

Integrating MOOCs and Intelligent Tutoring Systems: edX, GIFT, and CTAT

Presentation at the 5th Annual GIFT Users Symposium (GIFTSym5)

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Vincent Aleven¹, Ryan Baker², Nathan Blomberg³,
Juan Miguel Andres², Jonathan Sewall¹, Yuan Wang⁴,
Octav Popescu¹

¹Human-Computer Interaction Institute, Carnegie Mellon University

²Graduate School of Education, University of Pennsylvania

³Dignitas Technologies, LLC,

⁴Teachers College, Columbia University

Outline

- Motivation and Goals
- Context: Big Data in Education MOOC
- Background: What is CTAT?
- Accomplishments: Integration of GIFT into edX
- On-going: Add course content under GIFT-EMAP
- Next steps
- Discussion and Outlook

Motivation

- MOOCs are successful at delivering courses at scale, often for free
- Some challenges in MOOCs: feedback, individual attention, low retention
 - Proposed solution: add adaptivity
- Integrating MOOCs with intelligent tutoring systems (ITSs) is not always straightforward
 - Existing standards promise this capability
- Possible advantages of integration: more reuse, complementary strengths, wider dissemination

Project Goals

- Provide a novel framework and reproducible exemplar for adaptivity in MOOCs, supported by proven, domain-independent authoring tools for adaptive learning technologies
- Create a highly adaptive MOOC combining the adaptive capabilities of GIFT and CTAT
- Improve an existing online course in educational data mining, a field of growing interest

Why Combine CTAT and GIFT?

Complementary Strengths

- Complementary adaptive behaviors
 - GIFT outer loop: chooses material according to assessment, characterized by difficulty, media, user control, etc.
 - CTAT outer loop: chooses only by fine-grained skill probabilities
 - CTAT inner loop: includes step-based problem solving, immediate feedback, multi-level hints, varied solution strategies
- Complementary student models
 - GIFT: concept knowledge, engagement, motivation, anxiety
 - CTAT: fine-grained skills or knowledge components

Context: MOOC on Big Data in Education

Big Data in Education: Online course in Educational Data Mining

The screenshot shows a web browser displaying the edX course page for "Big Data and Education". The browser's address bar shows the URL: <https://www.edx.org/course/big-data-education-pennx-bde1x>. The page features the edX logo and navigation links for Courses, Programs, Schools & Partners, and About. A search bar and a user profile dropdown for "JonathanEdxSewall" are also visible. The main content area includes a video thumbnail of a child with a play button, the course title "Big Data and Education", a description: "Learn the methods and strategies for using large-scale educational data to improve education and make discoveries about learning.", and a green button that says "You Are Enrolled". The course starts on June 19, 2017. Below the main content, there is an "About this course" section with a 0/5 star rating and a "See more" link. The "What you'll learn" section lists three bullet points: "Key methods for educational data mining", "How to apply methods using standard tools such as RapidMiner", and "How to use methods to answer practical educational questions". On the right side, a sidebar provides course details: Length (8 weeks), Effort (6-12 hours/week), Price (FREE, with an option to add a Verified Certificate for \$49.00), Institution (PennX), Subject (Data Analysis & Statistics), Level (Advanced), and Languages (English). The browser's taskbar at the bottom shows open files like "giftsym5 presenta...pptx" and "PennX_BDE_2017_...zip".

Offered twice on edX from Teachers College, Columbia University Beginning June 19, 2017, on edX from University of Pennsylvania

Big Data in Education Course Topics

Week 1: Prediction

Week 2: Diagnostic Metrics and Cross-Validation

Week 3: Feature Engineering and Behavior Detection

Week 4: Knowledge Inference and Knowledge Structures

Week 5: Relationship Mining

Week 6: Visualization

Week 7: Clustering and Factor Analysis

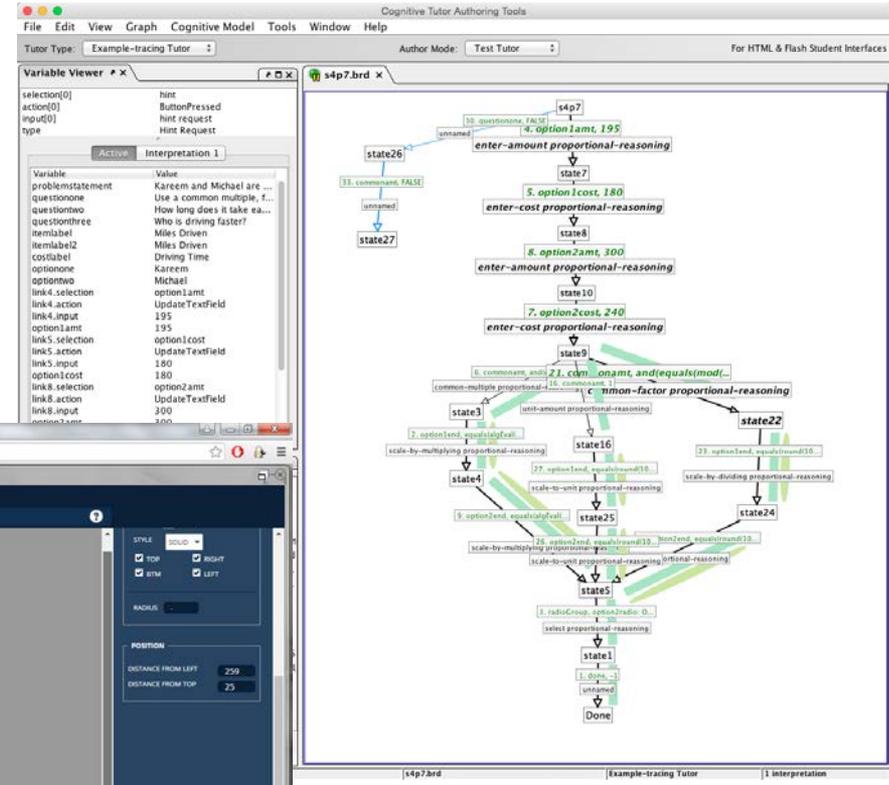
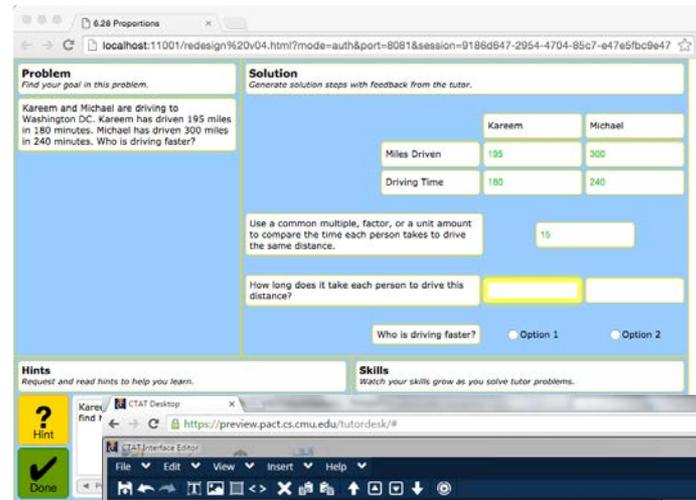
Week 8: Discovery with Models

