



Seventeen Years Later: Why Open Educational Resources Have Not Noticeably Affected Higher Education, and Why We Should Care

Gerd Kortemeyer

Seventeen Years

- October 2002: MIT announces Open Courseware (OCW)
 - Birth of Open Educational Resources (OERs)
 - Shook business models of Virtual Universities in the United States
 - “We don’t sell learning resources but certification of learning”
 - No **monetary** value in learning resources, only in degrees
 - Vast majority of the knowledge of the world is available for free anyway on the web
 - ... somewhere ...

Seventeen Years

- Fast forward to 2019:
 - United States: publisher textbooks still dominate
 - traditional paper or
 - licensed online
 - Europe: “private” lecture scripts, recommended textbooks
- Why have OERs not gained more traction?

Outline

- Advocacy
- Introduce suspected hurdles to adoption of OERs
 1. Discoverability
 2. Quality control
 3. Bridging the last mile
 4. Acquisition
- Followed by proposal to save the world



Advocacy

- Advocacy is important!
- After 17 years of advocacy for OERs, the idea has gained traction
- Reached general agreement: **OERs are a good idea, let's do it!**
 - politically: funding has been available for a long time
 - institutionally and personally: academia has always been about sharing
- Unfortunately, OERs themselves have not gained corresponding traction
 - in the end, it's faculty who decide to use or contribute OERs

Hurdles

You want me
to fill out all
that metadata?

My stuff is in
Moodle, not sure
how to pull it out

What are all
these menus
on the side?

What are all
these menus
on the side?

That's more
than I need

How do I know
this page is
correct?

I don't want a
separate
gradebook!

Can't find a
thing here
...

How do I
get this
into my
course?

I am not going to make my exam
problems open to the world

My students will
get lost following
those links

1. Discoverability

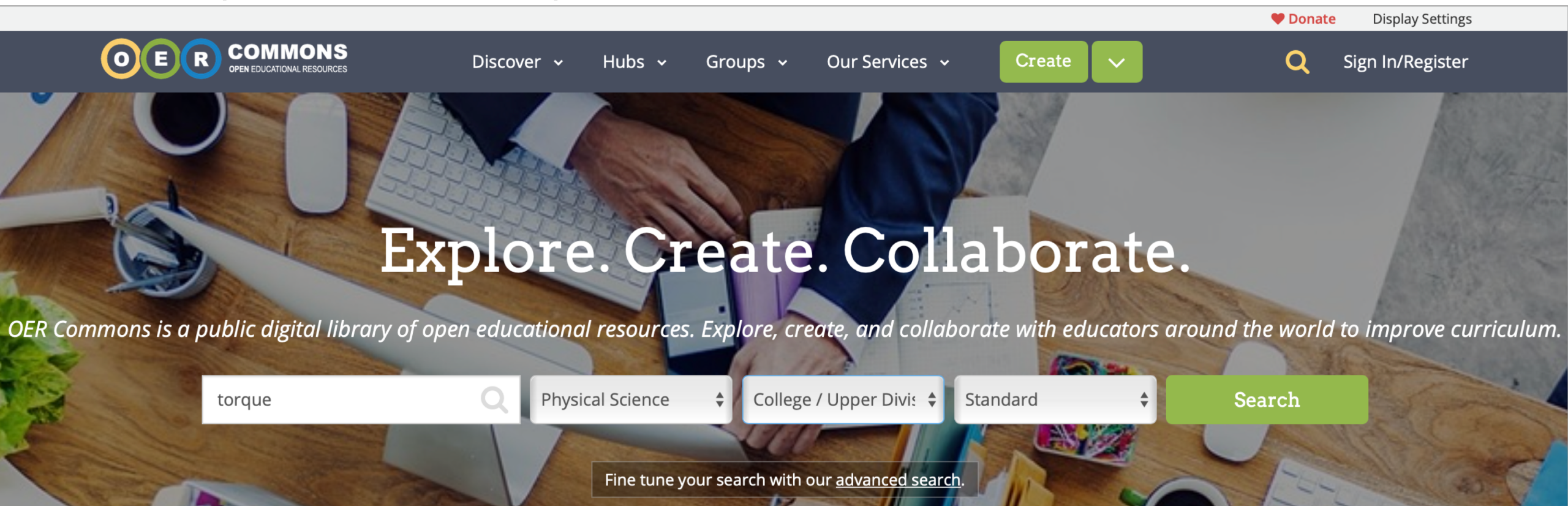
- OERs are only useful if you can actually find them
- Search engines:
 - good at locating and ranking isolated content for specific questions
 - ill-equipped to build curricula, i.e., sequenced content
 - level, pre-requisites

1. Discoverability

- Educational metadata:
 - authors don't fill it out
 - no established taxonomies
 - missing context and sequencing information
 - in reality: unfortunately frequently incomplete, incorrect, and mostly useless
 - expensive to establish and maintain curatorship (like MIT OCW)

1. Discoverability

- Example: search for “torque”



1. Discoverability

The screenshot shows the OER Commons website interface. The top navigation bar includes the OER Commons logo, a search bar, and links for Discover, Hubs, Groups, Our Services, Create, and Sign In/Register. A green arrow labeled "One!?" points to the search results. The left sidebar contains filters for Education Standards, Subject Area (Physical Science, Physics), Education Level (Community College / Lower Division, College / Upper Division), Material Type, and Conditions of Use. The main content area displays search results for "torque" with filters for College / Upper Division and Physical Science. A single result is shown: "Intellus Open Course - College Physics 1 - Lecture Presentations" with a 5-star rating. A green arrow labeled "PowerPoint!" points to the "Material Type" field, which lists "Lecture Presentations" and "Student Guide".

Refine your search

Education Standards

Subject Area

Physical Science

Physics

Education Level

Community College / Lower Division

College / Upper Division

Material Type

Conditions of Use

Search results: torque (1)

Per page 20 By Relevance View

Selected filters: College / Upper Division Physical Science

Intellus Open Course - College Physics 1 - Lecture Presentations

Rating ★★★★★

Accessible presentation files created for the College Physics 1 - Intellus Open ...

