

Adapting Adaptive Learning for Africa

World Bank

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This presentation will explore challenges and opportunities to consider when evaluating and implementing adaptive learning systems. I will describe their benefits, costs, and potential to transform the learning process based on my implementation experience at Arizona State University.

At the end of the seminar, the participants will be able to:

- Explain adaptive systems and terminology,
- Describe how they can be used in courses,
- Assess the challenges and opportunities of using them, and
- Analyze their costs and benefits.

Our Experience



2011



2018

Biology - CogBooks

Chemistry - McGraw Hill Connect

College Algebra - McGraw Hill ALEKS

College Math – McGraw Hill ALEKS

Economics – Cengage Learning Objects

General Science - SmartSparrow

History - CogBooks

Physics - Pearson Mastering Physics

Psychology – Cengage Learning Objects

Where is Arizona State University?



What is Arizona known for?



What is Arizona State University like?



Public university

100,000 students

70,000 on-ground
30,000 online

Urban population 4.7 million

What is Arizona State University known for?



How is ASU already helping African students?

Education for Humanity East Africa

Deliver high-quality online education for refugees and host communities

Address systemic and technical barriers refugees face in accessing education

Facilitate refugee integration through university partnerships



Evaluation of an adaptive learning technology in a first-year extended curriculum programme physics course

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ABSTRACT

Personalised, adaptive online learning platforms that form part of web-based proficiency tests play a major role in the improvement of the quality of learning in physics and assist learners in building proficiency, preparing for tests and using their time more effectively. In this study, the effectiveness of an adaptive learning platform, Wiley Plus ORION, was evaluated using proficiency test scores compared to paper-based test scores in a first-year introductory engineering physics course. Learners' performance activities on the adaptive learning platform as well as their performance on the proficiency tests and their impact on the paper-based midterm averaged test were investigated using both qualitative and quantitative methods of data collection. A comparison between learners' performance on the proficiency tests and a paper-based midterm test was done to evaluate whether there was a correlation between their performance on the proficiency tests and the midterm test. Focus group interviews were carried out with three categories of learners to elicit their experiences. Results showed that there was a positive relationship between high-performing learners' proficiency score in the midterm averaged test and that the proficiency test enhanced learners' performance in the paper-based midterm averaged test.

Keywords: adaptive, metacognitive report, online assessment, productivity reports, Wiley Plus ORION

Categories: • Human-centred computing ~ Interaction design theory, concepts and paradigms • Applied computing ~ Education • Applied computing ~ Computer-managed instruction • Applied computing ~ Collaborative learning

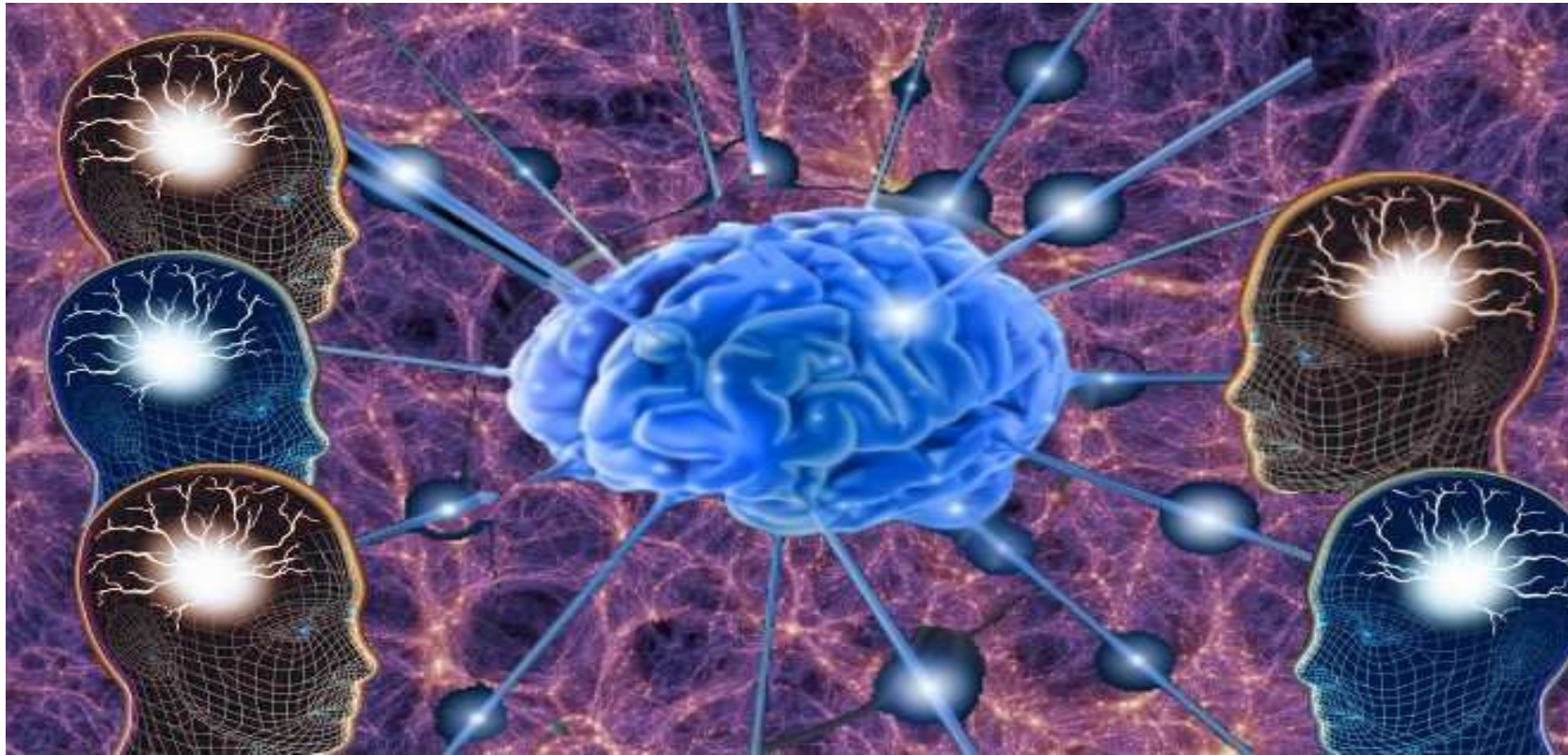
Where are we in the technology cycle?



Adaptive knowledge networks could scale like cellular technology in Africa.

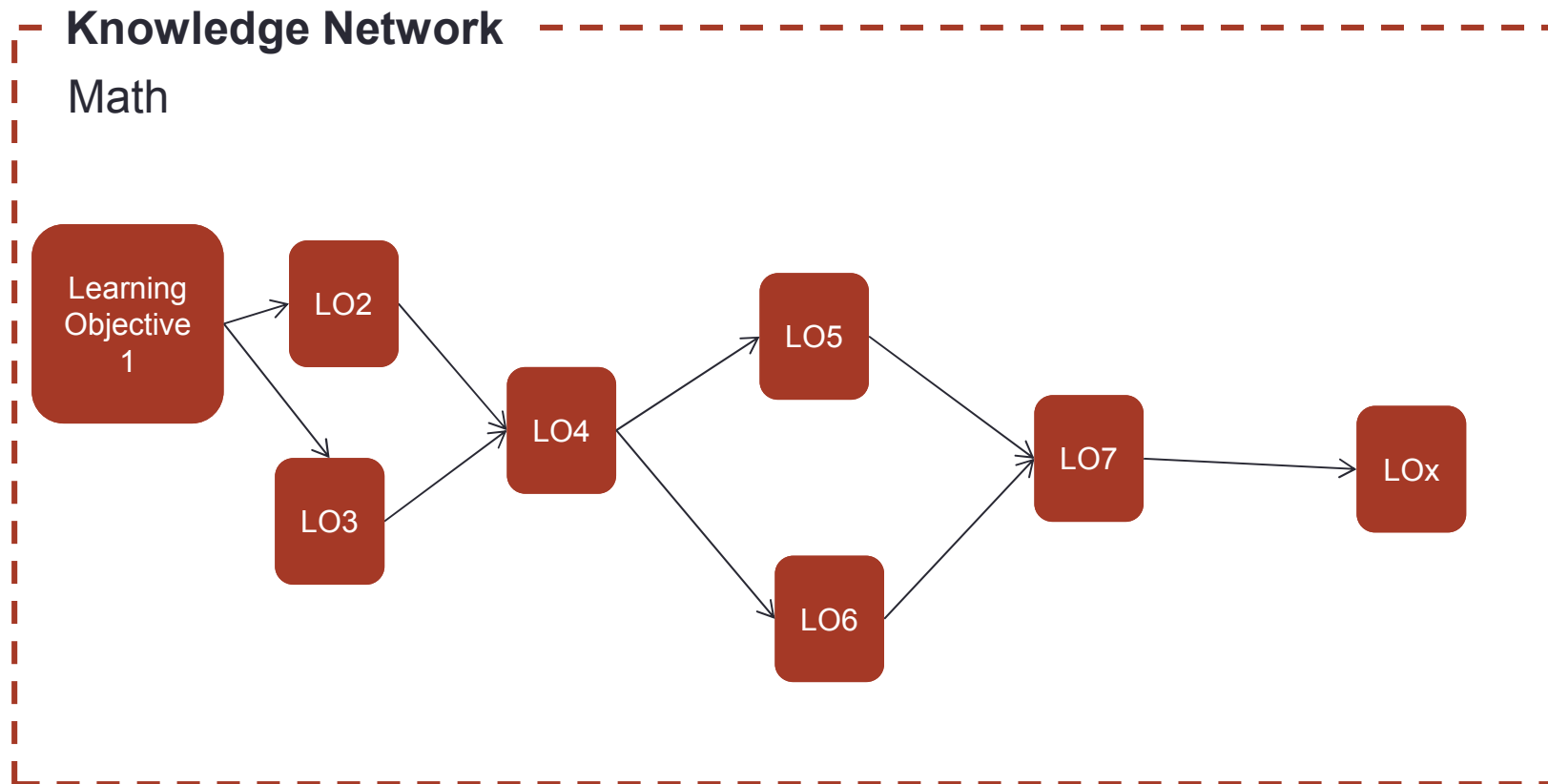
What is the future of educational technology?

Adaptive knowledge networks are being built to be configured by teachers and personalized for students.



