



Building an All Hands-on-Deck Effort to Support 21st Century Career and Technical Education

White House Office of Science & Technology Policy

Office of Science & Technology Policy

Quick Background

- Director's Office
- Environment & Energy
- National Security & International Affairs
- Science
- Technology



Overall Vision: Making Every Child College and Career Ready

Four Key Levers

- Develop common college and career-ready standards
- Elevating the teaching profession, through better recruitment, support, reward and retention
- Robust use of technology and data, so student progress can be effectively tracked
- A focus on turning around most challenged schools, through new innovative strategies.



Presidential Focus on Improving STEM Education

“I'm committed to moving our country from the middle to the top of the pack in science and math education over the next decade.

This is probably going to make more of a difference in determining how well we do as a country than just about anything else that we do here.”

—President Barack Obama, Nov 3, 2009



Why this Administration Believes Getting This Right is Essential to All of our Other Goals

Catalyze Breakthroughs for National Priorities

- Unleash a clean energy revolution
- Support advanced vehicle technology
- Drive breakthroughs in health IT
- Address the “grand challenges” of the 21st century

Promote Competitive Markets that Spur Productive Entrepreneurship

- Promote American exports
- Support open capital markets that allocate resources to the most promising ideas
- Encourage high-growth and innovation-based entrepreneurship
- Improve public sector innovation and support community innovation

Invest in the Building Blocks of American Innovation

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- Educate the next generation with 21st century knowledge and skills while creating a world-class workforce
 - Restore American leadership in fundamental research
 - Build a leading physical infrastructure
 - Develop an advanced information technology ecosystem



Our Toolkit for Action

- Authoritative statements of national policy (Executive Orders, Presidential Policy Directives, agenda-setting documents, etc.)
- President's Budget
- Work with Congress on legislation
- Presidential events and speeches
 - “And so today, I am pleased to announce that ...”
- Bully pulpit/ability to convene
 - “All hands on deck” – public-private partnerships such as “Educate to Innovate”
 - If you could call anyone, who would you call and what would you ask for?



A Historic \$2 Billion Investment in Community Colleges, with a New of Harnessing Technology

“We'll support the creation of a new online - and open-source - clearinghouse of courses so that community colleges across the country can offer more classes without building more classrooms.

This will make it possible for a professor to complement his lecture with an online exercise, or for a student who can't be away from her family to still keep up with her coursework.

—President Barack Obama, July, 2009



New: Race to The Top District Competition Announced

Personalized Education is Focus

- A first-ever focus on moving classroom education past “one-size-fits-all”
- \$400M in competitive grants to districts
- Ambitious proposals to give students education tailored to their needs (using, e.g., technology, skilled volunteers, parents)
- Draft rules open for comment and then launches in fall





Education Dominance

Challenge Creating experts faster

- Training pipeline relies on cycles of classroom & hands on experience - lengthy & costly
- *Best* live instructors adapt their teaching methods to each student's needs – not scalable
- (Some) Computer Based Instruction systems can be implemented on large scale, but don't adapt to individual student preferences

Plan

Prove: Capture how best instructors teach massive amounts of information: demonstrate novices into experts (Phase 1 - completed)

Create: Digital Tutor based on models of how expert instructors teach (Phase 2 - ongoing)

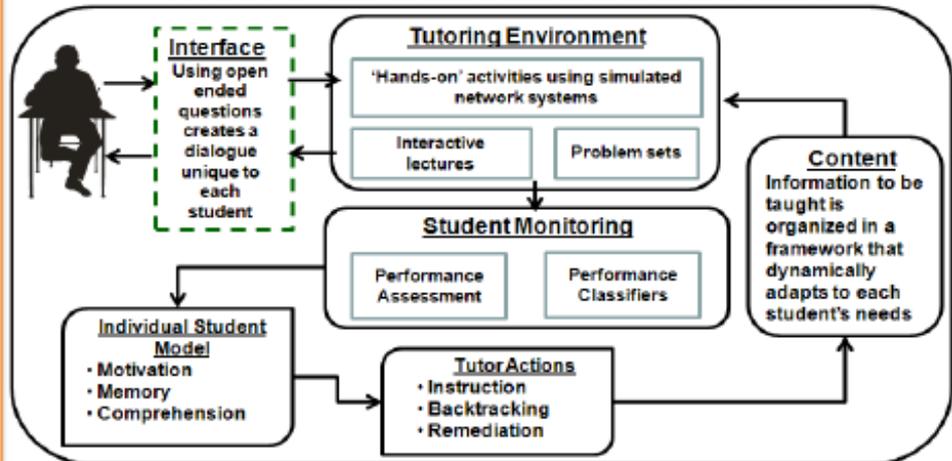
Validate: Digital Tutor can quickly transform novices into experts (Phase 2 - ongoing)