More

Subject: Physical Science

Material Type: Lecture Presentations Student Guide

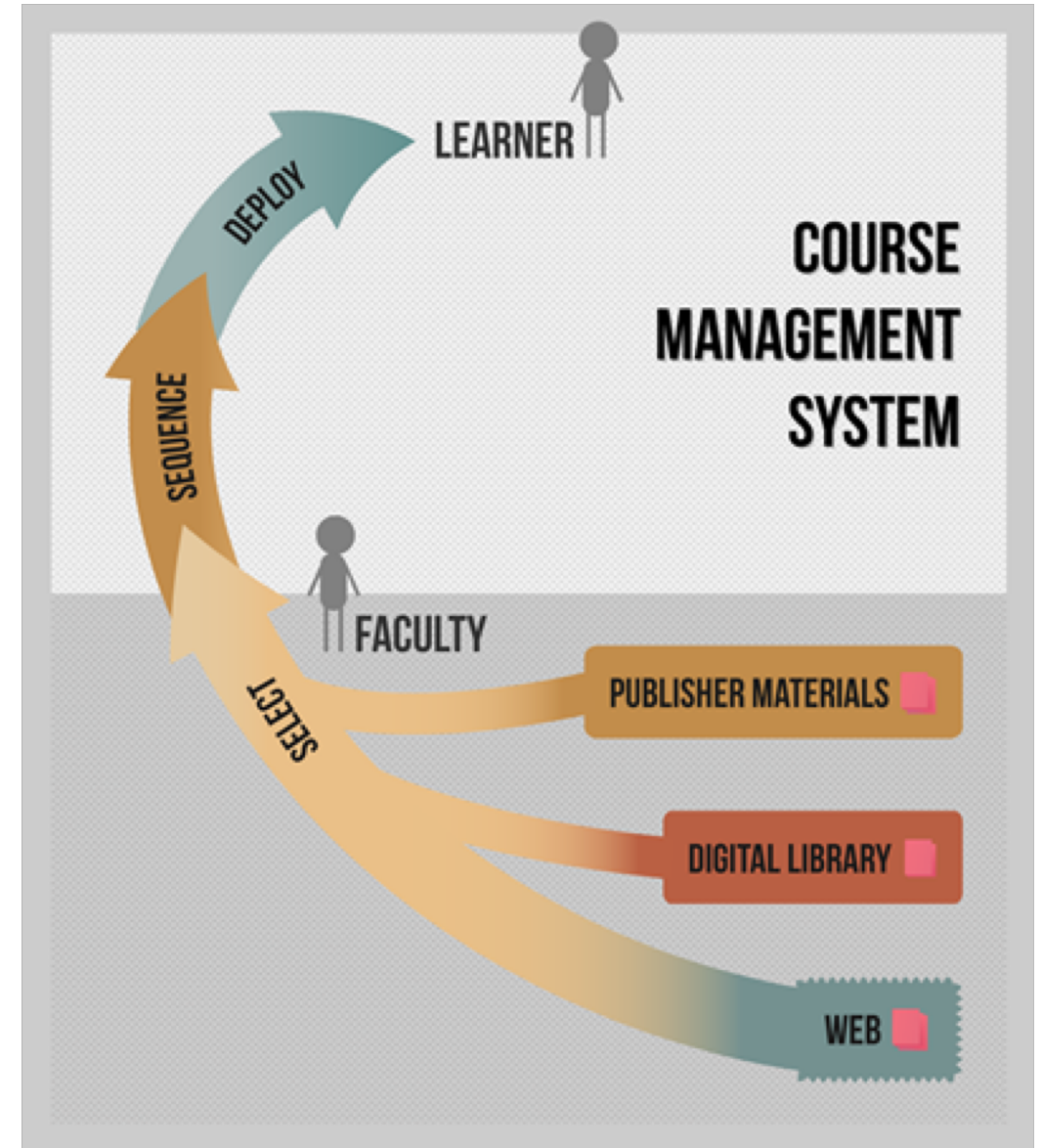
Provider: Intellus Learning

Date Added: 11/12/2018

Conditions of Use: No Strings Attached

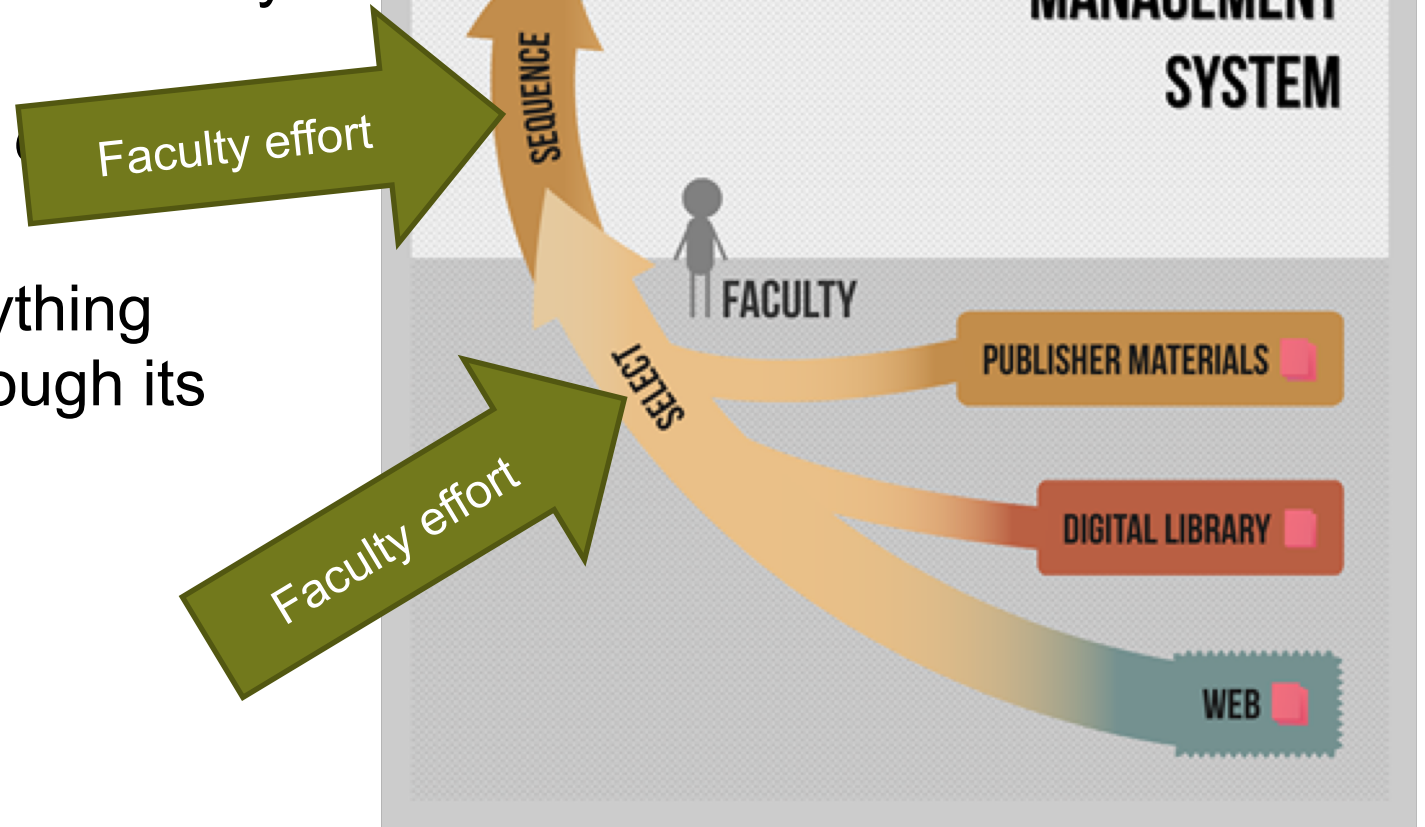
1. Discoverability

- Problem: using a resource is a one-way street of information
- Contextual usage information does not flow back
- Repository does not learn anything about a learning resource through its usage in courses
 - subject-matter information lost
 - context lost
 - sequencing information lost



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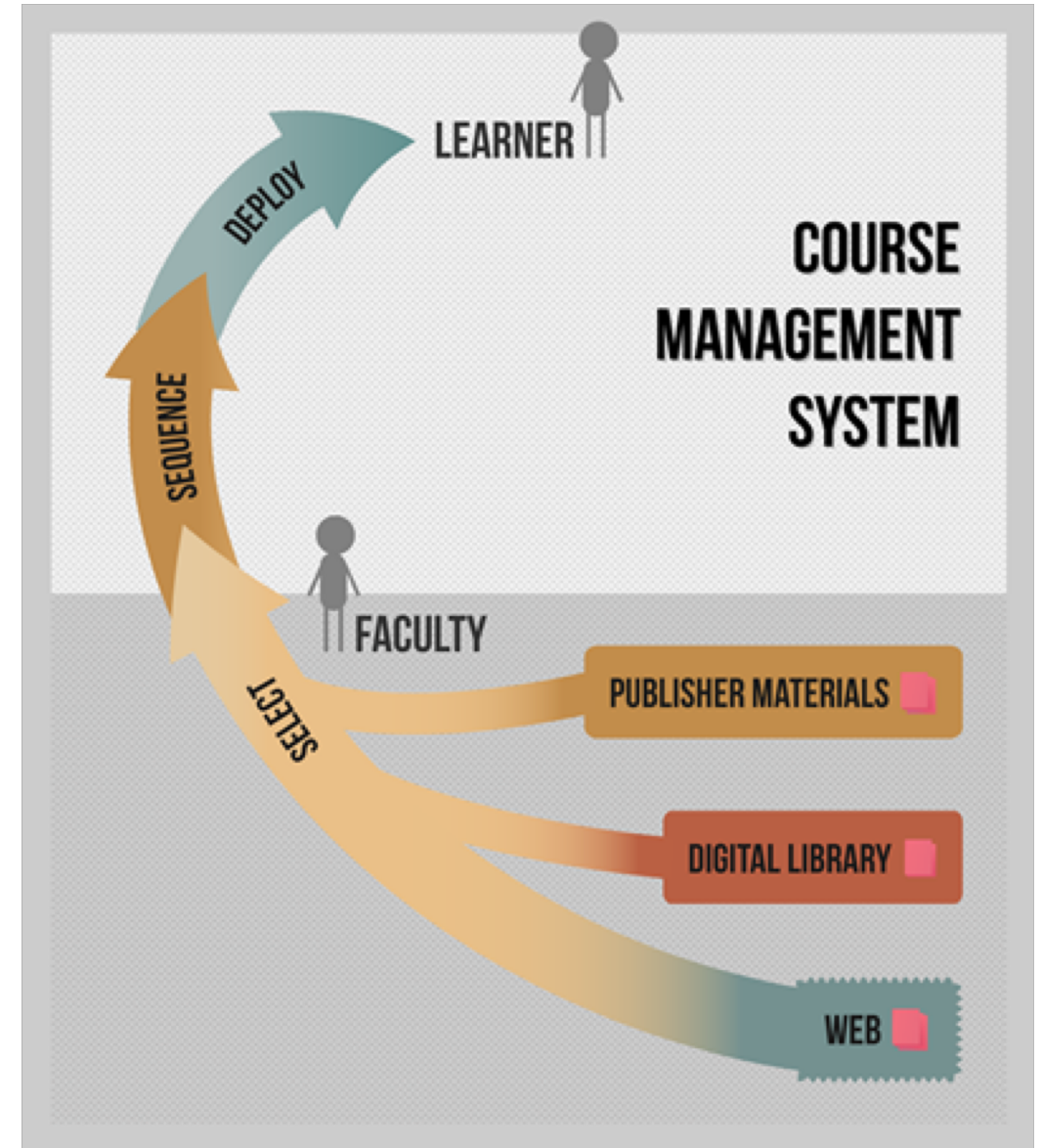
- Nuisance: OER repositories are oftentimes a mix of
 - lesson plans: resources for instructors
 - learning objects: resources for learners
- Most of the time need the latter for online course materials

2. Quality Control

- Errors in materials can be painful
 - frustration
 - confusion
 - detrimental in homework and exams
- Traditionally the forte of publishing companies
 - materials carefully reviewed and edited
- Introduction of reviewers and editors for OERs problematic
 - bottleneck
 - expected volume higher than occasional journal reviews
 - hurdle for authors to publish materials
 - why accept that kind of scrutiny for no reward?

