

Scalable, web-delivered supports to help students "Learn to Learn"

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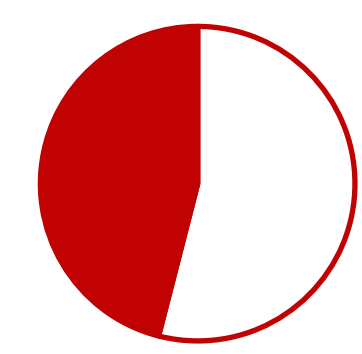
PROJECT OVERVIEW: Learning Theory and Analytics as Guides to Improve Undergraduate STEM Education (Learning TAGs)

RESULTS & FUTURE DIRECTIONS

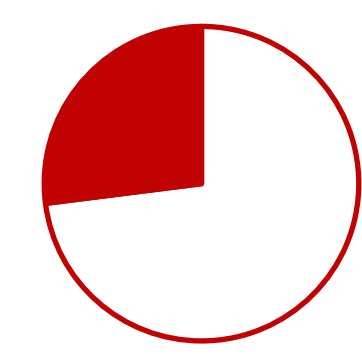
The Need

- Many graduate K-12 without skills necessary to manage learning (ACT, 2008)
- Incoming STEM majors typically fail to complete a STEM degree; more pronounced trend in underrepresented populations (Eagen, Hurtado & Chen, 2006)

6-year completion rate:



All STEM majors



From underrepresented groups

- Primary reasons for leaving STEM include

- perceived **lack of skills** to perform critical STEM tasks
- lack of motivation** to continue with training (Perez, Cromley & Kaplan, 2013)

The Project

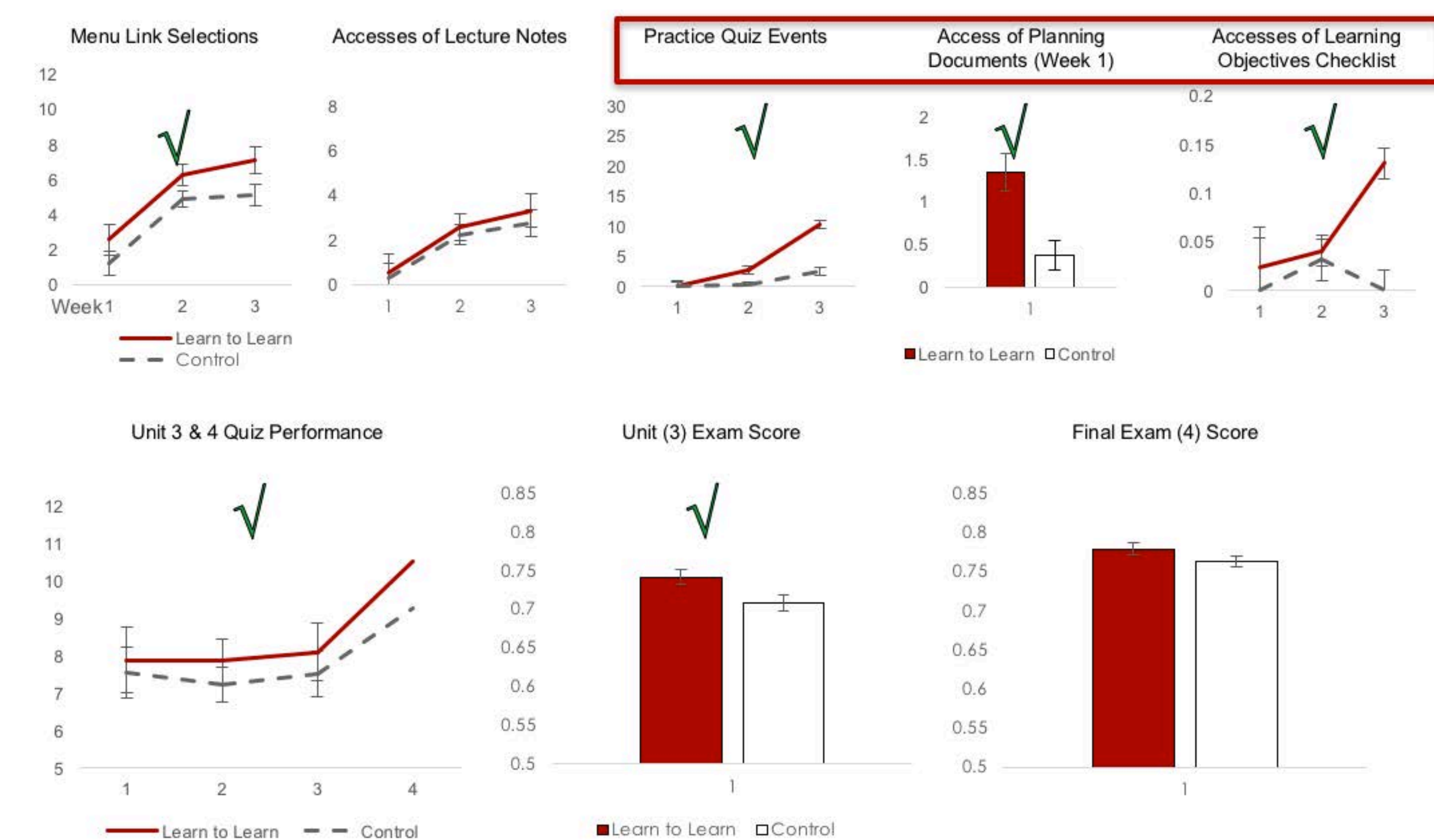
- Learning management systems (LMSs) are ubiquitous in higher education, provide a platform for scalable, web-delivered support
- Learning sciences provide insight about ways learning skills can be built and motivation can be supported
- LMSs + Learning Theory + Analytics provide an opportunity to