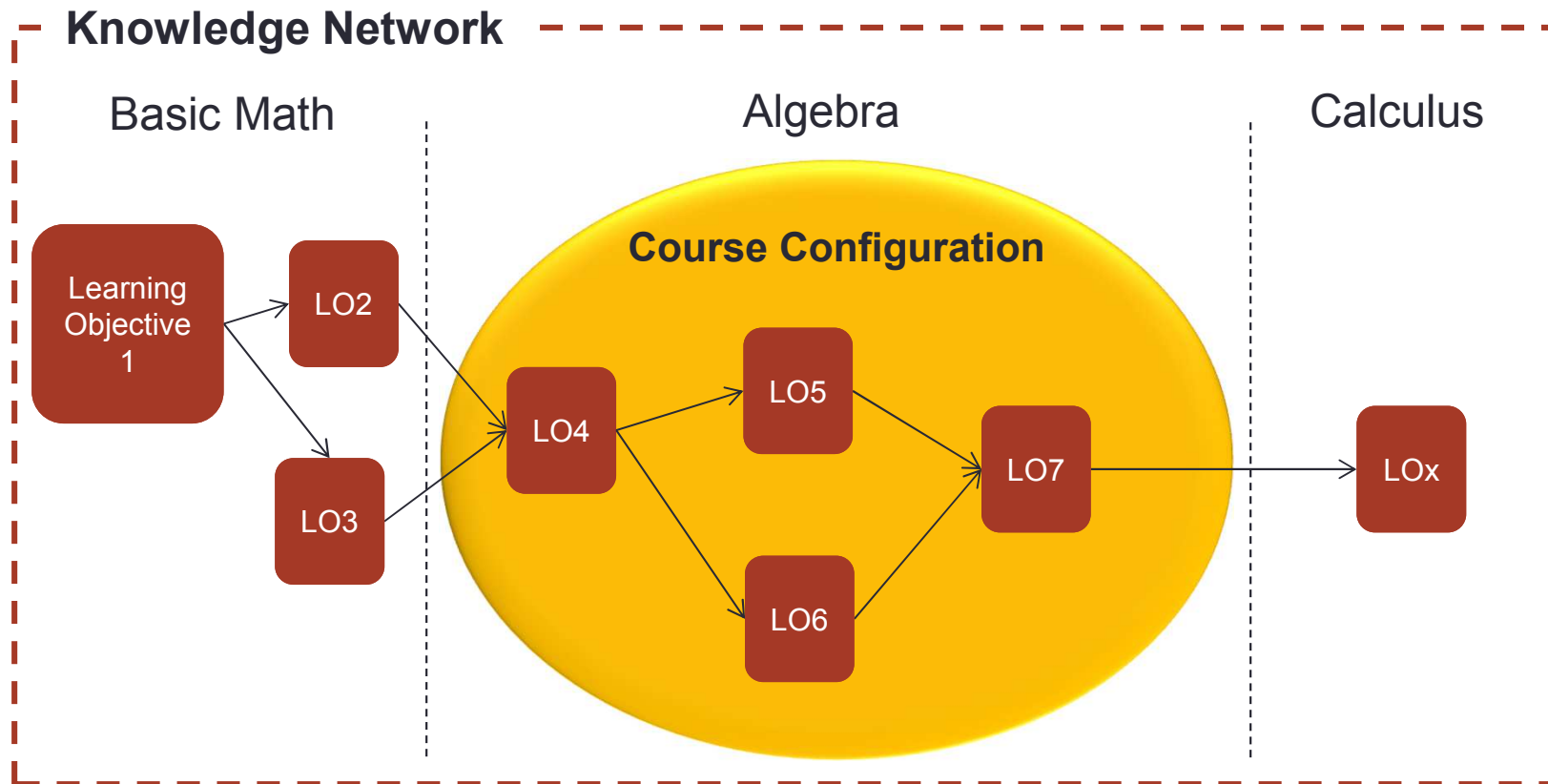
What is the first investment?

Adaptive knowledge networks are being built to be configured by teachers and personalized for students.



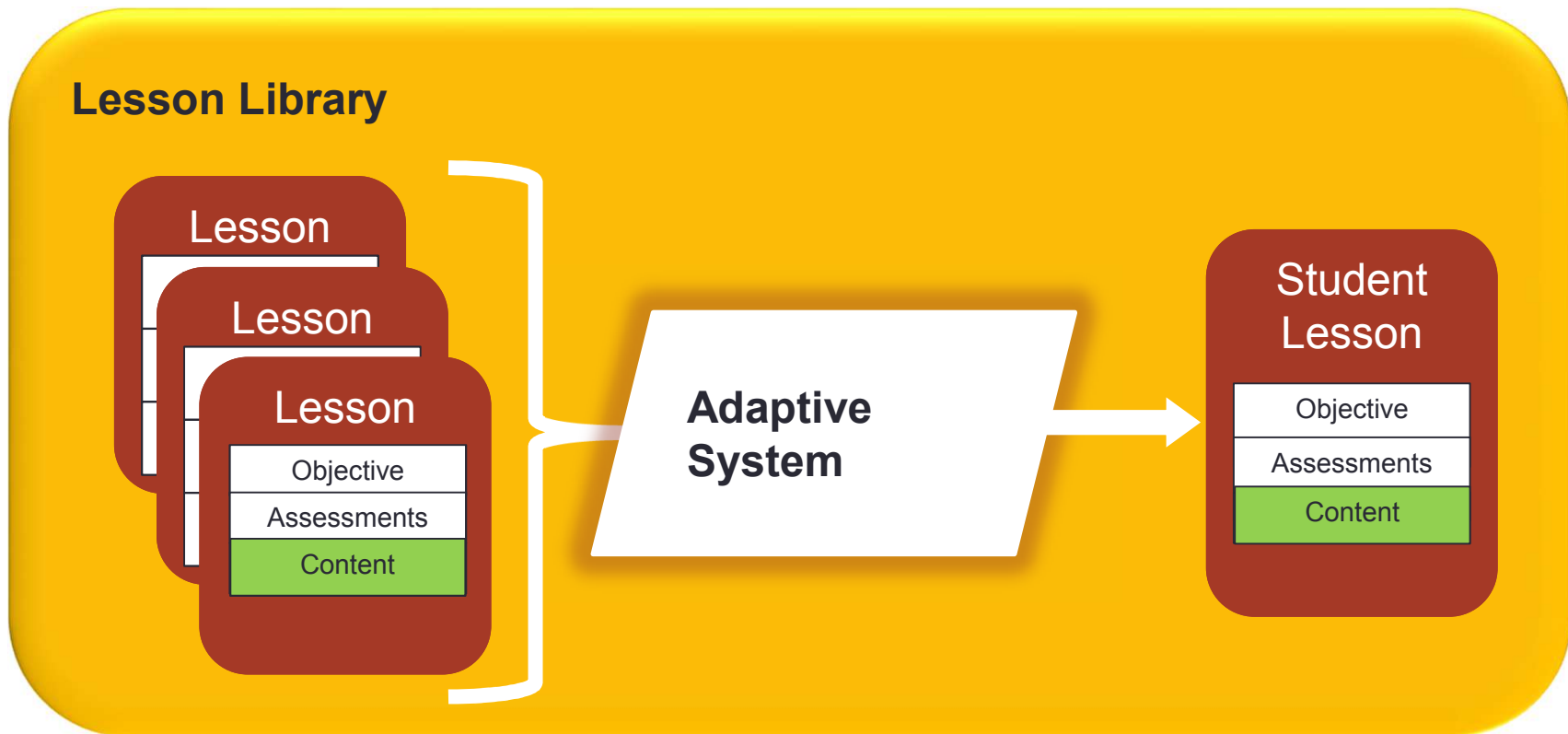
How will it work in practice?

Adaptive knowledge networks are being built to be **configured by teachers** and personalized for students.



What will students experience?

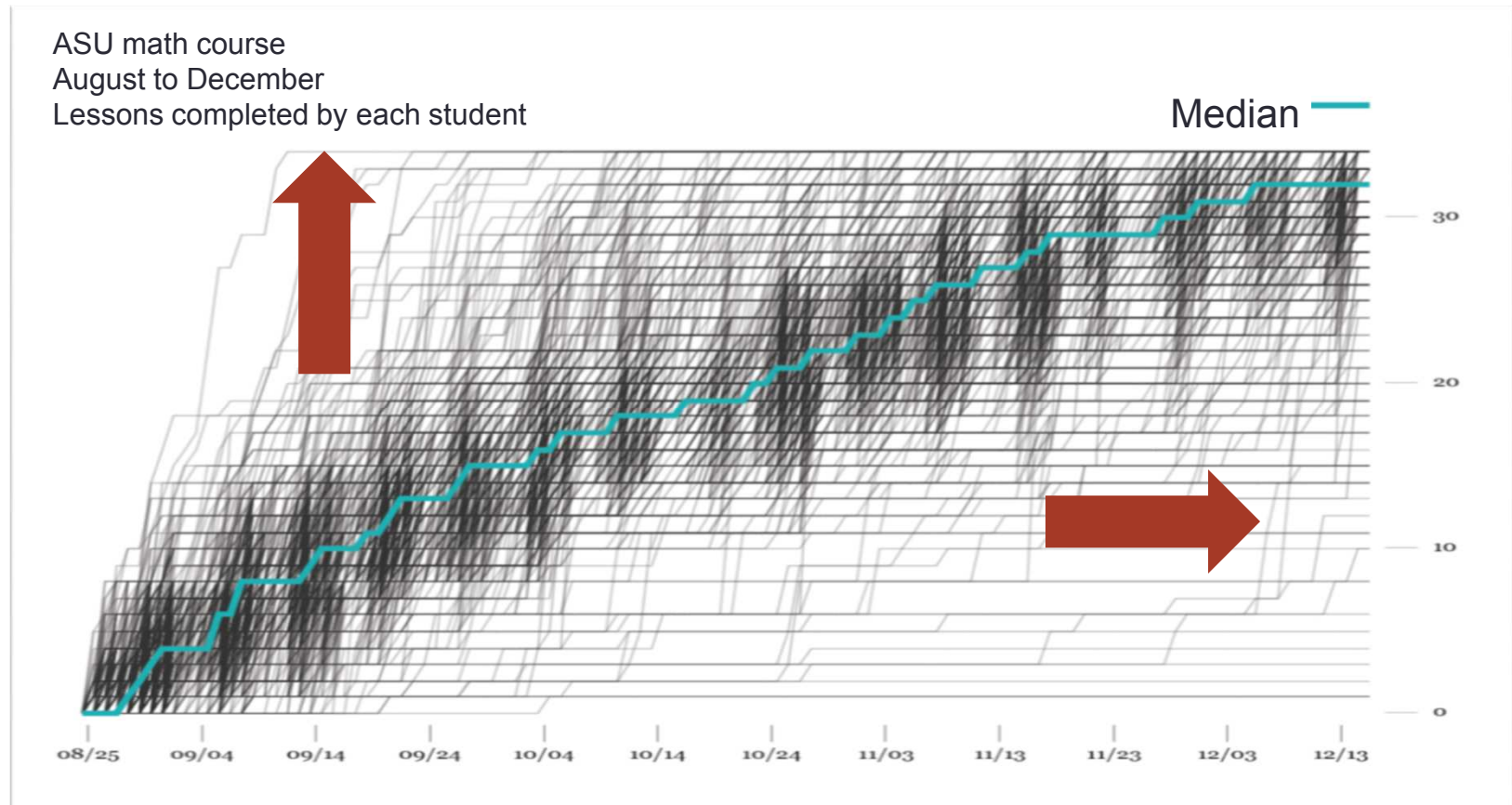
Adaptive knowledge networks are being built to be configured by teachers and **personalized for students.**



What does adaptive courseware do?



