Adaptive Assessments in a HarvardX Course

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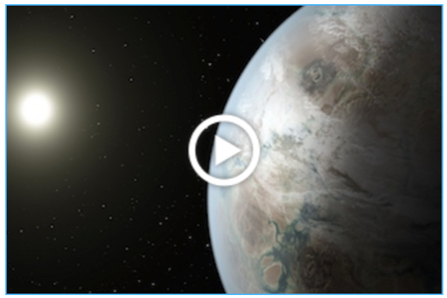

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Learn about alien life, how we search for it, and what this teaches us about our place in the universe.

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Outline

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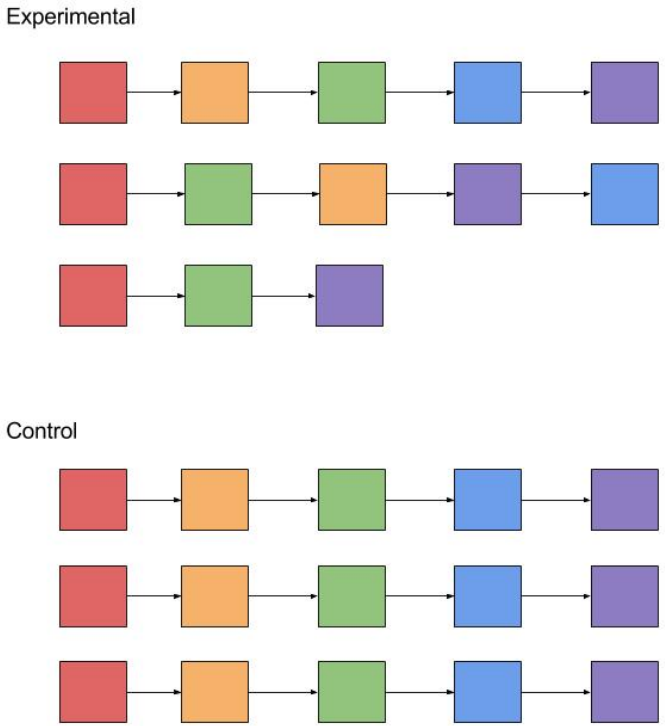
Motivating adaptivity in MOOCs

MOOC learners come from diverse educational backgrounds, and have different reasons for taking a course. How can we more effectively cater to a large, diverse population?

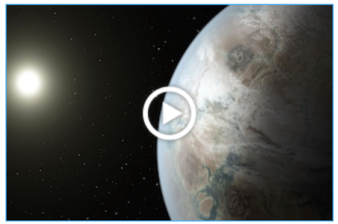
Engagement & Competency

Scope of adaptivity: problem sequences



The next problem (or activity) is determined dynamically, based on real-time student response data.

About the course



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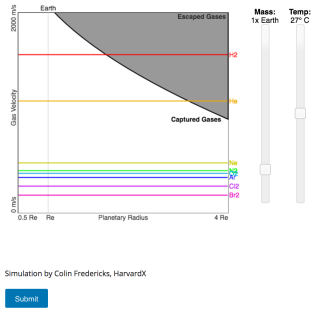
- *Super-Earths And Life is a course about alien life, how we search for it, and what this teaches us about our place in the universe.*
- Course launch: October 2016
- Version 3; pre-existing course material authored in edX
- Custom javascript problems

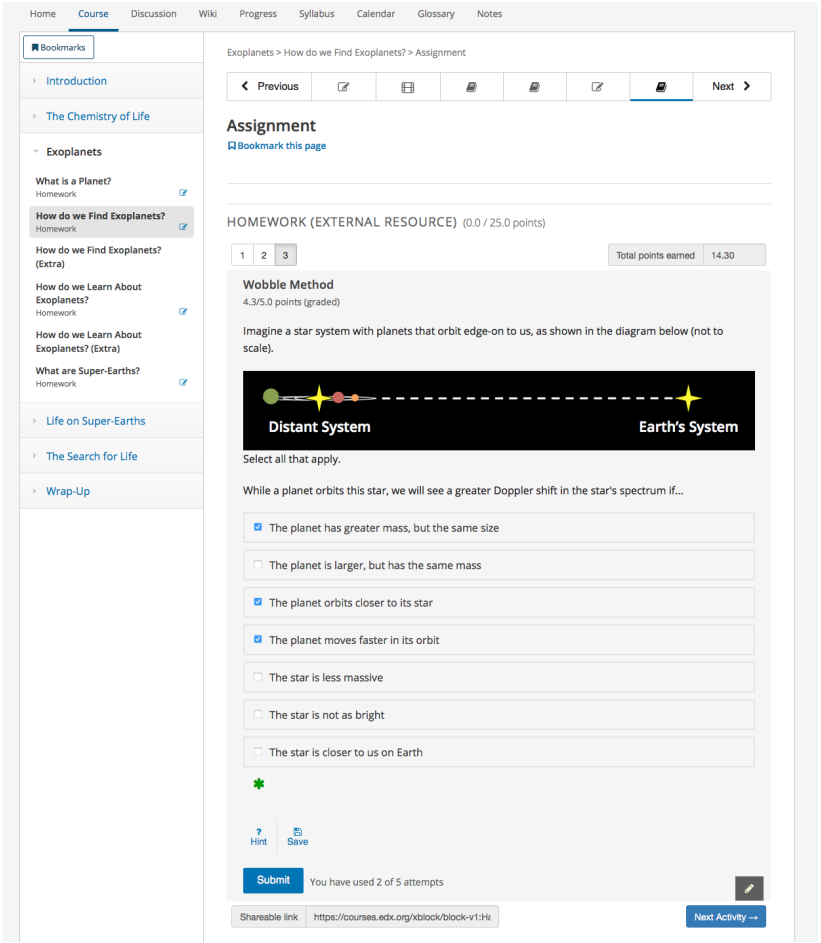


Project goals and scope

- Serve edX problems in a dynamically generated sequence
- Minimum viable product / pilot study; meant to:
  - investigate technology requirements
  - explore implications for course (re)design
  - establish the foundation for future study of adaptive functionality in MOOCs on learning outcomes, engagement and course drop-out rates

