The Action Lab is a dedicated teaching and learning laboratory within EdPlus that engages in deep research in digital teaching and learning science enabling continuous improvement in online programs which ultimately result in student success.
Actionability
- Practical application of research for continuous course design improvement
- Private/public sector EdTech collaboration and co-creation

Insight
- Multidimensional research
- Digital learning design focus
- Grounded in Learning and Data Sciences

Innovation
- Continuous, sustainable impact on student success
- Increased success rates in digital learning market solutions

Action Lab
Action Lab
Research Tracks

ASU Online
Open Scale Courses

Adaptive & Emerging Technology
Socio-cultural, Metacognitive, & SEL

Student Learning Pathways: Learning Efficacy and Analytics

Cross-Cutting Factors and Design Strategies:
Student Engagement and Adaptive Learning
Action Lab Research

Strategic Goals

**Academic Outcomes**
What is the distribution of student success across ASU courses? How does success differ for different student groups?

**Socio-Cultural & Metacognitive**
What context factors moderate student success? To what degree and through which mechanisms can these factors be leveraged to increase student success through interventions?

**Course Design Features**
Which course design features predict student success? Why are some more effective than others, and under what circumstances are they most effective?

**Delivery Method**
How does a course’s delivery method impact student success? Why are some delivery strategies more effective than others, and under what circumstances? How can we best adapt pedagogy and technology for Open Scale courses?

**Student Learning**
What student learning indicators can be extracted from LMS and external data sources? To what degree are students completing courses and graduating programs with the expected knowledge and skills?
Research Questions

Are there meaningful gaps in undergraduate student success between face-to-face and online programs?
252 Courses Across 70 Academic Disciplines

- Humanities
- Social Sciences
- Public Programs
- Design and the Arts
- Health
- Math
- Engineering
- STEM Natural Sciences
- Business Administration
- Education & Learning Sciences

Number of Courses
Moderated Logistic Regression
Predicted student success, ASUO compared with Face-to-Face

- Common model across all courses, outcomes
- Primary predictor variable: modality (face-to-face vs. online)
- Interaction terms for gender, under-represented minority, SES level, etc.
- Covariate adjustment (GPA at course start, age, etc.)
- Grade-based outcome measures:
  - Completion: non-withdrawal vs. withdrawal
  - Passing: passing vs. nonpassing grade for those who completed
  - Mastery: AB vs. CD for those who passed
Average Course Performance
252 Courses | 160k Students | 1M Observations

Predicted Success Rate (%)

Completion
Online +3.6
Passing
Online -2.7
Mastery
Online -1.4

Online
On-Campus
Research Question

Do online undergraduate programs disadvantage certain subgroups?

Gender and Ethnicity: Equity in Online Programs
Online and Face-to-Face populations differ on characteristics that correlate with GPA

2014-2018     4,900 Courses    140k Students    AIPW adjusted

Method

- units_per_termWinz
- admit_age
- transfer
- full_time
- full_time2Part-time
- transfer_unitsWinz
- isfemale:Eth.RecodeWhite
- Eth.RecodeWhite
- isfemale
- ever_pell
- prev_gpa
- Eth.RecodeHispanic
- first_gen
- isfemale:Eth.RecodeBlack
- Eth.RecodeBlack
- isfemale:Eth.RecodeHispanic
- fed_efc0
- Eth.RecodeNR
- isfemale:Eth.RecodeOther
- log(1 + fed_efcWinz)
- isfemale:Eth.RecodeNR
- Eth.RecodeOther

Absolute standardized difference
Online programs are beneficial for all student subgroups

2014-2018 4,900 Courses 140k Students AIPW adjusted

Results

Gap in Cumulative GPA

Male

Asian | Black | Hispanic | White | Mixed/Other

Adjusted Gap

Raw Gap

Online programs are beneficial for all student subgroups

Adjustment

+ Online

+ Face-to-Face

Asian
Black
Hispanic
White
Mixed/Other
Heterogeneous Effects of Adaptive Learning

Research Questions
How effective is adaptive tutoring in increasing student success in college algebra?
Is it equally effective for everyone?
Method

Procedure

• MAT 117 algebra course adopted ALEKS adaptive tutoring
  • Fall 2016
  • On-campus and Online

• Interrupted time series analysis comparing student outcomes between
  • Pre-ALEKS: AY 2014/15, 15/16 and
  • Post-ALEKS: AY 2016/17, 17/18

• Augmented Inverse Probability Weighting (AIPW) Estimator with Robust Standard Errors
  • Doubly robust to model misspecification
  • Accounts for imbalance in population between before/after adaptive tutoring was introduced
  • Trim 2.9% of sample due to extreme propensity of being pre/post adaptive tutoring
Sample

- N = 12,711 students who enrolled in College Algebra
- Avg. age 21.20 (SD=6.04)
- 52% female
- 39% URM (54% White, 7% Asian, 24% Hispanic, 7% Black, 7% Other/Mixed)
- 44% Pell grant eligible (lower socioeconomic status)
- 24% ASU Online
- 28% transfer students
- 25% enrolled part-time
- Avg. SAT Math 501.13 (SD=78.77); available for 66% of sample
Pre-Post Imbalance Precludes Causal Inference
IPW Adjustment creates balance pre/post-ALEKS
Adaptive tutoring improves Algebra grades in Face-to-Face and Online