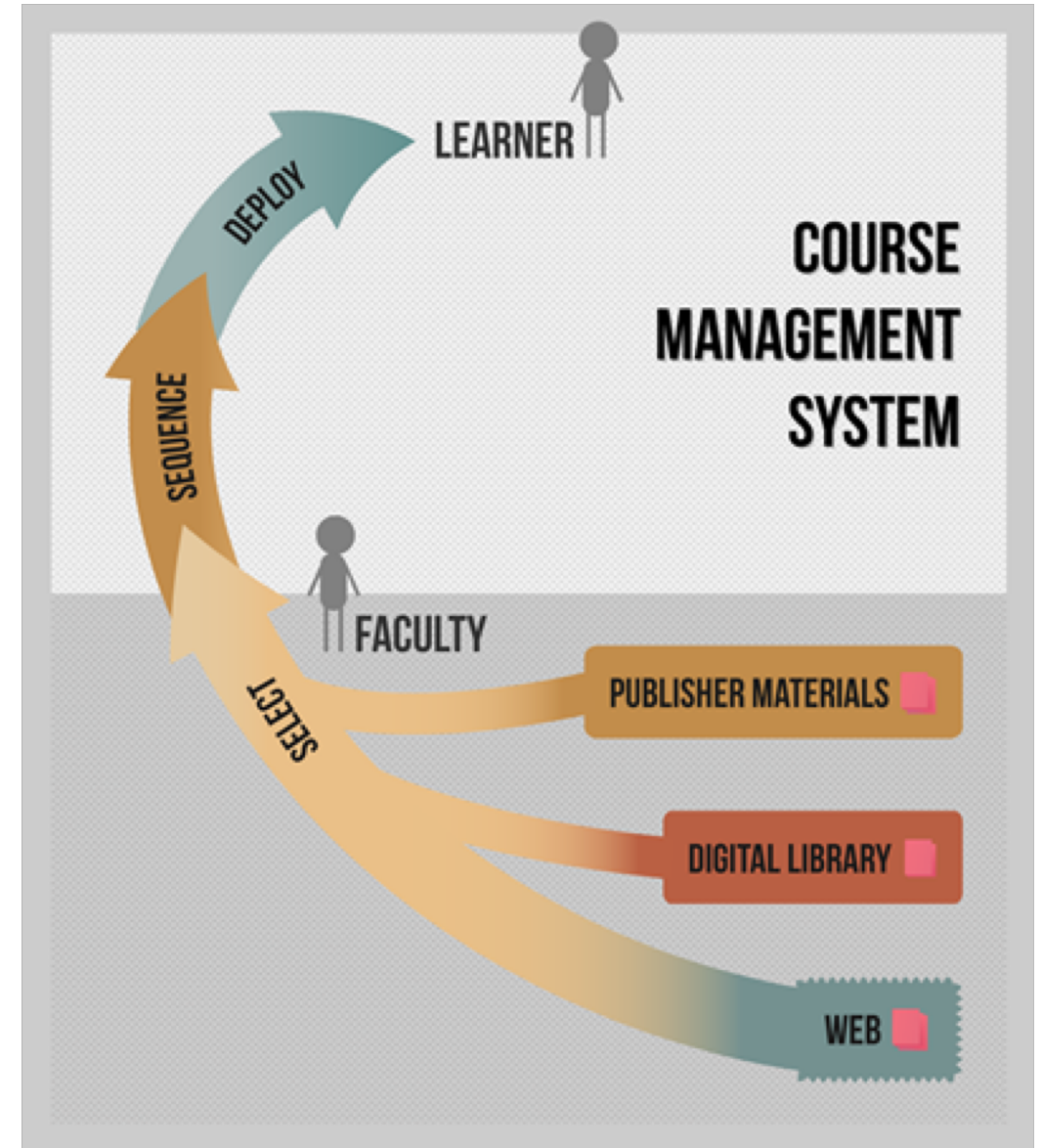
2. Quality Control

- Frequent use is an indicator of quality
- One download from a repository could mean anything from
 - instructor looked at it and discarded it
 - thousands of students using it in courses
- No information flows back



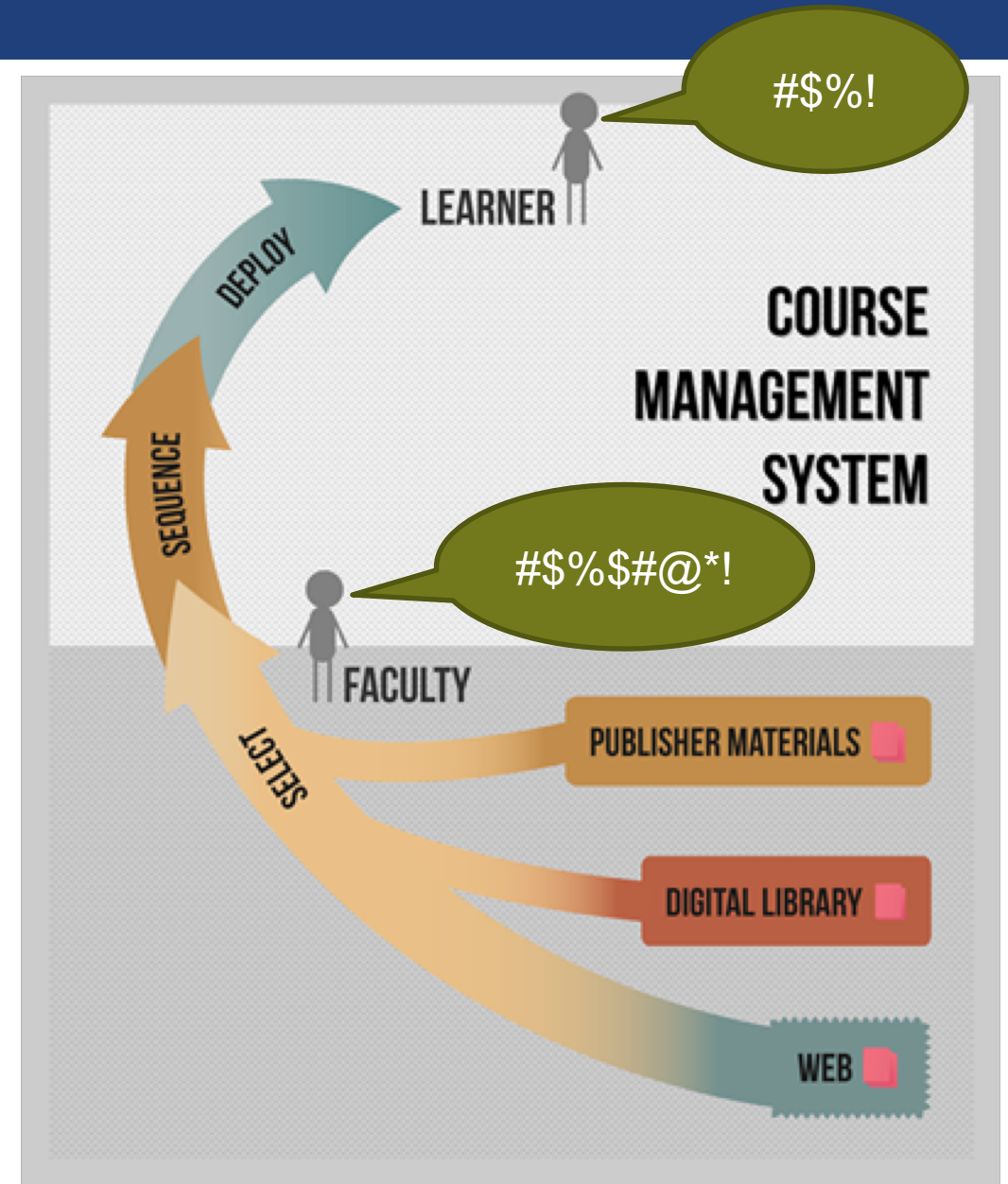
2. Quality Control

- Problem: using a resource is a one-way street of information
- Faculty selecting a resource is a form of peer review
 - information lost
- For homework and exam problems: item difficulty and discrimination information
 - information lost



2. Quality Control

- And: fixing bugs, typos, or errors does not fix the original resource



3. Last Mile

- Typical problem in telecommunications:
 - fiber optics running through town
 - no connections into the neighborhoods
- “Bridging the last mile”
- In courses, the neighborhood is usually a course management system
 - Moodle, BlackBoard, D2L, Canvas, ...
- Using OERs means either
 - downloading and uploading again (including dependencies!)or
 - linking to it

3. Last Mile

- Many OERs already contextualized
- Very hard to reuse

Branding

Branding

Platform Functionality

Menu

Menu

The screenshot displays the comPADRE website, which is part of the Physics and Astronomy Education Communities. The interface includes a top navigation bar with options like 'Save', 'My items', 'Comment', 'Evaluate', 'Tags', 'Link', and 'Share'. A sidebar on the left contains a 'Menu' with various categories such as 'comPADRE Pedagogic Library', 'PhET Interactive Science Simulations', and 'Teaching with Data Simulations'. The main content area features a search bar, a 'Menu' button, and a list of collections. The selected collection is 'Introduction to Torques: A Question of Balance, Featuring the Sledge Hammer of the Sierra Madre' by Steve Shropshire. The page includes a 'Summary' section with a photograph of a sledge hammer and a detailed description of the activity, which involves introducing torques and static balance to students.

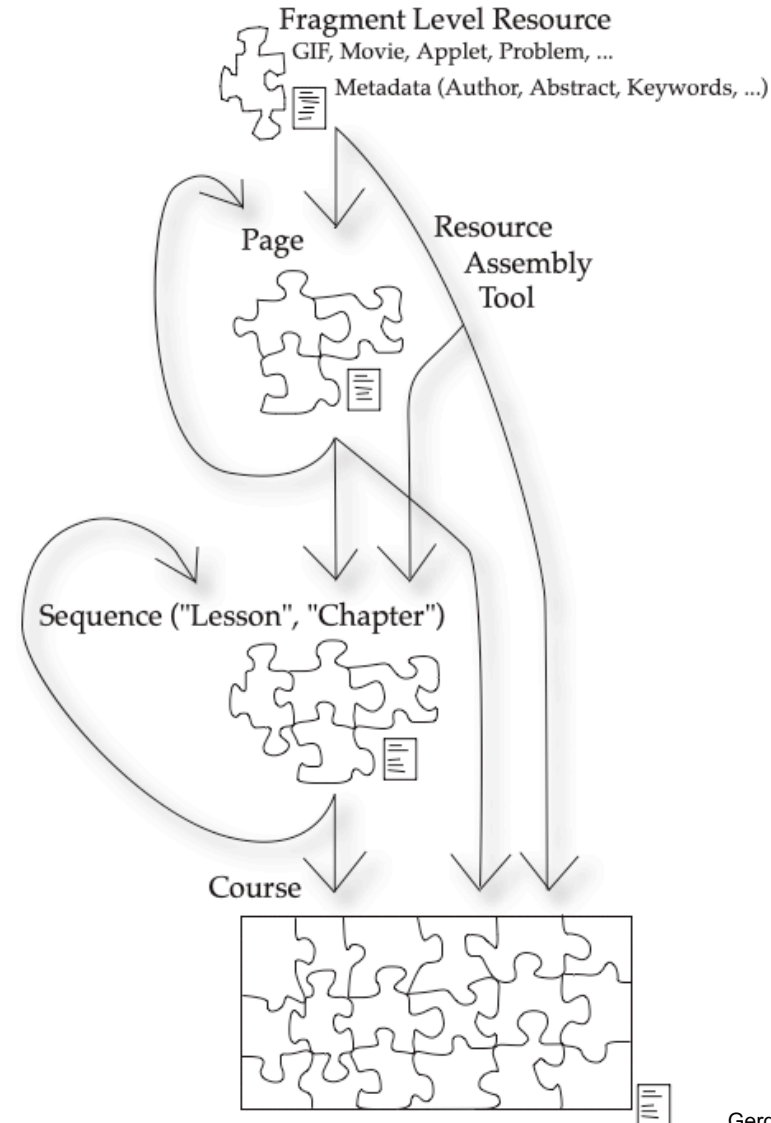
3. Last Mile

- OER quizzes
 - Performance data does not go into the gradebook of the course management system
 - Performance data split across platforms