- Provide resources to students
- Teach students how to use resources effectively
- Observe & adaptively respond to student learning data

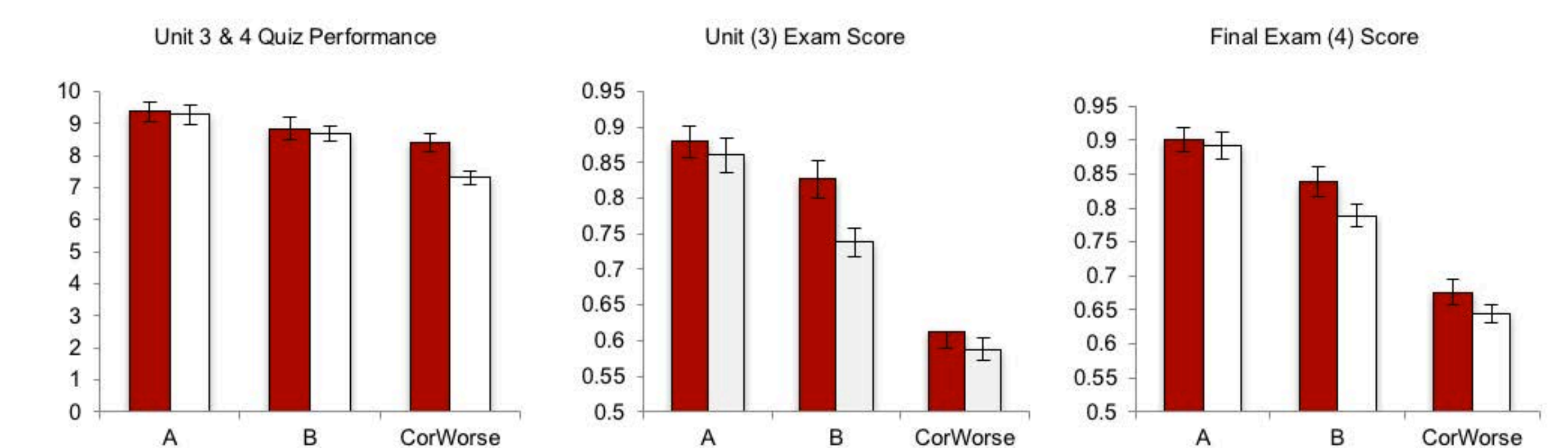
The Science of Learning to Learn (below)