Digital Tutor runs on standard desktop configuration

Approach

Model how expert instructors teach
Not how the ideal student should learn

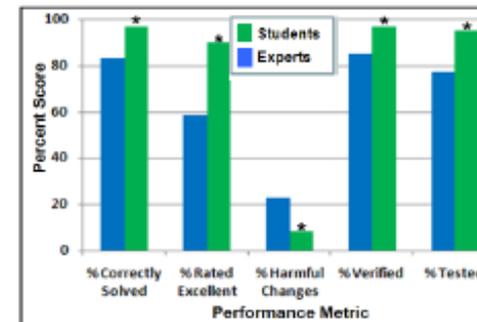


Phase 1 Results

20 randomly selected IT novices

16 weeks training

Outperform experts with ~7 years experience in specific IT network problem solving



Leveraging Data Also Driving our Growing Interest in Games for Learning

“I’m calling for investments in educational technology that will help create... educational software that’s as compelling as the best video game.

I want you guys to be stuck on a video game that’s teaching you something other than just blowing something up.

–Barak Obama, March 8, 2011



Doing Things Differently

Using “All Hands on Deck” Call to Build Partnerships for Impact

“But I think all of you understand it will take far more than the work of government. It will take all of us.

It will take all of you. And so today I want to challenge you to use your love and knowledge of science to spark the same sense of wonder and excitement in a new generation.”



–President Barack Obama, speaking to National Academies of Science, April 27th, 2009



“Educate to Innovate” Launched in 2009

Public-Private Campaign to Spur STEM; \$700M in direct/in-kind raised

Some Key Partnerships

- “100Kin10”
- NMSI AP Initiative
- Digital Promise
- Maker Movement
- Annual White House Science Fair
- Change the Equation
- Focus on women and girls

“Through these efforts, we going to expand the scope and scale of science and math education all across America.”

–President Barack Obama, November 3rd, 2009



100Kin10

ANSWERING THE NATION'S STEM CHALLENGE

- Over 115 organizations that have come together to meet the President's goal of 100,000 STEM teachers over the next decade
- Led by Carnegie Corp., they have raised a \$22M fund (including over 15 different funders) and are now exploring a second fund.
- In addition to funding, over 100 other individual commitments, including by UChicago to build research track on the investments



Every Child a Maker

Maker Education Initiative

- Growing movement to give more opportunities to children to be able to make things – not just consume.
- Over 60+ “Maker Faires” planned this year. San Mateo Faire gets over 100,000 visitors.
- With support from Cognizant, Pixar, Make and Intel, Maker Education Initiative launched earlier this month, with goal of building a movement to thousands more children a making experience.



Maker Faire®





- Great example of intersecting initiatives: President's Focus on STEM, community colleges and his Startup America campaign to promote youth entrepreneurship
- Working with the National Association for Community College Entrepreneurship
 - Over 75 community college Presidents have already come together already
 - Key commitments steps include: (1) Standup an internal team focused on creating more entrepreneurs, (2) Do a community asset map, (3) Develop a student engagement campaign



OpenBadges



- Goal: helping more students and adults build 21st century resumes
- Key opportunity: build pathways for students to go from amateur to expert (space cadet to astronaut!), and more ways for adults to show their skills through alternate credentialing
- With MacArthur Foundation hosting \$2M competition, a number of agencies (NASA, VA, etc) participated and will be building new badges this year