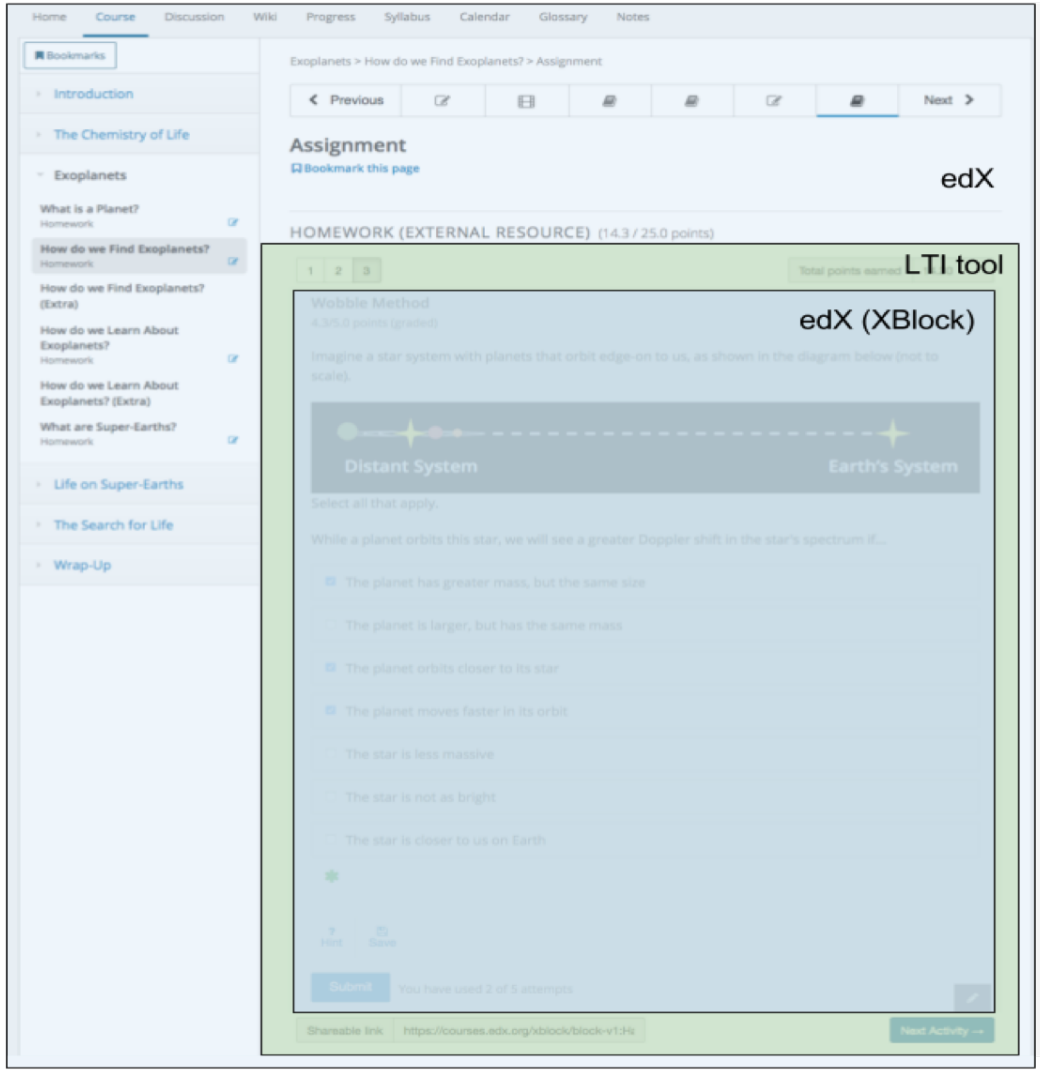
Outline

Adaptive assessment appearance in edX course

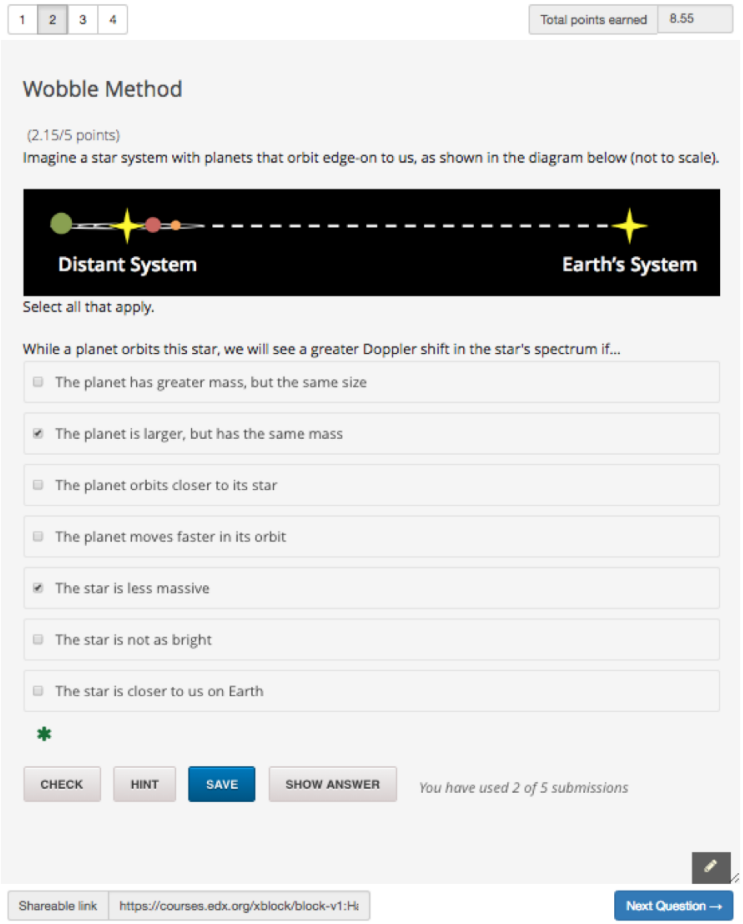


Adaptive assessment tool is embedded as a graded external tool assignment.