The screenshot shows a quiz interface with a dark purple header. The header contains a search icon and the text 'Find a Quiz', and a plus icon and the text 'Create a new quiz'. Below the header, the quiz title 'Torque and more' is displayed with a document icon. To the left of the title is a small image of a globe on a stand. Below the title, the quiz is categorized as '10th - University grade' and 'Physics'. It has been taken '58 times' and has an 'average accuracy' of '55%'. Below this information, there are buttons for '0' (likes), 'Save', and 'Duplicate'. The quiz was created '2 years ago' by 'sancheal'. Below the quiz details, there are two main sections: 'Host a game' and 'Play solo'. Under 'Host a game', there are buttons for 'Live Game' and 'Homework'. Under 'Play solo', there is a button for 'Solo Game'. Below these sections, it says '29 Questions' and there is a 'SHOW ANSWERS' link. The first question is displayed: 'Question 1' with a 30-second timer. The question text is 'Q. What force does not cause any torque?'. To the left of the question is a diagram of a lever with a fulcrum in the center. A blue block is on the left end of the lever, and a green block is on the right end. Arrows indicate forces acting on the blocks. Below the question, there are four answer choices, each with a radio button: 'Force perpendicular to the fulcrum, and not on the fulcrum', 'Force horizontal to the fulcrum, and not on the fulcrum', 'Force perpendicular to the fulcrum, and slightly off center of the fulcrum', and 'Forces at a 45 degree angle to the fulcrum, and not on the fulcrum'.

3. Last Mile

- Wrong granularity
- Oftentimes OERs come as whole modules or long pages
 - cannot remix or re-sequence
- Need fine-granular content
- Compiling and sequencing should happen within platform
 - information stored
 - combinations become new OERs



4. Acquisition

- Convincing faculty to make OERs available is challenging:
 - Discoverability:
 - forcing faculty to fill out elaborate metadata: they won't upload
 - Quality control:
 - faculty might want to keep control over their resources, so they can fix bugs, etc.
 - Last mile:
 - hard to extract a resource from course management system, then uploading it to repository

4. Acquisition

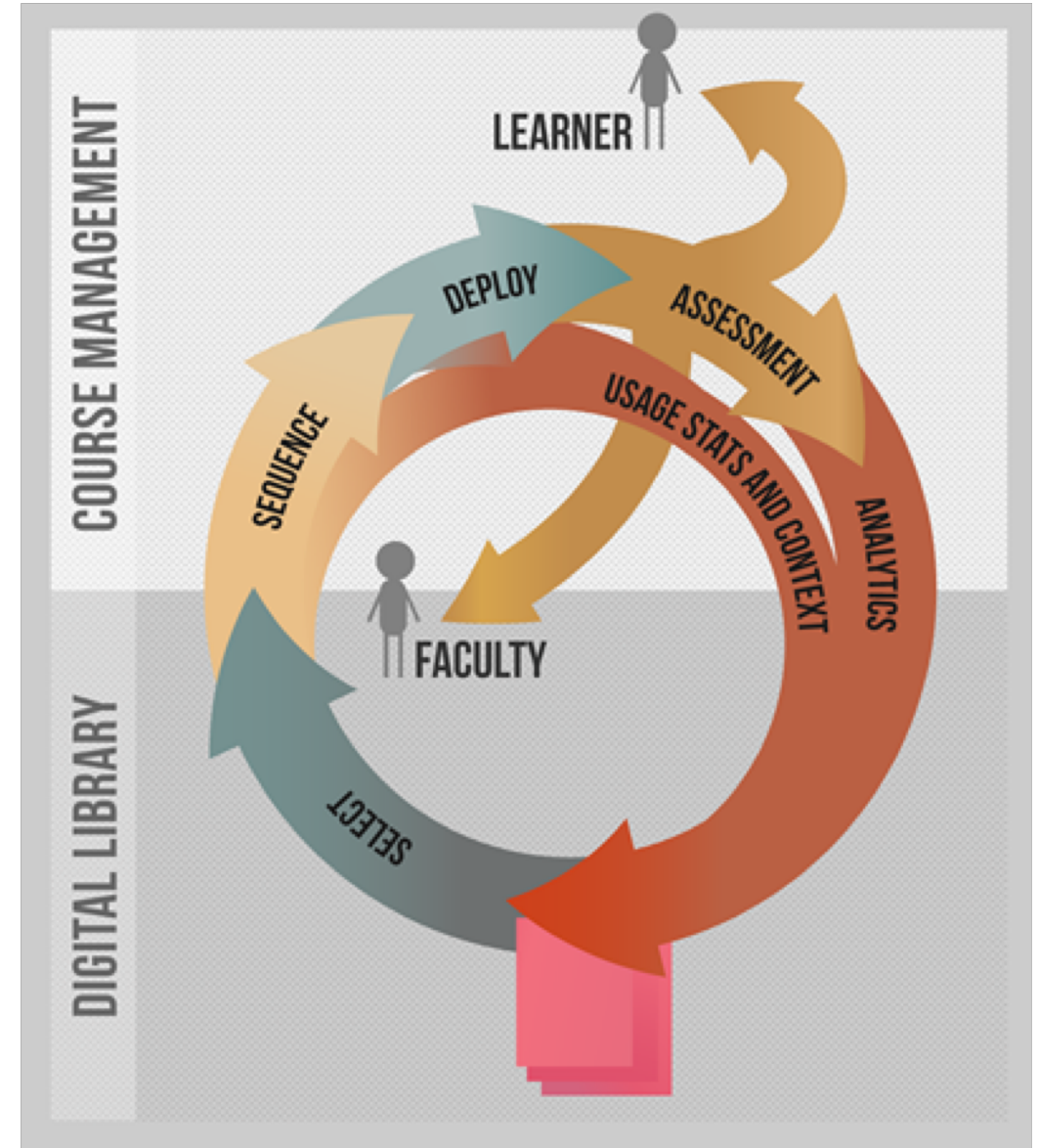
- Some content can be available to other faculty, but not students:
 - exam problems, homework, sample solutions
- Assessment content, particularly if electronically graded, is not "open source."
- A repository must not only preserve the integrity of the entrusted content but also has stewardship obligations
 - current OER licenses have no provision for this kind of openness
 - repositories have no way of enforcing licenses when content is deployed outside these systems

4. Acquisition

- Pure OER-ideology maybe not helpful:
 - it's about **sharing** ...
 - ... but sharing is not necessarily black-and-white!
- Faculty need some control over their content:
 - e.g. only visible to other faculty
 - then only visible to learners after other faculty selected it
 - derivative works
 - enforcing campus-licenses
 - ...

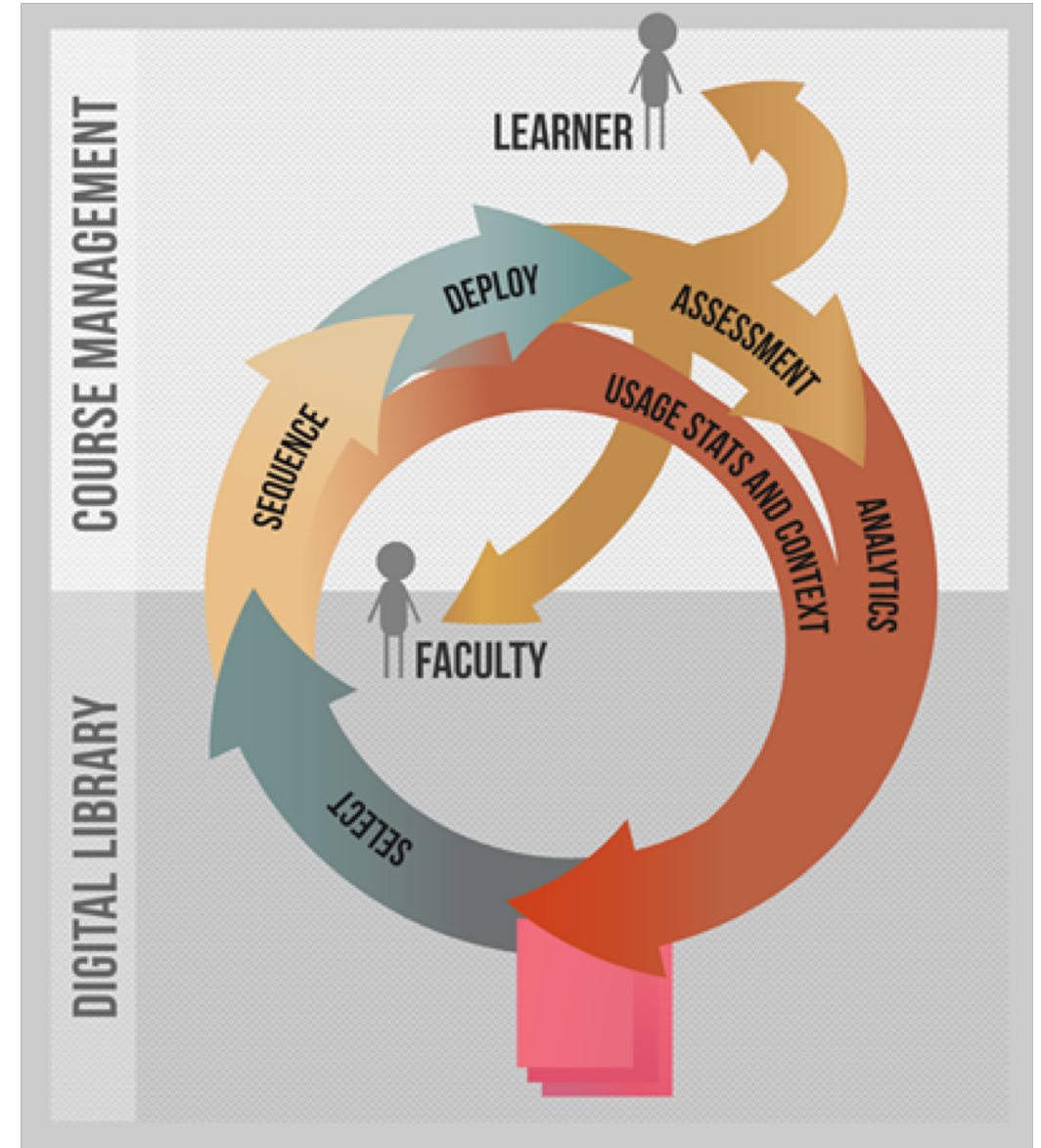
Proposal to Save the World

There it is!