Why are adaptive learning systems needed?



- **Students get a personalized lesson plan**
- **Professors get data to help focus on individuals**

What is the value of adaptive systems?

Mass Personalization

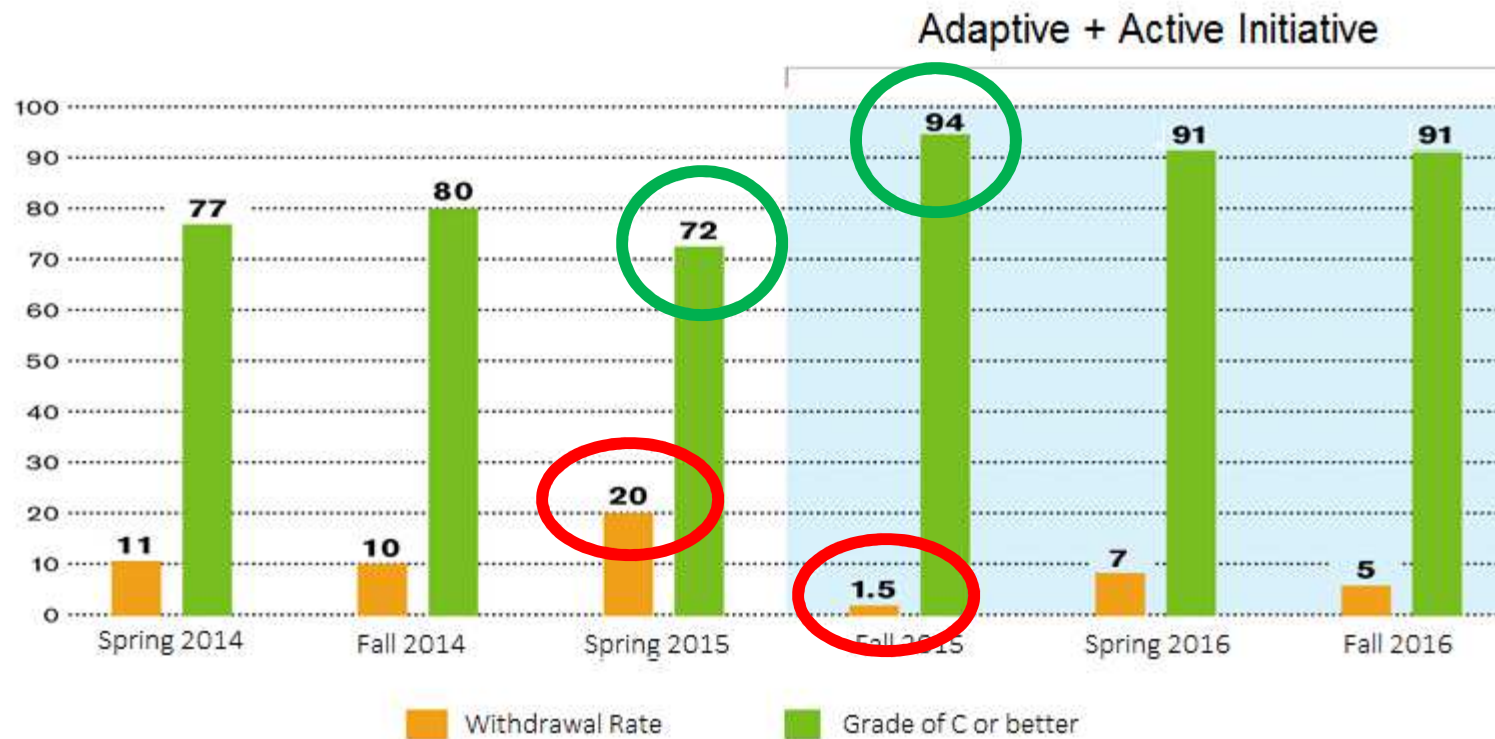


How has it worked at ASU?

Introduction to Biology ~ 850 students

Fall 2015 implemented CogBooks

Same instructor, curriculum and assessments

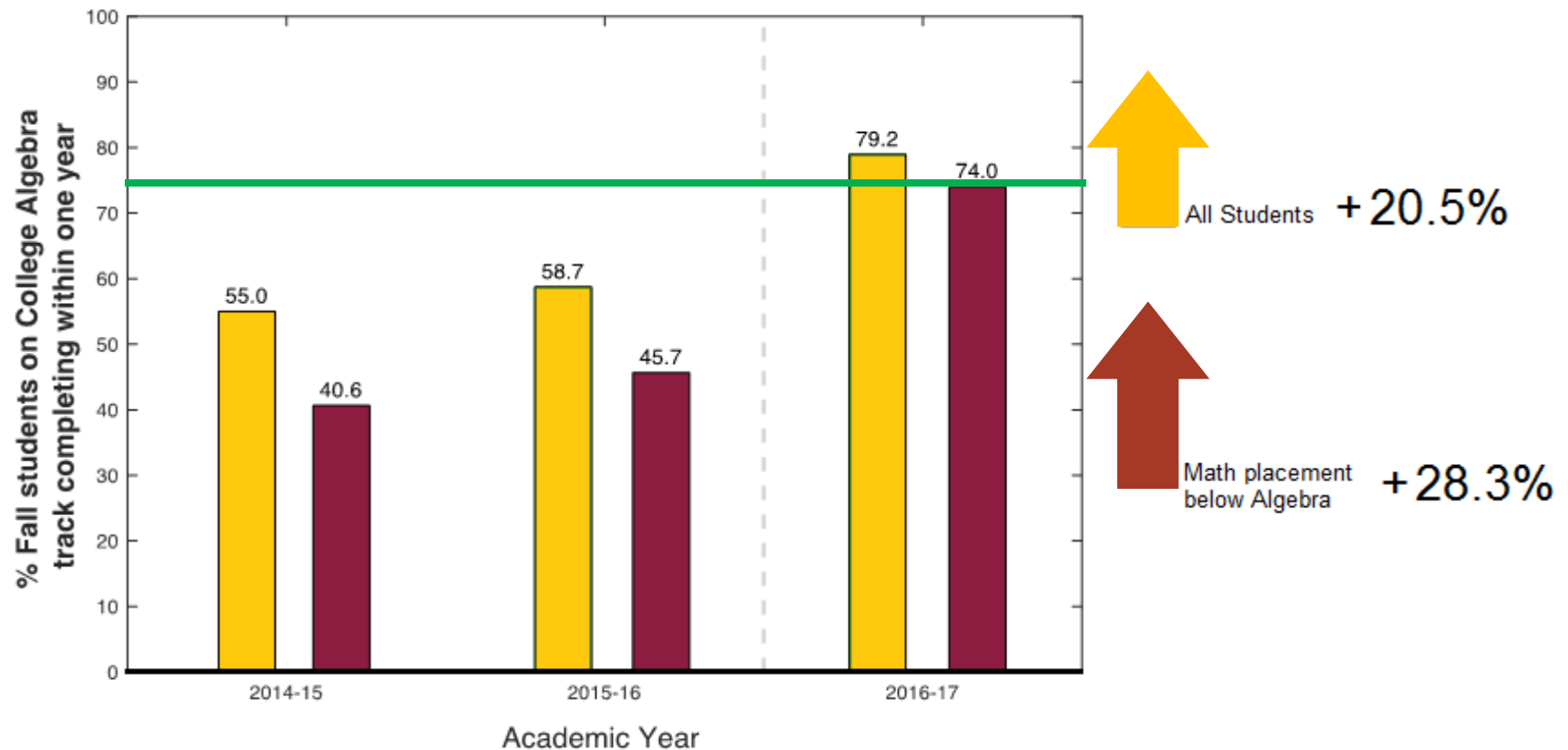


How has it worked at ASU?