Nested iframe implementation



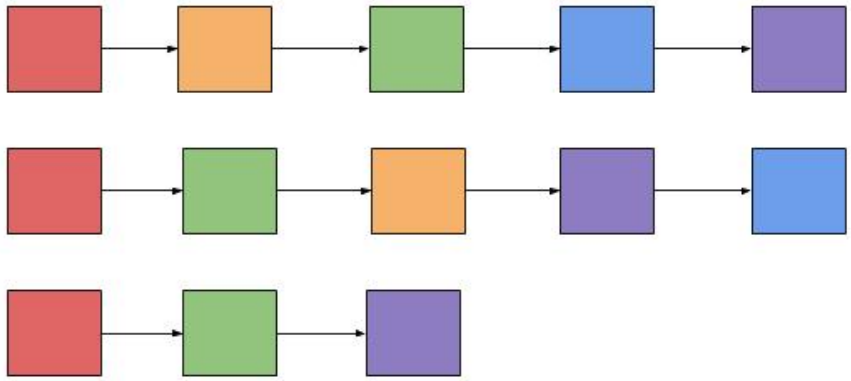
UI components



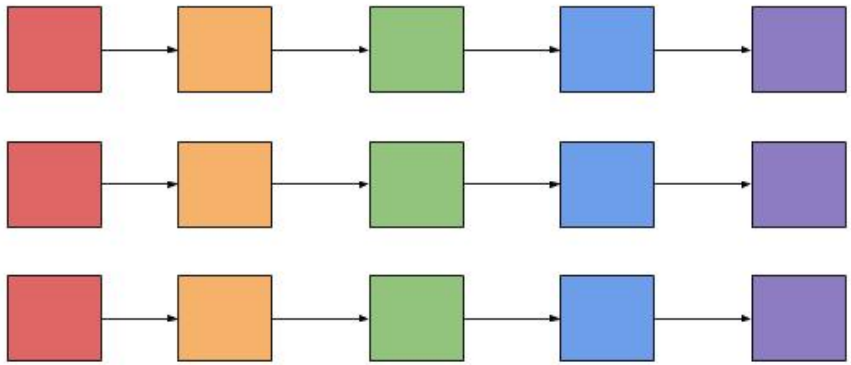
Nav bar (upper left), score (upper right), sharable link (lower left), next activity (lower right)

