Adaptive Education at SCALE®

Student Centered Adaptive Learning Engine

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About Me

• Graduated from UNC Charlotte in 2010 working with Tiffany Barnes.

• I currently am an Assistant Professor in the HCII at Carnegie Mellon University.

• Prior to getting my PhD, I was in the software industry for over 10 years.
Inspiration

While working in AI research, I read this book at the same time that I found intelligent tutors.

Technology and research exists to allow adaptive learning experiences! Why isn’t it more widely adopted?
Issues:

Adaptive content is expensive to create

• Manually creating adaptive content is time consuming.
• Creating adaptive content requires both content and pedagogical experts.
• Smaller domains often find adaptive cost-prohibitive.
• Traditional focus was on top-down methods – building authoring tools and platforms.
• Each content developer / edtech platform has to re-architect.
• Everyone is talking about adaptive and personalized learning – confusion
We are born to learn – how do we maximize opportunities?

Built on teaching, learning, research, and the human experience

TutorGen believes technology can revolutionize learning, but only if we never lose sight of the people who will use it. That’s the vision that inspires each of us every day.
How We Started...

Founder – Dr. John Stamper in 2011

Initial work in building out the platform started in 2013

Use data to build from the ground up rather than building authoring tools and pushing from the top down.
Working with Great Partners
Adaptive Education at SCALE®

*Student Centered Adaptive Learning Engine*

**Building from the Ground Up**

- Use data to drive adaptive capabilities.
- Follow a human-centered approach.
- Embrace traditional academic research methods.
- Allow existing clients to utilize their systems investment.
- Use a white-box method.

**SCALE® takes already collected data and reduces the cost to create adaptive content**
Funding – Leading to SCALE

Operating as a lean startup, funding via SBIR/STTR

- 3 NSF grants and supplements ($1.44m)
- 3 Kentucky matching grants ($811k)
- 1 Institutes of Educational Sciences (IES) grant ($150k)
- Related projects and pilots ($600k)
Underlying Magic
SCALE®

New or Existing Educational Software → DataConnector Library → DataConnector Adapter → Student Model → Assessment and Support Tools → Educators

Student Model:
- Cognitive Tracker
- Boredom Detector
- Gaming Detector
- Student Interests Selector

Assessment and Support Tools:
- Problem Selector
- Hint & Feedback Selector
- Activity Selector

Data Driven | Human Centered | Research Grounded | API Connections

Students → TUTOR ENGINE → Database → Educators
SCALE®
Initial Focus – Cognitive Factors

- Knowledge Tracing
- Problem Selection
- Automated Hint Generation
• Ensemble method for problem selection
• Next best activity
• Expanded learner interaction modes (formative, review, assessment)
• Support and management of multiple learner models approach
SCALE®
Modeling Across Curriculum

- Learner personnas
- Learning plans employed
- Learning goals beyond the course
SCALE®
Exploring Meta-Cognitive Factors

Still using data
- Learner Affective States (boredom, frustration)
- Learner Behaviors (gaming-the-system, carelessness)
- Learner Preferences
On-Boarding Process

- Review content mapping strategies (knowledge components / skills granularity)
- Identify new KCs or tease out distractors
- Perform learning curve analysis
- Conduct pilot studies for existing courses / content
- Analyze and assess data and performance with recommendations

Using the TutorGen instance of DataShop and our SCALE Dashboard, assess current content and student performance to identify areas for improvement.
On-Boarding Process

- Most systems do not collect data at the granularity needed to have maximum effectiveness

- Many systems do not have enough opportunities, which means more content creation is likely needed

- There is no “black-box” solution, effort from is needed to make it work!

**TutorGen has the motto – Data Driven, Human Centered.**
On-Going Operations

- Administrator content / system monitoring
- Educator dashboard for student monitoring
- Student model review / input
- Ongoing analysis and assessment with recommendations

Once the system is operational, we are not finished. There is a continual process to assist in monitoring the performance of the system and assist in making recommendations to optimize performance.
Continuous Improvement

Are students learning within the course?
• http://Datashop.tutorgen.com
Status of SCALE

- Currently out of BETA status for some clients
- Onboarding with other clients
- Approaching 100,000 students monthly
Thoughts

• White box? Why wouldn’t I just do this on my own?

• Where is adaptive education at scale headed?

• When will TutorGen corner the market?

In order to have a robust ecosystem of commercial adaptive learning and intelligent tutors, there needs to be more players doing real adaptivity and real evaluation of the outcomes.