The Block Center for Technology and Society
Future of Work Initiative

https://www.cmu.edu/block-center/

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For more than 100 years, America led the world in educating its citizens.
But the supply of skill has grown far more slowly in recent decades
A growing imbalance between skill supply and skill demand has exacerbated income inequality.
These broad trends hit disadvantaged groups especially hard...
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Figure 25. Trend in NAEP mathematics average scores and score gaps for White and Black 13-year-old students

* Significantly different (p < .05) from 2012.

1 Extrapolated data adjusting for the limited number of questions from the 1973 mathematics assessment in common with the assessments that followed.

NOTE: Black includes African American. Race categories exclude Hispanic origin. Score gaps are calculated based on differences between unrounded average scores.
Foundational research on the impact of personalized learning suggests the possibility of revolutionary advances in education

(Bloom, 1984)
The inspiring lessons of Jon Guryan’s research in Chicago...

- Jon’s team conducted a large-scale RCT in some of Chicago’s most challenged school districts.
- Underperforming male students were provided with intensive 1-on-2 tutoring every day for an academic year, using a program developed by SAGA Innovations.
- The learning gains were large enough to narrow the achievement gap by one-third after just one year.
- The high human resource costs of this program put it beyond the bounds of political feasibility for the districts that need it most.
What if we used AI to accelerate math learning by personalizing math instruction?

AI systems **double** the rate of math learning

Prof. Ken Koedinger
Carnegie Mellon University
Our plan: run parallel randomized control trials in Pittsburgh and Chicago...
The biggest benefits from community college education go to those who pursue technical degrees - which often require a significant amount of math!
Math skills deficits are a barrier to success in community colleges and vocational training centers

• Colleges of all kinds find as many as 60% of entering freshman unprepared for college work, most often in mathematics.

• When students are assigned to remedial classes, the pass rate is low (only 38%, according to one study).

• The City University of New York found that the graduation rate for freshman required to take remedial courses was only one quarter that of students who faced no such requirement.

• Mathematics remediation may be the single biggest barrier to increasing graduation rates and this barrier falls especially heavily on members of historically underrepresented groups (Attewell et al., 2006).
We will partner with CCAC to deploy our technology in a community college setting...

- CCAC serves more than 40,000 students (including part-time and noncredit students) annually across 9 campuses and training centers.
- It offers 160 programs of study, and annually awards nearly 2,000 associates’ degrees per year to its graduates, as well as over 600 additional certificates and diplomas.
- But many incoming students struggle with serious math skill deficits.
We will also partner with Pittsburgh’s Manchester Bidwell Corporation to deploy this technology in a vocational training setting...

Bill Strickland, Founder
Cognitive tutors can also be used to provide more job-specific skills

**Figure 6. Troubleshooting Problems Attempted and Solved by Difficulty Level**
We will develop cognitive tutors that can prepare students for entry-level jobs in the digital economy.
New learning technologies and advances in learning science open up the possibilities for a major breakthrough in learning outcomes

• We can accelerate math learning in the K-12 grades.

• We can provide much more effective remediation of math skill gaps in community colleges and vocational training centers.

• We can create new learning models that accelerate job-specific skill formation, providing a new pathway for disadvantaged adults to take advantage of emerging opportunities in the digital economy.

• Getting there will take time and a significant investment in research.
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