- Capture learning behaviors using log files
- Develop prediction models that accurately identify students likely to struggle, obtain poor grades
- Provide adaptive, personalized feedback to students via the LMS, directing resources to those likely to struggle

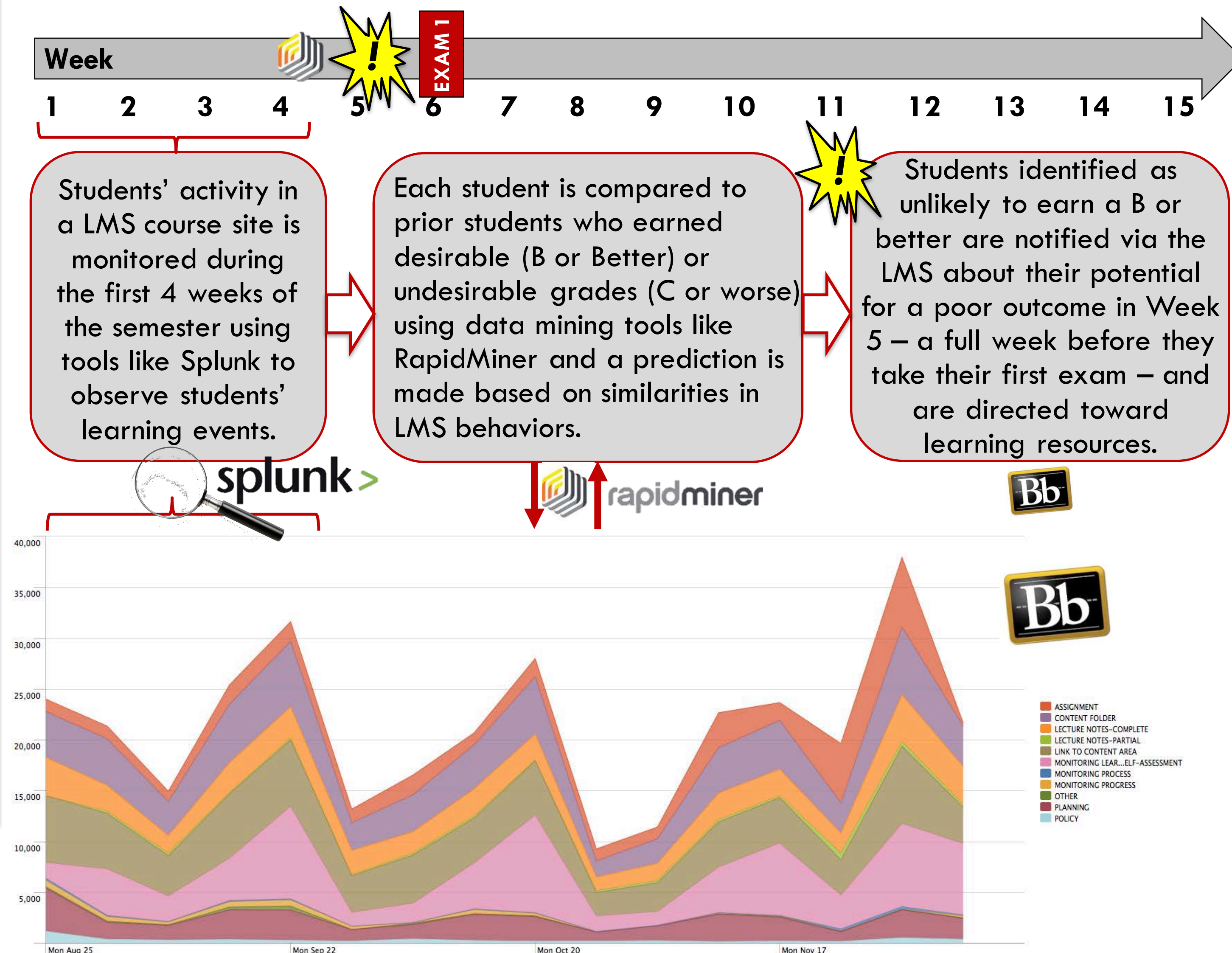
- Learning to Learn training had a demonstrable impact on biology students' (N = 205) learning behavior & achievement in a lecture course