Past BDE Iterations: Students, Enrollment, Research

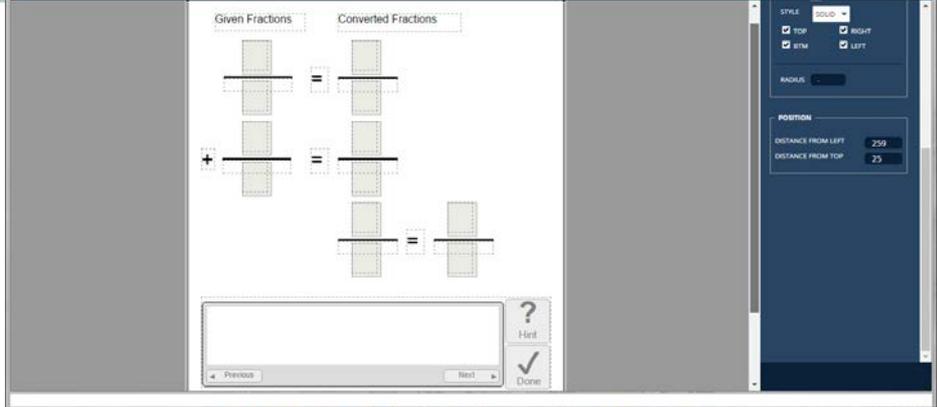
- Over 72,000 students at official course end across iterations
- Several thousand more have accessed material outside of official course runs
- BDEMOOC has been used as a platform for research many times already, resulting in 11 papers

Background: What is CTAT?

Cognitive Tutor Authoring Tools (CTAT): a software suite for ITS development by non-programmers



Editable behavior graph created through programming by demonstration



Drag-and-drop HTML editor for creating tutable interface

CTAT Use and Effectiveness

- Development costs of CTAT tutors 4 to 8 times lower than “historical” estimates of ITS development time and cost (Alevan et al., 2009)
- Has been used by ~650 authors
- Many tutors have been built with CTAT and demonstrated learning gains in classrooms
 - Selected 18 for 2016 IJAIED paper, many more implemented
- CTAT tutors have been used in over 50 studies

Alevan, V., McLaren, B. M., Sewall, J., van Velsen, M., Popescu, O., Demi, S., . . . Koedinger, K. R. (2016). Example-Tracing tutors: Intelligent tutor development for non-programmers. *International Journal of Artificial Intelligence in Education*, 26(1), 224-269. doi:10.1007/s40593-015-0088-2

CTAT Tutors in real educational settings: variety of domains, from grade school to graduate school

Parameter Tuning: 1 2 3 4 5 6 7 8 9 10

In the first stage we selected the settings we would use to build a tuned model over the whole data set (which we would use in stage 2). Now we want to estimate what that model's performance would be on new data (stage 3). We do that using an embedded cross validation.

In the table below, the top 5 rows represent the inner loop of the cross validation and the bottom 5 rows represent the outer loop. For the outer loop we just divide each fold into a training set and a testing set, as we did for the simple cross validation. The only exception here is that we may subset a different setting on each fold based on the inner loop. For the inner loop, instead of a cross validation on the training data for each fold, we divide each fold into train, validation, and hold out. The hold out is the test set, which we will not cross on the inner loop. The train set is what we train on and the validation set is what we test on. Based on the performance on the validation set, we will make a selection of a setting for that fold, which we will then use in the outer loop.

Training	Validation	Hold out	A	B	C	D
(7)(3)(4)(5)	(7)(2)	(7)(1)	0.86	0.73	0.84	0.71
(7)(3)(3)(5)	(7)(2)	(7)(1)	0.45	0.59	0.52	0.67
(7)(3)(2)(5)	(7)(1)	(7)(5)	0.74	0.67	0.58	0.68
(7)(3)(2)(5)	(7)(6)	(7)(4)	0.78	0.79	0.67	0.5
(7)(3)(2)(5)	(7)(1)	(7)(5)	0.68	0.75	0.61	0.43
(7)(2)(3)(4)(5)	(7)(1)	(7)(5)	0.89	0.86	0.62	0.57
(7)(2)(3)(4)(5)	(7)(2)	(7)(1)	0.81	0.68	0.62	0.82
(7)(2)(3)(4)(5)	(7)(2)	(7)(1)	0.81	0.37	0.79	0.76
(7)(2)(3)(3)(5)	(7)(6)	(7)(4)	0.71	0.8	0.53	0.57
(7)(2)(3)(2)(5)	(7)(6)	(7)(5)	0.89	0.68	0.52	0.64

The performance value you have selected on the inner loop is the highest performance value.

Buttons: ? (Hint), Done

Metaprophylaxis: cancer is a problem with a cell's accelerator and brake.

The accelerator is the set of pathways that switch on cell growth (cell cycle progression). The brake is the set of pathways that instruct a cell to self-destruct for the good of other cells (apoptosis).

(Mori et al., 2012) performed a genomic analysis of 180 Diffuse Large B Cell lymphomas. The type of data we collected: copy number alterations and transcriptional variations. They were interested in mutations which affected the regulation of signaling proteins in cell cycle, apoptosis and p53 pathways. They were also interested in how these changes in gene sequences might affect the transcription of proteins in cancer pathways.

To explore this further, Dr. Mori and his colleagues:

- Identified genes with copy number alterations (CNAs) from normal cell genotypes.
- Generated a transcriptional profile of the genes affected by the CNAs using a computational technique called Gene Set Enrichment Analysis.
- Performed a pathway analysis: they looked at known pathways to filter CNAs/genes.

For this problem your task is to summarize how the CNAs affect the behavior of

Genotype

Copy Number Alteration (CNA)

- Homozygous copy gain in cyclinD3
- Homozygous copy loss in p18
- Homozygous copy loss of Notch1
- Homozygous copy loss of Notch2
- Homozygous copy gain in BCL2L2

For each copy loss or gain, explain the impact on the cellular pathways.

The CNA at the left causes... WHICH THEN...

- Gain in expression of cyclinD3 → increases activity of Notch1 phosphorylation
- Loss of expression of p18 → reduces inhibition of cyclinD3/Cdk
- Loss of expression of Notch1 → reduces activity of Pro-Caspase3/7 maturation
- Loss of expression of Notch2 → causes the pathway unchanged
- Gain in expression of BCL2L2 → increases inhibition of TP53 transcription and Caspase 3/7

Phenotype

Change (+/-) in Cell Cycle / Apoptosis

- ↑ (increase)
- ↓ (decrease)
- 0 (no impact)

Impact on Cell Proliferation

- ↑ (small increase in cell proliferation)
- ↓ (small decrease in cell proliferation)
- 0 (no impact on cell proliferation)

STAT TUTOR WORK PLAN

Problem: Questions: Variables: Data: Help

Identify the relevant variables:

- Quantity Name
- Unit
- Partly size
- Snacks

Classify the relevant variables:

- Quantity Name
- Unit
- Partly size
- Snacks

Buttons: ? (Hint), Done

RedBlackTree Tutor

Step 1: What is the current node X? (31)

Step 2: What is the current node X? (27)

Step 3: What is the current node X? (1)

The top-down insertion algorithm starts from the root of the tree, and moves down one level on the left or right until it finds a null node to insert the new element. Once a null node is found what becomes the current node X?

Buttons: ? (Hint), Done

Stoichiometry Tutor

Problem Statement

Suppose the WHO recommended limit for arsenic in drinking water is equal to 0.00014 grams of arsenite (AsO₂⁻) / L solution. To determine the concentration of arsenite in a solution sample that is safe, one needs to check it against the WHO recommendation. How many grams of arsenite (AsO₂⁻) / L solution are in a sample with 0.58 moles of arsenite (AsO₂⁻) in 100 kiloliters (100 kL) of solution? The result should have 2 significant figures. (Hint: the molecular weight of arsenite (AsO₂⁻) is 109.9 g AsO₂⁻ / mol AsO₂⁻.)