College Algebra ~ 5,000 students

Fall 2016 implemented McGraw Hill ALEKS

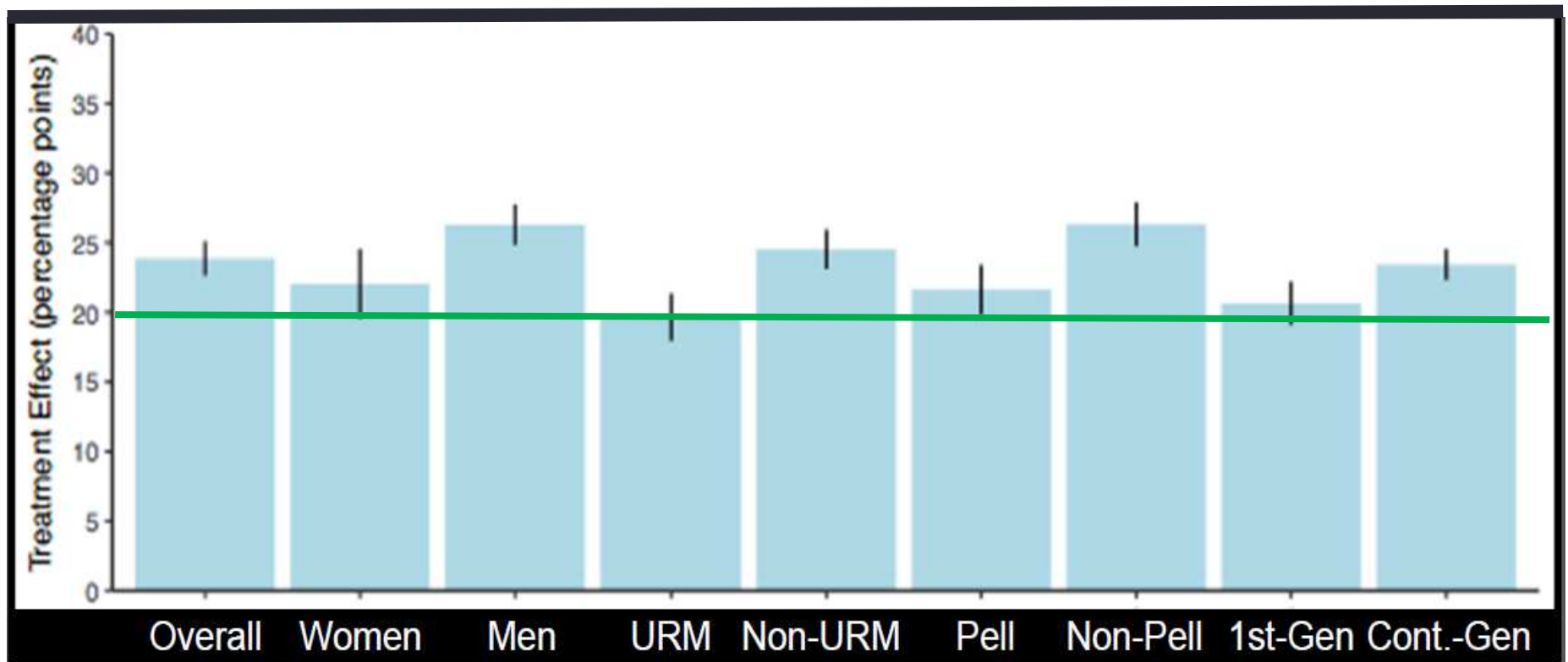
Same instructors, curriculum and assessments



What about different demographic groups?

College Algebra

AY 2016-17 increases in success rates among all groups

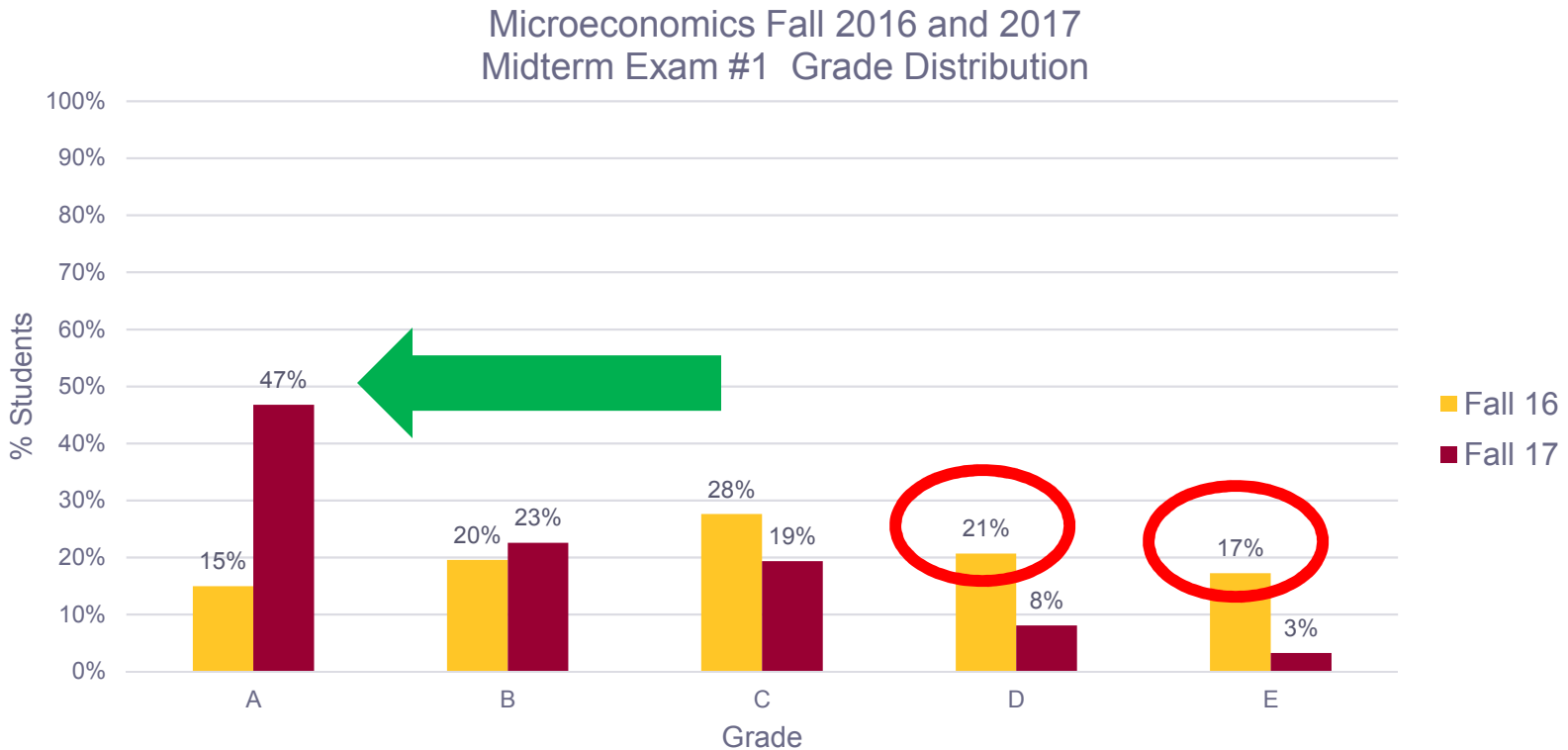


How has it worked at ASU?

Microeconomics ~ 2,000 students per year

Fall 2017 Cengage Learning Objects

Same instructor, curriculum and assessment



How are the adaptive systems different?

	LMS/MOOC		ADAPTIVE
- Lesson Plan	Fixed	→	Variable
- Presentation	Group	→	Individual
- Content	Common	→	Personalized

How do the systems help students?

3 RS

Respect their
Respond to the
Reduce gaps

Personalize

All lessons
ASU MATH 110 MATH READINESS (LITE - TRACK 1) | #MATH 110-2023
AVERAGE SCORE: 60%

Sort by: All | Score | Topic

The number system • Equations & expressions • Ratios & proportions • Functions • Algebra

The number system

These lessons teach the basic building blocks that make up the language of math, including fractions, decimals, percentages, exponents and more.

LONG DIVISION	DECIMALS	FACTORS AND MULTIPLES	NEGATIVES IN THE XY-PLANE	NEGATIVE QUANTITIES
2 ATTEMPTS 30%	IN PROGRESS	PASSED 80%	LOCKED	LOCKED

MOVING IN THE XY-PLANE	ALL ABOUT ADDITION	PROPERTIES OF MATH	FRACTIONS AND DECIMALS	RATIONAL EXPONENT RULES
LOCKED	LOCKED	LOCKED	LOCKED	LOCKED

Equations & expressions

These lessons teach you how to combine numbers and operations to express ideas and model real-world situations.

VARIABLES AND OPERATIONS	MATHEMATICAL EXPRESSIONS	EQUIVALENT EXPRESSIONS	TESTING VALUES	EQUATIONS
RECOMMENDED				

INCOMPLETE ... 2/52
TODAY (50 TO DO)

How do the systems help teachers?

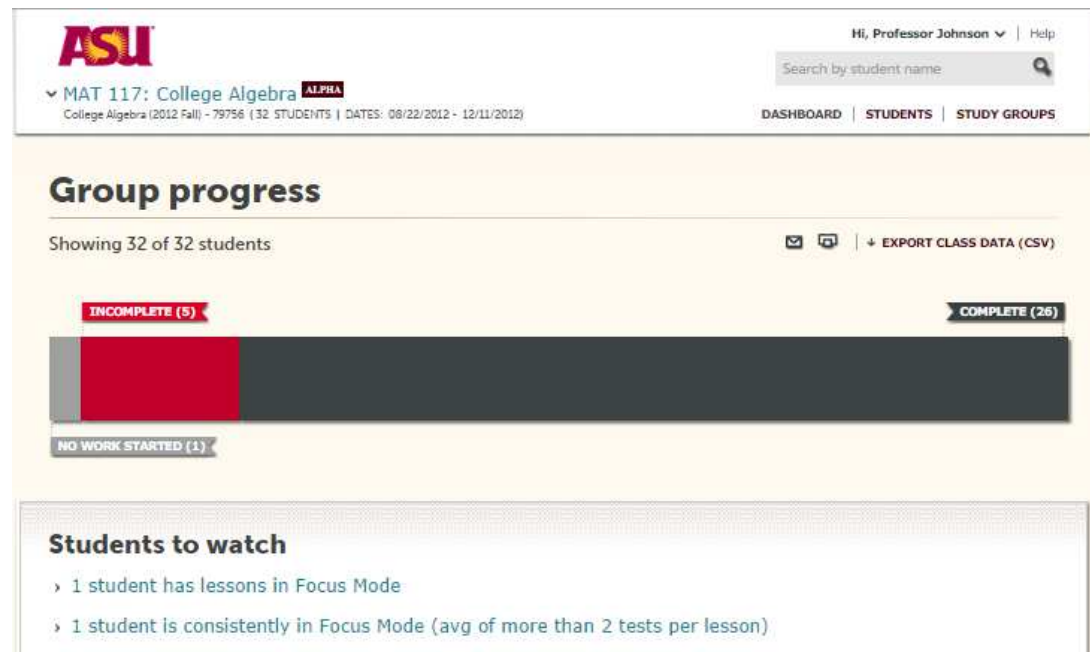
3 Ms

Monitor which students need assistance

Measure curriculum performance

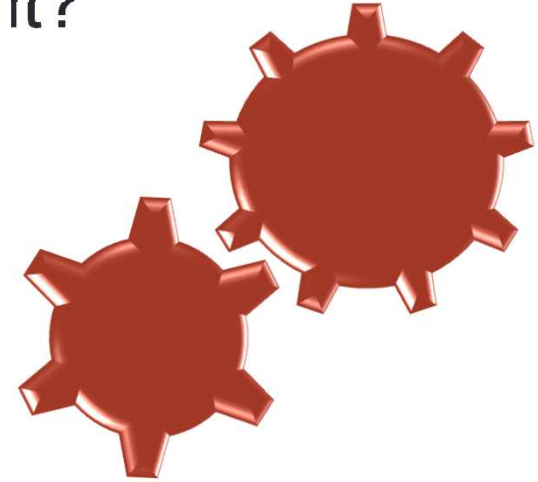
Maximize course outcomes

Tracking



What is adapting to the student?

