EXPANDING STEM CAREER PATHWAYS THROUGH ONLINE EDUCATION

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CREATING THE NEXT®
Improving Education through Accessibility and Affordability
Georgia Tech –
A Potentially New Model

• GA Tech’s Online MSCS launched in 2013
  • Fully version of well regarded on-campus M.S. (MSCS)
  • Open to all with relevant B.A. and GPA of 3.0+
  • Developed with Udacity, subsidized with $4 million from AT&T.

• Classes are “asynchronous,” so no fixed time commitments.
  • 10 courses for degree, part time over 6-7 terms.
  • similar grading standards as in-person program.
The OMSCS Motto

Accessibility through Affordability and Technology

• OMSCS total degree cost: ~$6,600
• Typical MS CS (public university, out-of-state) ~$40,000
• Typical MS CS (private university) ~$70,000

Improving Education through Accessibility and Affordability
Comparing On-Site to On-Line
Raw numbers (annualized)

MSCS (n=120)
- Apply: 1,851
- Admitted: 13%
- Enroll: 6%

OMSCS (n=1,663)
- Apply: 3,410
- Admitted: 61%
- Enroll: 49%

- 14 times larger than on-campus program, three times larger than largest on-campus program (Carnegie Mellon ~600 per year).
- Important: Fewer than 0.2% of applicants apply to both programs.
Attracting Different Types of Students:

- Average on-campus applicant: 24-year old Indian recent college grad
- Average online applicant: 34-year old employed American

- OMSCS attracts:
  - large numbers of applicants
  - mid-career workers of various ages in the U.S. (>70% US)
  - students similar to MSCS applicants in terms of race and gender
  - high-yield-- nearly all who are accepted ultimately enroll

- Strong evidence of unmet need for mid-career training that’s flexible, relatively low cost, and of serious quality (particularly in technical disciplines)
To what extent are we reaching a new market?

- Can we provide rigorous evidence that this is a new educational “product” for which close substitutes do not currently exist?
  - If not for OMSCS, would applicants enroll elsewhere?

[https://www.journals.uchicago.edu/doi/abs/10.1086/698895](https://www.journals.uchicago.edu/doi/abs/10.1086/698895)
What did we learn about demand?

• **High demand** for the first low cost, high quality MOOC degree in computer science.
  - BUT – demand is DIFFERENT (comes largely from mid-career Americans)

• Online version **increases access** for
  - Older/employed students (time flexibility offers appeal?)
  - American students (no need for physical access to U.S. networks and labor markets?)

• New form of formal ed has **no close substitutes** in current market (formal or informal)
• Existence of OMSCS thus **increases educational attainment and overall training hours**
Implications?

• OMSCS should increase annual production of U.S. master’s degree holders in computer science by at least 7%.
  • 11,000 Americans earn CS master’s annually
  • At least 62% of OMSCS-ers persist after two years (possibly 90%)
  • Averaging 1,170 US enrollees per year so far (*0.62 ~ 725)
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- What are the characteristics of student pursuing this new-market degree relevant to persistence and completion?
  - Particularly for students under-represented in CS, and/or transitioning to the IT workforce?
What Challenges Exist Given This Student Base?

- **Advancing education**: OMSCS is one of a kind in US Higher Education
- **Bridging fields**: OMSCS opens, bringing theoretical and empirical foundational knowledge to this new setting

**Research Agenda:**

- **Filling Gaps**: Exploratory, novel research that breaks new ground in social and economic sciences
- **Providing feedback**: Provide feedback that will help OMSCS
A Simplified View of How Career-related Interests and Choices Develop over Time, According to SCCT


➢ What can we understand about the factors that matter for student attraction, retention, completion and career impacts?
OMSCS as enabling Career Change/Advancement?

What do you hope to do following graduation?

- Stay in Current Job
- Get Promoted
- Find a New Job in Computing
- Get a PhD

IT labor market does not require the MS (although does value it --$$)

Female Students (n=286)  Male Students (n=566)
How Does Efficacy Shape Perceptions?

- Kreth Q, Spirou M E, Budenstein S, Melkers J. How Prior Experience and Self-Efficacy Shape Graduate Student Perceptions of an Online Learning Environment in Computing. Under Review

- **Student perceptions** older students and women perceive the OMSCS environment
  - **BUT** pre-existing student self-efficacy has a mediating effect

- **Self-efficacy** CS degree or job experience do not explain self-efficacy

- **KEY FINDING**: Bi-directional relationship between self-efficacy and the online learning environment
Challenge: Helping Mid-Career Students to Succeed: Boosting Area-Specific Self-Efficacy?

OLS Regression Coefficients: Computing Self-Efficacy

- **Human Capital**
  - Semesters in Program
  - BS in Computer Science
  - Other STEM Bachelors
  - Current Computing Job
  - Past Computing Job

- Gender
  - Female
  - Student Age
  - Asian
  - Two or More Races
  - Hispanic or Latino
  - Black
  - Permanent Resident
  - Temporary Visa or Overseas Alien

*** p<0.001, ** p<0.01, * p<0.05
How Do Students “Participate”?

- Stevens J, Kreth Q, Ruthotto I, Melkers J. *Virtual Inequality? An Exploratory Study of Participation Patterns among Graduate Students in an Asynchronous Online Discussion*

- **Question:** Does the online environment remove barriers to participation?
- **Focus:** understand learner characteristics and participation patterns (PIAZZA)
- **Findings:** Demographics variation in the frequencies of *active* (posts, asks) and *passive* (views) participation based on Piazza user data
  - Women and under-represented groups engage at lower rates (esp answers)
Future work: New Opportunities to Learn About CS Mid-Career Students

• **Future Research Questions of Interest**
  - What motivates students to pursue an online degree versus a traditional degree?
  - Does online education help to increase the diversity of students in STEM disciplines?
  - Which factors predict the persistence of students in online learning?
  - What are the returns to an online degree?