Problem

Units	Substance	#	Units	Substance	#	Units	Substance	#	Units	Substance	#	Result
0.58	mol	1	AsO ₂ ⁻	100	kL	1	g	AsO ₂ ⁻				
100	kL	1	AsO ₂ ⁻	109.9	g/mol	1	g	AsO ₂ ⁻				

Reason: Given Value, Unit Conversion

Hint: The goal is to convert the amount of substance in moles to grams by using molecular weight.

Carting service "No Head, Just Get"

1. How many snacks does the carting service need for a party of 42 guests?

2. How many snacks does the carting service need for a party of 42 guests?

3. How many snacks does the carting service need for a party of 42 guests?

Hint: Use the line graph to find the answer for question 4 and 5 below.

4. How many guests are there in a party if you order 1455 snacks?

5. The carting service has 4815 snacks left in stock today. What is the maximum number of guests that can be catered?

Quantity Name: party size, snacks

Unit: guests, snacks

Question 1: 10, 210

Question 2: 42, 840

Question 3: 210, 420

Question 4: 93, 1455

Question 5: 317, 4815

Equation: y = x

Buttons: ? (Hint), Done

Algae Processing - Tutored Problem

File Edit View Insert Format Data Tools Add-ons Help CTAT

Year	Algae	Other	Machine	Other	Machine	Sea	Machine	Spring	Equipment	Building	Machine	Packing	Machine	Test	Equipment
1999	2.80	7	4	3	2	9	1	1	2	4	1	2	4	1	
1999	6.00	4	4	4	3	11	1	1	1	4	1	1	4	7	
2000	7.00	12	11	11	11	11	11	11	11	11	11	11	11	11	
2001	10.00	8	8	4	4	15	2	1	1	1	1	1	1	1	
2002	14.00	7	12	5	5	16	1	1	1	1	1	1	1	1	
2003	18.00	11	11	11	11	11	11	11	11	11	11	11	11	11	
2004	17.00	8	15	6	6	21	3	1	1	1	1	1	1	1	
2005	20.00	8	16	11	11	22	3	1	1	1	1	1	1	1	
2006	23.00	10	19	7	7	24	5	1	1	1	1	1	1	1	
2007	27.00														
2008	31.0														
2009	35.0														
2010	40.7														
2011	45.0														
2012	50.19														
2013	55.00														
2014	60.00														
2015	65.00														
2016	70.00														

Buttons: ? (Hint), Done

Atoms and Electrons

A. Let's revisit the Bohr model for chlorine!

B. Let's revisit the energy diagram for chlorine!

C. Let's look at the differences between these diagrams!

- Regarding the electrons, the Bohr model shows... whereas the energy diagram shows...
- The Bohr model shows the relative energy levels of... whereas the energy diagram shows...
- Regarding the spin states of electrons, the Bohr model shows... whereas the energy diagram shows...

Equivalent Fractions

A. Let's review a rectangle as an example to find equivalent fractions!

B. Let's partition number lines to make equivalent fractions!

C. What did we learn about the rectangle and the number line?

1. Multiplying the numerator and the denominator by the same amount is like partitioning the area into more sections... changing the amount.

2. Rectangles and number lines show the same amount... numbers of sections show equivalent fractions.

You did it!

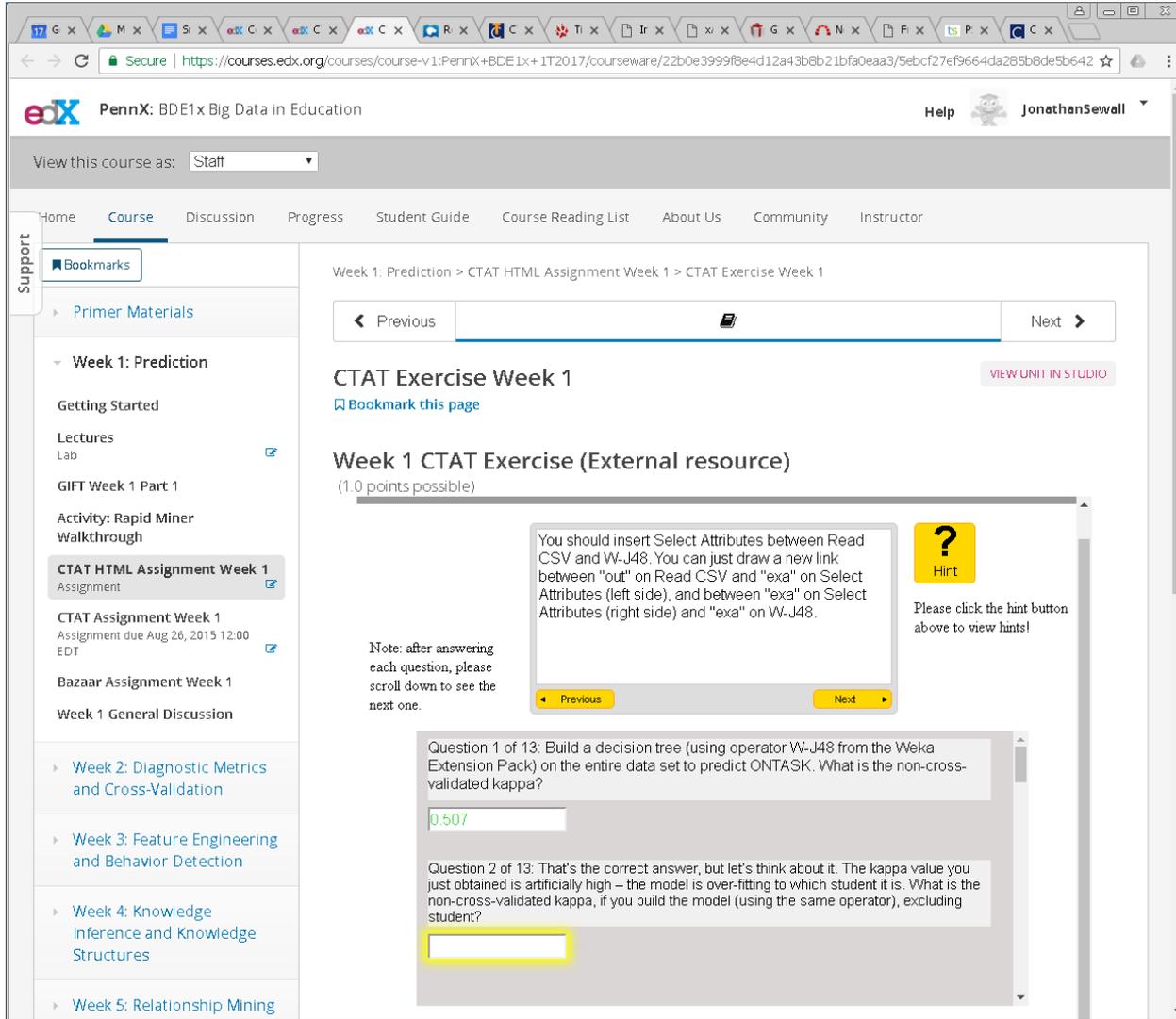
Accomplishments: Integration of GIFT into edX (and other LTI-compliant LMSs)