Experimental setup

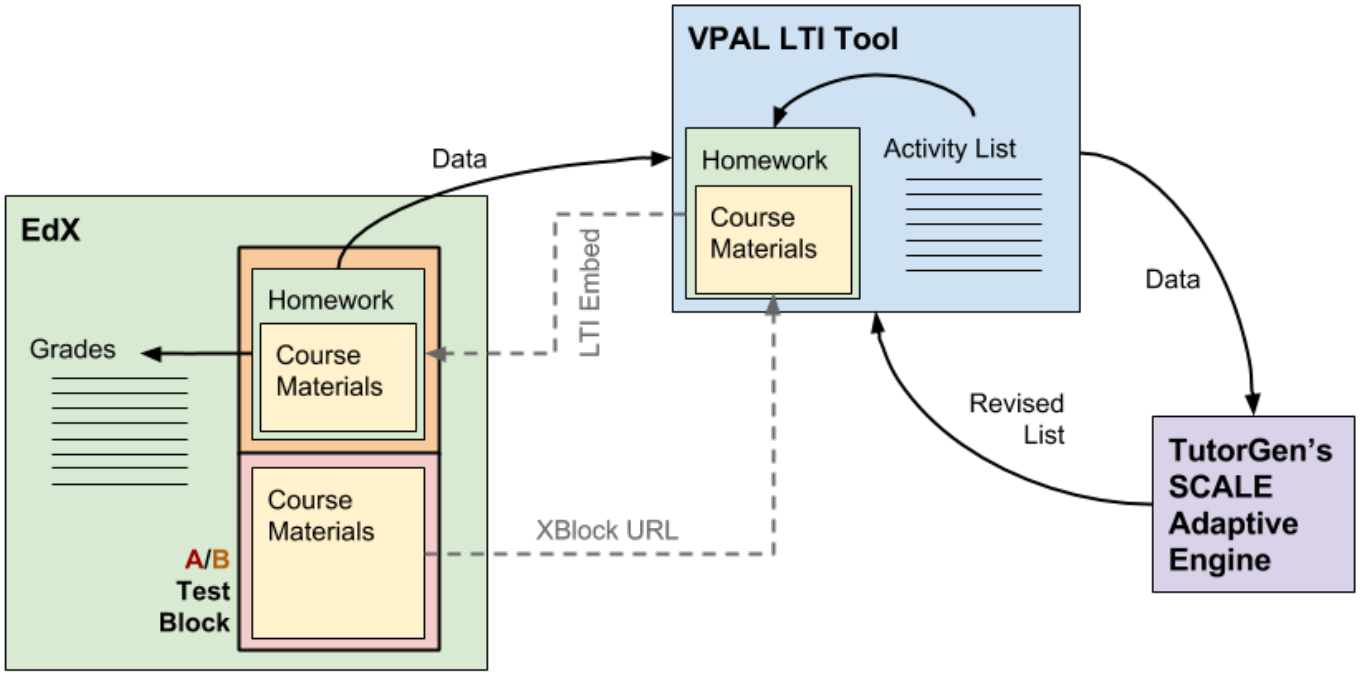
Experimental



Control

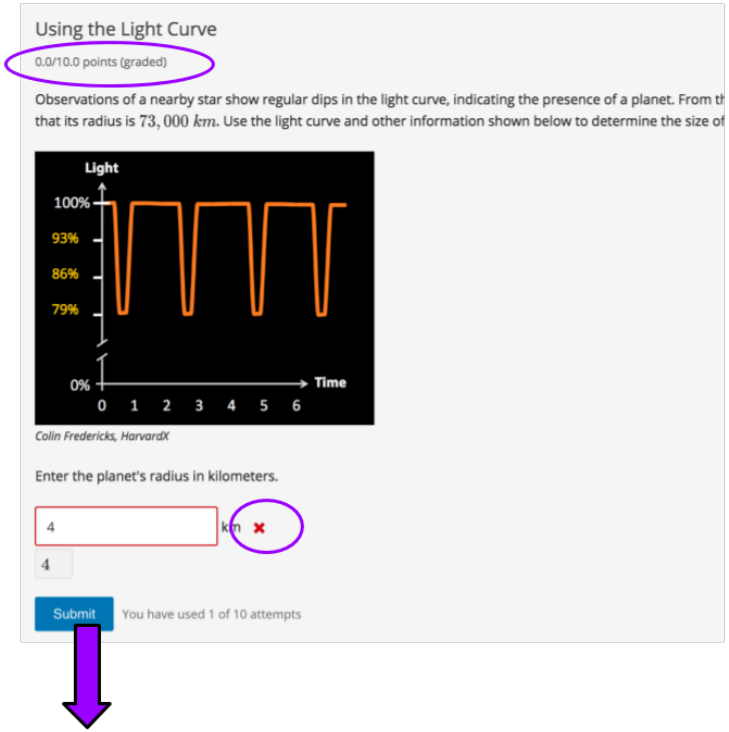


Course design for adaptive experimentation



All problems for adaptive sections are kept in the control group portion of an A/B testing block (Content Experiment). Experimental group portion contains an LTI component.