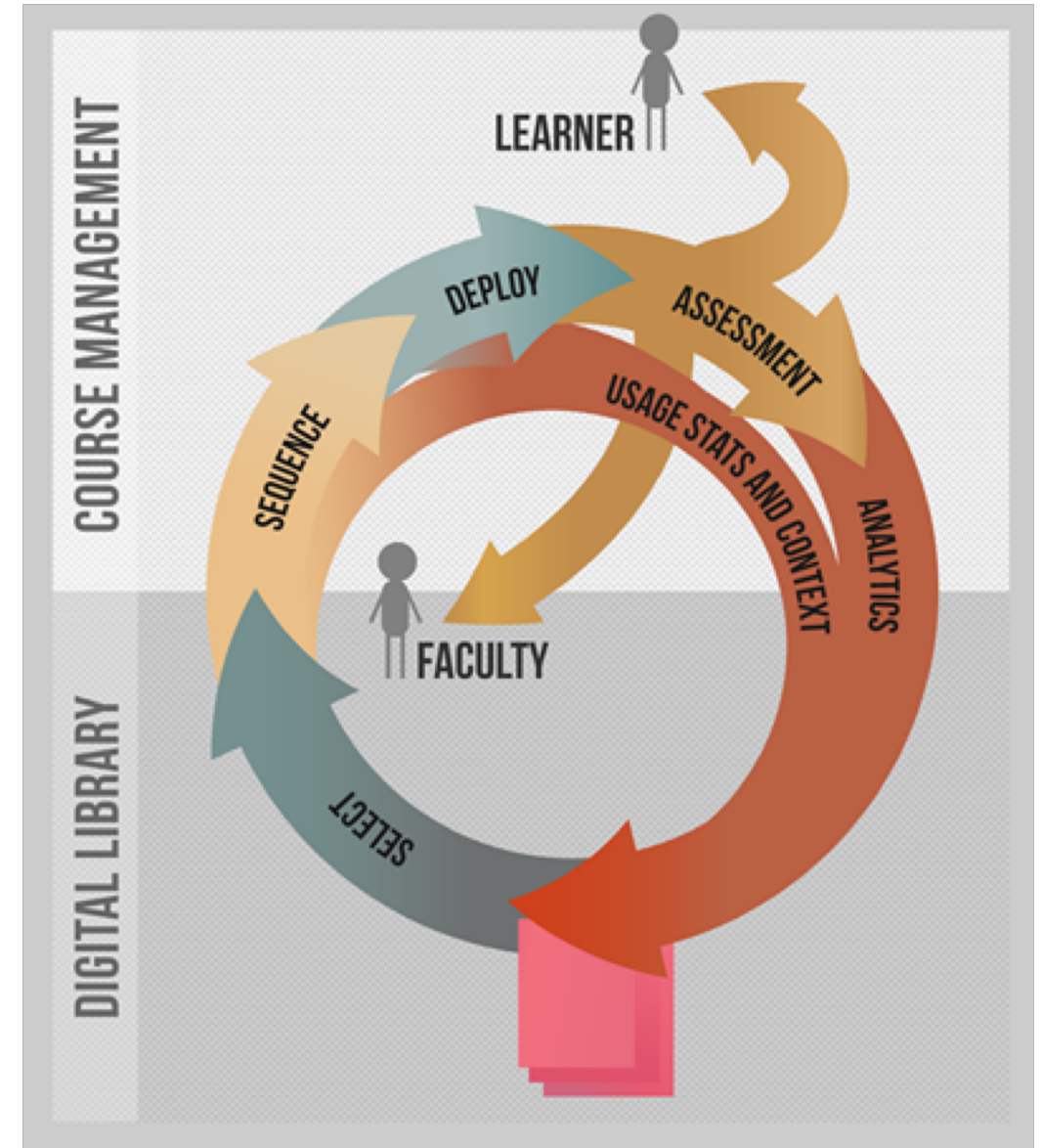
Integrating Course Management System and Repository

- Closing the circle
- Flowing back into metadata of resource:
 - Selection information (“peer review”)
 - Usage information (quality/reliability)
 - Sequencing information (context)
 - Analytics (test theoretical properties)
- Flowing back into gradebook:
 - Performance data
- Flowing back into learner profile
 - Getting to know the learner (temporary data!)

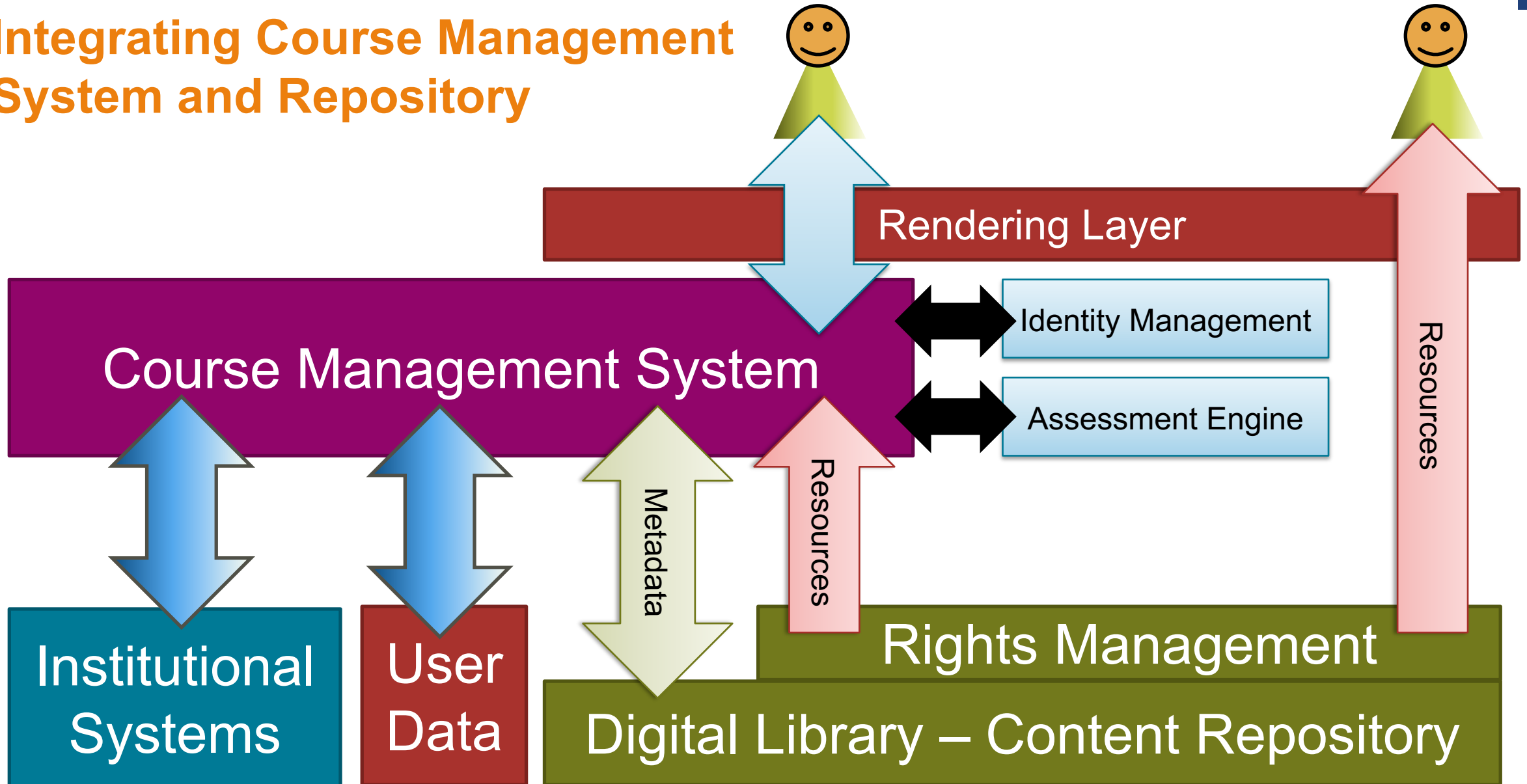


Integrating Course Management System and Repository

- Enabling:
 - discovery: dynamic metadata
 - context, sequencing
 - resource recommendations to faculty
 - quality control:
 - test-theory, etc.
 - adaptivity:
 - formative feedback to faculty
 - recommendations for learners