- Struggling students — **students with poor prior exam scores** — experienced the greatest benefits from Learning to Learn.



- Learning to Learn training benefits struggling students, burdens others
- NEW CHALLENGE: 1) identify students who need help
2) deliver timely help to them *and only them*
- A pilot project (underway) targets training to students in need.



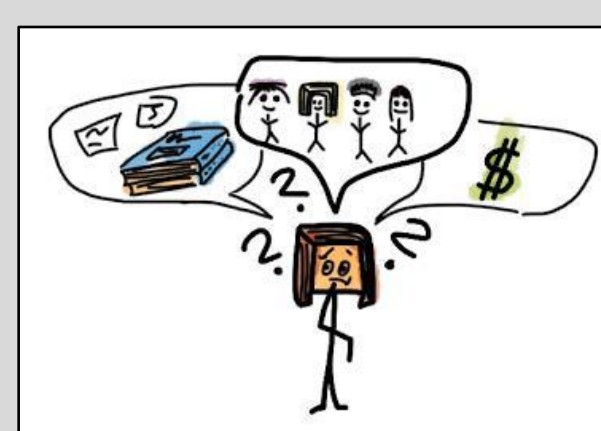
THE SCIENCE OF LEARNING TO LEARN

- Web-delivered set of training modules delivered via LMS
- Embedded in students' course site, teach students (in 30-45 min per module):
 - cognitive strategies known to improve learning outcomes
 - methods of managing their learning process
 - methods of managing self, behaviors, & one's environment
- Instructional methods aligned to research on learning (Table 1)
- Ongoing trace data on student learning behaviors collected from University servers using Splunk application, performance data from LMS gradebook

Table 1 Instructional Design of Science of Learning to Learn Modules	
Brief explanation of the learning principle + assessment of learning with feedback	
Description of studies showing practical effect on performance in a college course	
Worked example illustrating how to use the learning principle in a STEM course	
Vignette where learning principle is applicable, opportunity to advise a protagonist	
Prompt to evaluate course resources that afford use of the learning principle	
Prompt to develop a specific plan how to use the learning principle in the course	

Module 1: Introduction & Learning Principles

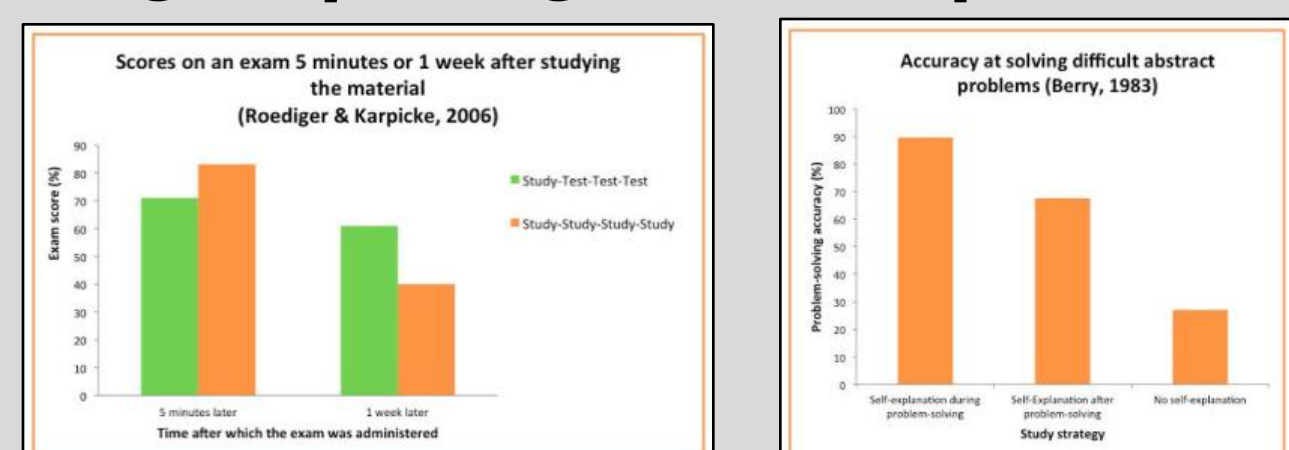
Opening Vignette: Emily the struggling student