- **Lesson sequence**
- **Content selection**

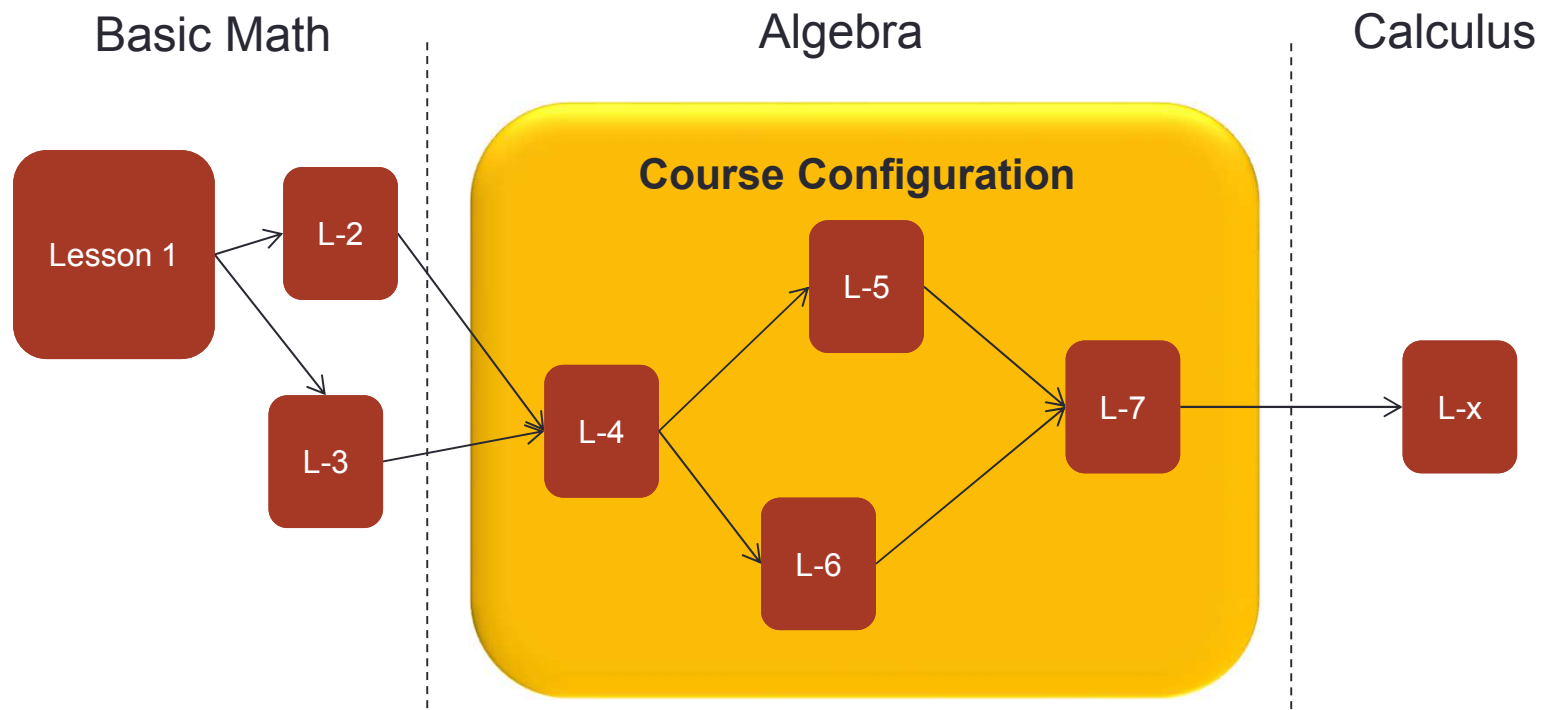


What is guiding the adaptation?

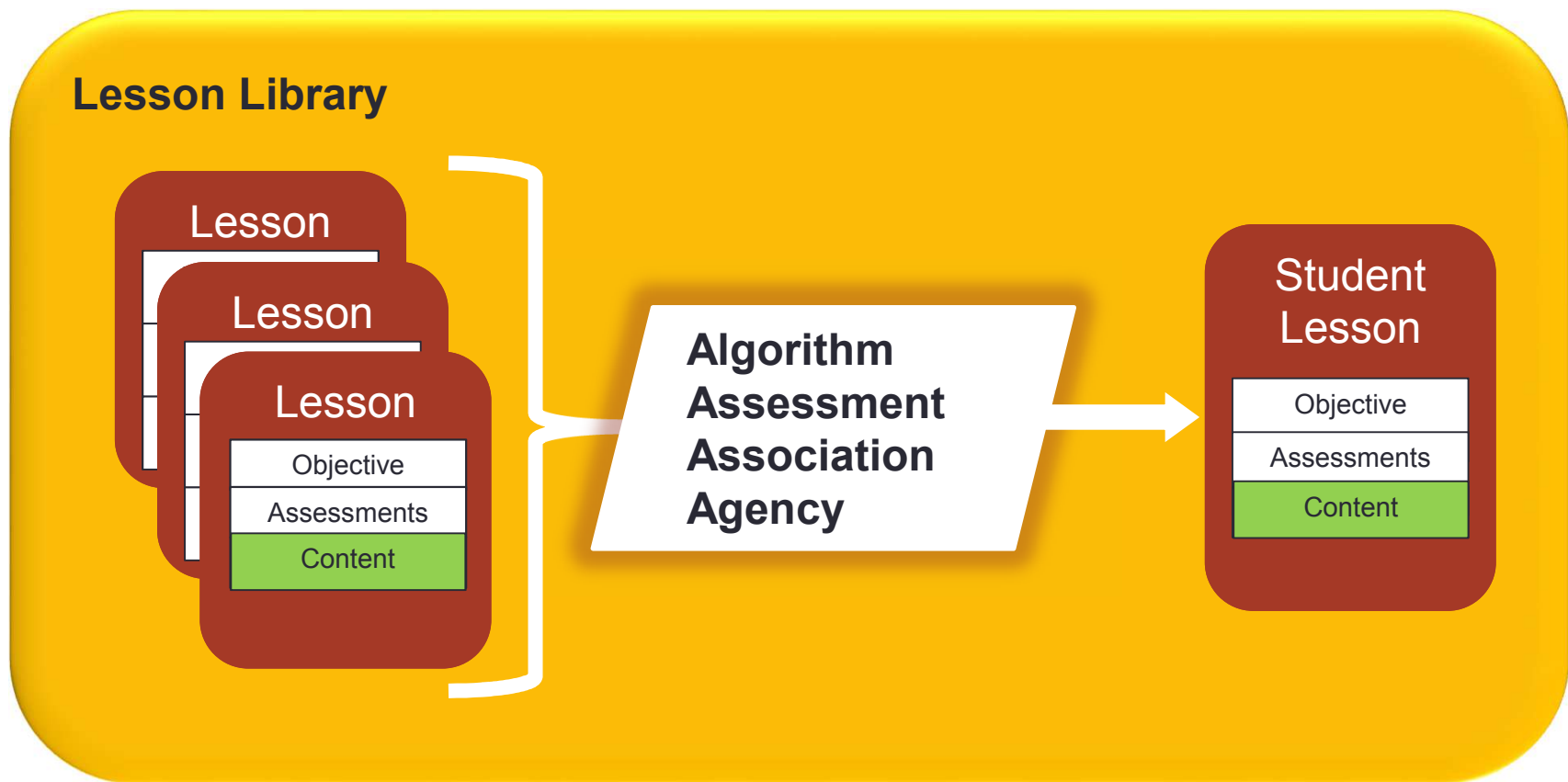
- **Algorithm** (analytics) – recommendations
- **Assessment** – rapid remediation
- **Association** – knowledge network
- **Agency** – student chooses

How does Lesson Sequencing work?

➤ Knowledge Network



How does Content Selection work?



What is an example of a vendor?

Vendors use a mix of the different techniques:

The screenshot shows a quiz interface for 'ASU BIO 100 V2' titled 'The Nature of Energy'. It includes a progress bar at 17%, a recommendation section for 'Cells - The Smallest Unit of a Living Organism', and a 'Concept Quiz: Energy and Thermodynamics'.

Agency points to the progress bar showing 17% completion.

Algorithm points to the recommendation section titled 'We recommend the following content:'.

Association points to the section titled 'These may also help:'.

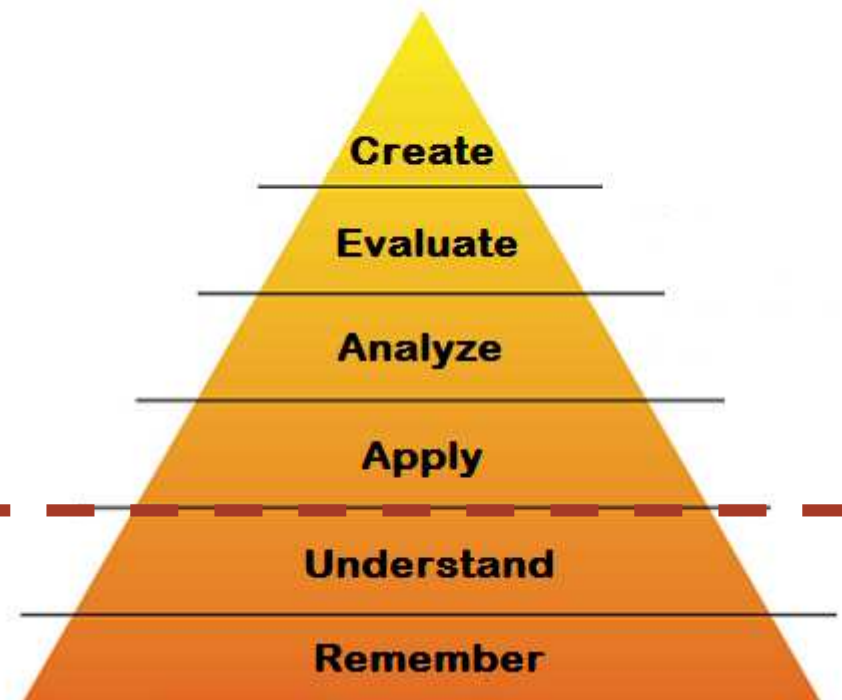
Assessment points to the 'Concept Quiz: Energy and Thermodynamics' section.