Integration via the Learning Tools Interoperability (LTI) Standard

- LTI vs other LMS standards (SCORM, e.g.)
- LTI v1.1 specification
 - API for “Tool Consumer” (LMSs)
 - API for “Tool Provider” (store of learning objects)
 - edX, Coursera, Canvas, Moodle and Blackboard.
 implement the LTI Tool Consumer interface: GIFT content now available to course authors for those MOOC LMSs
- Our first step: Embed GIFT and CTAT (separately) into edX
 - both must implement the LTI Tool Provider API

IMS Global Learning Tools Interoperability™ Implementation Guide (Final Version 1.1). (2012, March 13). Retrieved from <https://www.imsglobal.org/specs/ltiv1p1/implementation-guide>

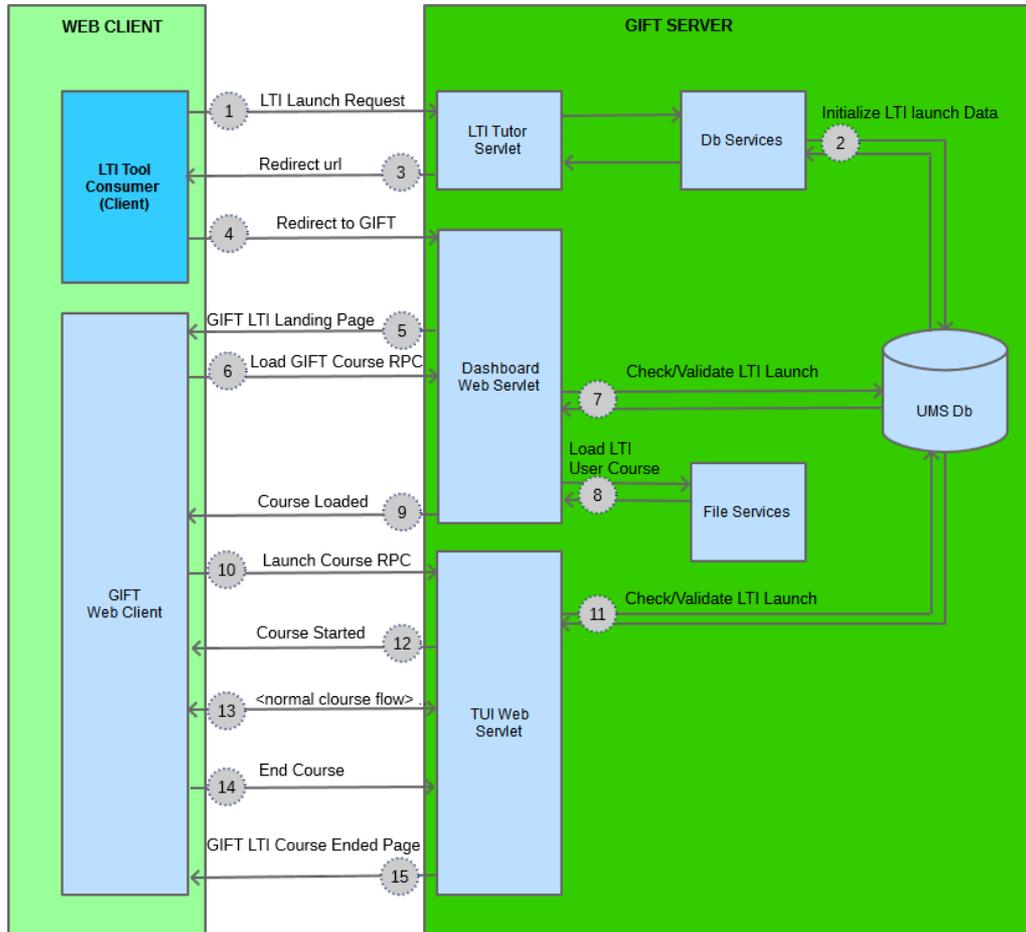
Already an LTI Tool: CTAT Tutor in edX



The screenshot shows a web browser window displaying an edX course page. The URL is <https://courses.edx.org/courses/course-v1:PennX+BDE1x+IT2017/courseware/22b0e3999f8e4d12a43b8b21bfa0ea3/5ebcf27ef9664da285b8de5b642>. The page title is "PennX: BDE1x Big Data in Education". The user is logged in as Jonathan Sewell. The course is viewed as "Staff". The navigation menu includes Home, Course, Discussion, Progress, Student Guide, Course Reading List, About Us, Community, and Instructor. The left sidebar shows a "Support" section with "Bookmarks" and "Primer Materials". The main content area shows "Week 1: Prediction > CTAT HTML Assignment Week 1 > CTAT Exercise Week 1". There are "Previous" and "Next" navigation buttons. The title is "CTAT Exercise Week 1" with a "VIEW UNIT IN STUDIO" button. Below the title is "Week 1 CTAT Exercise (External resource)" with "(1.0 points possible)". A hint box contains the text: "You should insert Select Attributes between Read CSV and W-J48. You can just draw a new link between 'out' on Read CSV and 'exa' on Select Attributes (left side), and between 'exa' on Select Attributes (right side) and 'exa' on W-J48." A yellow "Hint" button is next to it. Below the hint is a note: "Note: after answering each question, please scroll down to see the next one." The question text is: "Question 1 of 13: Build a decision tree (using operator W-J48 from the Weka Extension Pack) on the entire data set to predict ONTASK. What is the non-cross-validated kappa?" The answer field contains "0.507". Below the question is another question: "Question 2 of 13: That's the correct answer, but let's think about it. The kappa value you just obtained is artificially high – the model is over-fitting to which student it is. What is the non-cross-validated kappa, if you build the model (using the same operator), excluding student?" The answer field for this question is empty.

ARL-Dignitas Implemented the LTI Tool Provider Interface in GIFT

GIFT LTI (v1.1) Tool Provider Launch Request Sequence



Strategy:

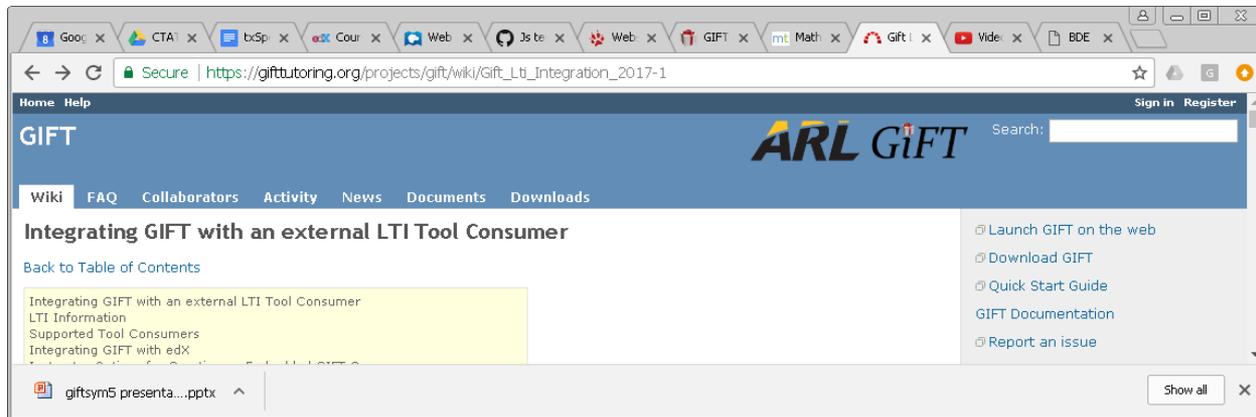
- New servlet fields LTI launch request, authenticates, redirects to GIFT