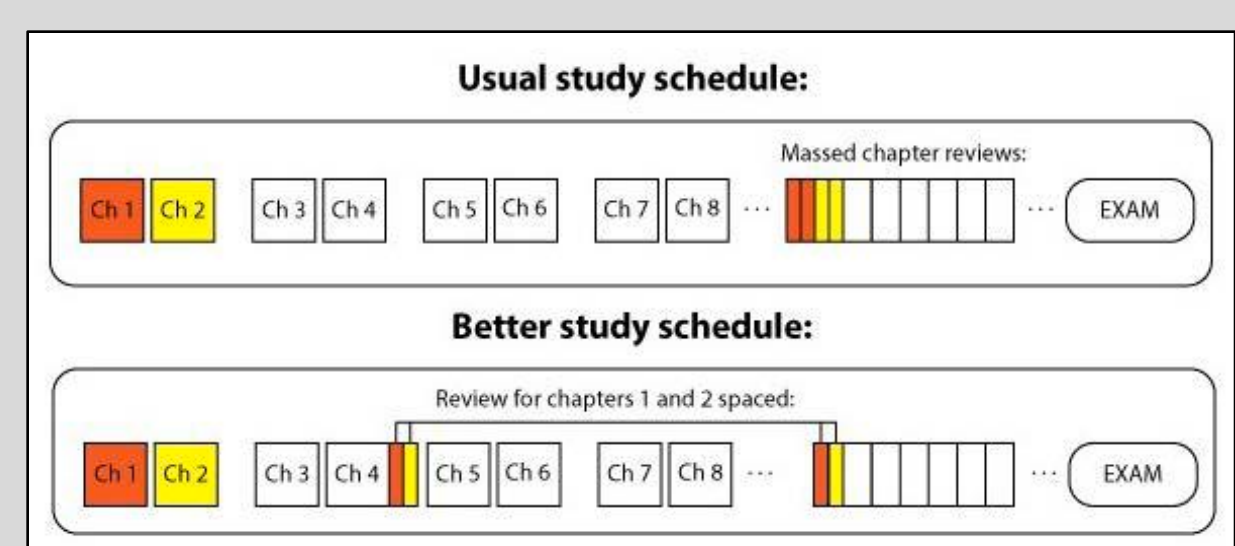
Realities of college life
As you've recently learned, there are two important realities that college students face:
#1 College students need to pursue many important goals at once. College students need to earn good grades in challenging courses, make money to cover expenses, and keep up relationships with family, friends, and significant others.
#2 College courses are much more challenging than high school courses. College courses often cover more material in a semester than high school courses do in a year, and the material is more complex and challenging.