How is ASU using the adaptive systems?

- **Best results with “Adaptive and Active” approach**

**Active Learning
in class**

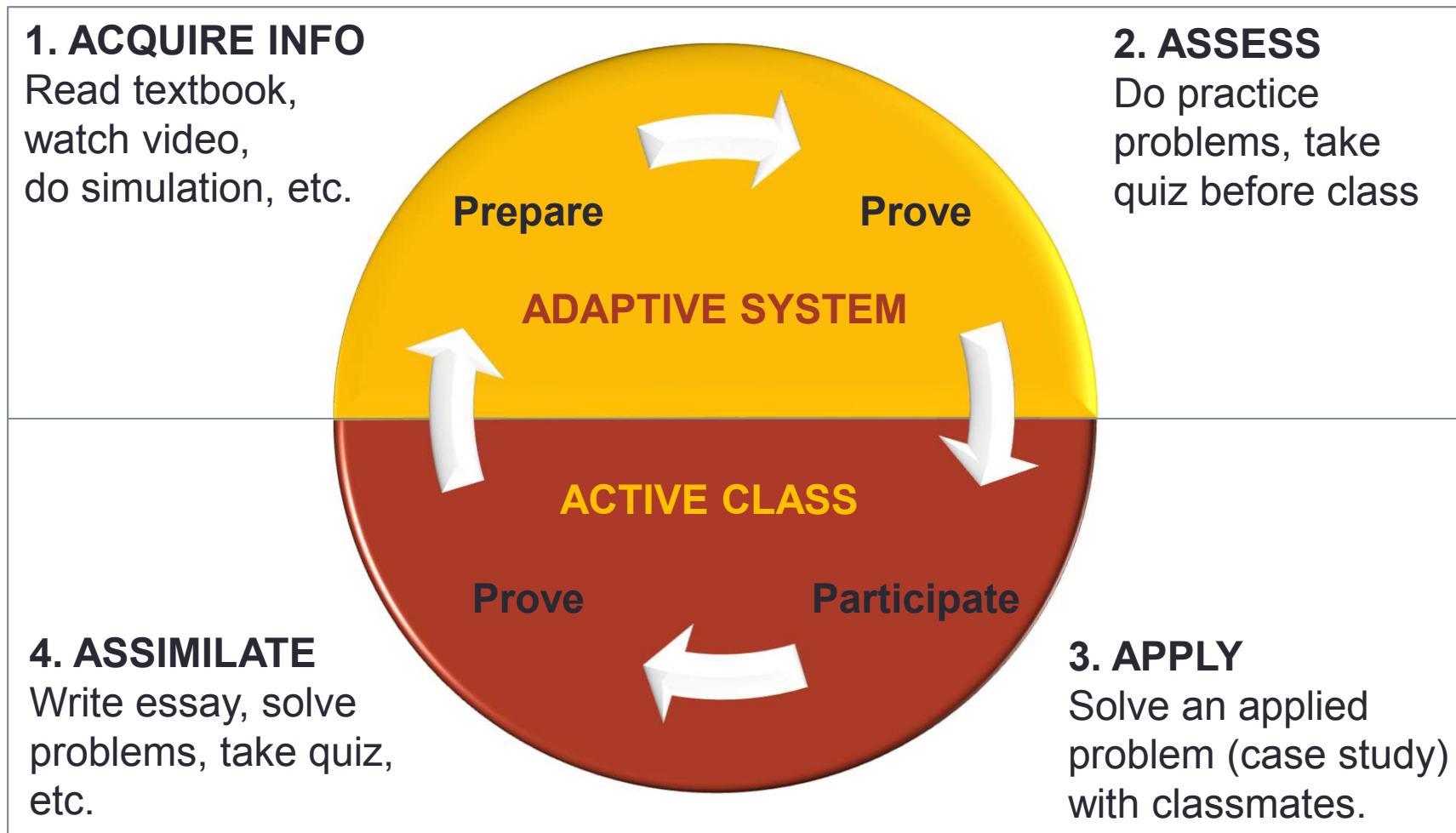
**Adaptive Learning
before class**



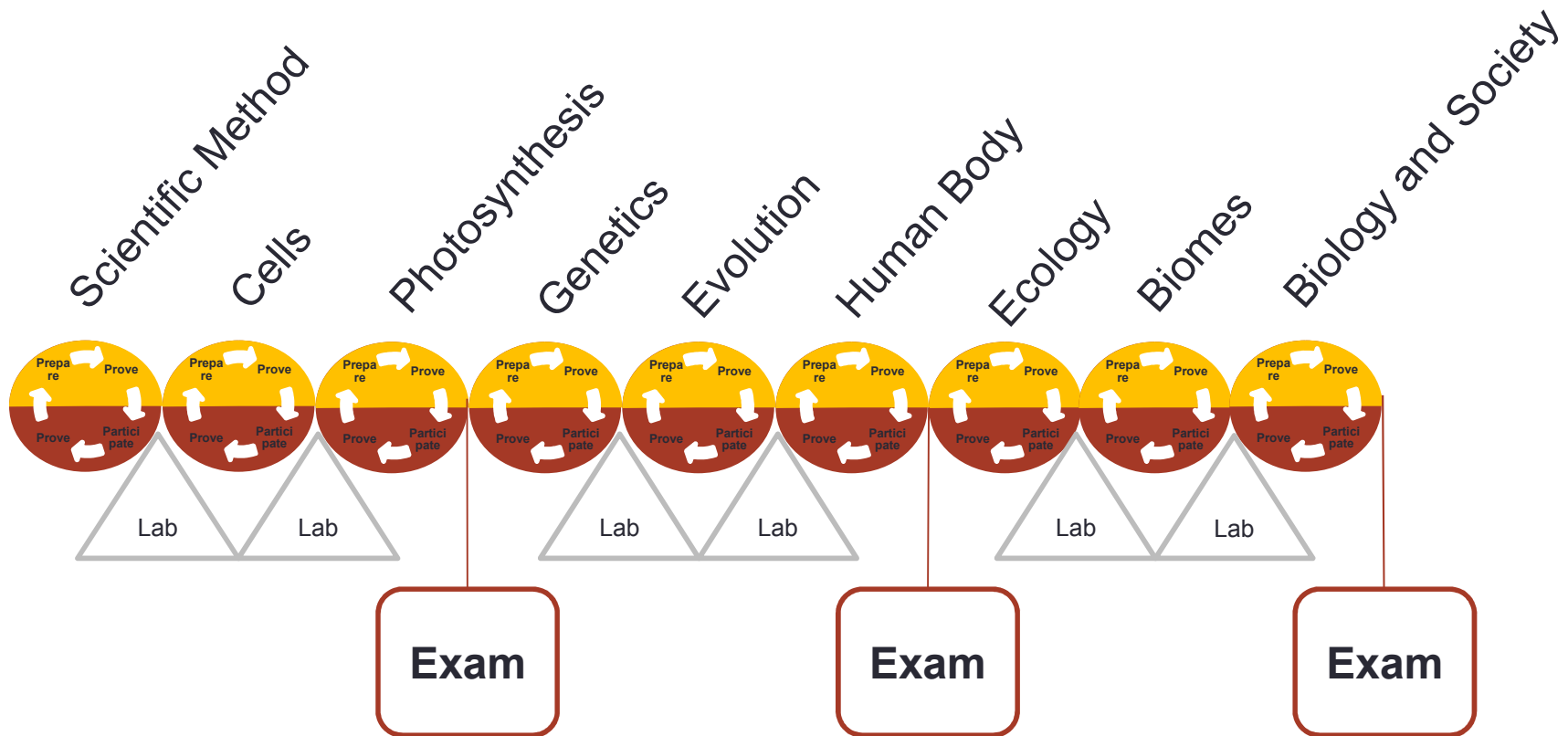
Bloom's Taxonomy

Optimize high-tech (adaptive) and high-touch (active) learning

How does this process work in practice?



What does a sample course look like?



Adaptive and Active learning are symbiotic in the educational ecosystem.

How are the classrooms organized?



Students work in small teams to solve problems.

What is the new role of the teacher?



Teachers guide students through the group activities.



How does ASU evaluate our efforts?

MISSION: Achieve 90% freshman retention

OBJECTIVES:



Do Applied Concept Exercise every class



Help 90% of students get C or better



Lower withdrawal rate to less than 5%



Identify struggling students by week 2

What factors do we evaluate?

➤ **Macro indicators**

Persistence (lower withdraw rate)

Performance (higher pass rate)

Satisfaction

Student

Instructor

Administrator

Financials

Money saved or spent

➤ **Micro indicators**

Assessment data (lesson or exam level)

What has course development cost ASU?