Javascript sensors embedded in problems

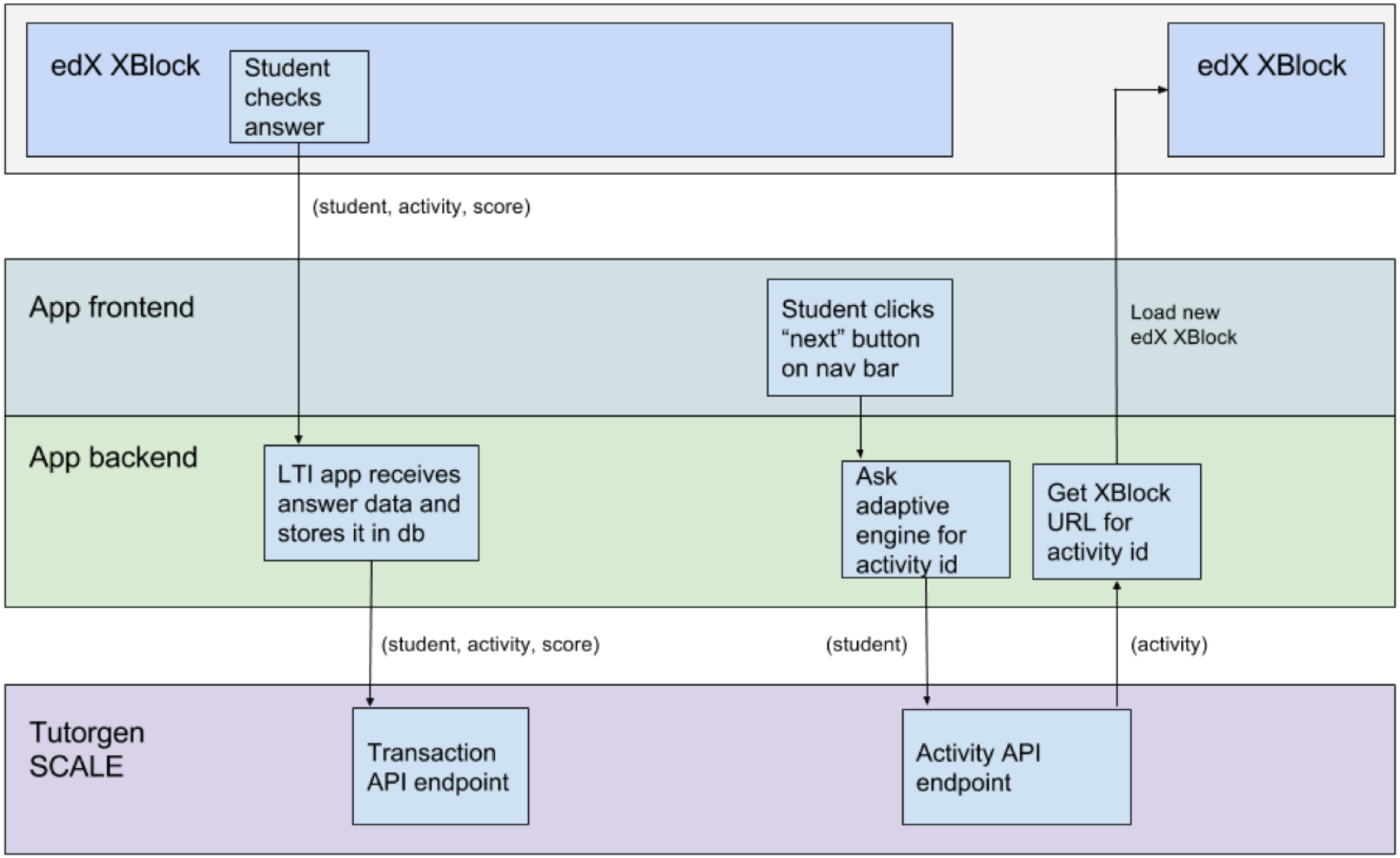


Javascript embedded in problem sends data to adaptivity web application (Django, AWS) on problem submit event.

Adaptive engine

- Tutorgen adaptive engine (SCALE: Student-Centered Adaptive Learning Engine)
- Uses a variant of Bayesian Knowledge Tracing to make activity recommendations
- Implements 2 API endpoints:
  - post transaction
  - get activity