Challenges:

- LTI users not authenticated. Solution: Servlet validates and stores LTI user info in new database table.
- GIFT URL had path to plain-text GIFT course file name. Solution: Replace file path with universally unique identifier (UUID)

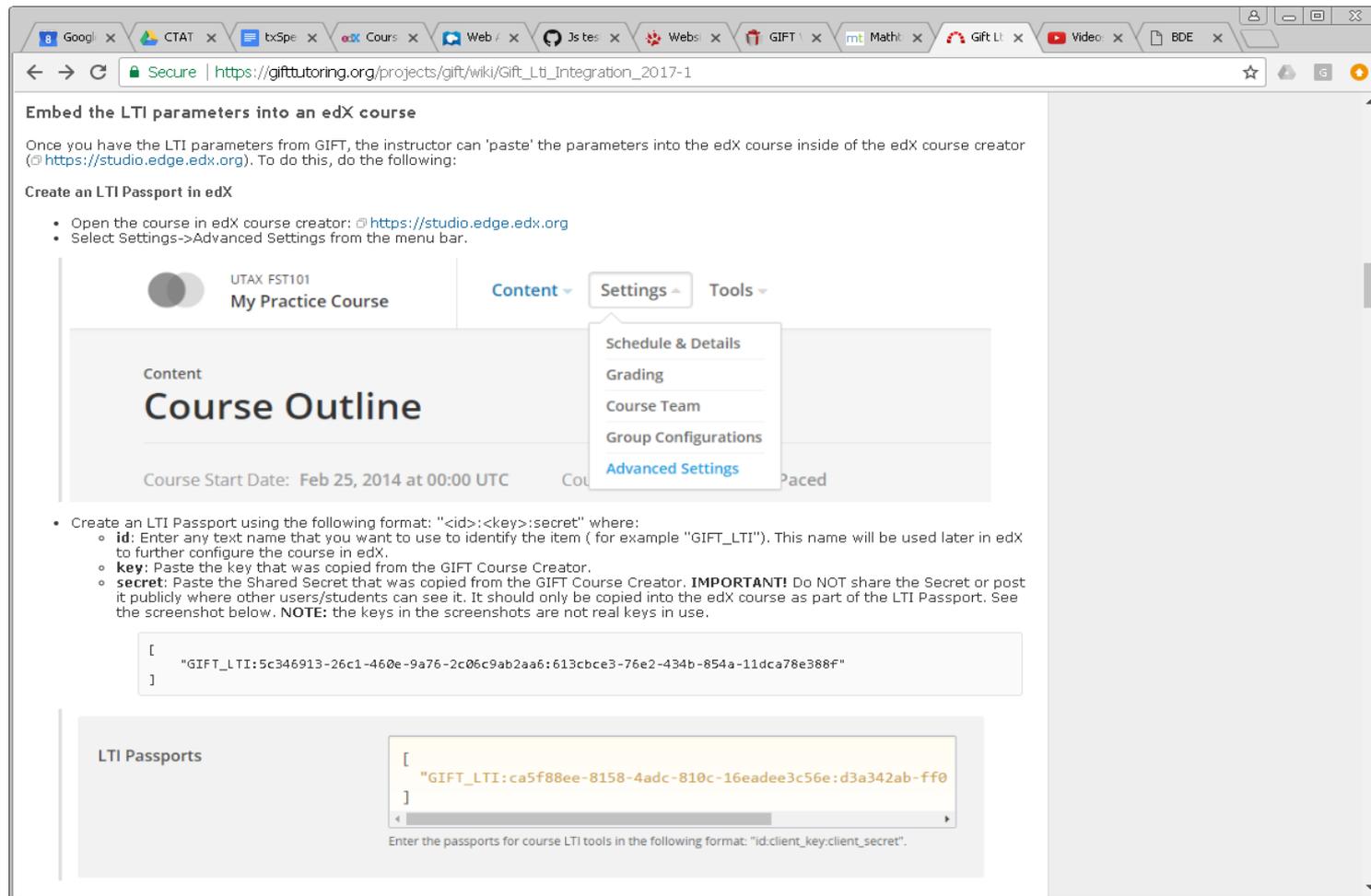
Inserting an LTI Tool instance into edX

- Next is a series of screenshots showing some details of how to embed GIFT into edX or other LTI Consumers
- Unit of integration: entire course or selected problem(s)
- Simple concise instructions on gifttutoring.org:



https://gifttutoring.org/projects/gift/wiki/Gift_Lti_Integration_2017-1

Copy LTI Tool credentials into edX, so GIFT will recognize edX launch requests



Embed the LTI parameters into an edX course

Once you have the LTI parameters from GIFT, the instructor can "paste" the parameters into the edX course inside of the edX course creator (<https://studio.edge.edx.org>). To do this, do the following:

Create an LTI Passport in edX

- Open the course in edX course creator: <https://studio.edge.edx.org>
- Select Settings->Advanced Settings from the menu bar.

Example 1:

```
[
  "GIFT_LTI:5c346913-26c1-460e-9a76-2c06c9ab2aa6:613cbce3-76e2-434b-854a-11dca78e388f"
]
```

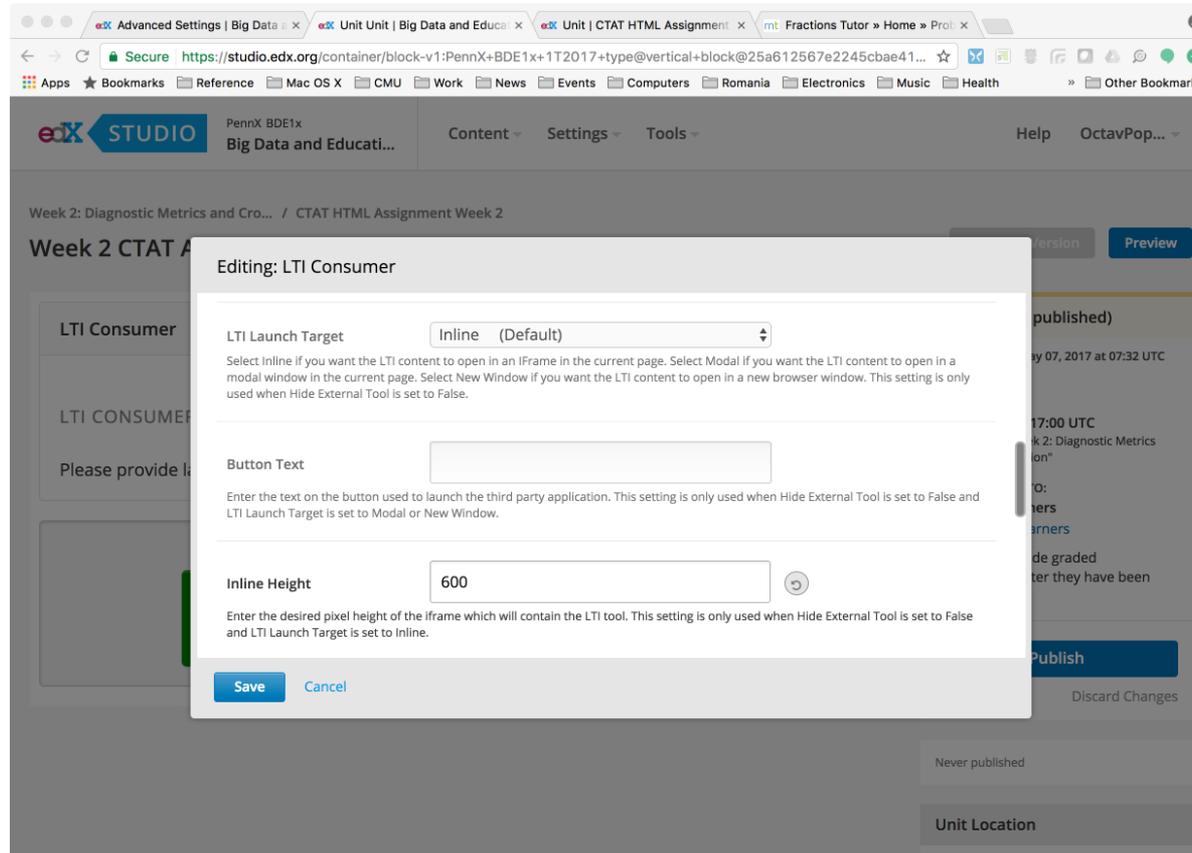
Example 2:

```
[
  "GIFT_LTI:ca5f88ee-8158-4adc-810c-16eadee3c56e:d3a342ab-ff0"
]
```