Open Badges

Making it easy to issue and display badges across the web

mozilla

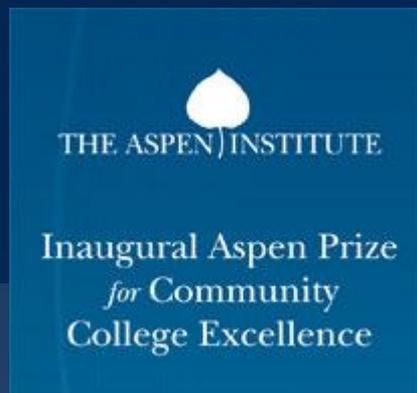


Open Badges is a project of Mozilla with support from the MacArthur Foundation

MacArthur
Foundation

DIGITAL MEDIA + LEARNING competition





- First-ever prize to shine spotlight on community colleges showing exceptional results
- Out of 1200, top 120 were selected and submitted data (completion rates, labor market outcomes, student learning). Winner was Valencia College (FL). Four finalists-with-distinction: Lake Area Technical Institute (SD), Miami Dade College (FL), Walla Walla Community College (WA), and West Kentucky Community and Technical College (KY)
- Fits with Administration's broader use of prizes as a tool for innovation
- Powerful role for philanthropy to play

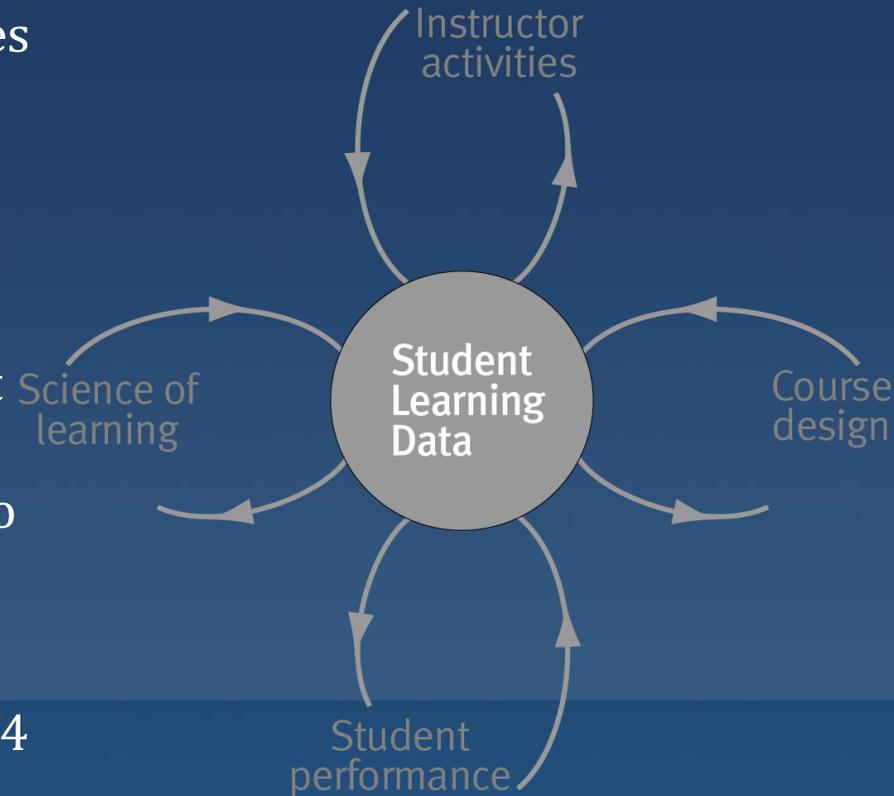




OPEN

Open Professionals Education Network

- Free technical support for all the grantees for DOL's \$2B community college grant program from CMU's Open Learning Initiative, Creative Commons and Gates
- By capturing click-stream data, you can provide feedback not only to the student (the next "minimum hint"), but also to the instructor, the course designer and to the learning scientist
- Large data sets can lead to new insights (e.g. Wireless Generation has data set of 4 million students learning to read. Took on the "should you teach B and D" close or apart problem)





- NMSI developed a “waiting list” of 150 high-schools with large number of military children and no AP classes
- Implemented their AP Training Program (mix of teacher training and student incentives) in 4 schools with private funding and saw 57% increase in students with AP passing scores
- In past year, under First Lady’s Joining Force effort, grown to a diverse set of funders (Defense Education Authority), Navy, BAE, Boeing and others to fund 52 of the schools in 14 states, impacting 30,000 military children in 2012-2013 school year



digitalpromise

- Build a League of Innovative Schools that can engage in “smart demand” (buyer’s consortium for new innovation), and as a test bed for researchers and entrepreneurs. Major cities already signed up, and number of experiments planned this summer.
- Make the case for more R&D investment in education technology, to leverage advances in learning sciences, big data, games and DARPA investment in digital tutors.