➤ Implementation

Construct ~ \$50,000

Faculty time ~ 9 months

Staff time ~ 12 months

Systems integration ~ 1 month

Content development and licensing

Configure ~ \$5,000

Faculty time ~ 1 month

Staff time ~ 3 months

➤ Operation

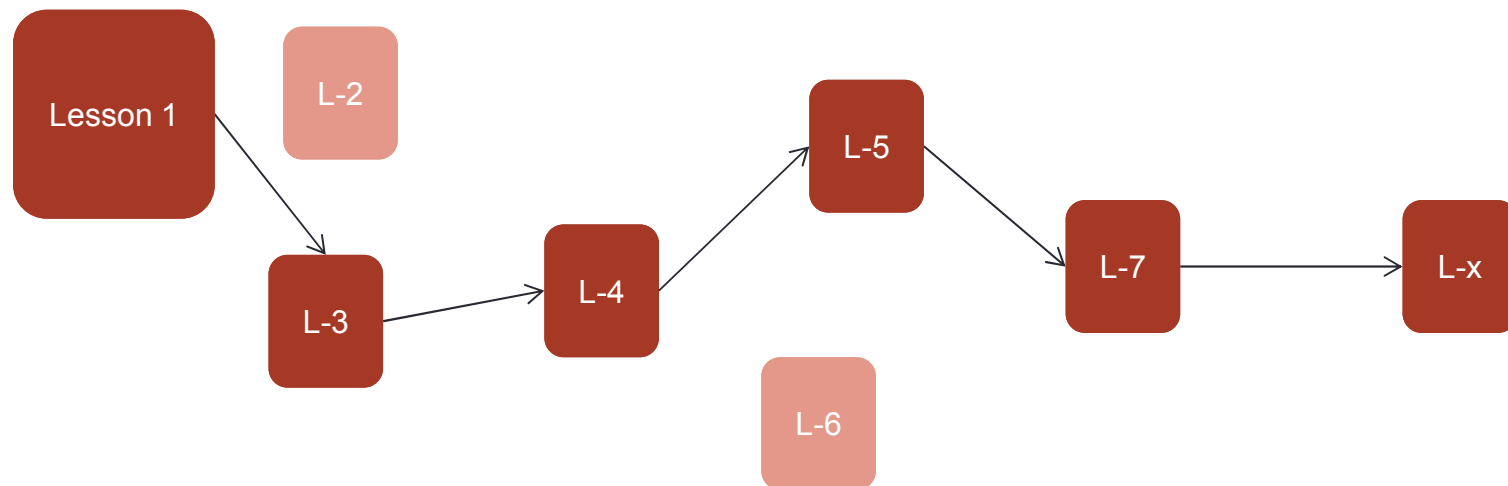
Student license \$35 - \$100

Faculty training – every semester

Additional Slides for Reference

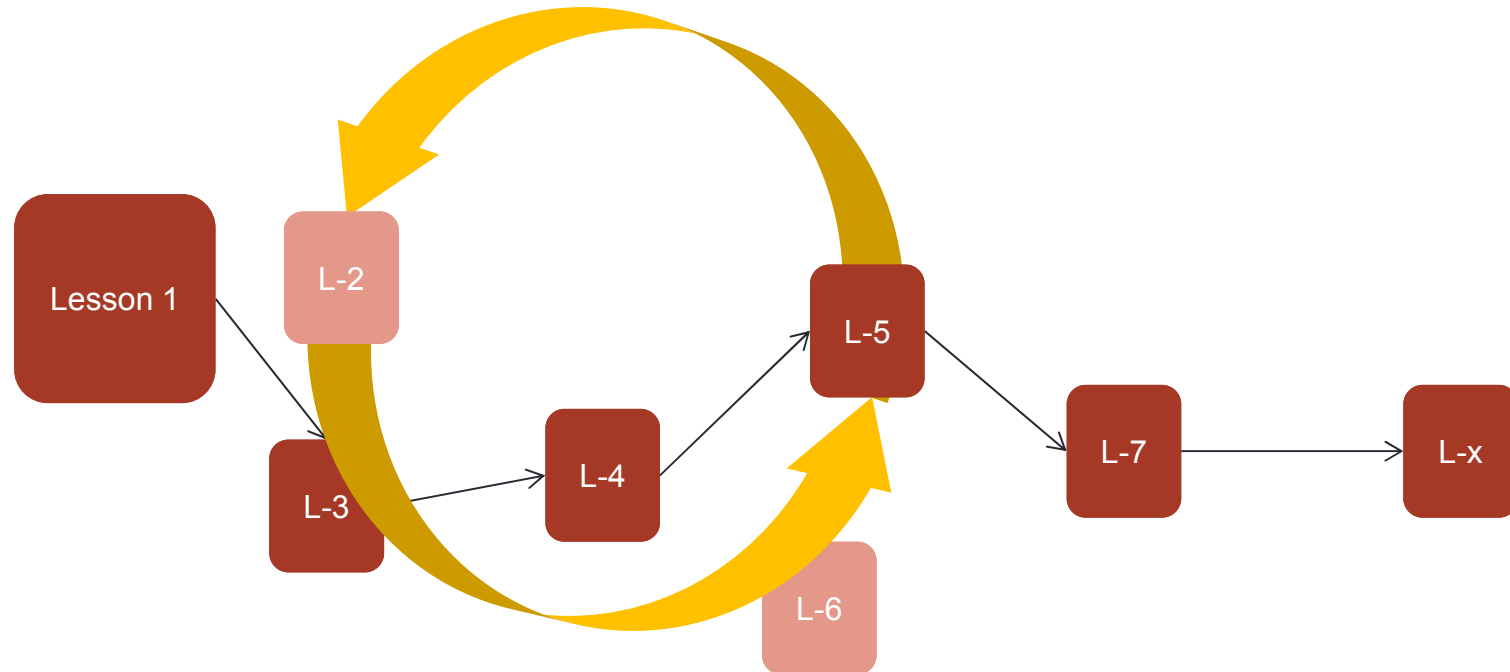
How are these techniques implemented?

Personalized Lesson Sequence (Algorithm, Association, Agency)



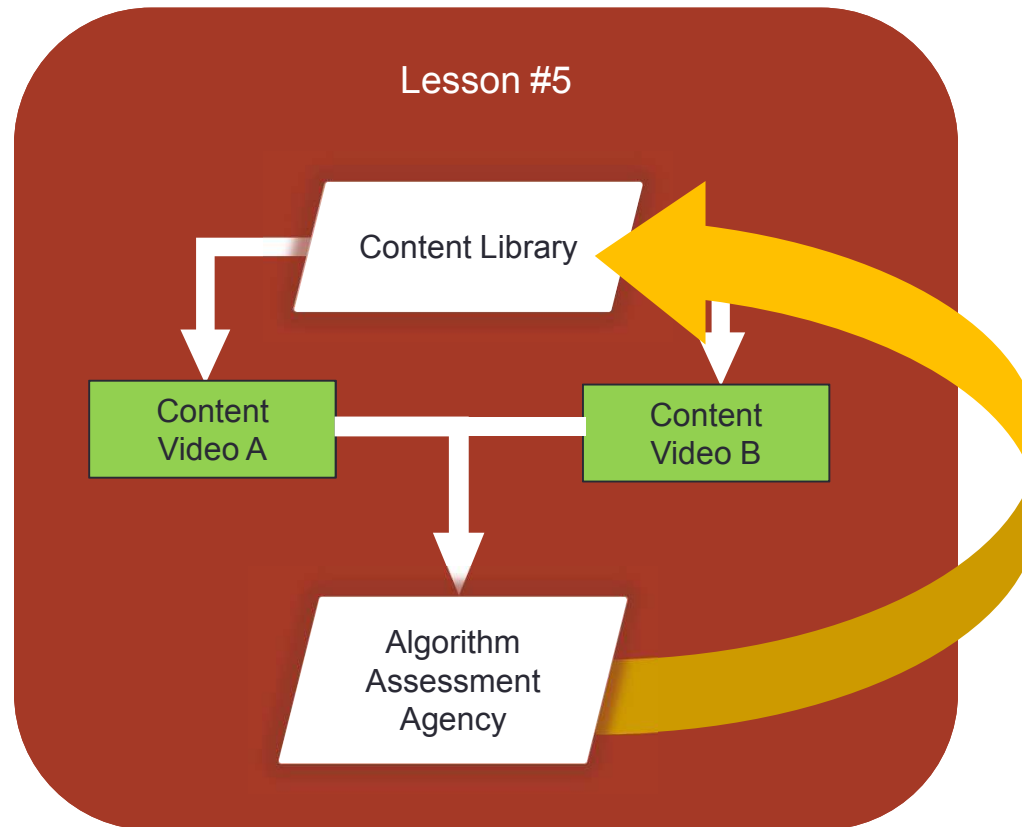
How are these techniques implemented?

Rapid Remediation (Assessment)



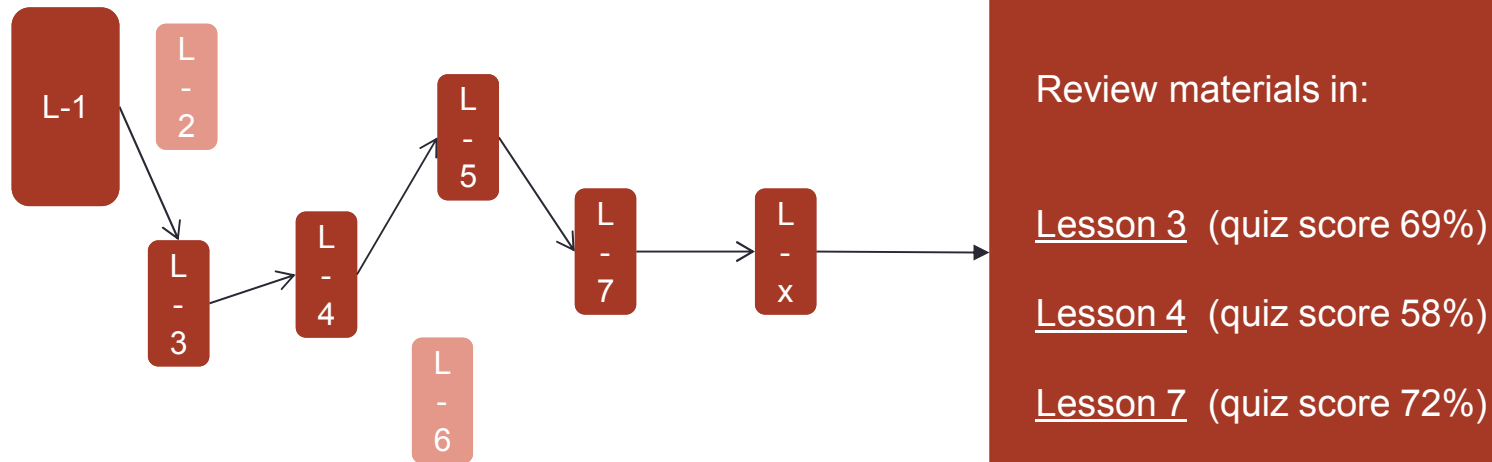
How are these techniques implemented?

Content Selection (Algorithm, Assessment, Agency)



How are these techniques implemented?

Personalized Review (Algorithm, Assessment)



What are the major challenges and decisions?

- **Pedagogy**
- **System**
- **Course Development**
- **Faculty**
- **Facilities**

How can the system support your Pedagogy?

- **Lecture** - practice and assessment
- **Flipped** - instruction and assessment
- **Online** - instruction, practice and assessment

What other Pedagogical decisions matter?