2014-2017  12,711 Students  52% female  39% URM  44% Pell eligible

Higher Math Ability

Lower Math Ability

Traditional Instruction

Adaptive Instruction

Average Course Grade

Academic Year

2014  2015  2016  2017
Adaptive tutoring helps students regardless of ethnicity and gender

Results

…but adaptive tutoring helps URM, Pell Eligible women less than other students
Workforce, Socio-Emotional Skills, and Student Success

Research Questions

What are the contextual variables — social, personal, cultural, and emotional — that influence learning?

How can we meet learners in their unique contexts, in lifelong learning, to create a 21st century workforce?

How can we shape key non-cognitive outcomes that drive workforce success?
### Behavioral Skills

Behavioral skills include interpersonal, self-regulatory, and task-related behaviors important for adaptation to and successful performance in education and workplace settings.

#### Acting Honestly
Describes the extent to which a person values and adheres to ethical and moral standards of behavior, as well as personal level of humility.

#### Getting Along with Others
Describes the extent to which a person interacts positively and cooperates with others, and is generally kind, friendly, and tactful.

#### Keeping an Open Mind
Describes a person’s level of open-mindedness and curiosity about a variety of ideas, beliefs, people, and experiences.

#### Maintaining Composure
Describes the extent to which a person is relatively calm, serene, and able to manage emotions effectively.

#### Socializing with Others
Describes a person’s preferred level of social interaction, behavior in interpersonal situations, and optimism.

#### Sustaining Effort
Describes a person’s level of diligence, effort organization, self-control, and compliance with rules.

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### Core Academic Skills

Core academic knowledge and skills include domain-specific knowledge and skills that are required to effectively perform essential tasks in the core academic contents.

#### English Language Arts
Literacy skills related to comprehension and capacity for use of written and oral language.

#### Mathematics
Relating and transforming numeric and symbolic quantities, including applications to data sets, patterns, space, and change.

#### Science
Gathering and interpreting observations, experimental data, and disciplinary content knowledge in order to predict and explain phenomena.

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### Education & Career Navigation

Education and Career navigation includes personal characteristics, processes, knowledge and skills that influence individuals as they progress through their educational and career paths.

#### Self-Knowledge
Perceptions of one’s own abilities, interests, values, attitudes, beliefs, etc. that contribute to understanding the self.

#### Environmental Factors
Information, conditions, and experiences related to education and work that are acquired primarily from external sources and surroundings.

#### Integration
Ongoing process of combining self-knowledge and environmental factors to form a coherent understanding of one’s capabilities used to evaluate information and to plan courses of action pertaining to education and work.

#### Managing Career & Education Actions
Ongoing process of implementing plans and enacting purposeful behaviors that facilitate education and occupation progress.

#### Cross-Cutting Capabilities

- **Collaborative Problem Solving**: Using social and cognitive knowledge, skills, and strategies to successfully collaborate with a group to solve a problem.
- **Learning Skills**: Using cognitive and behavioral strategies and methods to effectively facilitate and manage learning.
- **Technology and Information Literacy**: Using technology knowledge and skills to effectively acquire and apply information.
- **Thinking Skills**: Successfully employing modes of thinking that apply to a broad range of contexts.
### Principal Components Analysis on Indigo 21st Century Skills

<table>
<thead>
<tr>
<th>Indigo “21st Century Skill”</th>
<th>Component No. 1</th>
<th>Component No. 2</th>
<th>Component No. 3</th>
<th>Component No. 4</th>
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### Component Name

1. Leadership Skills
2. Decision Making & Organizational Skills
3. Creativity & Conceptual Skills
4. Time Management & Self-Regulation Skills
5. Empathy & Prosocial Skills
## PCA Components Differently Predict Student Achievement

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### PCA Components

1. Leadership Skills
2. Decision Making & Organizational Skills
3. Creativity & Conceptual Skills
4. Time Management & Self-Regulation Skills
5. Empathy & Prosocial Skills
Elastic Net On Cumulative GPA With Indigo 21st Century Skills

Indigo “21st Century Skill”

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Current Projects

- Equity and Opportunity in Online Education
- Open Scale (GFA) Efficacy Study
- Adaptive Learning Platforms: Efficacy and Learning Analytics (collaborations with McGraw Hill Education)
- Engagement and Social Network Analysis: Online Class Forums
- Computational Linguistics: Sentiment Analysis and NLP on Class Forums
- Course Archetypes at ASU: How are our digital tools being used?
- Online Performance and Engagement for Students on Academic Probation
- “Non-Cognitive”: Motivational, Attitudinal, and Metacognitive Factors in Student Success (collaborations with ACT)
- Faculty and Student Engagement
- Categories of Non-Success: DFW analysis for targeted course improvement
- Social Psychological Interventions: Improving Course Success in ASU101 and beyond (collaboration with Stanford and CMU)