Enter the passports for course LTI tools in the following format: "id:client_key:client_secret".

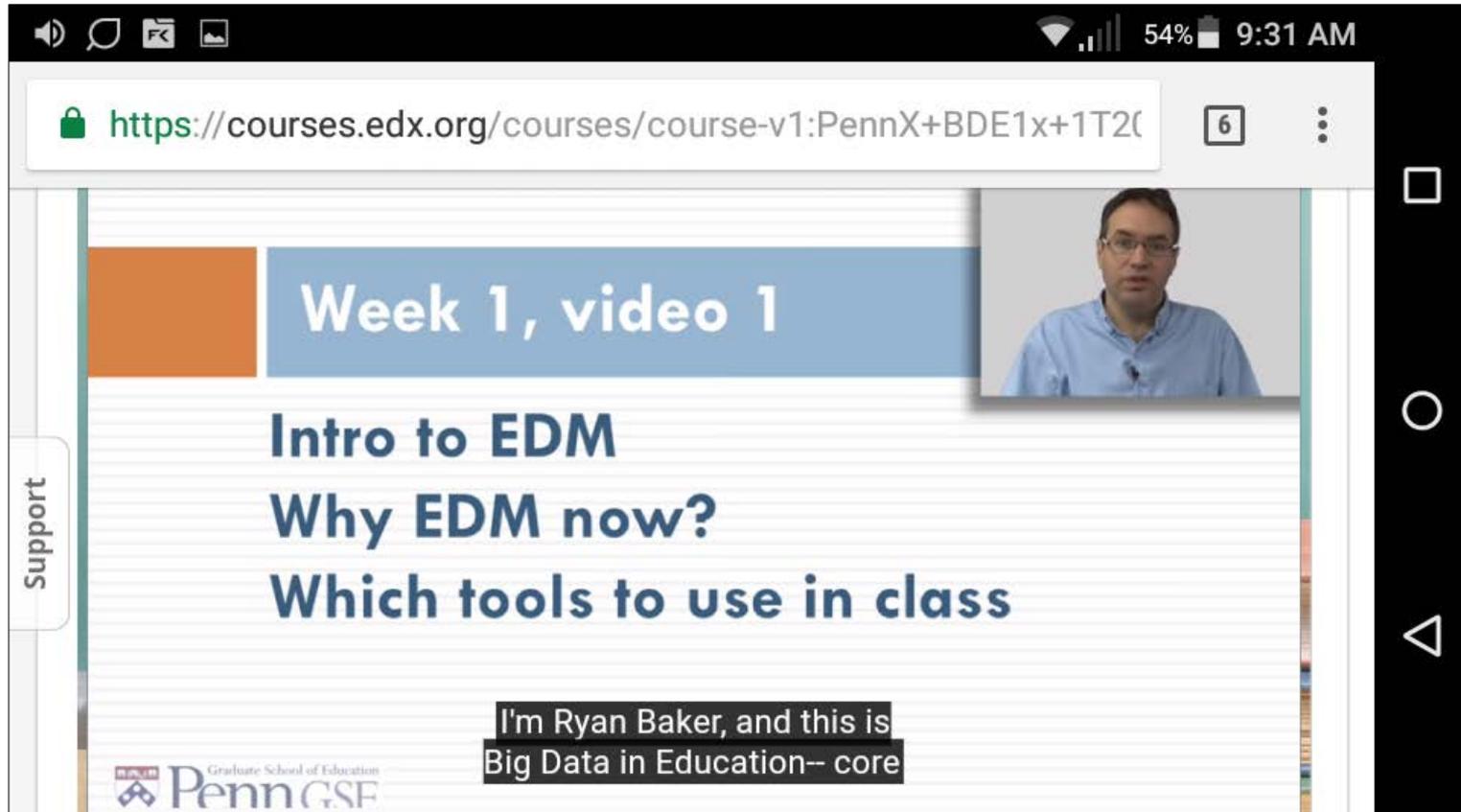
From https://gifttutoring.org/projects/gift/wiki/Gift_Lti_Integration_2017-1

Choose a proper frame height for the embedded GIFT activity



- Height parameter available using newer “lti_component” in edX’s Advanced Settings
- Judgment call: large enough to see, small enough for mobiles

Test on mobile devices and desktops



edX accessibility requirements:

- be sure video text, captions remain legible
- navigation buttons should be visible

On-going: Development of additional course content under GIFT-EMAP

Course Content

- Materials drawn from earlier editions of the course offered by Teachers College, Columbia
 - Videos
 - Assignments
 - Discussion Forums
 - Self-organized study groups on Facebook, LinkedIn
- Content to be adapted to work with GIFT
- Additional content to be created for these editions of the course, using edX, GIFT, and CTAT