➤ Student learning

Self-paced

Complex tracking

Flexible exam dates

Independent

Competency

or

Synced

Lesson alignment

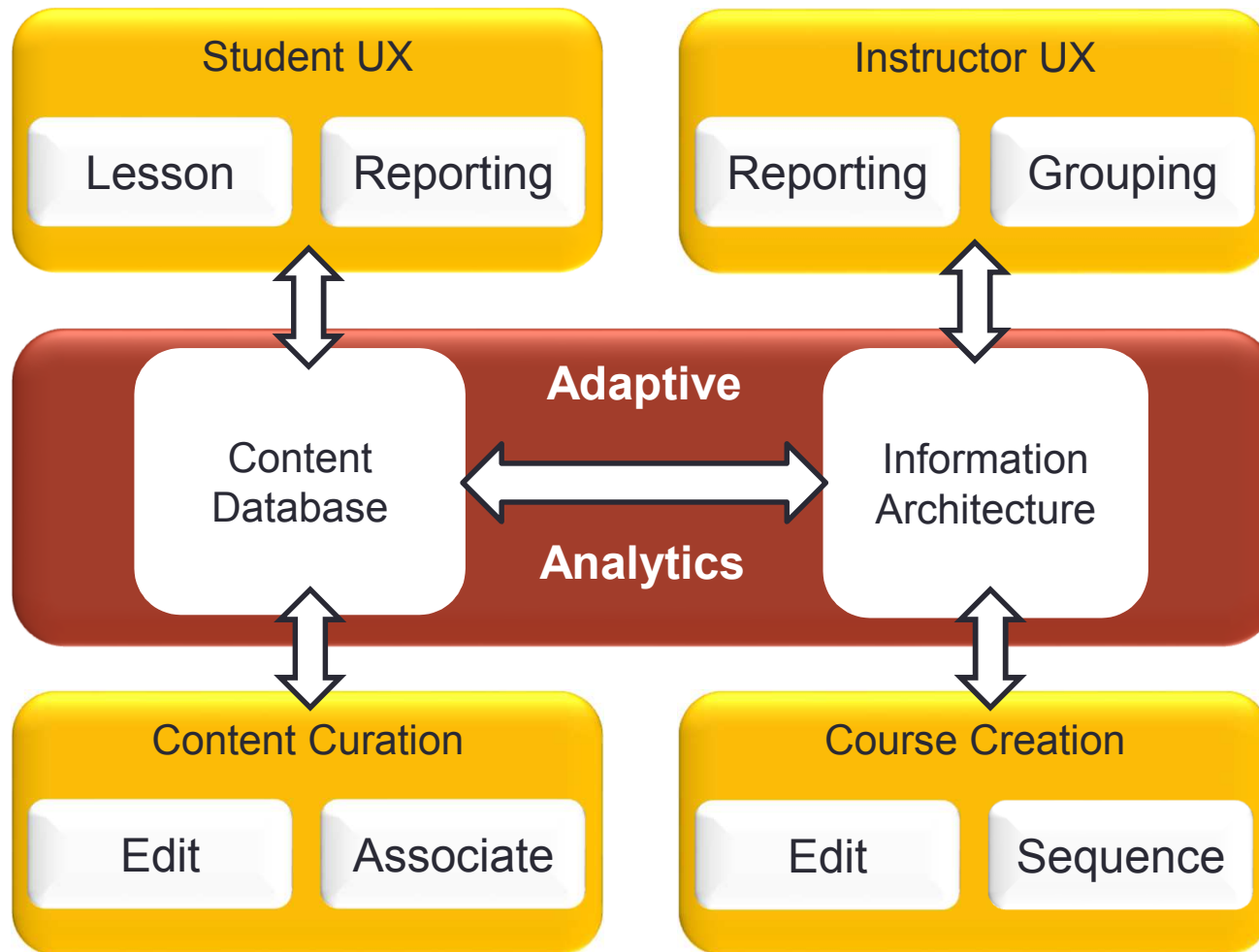
Fixed exam dates

Interactive

Completion

Faculty need to make these decisions first.

What are the major System components?



What are some key System development issues?

➤ Course Creation

Construct

Time consuming

Flexible

Costly

Riskier

or

Configure

Quick

Constrained

Cheaper

Safer

Consider the amount of effort before committing to a strategy.

How are different Systems implemented?

➤ Course Creation – Configure

MyMathLab[®] with KNEWTON Adaptive Learning

The following content areas are automatically included in your course. Uncheck any box to omit the selected content from the online test bank.

Click chapter and section link to expand and collapse [▶ Expand All](#)

<input type="checkbox"/> + 0. Orientation Questions for Students
<input type="checkbox"/> + R. Review
<input type="checkbox"/> + 1. Equations and Inequalities
<input type="checkbox"/> + 2. Graphs
<input checked="" type="checkbox"/> - 3. Functions and Their Graphs (partially included)
<input checked="" type="checkbox"/> - Section 3.1: Functions (partially included)
<input type="checkbox"/> ▶ Are You Prepared?
<input type="checkbox"/> ▶ Concepts and Vocabulary
<input checked="" type="checkbox"/> ▶ Determine whether a relation represents a function.
<input checked="" type="checkbox"/> ▶ Find the value of a function.
<input checked="" type="checkbox"/> ▶ Find the domain of a function defined by an equation.
<input checked="" type="checkbox"/> ▶ Form the sum, difference, product, and quotient of two functions.
<input type="checkbox"/> ▶ Find the difference quotient.
<input type="checkbox"/> ▶ Solve applications and extensions.
<input checked="" type="checkbox"/> + Section 3.2: The Graph of a Function (partially included)
<input checked="" type="checkbox"/> + Section 3.3: Properties of Functions (partially included)
<input checked="" type="checkbox"/> + Section 3.4: Library of Functions; Piecewise-defined Functions (partially included)
<input checked="" type="checkbox"/> + Section 3.5: Graphing Techniques: Transformations (partially included)
<input type="checkbox"/> + Section 3.6: Mathematical Models: Building Functions
<input type="checkbox"/> + Section 3.7: Chapter Project

Adaptive systems are moving toward modularity.

How can you manage content in the System?

- **Content Curation**
- **Vendor Resources**
 - **Prebuilt courses**
 - **Library of materials**
- **Other Resources**
 - **Teacher produced content**
 - **Open Educational Resources (OER)**



Will the vendor allow locally produced content in their system?



How does the System handle different subjects?

- **Course Creation – Subject Matter**

- **Math Model**

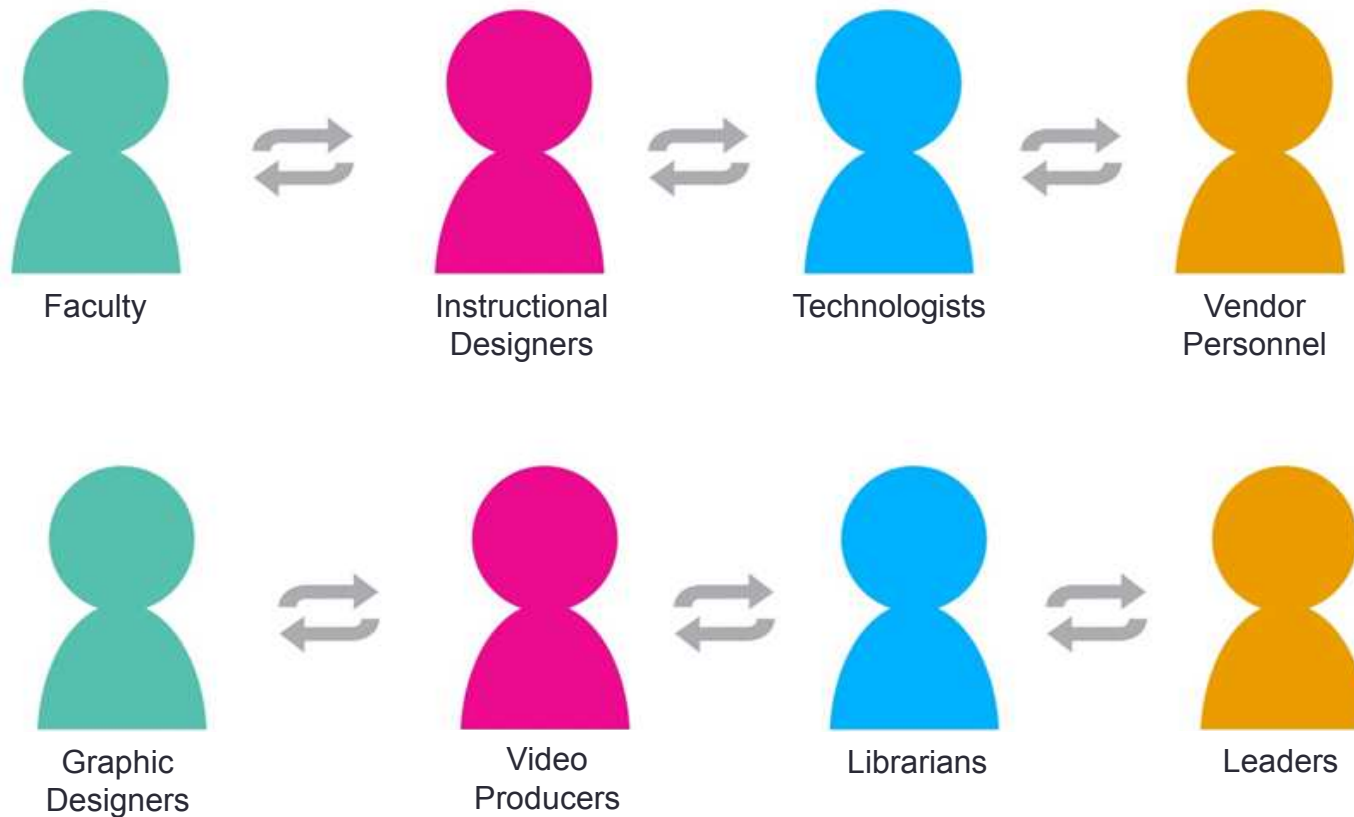
- **Assess, learn, assess**
 - **Predicated on 12 years of prior math education**

- **Other Disciplines**

- **More traditional presentation**
 - **Learn, assess, remediate, assess**

Adaptive logic is not the same for all subjects.

How can you manage Course Development?



Adaptive tech is a team sport, so plan accordingly.

What can help Faculty succeed with AL?

- ✓ **Strong academic leader support (and \$)**
- ✓ **Faculty leadership for each course**
- ✓ **Instructor peer mentoring for training**
- ✓ **“Guide on the Side” is not for everyone**
- ✓ **Be patient, it’s a learning process**

Success of the technology depends on the teacher!

What types of classroom Facilities will you need?

- ✓ **Flat floors**
- ✓ **Round tables**
- ✓ **White boards**
- ✓ **High speed Wifi**
- ✓ **A/V system with microphones**



How will you get the classroom Facilities ready?

- ✓ **How many active learning classrooms?**
- ✓ **How big do they need to be?**
- ✓ **How long will they take to build?**
- ✓ **How much will they cost?**
- ✓ **Who is going to pay for them?**
- ✓ **How will you support them?**

Think the project all the way through.

For More Information

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