Instruction: Introduction to, evidence for learning principles

Self Testing • Spacing • Self Explanation



Worked examples demonstrating how to use them

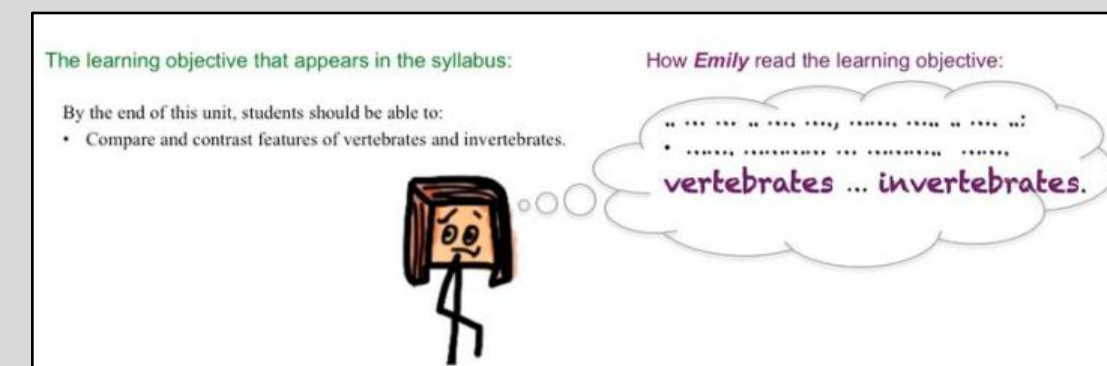


Practice: Identify Resources. Use what you've learned!

2: Planning, Organizing & Monitoring Learning

Training in **self-regulated learning**

Assess their course's learning objectives



Plan study: set goals & subgoals, enact strategies

Level of Understanding	Common verbs in this type of learning objective
1 Knowledge	Define, label, list, match, recall, recognize, name, identify
2 Comprehension	Explain, summarize, paraphrase, describe, compare, classify
3 Application	Apply, identify, solve, utilize, carry out, use, compute



Monitor learning process & progress ... and adapt.

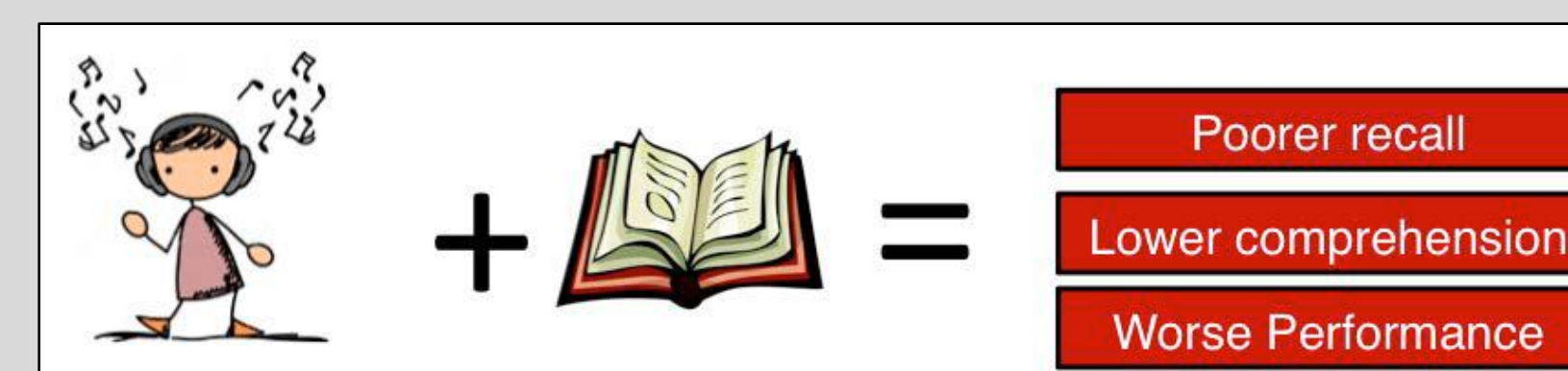
3: Regulating Behavior & Environment

Training to help students

Make **implementation intentions**

Engage in **mental contrasting**

Regulate their environment to avoid distraction



Make efficient use of study time, avoid pitfalls