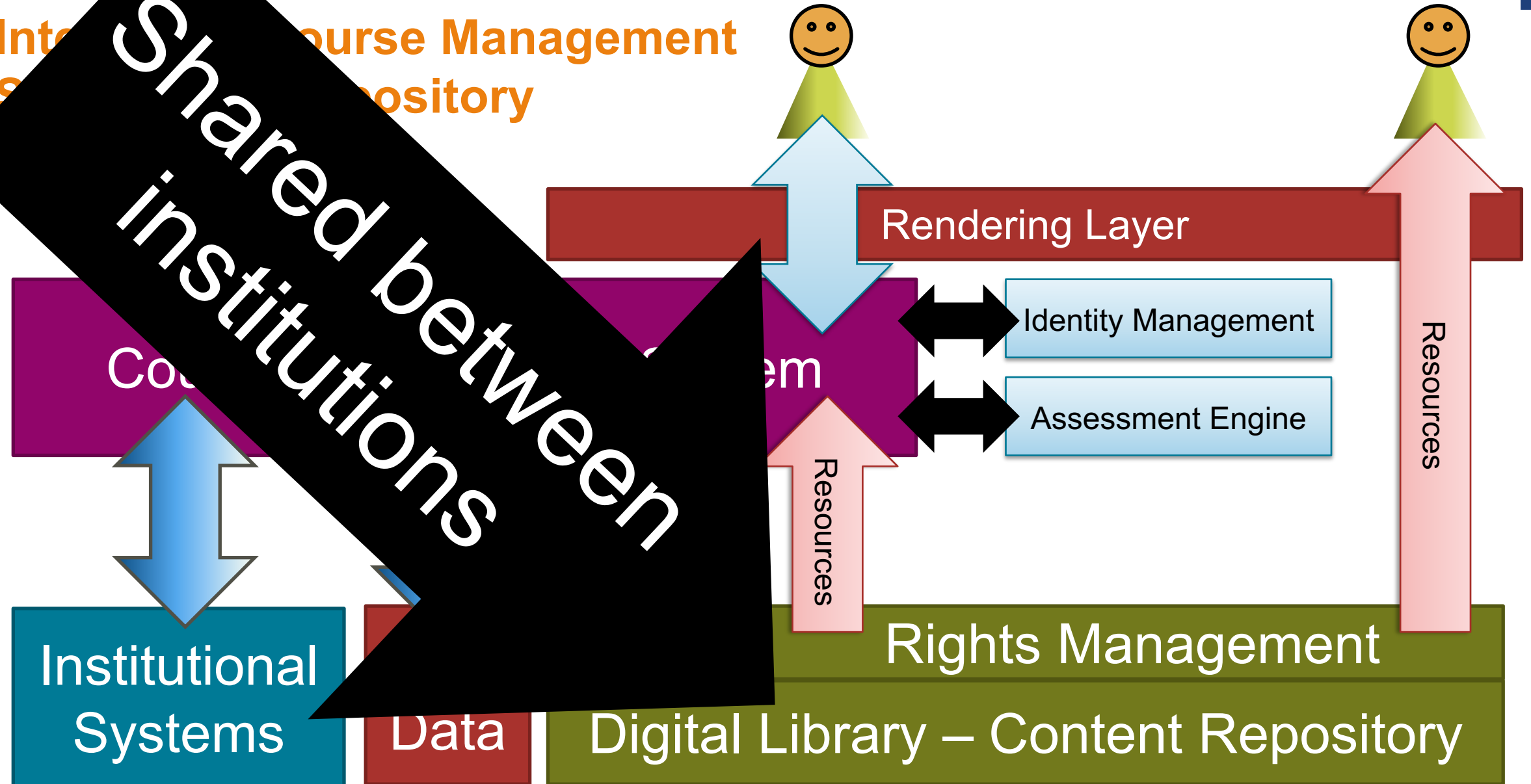


Integrating Course Management System and Repository

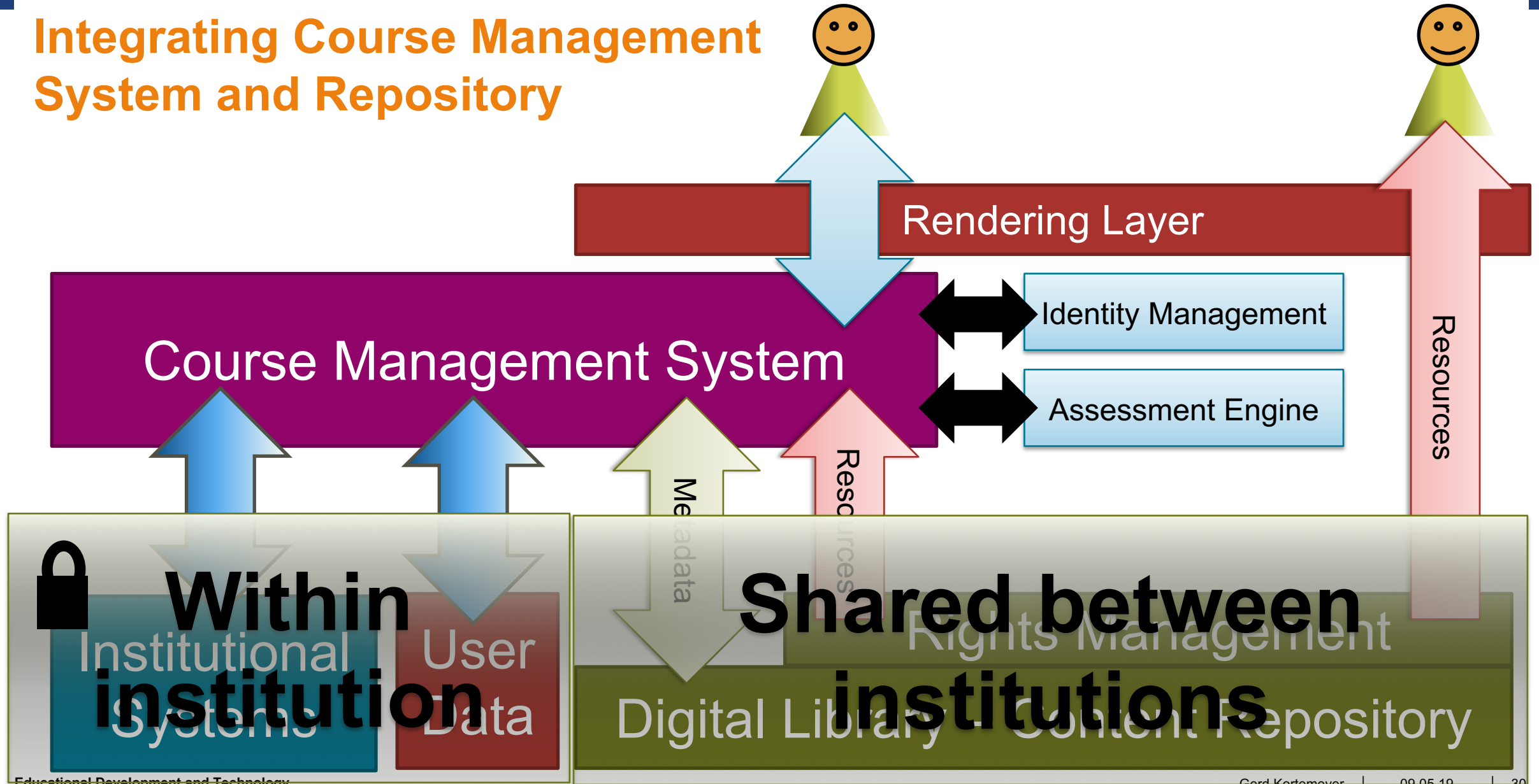


Inter Course Management
Repository

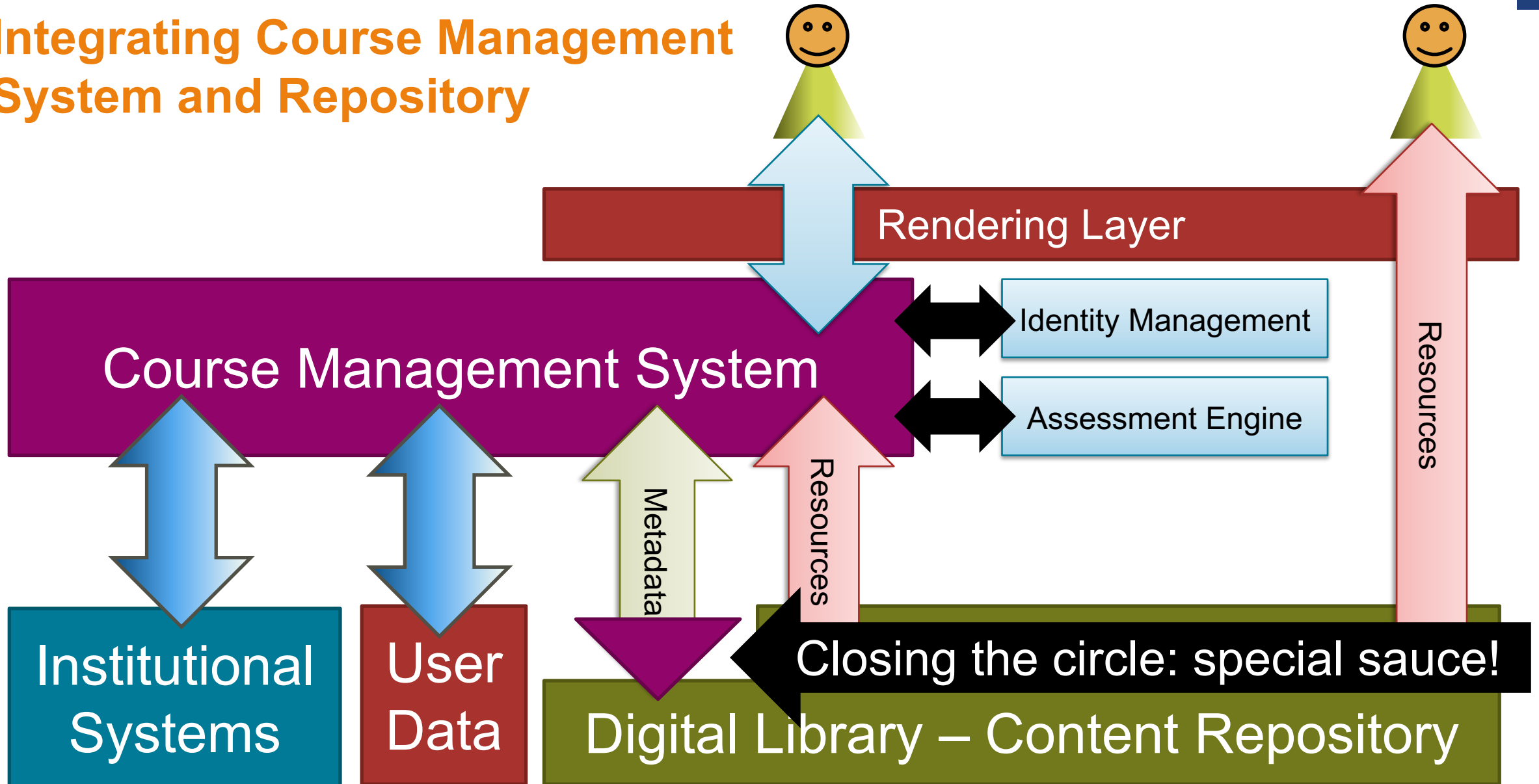
Shared between
institutions



Integrating Course Management System and Repository



Integrating Course Management System and Repository



Proof of Concept: LON-CAPA

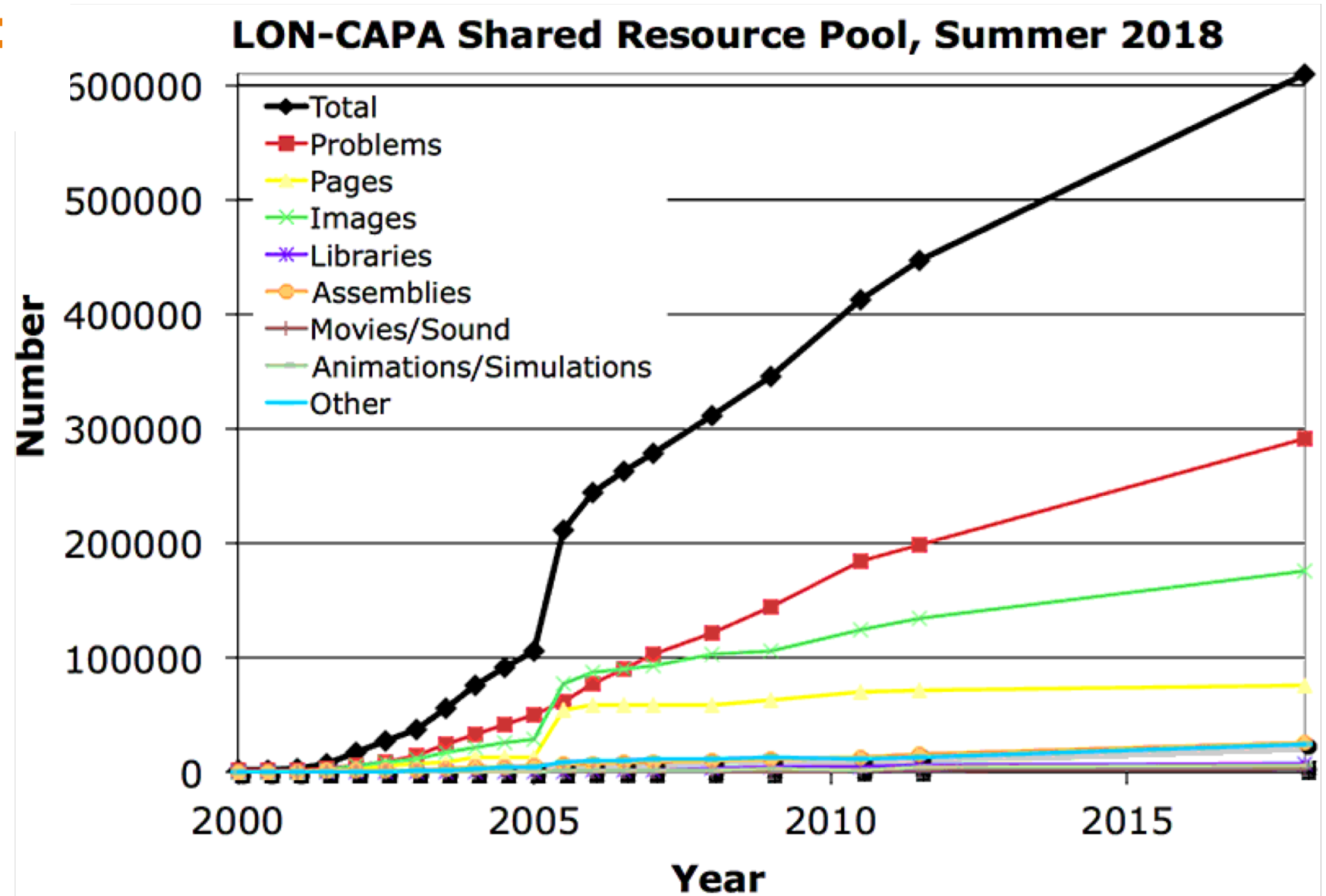
- 160 partner institutions
- 48% postsecondary institutions
- 610,000 shared learning objects
- 300,000 shared homework problems
- >7,700 courses hosted
- >965,000 student-course enrollments
- 94% postsecondary student-course enrollments
- >150,000 student-course enrollments per year
- >73,520,000 problems served
- >138,320,000 problem transactions
- >72,560,000 problems solved

Proof of Concept: LON-CAPA

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Proof of Concept: LON-CAPA



Proof of Concept: LON-CAPA

Typical course:

Sequenced learning
resources

The screenshot displays a LON-CAPA course interface for 'Time-Varying Currents Materials'. The course content is organized into a list of items, each with a blue circular icon and a question mark. The items are: Introduction, RC Circuit, RC Circuit Example, Applet: RC Circuit with Battery, RL Circuit with Battery, RL Circuit with Battery Example, LC Circuit, LC Circuit with Battery Example, LC Circuit Time Evolution, LC Time Evolution Example, DC RCL Circuit, DC Circuit Basics, Alternating Currents and Voltages, Applet: Oscilloscope, AC Power Dissipation in a Resistor, AC Power Dissipation Example, RMS Current, Voltage, and Power, Inductance in an AC Circuit, Inductance in AC Circuit Example, RL-Circuits, and Capacitor in an AC Circuit. The items 'DC Circuit Basics', 'RMS Current, Voltage, and Power', and 'RL-Circuits' are marked with a red 'X' and the text 'Answer available'. The item 'RL-Circuits' is also marked with a question mark. Green arrows point to specific items: 'Reading Materials' points to 'Introduction', 'Simulations' points to 'Applet: RC Circuit with Battery', 'Examples' points to 'RL Circuit with Battery Example', 'Discussions' points to 'LC Circuit with Battery Example', and 'Homework' points to 'RL-Circuits'.

Item	Icon	Answer available
Introduction	Blue circle with question mark	
RC Circuit	Blue circle with question mark	