Event sequence cascade: a bridge for adaptivity

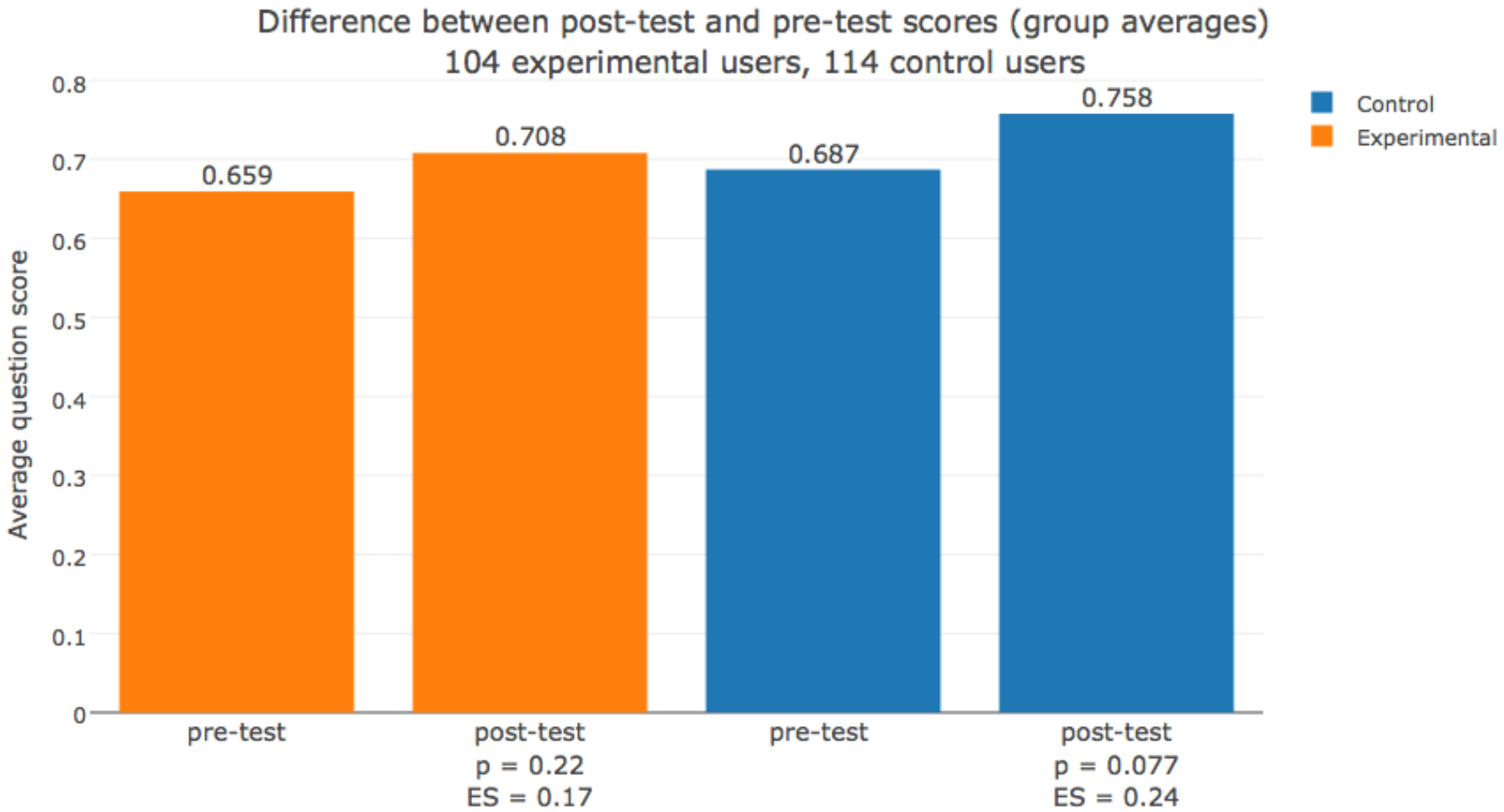


Outline

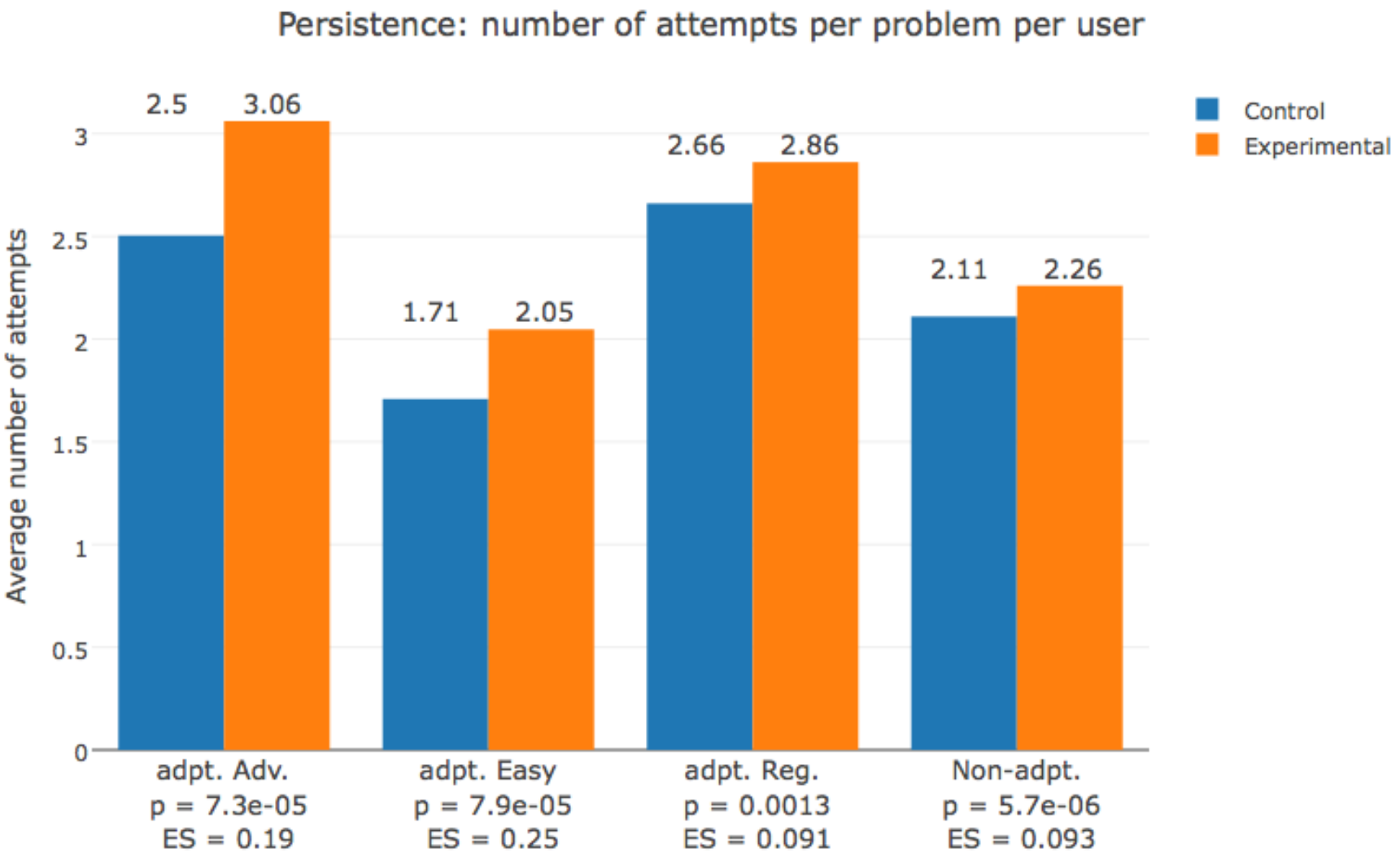
Preliminary findings

- Students who experienced adaptivity showed more persistence by giving more attempts per problem (presumably, because adaptively served problems are more likely to be on the appropriate current mastery level for a student)
- Higher efficiency of learning: students go through the course faster and attempt fewer problems, since the problems are served to them in a targeted way
- Technological challenge: getting real-time student activity from problems
- Implementing adaptivity in a course requires a large amount of new content and learning objective tagging