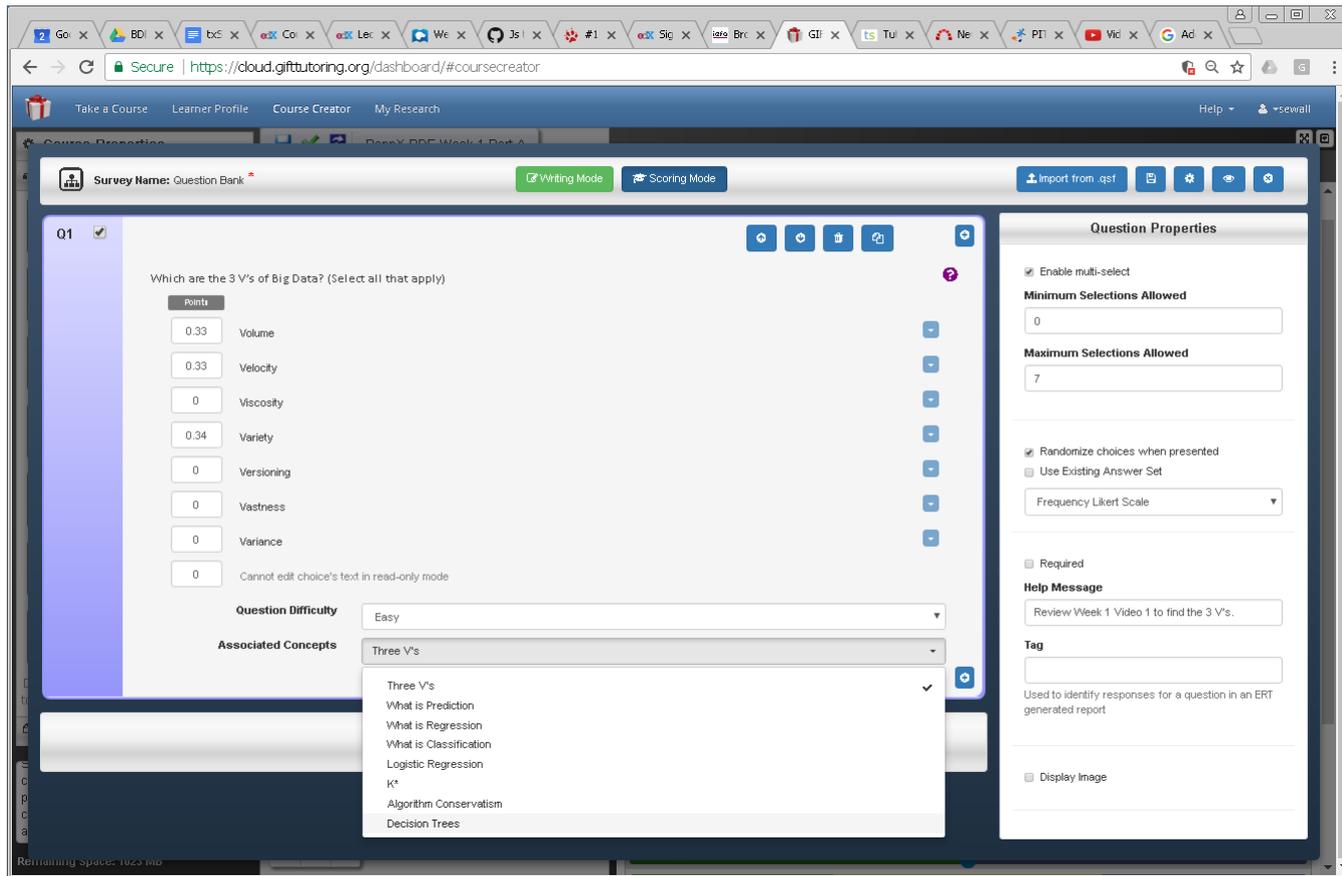
Mapping BDEMOOC Content to GIFT's EMAP Quadrants

BDEMOOC2017 -- CDT matrix ☆

fx	Topic	A	B	C	D	E	F	G	H
1	Topic		Rules/Exposition	Examples	Recall	Practice	Conceptual	External Resources	
2	Glossary of things we'll cover in more detail later, but you need for (the walkthrough, ba1, ca1)								
3	Course Introduction		V1-1	V1-1	R1-1				
4	Three V's		V1-1 (full re-record)						
5	Diagram of topics in course						Wk 1		
6	What is Prediction		V1-2	V1-2	R1-2		CC1-4		
7	What is Regression		V1-2	V1-2	R1-3, R1-4		CC1-4		
8	Computing a Value for Regression		V1-2	V1-2		V1-2-quiz1			
9	Understanding Contribution of Variable to Model		V1-2			V1-2-quiz2			
10	Variable Transformations		V1-2	V1-2					
11	Benefits of Linear Regression		V1-2	n/a					
12	Risks of Interpretation with Multicollinearity		V1-2	V1-2					
13	Regression Trees		V1-2	V1-2	R1-7				
14	What is Classification		V1-3	V1-5	R1-5, R1-6	W1 (add sao ped)	CC1-4		
15	Domain Specificity of Education		V1-3, V1-4	n/a					
16	Variables to Exclude in Classification		V1-3 (slides 49-54)	V1-3		A1 (bde asgn.1 should exclude UNIQUEID; UNIQUEID bug; eliminat V1-3-quiz-1 (green), A1			
17	Step Regression		V1-3	V1-3					
18	Logistic Regression		V1-3	V1-3, V1-5	R1-7, R1-8				
19	Logistic/Step Regression Limitations		V1-3	n/a			CC1-2		
20	Decision Trees		V1-3	V1-3	R1-8	W1, A1			
21	Decision Tree Benefits		V1-3	n/a			CC1-2		

- Identified concepts for each lecture
- Video lectures became EMAP Rule Quadrant content

New check-for-understanding questions



- Added, with scoring and characterization, for EMAP Recall Quadrant

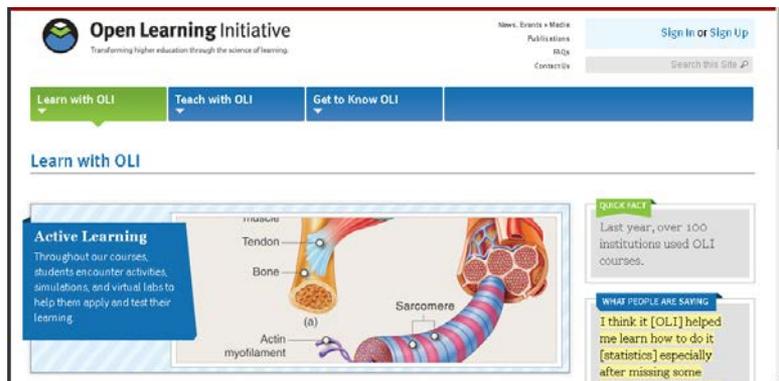
Next Steps: More LTI features in GIFT, direct integration with CTAT

Tighter Integration: Extending GIFT as an LTI Provider

- Give GIFT instructor the option to collect GIFT data on users who took GIFT course via LTI
 - Already available in newer version of GIFT
- Make GIFT report a score to the LTI Tool Consumer
 - Students could see GIFT performance in edX
 - Currently just a single percentage
 - Possibly richer results in LTI v2, but will have to see how many MOOC platforms will support that standard