RC Circuit Example	Blue circle with question mark	
Applet: RC Circuit with Battery	Blue circle with question mark	
RL Circuit with Battery	Blue circle with question mark	
RL Circuit with Battery Example	Blue circle with question mark	
LC Circuit	Blue circle with question mark	
LC Circuit with Battery Example	Blue circle with question mark	
LC Circuit Time Evolution	Blue circle with question mark	
LC Time Evolution Example	Blue circle with question mark	
DC RCL Circuit	Blue circle with question mark	
DC Circuit Basics	Blue circle with question mark	Answer available
Alternating Currents and Voltages	Blue circle with question mark	
Applet: Oscilloscope	Blue circle with question mark	
AC Power Dissipation in a Resistor	Blue circle with question mark	
AC Power Dissipation Example	Blue circle with question mark	
RMS Current, Voltage, and Power	Blue circle with question mark	Answer available
Inductance in an AC Circuit	Blue circle with question mark	
Inductance in AC Circuit Example	Blue circle with question mark	
RL-Circuits	Blue circle with question mark	Answer available
Capacitor in an AC Circuit	Blue circle with question mark	

Proof of Concept: LON-CAPA

Gerd Kortemeyer ▾ (Course Coordinator) **PHY233B, Spring 2015 - Calculus Concepts in Physics I** (More ...) Messages Roles Help Logout

Main Menu | **Contents** | **Course Editor** | **What's New** | **Grades ▾** | **People ▾** | **Settings ▾** | **Public ▾** | **Switch role ▾**

Course Contents ▸ Momentum and Collisions ◀ Timer Notes Stored Links Evaluate Feedback Print Info

Functions Edit Grades Content Settings

Superman Stops Train

Due this Friday, Feb 27 at 11:00 pm (EST)

An out-of-control train is racing toward this terminal train station - only Superman can help. The train has a mass of 45000 kg, and Superman has a mass of 103 kg. If the train has a velocity of 35 m/s, how fast does Superman have to fly in the opposite direction to stop it in a totally inelastic steel-Man-of-Steel collision?

Submit Answer Tries 0/5

Randomized problem

Multiple tries

Open-ended numerical



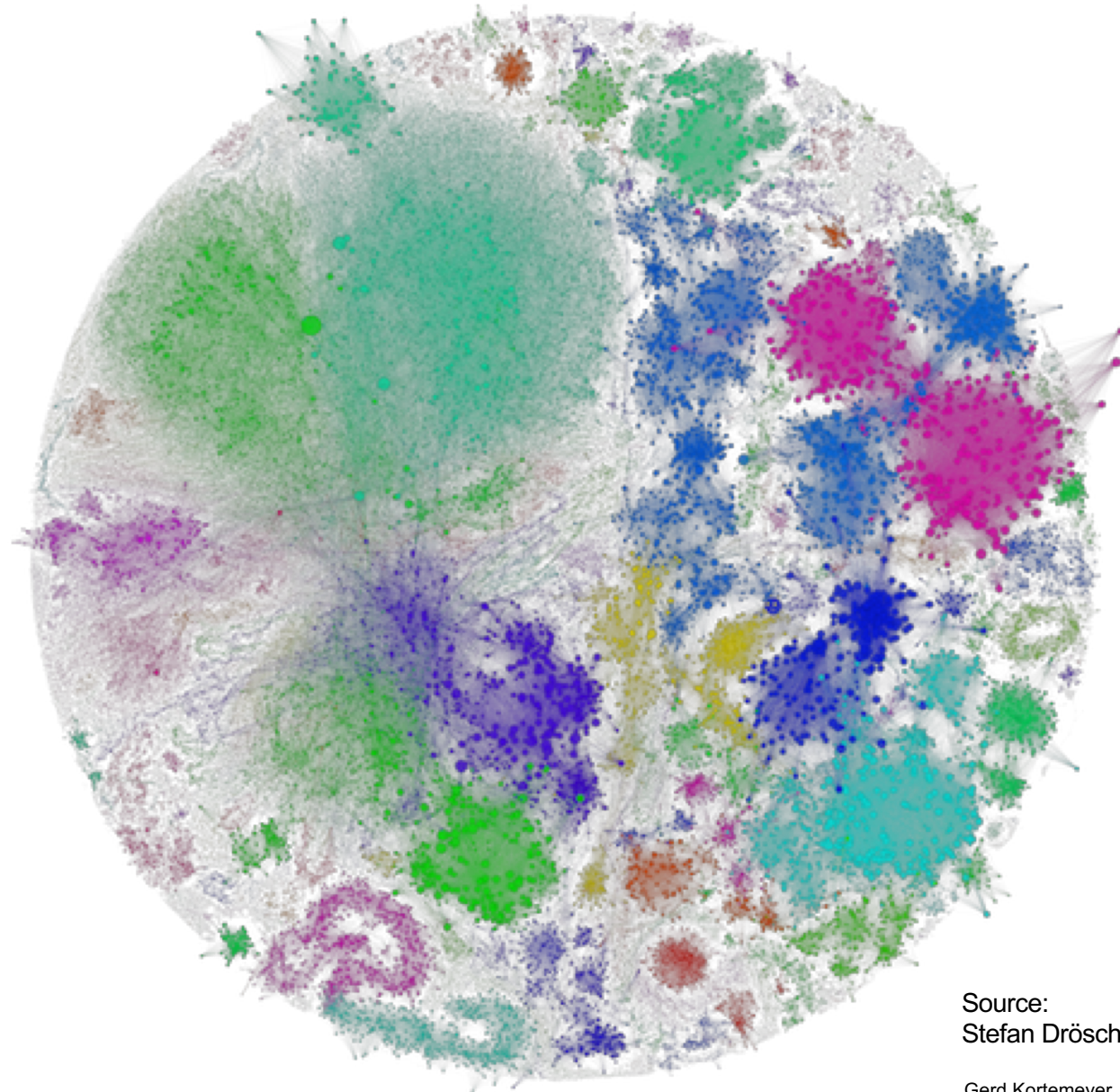
Post Discussion Send Feedback

Discovery

- Need sequenced “shopping cart”
- Amazon-like: “People who bought this also bought that”
 - But beyond: “People who bought this also bought that **afterwards**”