Council on Women and Girls

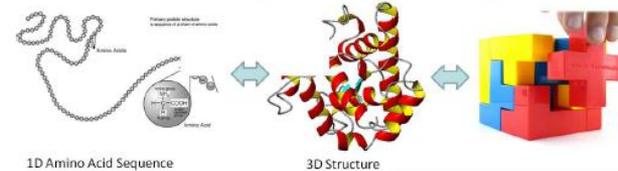
- Bolstering women's participation in key STEM fields by 1) elevating Female STEM role models, 2) mobilizing STEM workforce to volunteer & mentor, and 3) building a bridge between girl-serving groups and non-traditional partners, like the entertainment and tech industries, to deploy research-driven engagement.
- To-date, CWG has deployed female STEM officials from 9 agencies to partner programs across the country.
- Private sector commitments include support for expansion of STEM programming at Girls Inc, AAUW, and Girl Scouts



New Idea: National Virtual Learning Lab

- Goal: helping meet President's grand challenge of creating "online courses that get better the more students use them"
- Key elements needed: (1) tools for rapid low-cost experimentation, (2) community of researchers with hypothesis to test, and (3) participating companies or others with users
- Medium term would be to show that rapid experimentation could lead to demonstrable learning improvements (e.g., equivalent of 1-2 letter grades)

"Foldit" treated Proteins as Puzzles in a game that experts and non experts played



1D Amino Acid Sequence 3D Structure

At first:

- Don't know how to teach the rules
- Don't know visualization
- Don't know tools

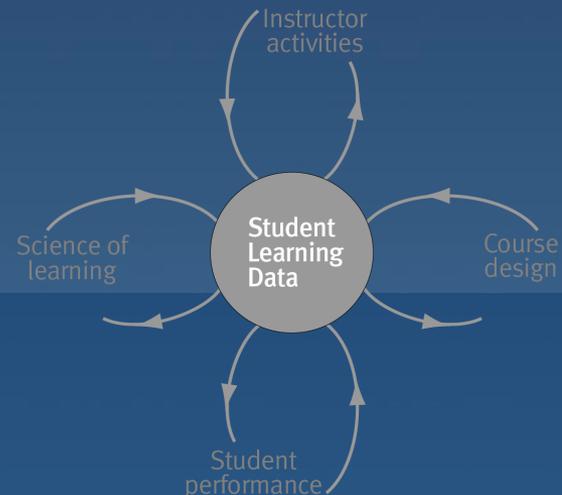
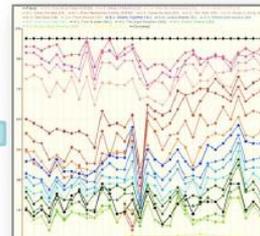
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Measure, measure, measure

- How many succeeded at each step
- Where did strategies stall
- **Feedback to game**

Results

- 10,000s of players
- Emergence of "protein savants" (e.g. 15-year old student & a cowboy)
- Game players outplay



Additional Ways to Build High-Impact Partnerships to Help CTE Community

- Key opportunities for industry and partners to step up:
 - Competency-Based Assessments: Employers and other stakeholders could identify what a worker needs to know for a given job and how they would demonstrate that they knew it. (Demonstrate mastery, not just seat time)
 - Cognitive Task Analysis: Improve the effectiveness of training methods by first decoding techniques that experts use in those jobs. Up-front investment would allow more effective course development for new and existing job types.
 - Leverage Advanced Training Technologies: A recent evaluation by the Institute for Defense Analysis of a DARPA/Navy project called “Education Dominance” suggests that it is possible to dramatically reduce the time required to become an expert in information technology from years to months.



But we can't stop there.
So let's brainstorm together!