Making GIFT an LTI Tool Consumer

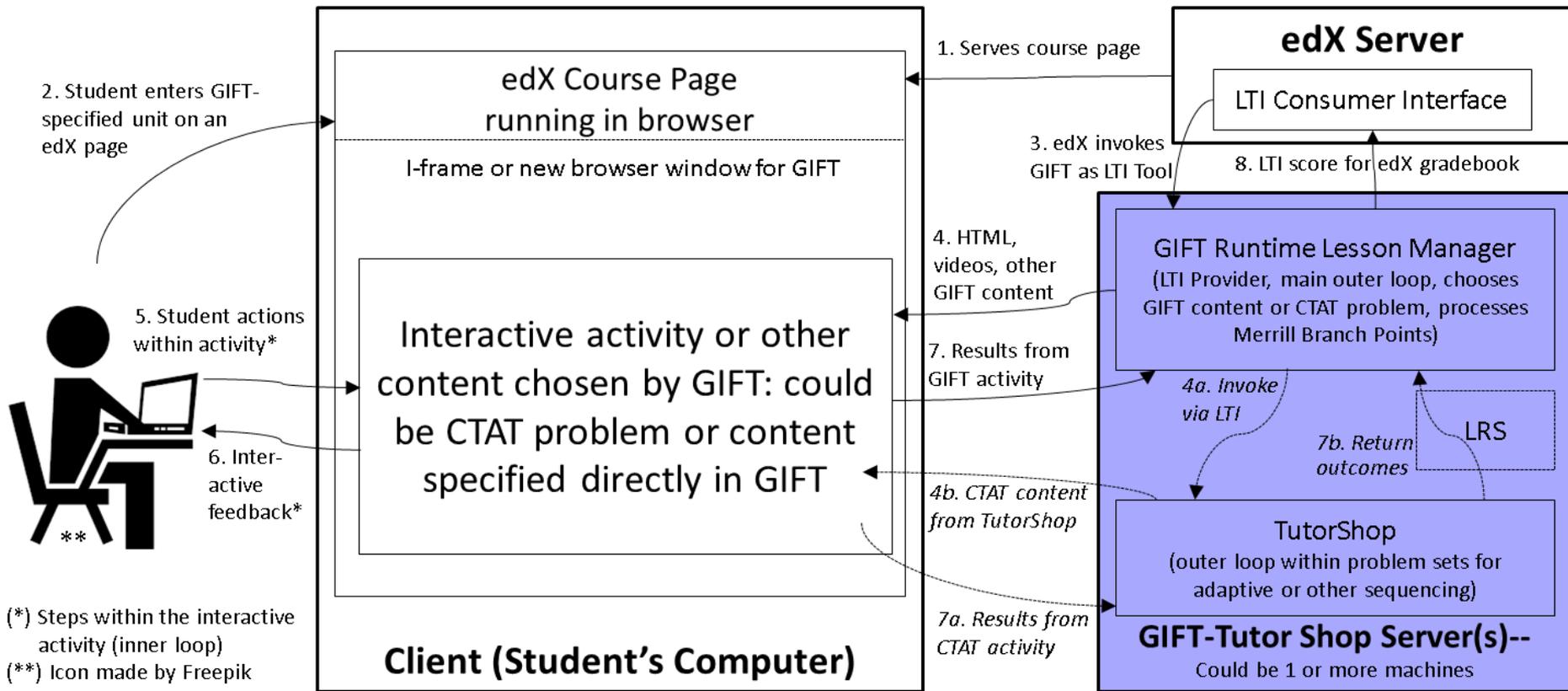
- Consumer is LMS half of the LTI standard
 - Invokes LTI Tool in iframe, dialogue, browser tab (maybe others)
 - Accepts authentication credentials; provides URLs for grading, saving state
- EMAP can choose and sequence CTAT content directly
- GIFT gains the ability to incorporate *any* LTI Tool
 - 100's of off-the-shelf learning activities are LTI Tools (list of certified tools: <https://www.imslobal.org/cc/statuschart.cfm>)



Since some LMSs themselves are LTI Tools, EMAP could route a student to an entire online course, such as those at <http://oli.cmu.edu/learn-with-oli/>

Planned Integration of edX, GIFT, & CTAT

Configuration as it will exist at the end of the project



- GIFT-EMAP selects content from its own and from CTAT activities
- GIFT could affect CTAT behavior by, e.g., specifying skills of interest, mastery thresholds
- CTAT skill values could drive GIFT expertise assessments

Discussion and Outlook

- By integrating GIFT/CTAT/edX, we are creating a MOOC that synergistically combines:
 - GIFT EMAP adaptive outer-loop control for all activities except course discussion forum
 - CTAT adaptive outer loop control and adaptive inner loop functionality, to support multi-step problem-solving activities

- Our project will provide a practical framework for adaptivity in MOOCs, supported by proven authoring tools

Accomplishments

- Initial integration in which GIFT and CTAT activities are embedded separately into edX
- Made GIFT an LTI Provider
- Start bringing BDEMOOC content into GIFT, start creating content for all four EMAP quadrants

Future Work

- For GIFT-EMAP control over CTAT tutors, further extend GIFT to implement the LTI Consumer protocol.
- Enable GIFT to affect CTAT behavior by setting parameters when it invokes CTAT: mastery thresholds, maximum problem counts, etc.
- Bring more content into GIFT.

Thank You

- Questions?
- Contact information:
 - Vincent Alevan, Carnegie Mellon University, aleven@cs.cmu.edu
 - Ryan Baker, University of Pennsylvania, ryanshaunbaker@gmail.com
 - Nathan Blomberg, Dignitas, nblomberg@dignitastechnologies.com
 - Juan Miguel Andres, Penn, miglimjapandres@gmail.com
 - Octav Popescu, CMU, octav@cmu.edu
 - Yuan Elle Wang, Columbia University, ellewy.wang@gmail.com
 - Jonathan Sewall, CMU, sewall@cs.cmu.edu
- Time for a break!

Comparing CTAT & GIFT student models

mathtutor Welcome System Administrator! [Exit](#)

Home » Classes » PCTM Demo

Class: PCTM Demo

Settings Assignments Students Reports

Student Skills All Problem Sets Group by Student

Student	Skill								
Arthur Coble	Trade Value	89%	64%	1	0	2012 Oct 31			
	No Trade	87%	62%	1	0	2012 Oct 31			
	Enter Given Value	97%	72%	1	0	2012 Oct 31			
	Choose Operation	61%	36%	1	0	2012 Oct 31			
	Enter Decimal Point	97%	72%	1	0	2012 Oct 31			
	Enter Addends	100%	75%	1	0	2012 Oct 31			
	Add Column No Carry	99%	74%	1	0	2012 Oct 31			
	Sub Column With No Borrow	86%	61%	1	0	2012 Oct 31			
	Sub Column With Borrow	86%	61%	1	0	2012 Oct 31			
	Add Column With Carry	63%	38%	1	0	2012 Oct 31			
	Add Column With Carry Prev	99%	74%	1	0	2012 Oct 31			
	Sub Column With Borrow And Loan	30%	5%	1	0	2012 Oct 31			
	Enter Expression	66%	41%	1	0	2012 Oct 31			
	Show Your Work	89%	64%	1	0	2012 Oct 31			
	Calculate New Value	79%	54%	1	0	2012 Oct 31			
Enter Variable	66%	41%	1	0	2012 Oct 31				
Enter Given Value	89%	64%	1	0	2012 Oct 31				

Legend Skill Level % Gain Level % Opportunity Count History Last Updated

Print Report Export Report

System Status

- Schools: 63
- Classes: 338
- Students: 27960
- Assignments: 3334
- Packages: 424
- Problem Sets: 466
- Problems: 8129
- Skills: 965
- Categories: 145
- Users: 595

Take a Course Learner Profile Course Creator My Research Help +sewall

Learner Configuration (Read Only)

Engagement

- Self Assessment TwoState
- Sine Wave TwoState

Arousal

- Mouse Arousal
- Q Arousal

Motivation

- Motivation Surrogate Know

Knowledge

- Expertise Surrogate Expe

Anxious

- Generic JSONState Gene

Eng. Concentration

- Kinect Generic

Data Sources

Source	Type
Sensor	Self-Assessment

Add Sensor Add Training Application Remove Data Source

Translate Raw Data

Self Assessment Translator

Classify Learner State

Engagement Two State Classifier

Predict Learner State

Engagement Two State Predictor

Add Interpreter Cancel

Remaining space: 1023 MB

Possible Example of Long-term Vision

How would we like it to work?

- Student in the BDEM00C reports interest in clustering, factor analysis, and bottom-up methods (key topics in educational data mining)
- In week 2 of the course, GIFT adapts to student interest to guide student to topic of interest (clustering), rather than the default path through the course (in which the week 2 topic is prediction models)
- In GIFT recall activities, student successfully demonstrates mastery of key facts and concepts around clustering
- Student starts the clustering CTAT assignment with RapidMiner but skips over the videos on procedures for clustering
- Student struggles with the first CTAT assignment on clustering, specifically with respect to selecting how many clusters to use.
- With data from CTAT, GIFT adaptively recommends that the student watch the video on how to select the number of clusters (it recognizes that the student needs remedial support but has covered the facts and concepts)