 2 Tutor Supply challenges - not enough high quality tutors available, transportation, scheduling challenges, training
- 3 Operational challenges - integrating tutoring during school requires a change in regular curricula - what will it substitute?
- 4 After school programs leads to low-take-up (Scheueler et al. 2021, Robinson et al. 2022)

Possible cost solutions: Volunteers

- 1-1 volunteer tutoring (e.g. Michela and La Ferrara, 2021)
- Servicio Pais en Educación (Cabezas, Ignacio, Cuesta, and Gallego, 2021)
- Group volunteer tutoring (e.g. Schoolhouse World)
- 1-1 Virtual tutoring
- SMS+phone message tutoring (e.g. Angrist et al. 2022)

Challenges include: finding enough tutors, scheduling challenges, training, turnover, safety

Possible cost solutions: peer-to-peer

- Use older grades to help younger grades

Challenges include: tutoring quality highly variable, some very low quality, training, takes away from other learning for tutors

Possible operational solutions

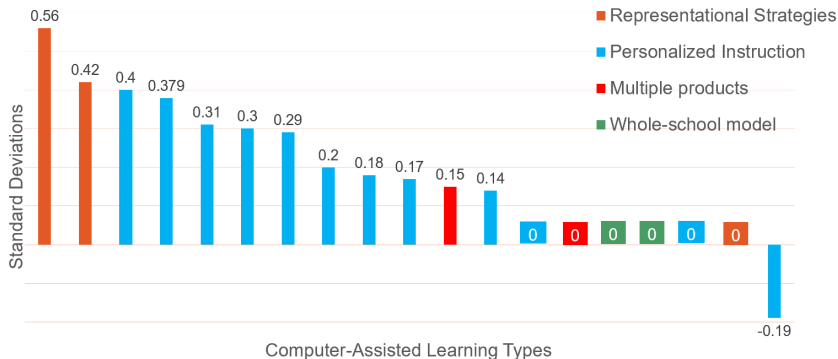
- Substitute other classes for tutoring (e.g. an hour each day: reading in Gr1-3, math in Gr4-8)
- Longer day
- Mandatory (or strongly encouraged) after school
- During independent study time

Challenges include: opportunity cost of learning something else, low demand for longer school day, home tutoring

Using CAL to scale personalized learning

- Computer Assisted Technology (CAL) offers potential for simulating tutoring experience
- Example: Khan Academy
 - Roadmap of incremental short math videos and exercises to follow for Grades 3 to 12
 - Can progress at own pace
 - Receive immediate feedback and help
 - Mastery approach - keep trying until successfully completing questions
 - Roadmap can be customized for each student
 - Teacher, parents, tutors can observe student progress and respond if student is stuck

Escuta, Nickow, Oreopoulos, and Quan, 2020



CAL Programs that were required as part of classroom instruction or to complete homework had effect sizes more than 0.4SD

Challenges with scaling CAL

- Students not motivated to use it - low take-up outside of school (e.g. Beg et al. 2022))
- Incorporating technology requires a change to the education production function by those delivering education
- Teachers and parents not familiar with it, concerned about additional effort and time costs to learn it, skeptical to adopt compared to using previous year's curriculum, too busy
- Sometimes limited computer access, in school and at home

Proposed Solution: Help teachers use CAL, and integrate volunteer tutors

- Motivate, educate, and scaffold teachers for using CAL effectively as part of their curriculum.
- Use CAL for regular individualized practice during math class, start of school, or independent time
- Use it as better way of doing homework
- Set mastery goals and monitor progress
- triage struggling students with additional virtual volunteer home-tutoring linked to school work
- Initial research indicates similar effects to other CAL programs

Chile's National Tutoring Program

- Recruiting 20,000 volunteers from universities, private and social organizations, and media to work with high needs children and Gr 2-4
- Things to look out for
 - How will tutors be trained, monitored, receive feedback to improve?
 - Exactly where and when will tutoring take place? Is that realistic?
 - Monitor and measure tutoring is taking place - adjust if necessary
 - Use CAL to facilitate tutoring, monitoring, reminding, training

Takeaways

- Personalized learning has the ability to facilitate impressive learning gains for everyone
- To lower costs, look for ways at incorporating technology and using volunteer tutors, and leverage teachers and parents
- Consider high dosage tutoring for reading for Gr1-3, math for Gr 4-8
- Monitor and adjust - you will know good tutoring when you see it