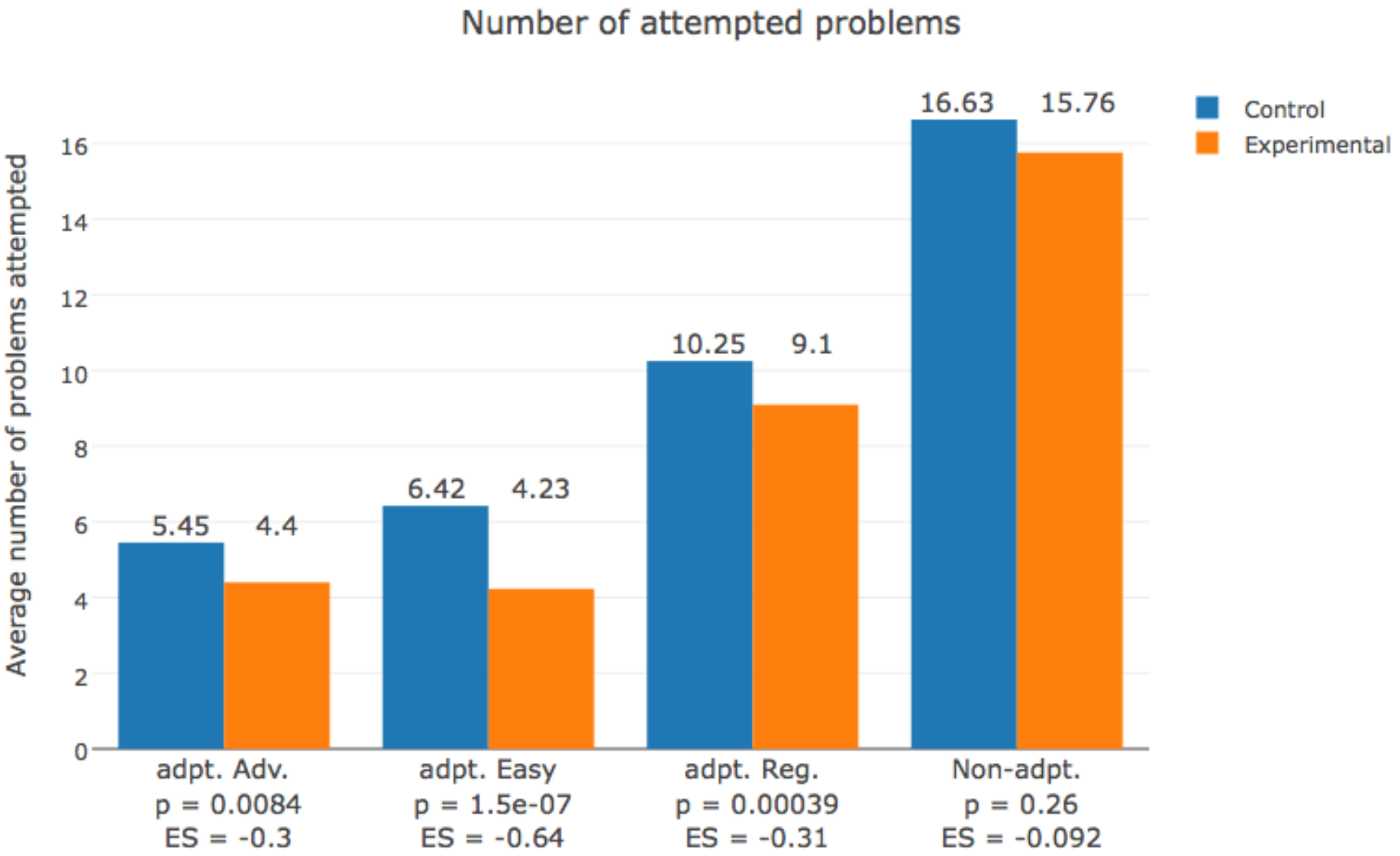
Comparing difference in learning gains



Number of attempts per problem

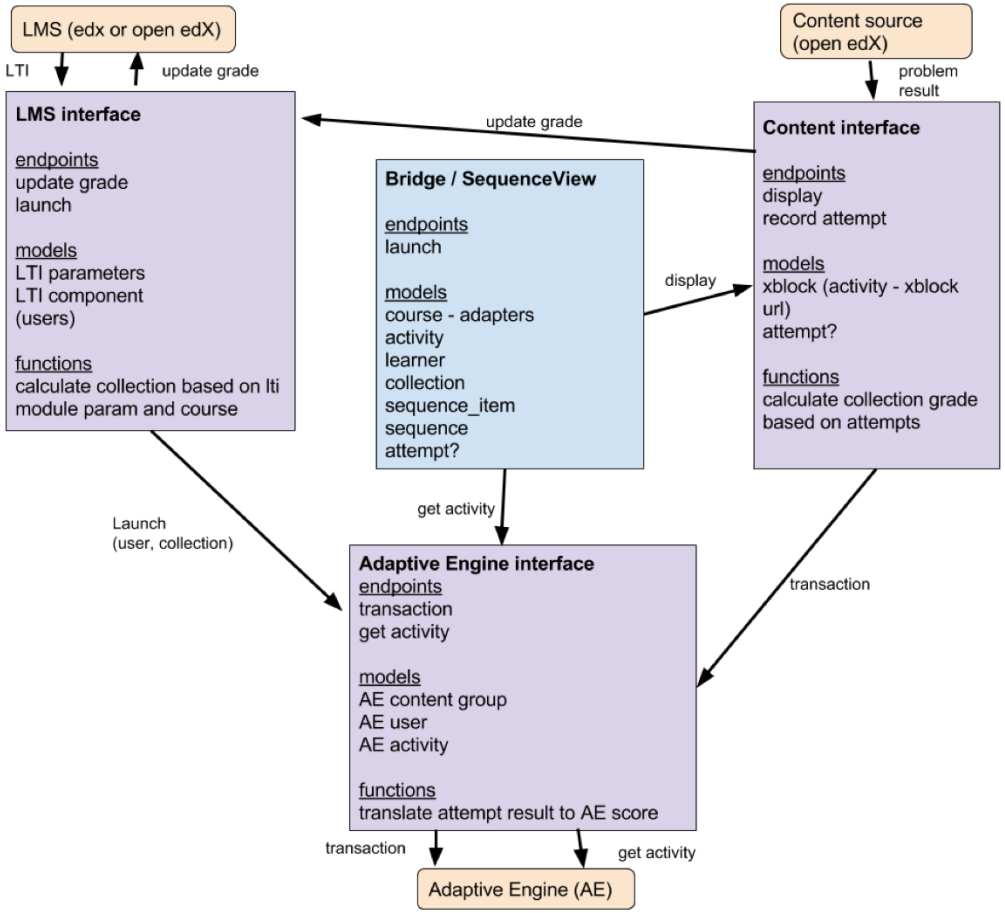


Number of problem attempts



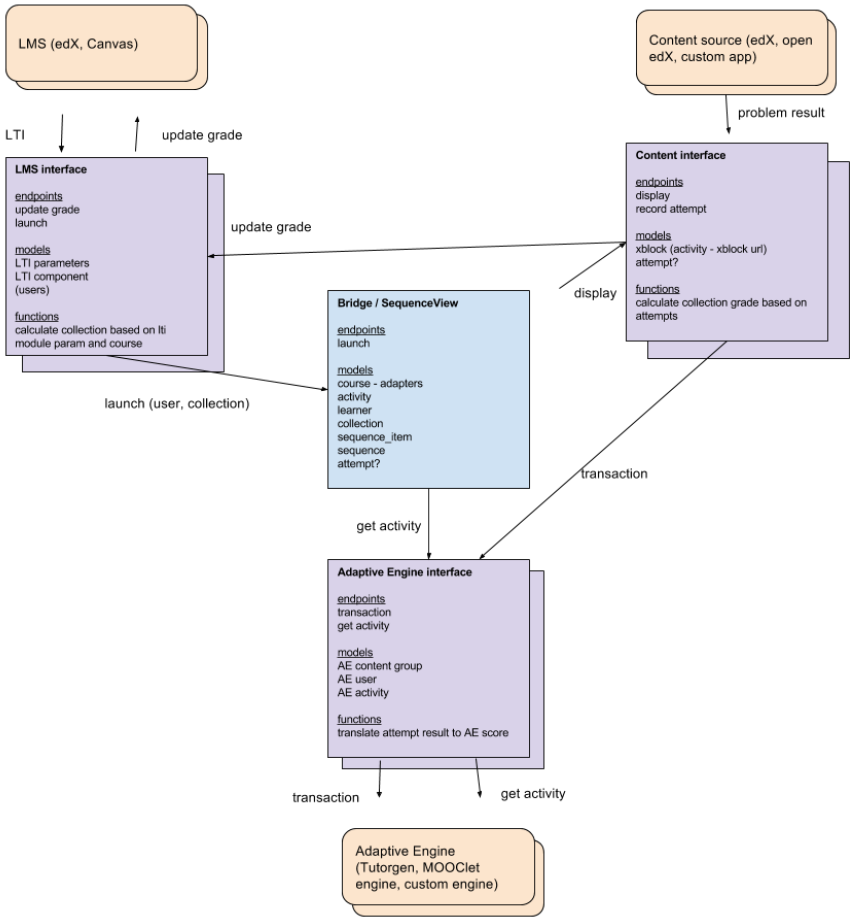
Outline

Generalizing content source interface



Using Open edX as a LTI provider for content display and student response data

Interfacing with multiple external systems

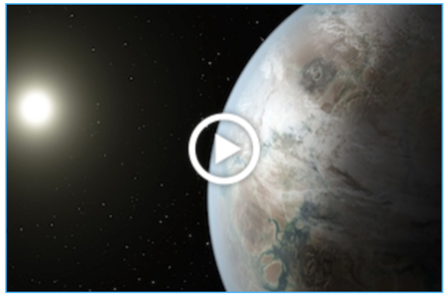


3 components: LMS (edX/Canvas), adaptive engine, content source

Streamlining course integration and setup

- How can we streamline the process of setting up a course to enable adaptivity?
- Possible API and/or UI for managing content and learning objective tagging

Upcoming course deployments



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Open Source Adaptive Learning Workshop

- VPAL Research is partnering with Microsoft to develop an open source adaptive engine for use in upcoming course deployments.
- Workshop objectives: engage participants in reviewing the adaptive engine algorithm, the research design of content experiments, and the architecture of our implementation
- Thursday, June 1st, 11am-2pm EST
- Join in-person or virtually via Skype
- Contact yigal_rosen@harvard.edu if interested