Discovery

- Graph of the LON-CAPA Resource Pool
- What follows what in course sequences?
- Vertices: Resources
- Edges: “comes after”
- Clustering: approximately corresponding to subject areas



Source:
Stefan Dröschler

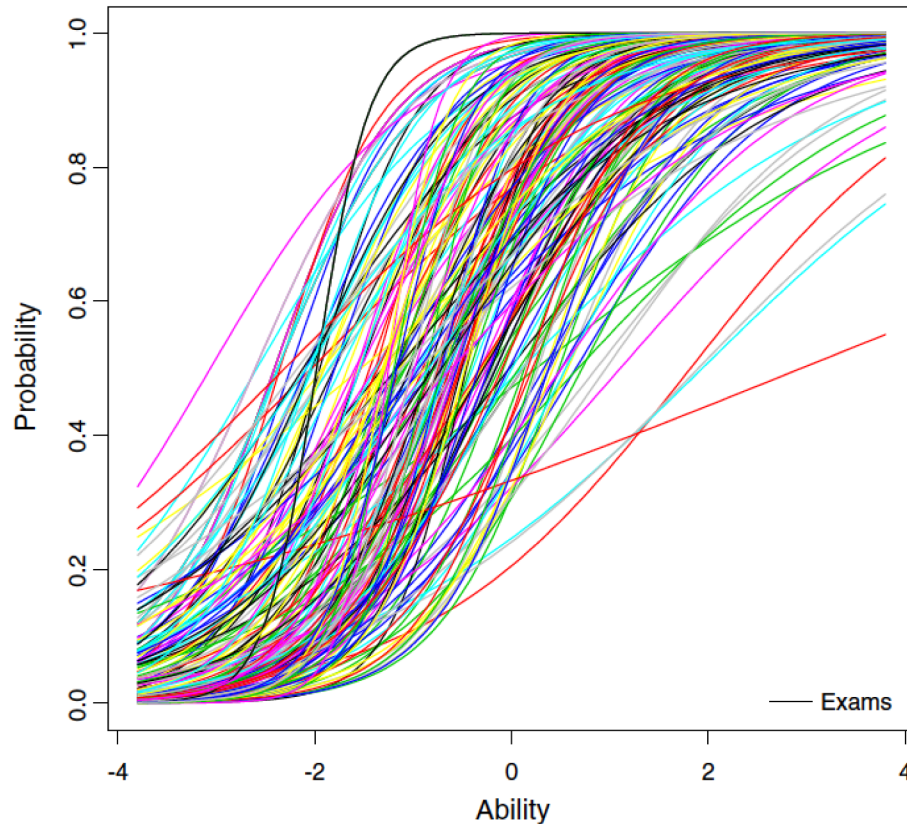
Quality Control

- Usage statistics
- Problem characteristics (“item parameters”)

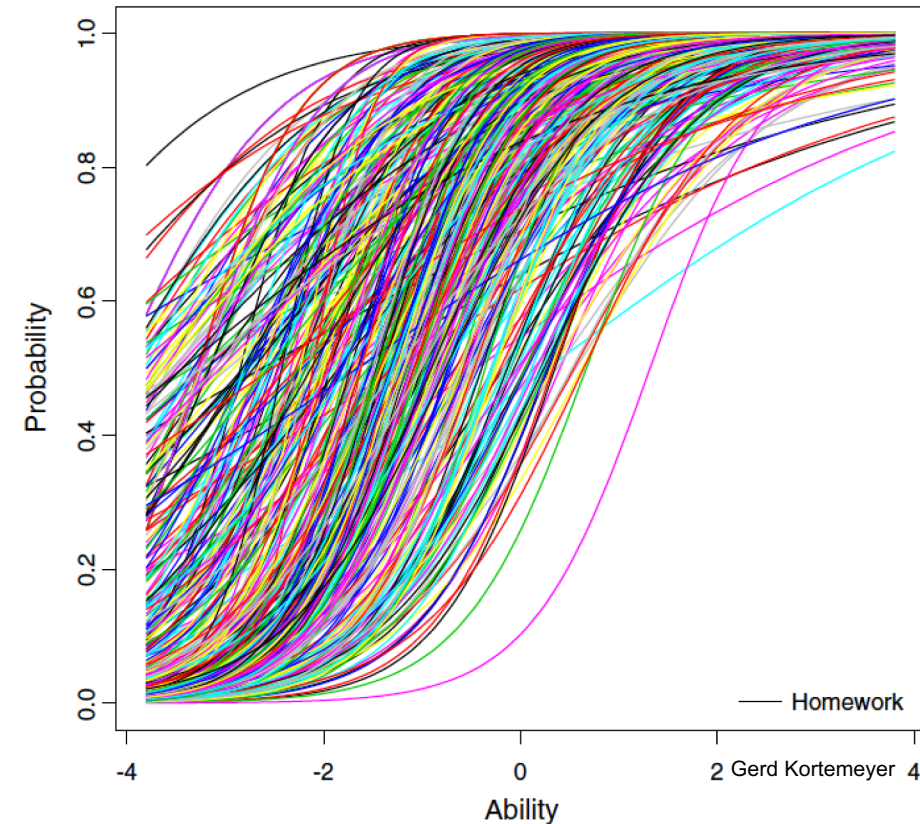
Quality Control

- Item Response Theory, using transactional data

Exams

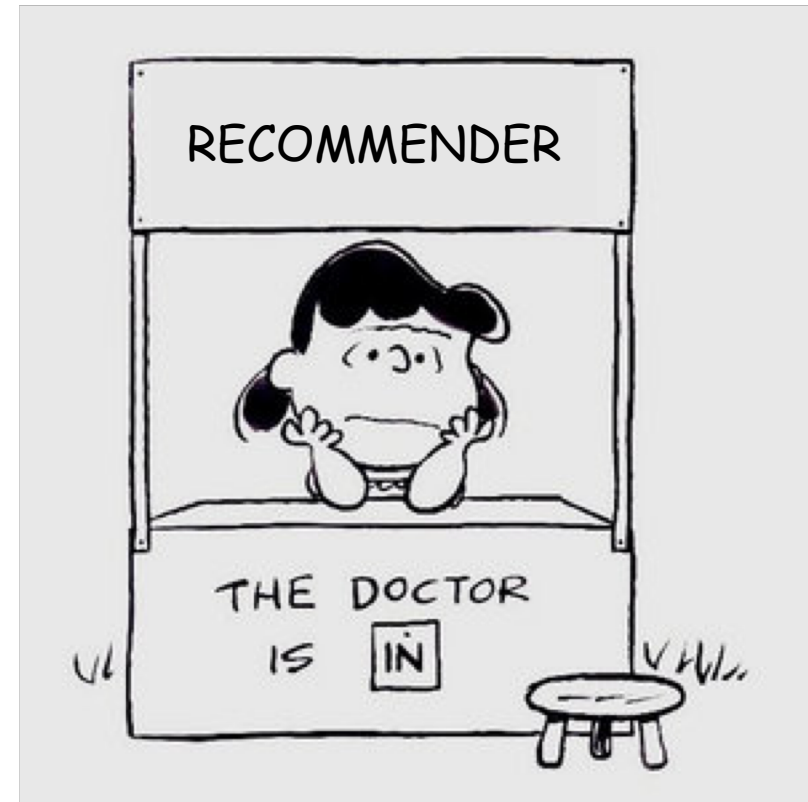


Online Homework



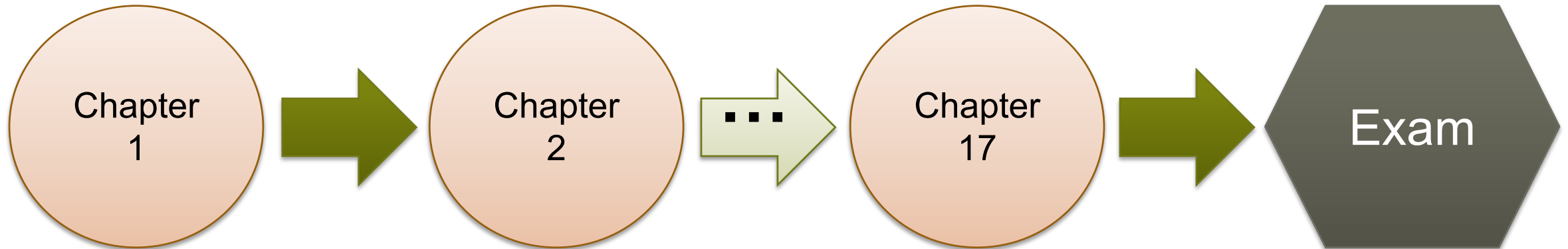
Adaptivity

- Large resource pool of OERs
 - wide variety of materials
 - at different level
- Large number of opportunities to help learners reach their goals



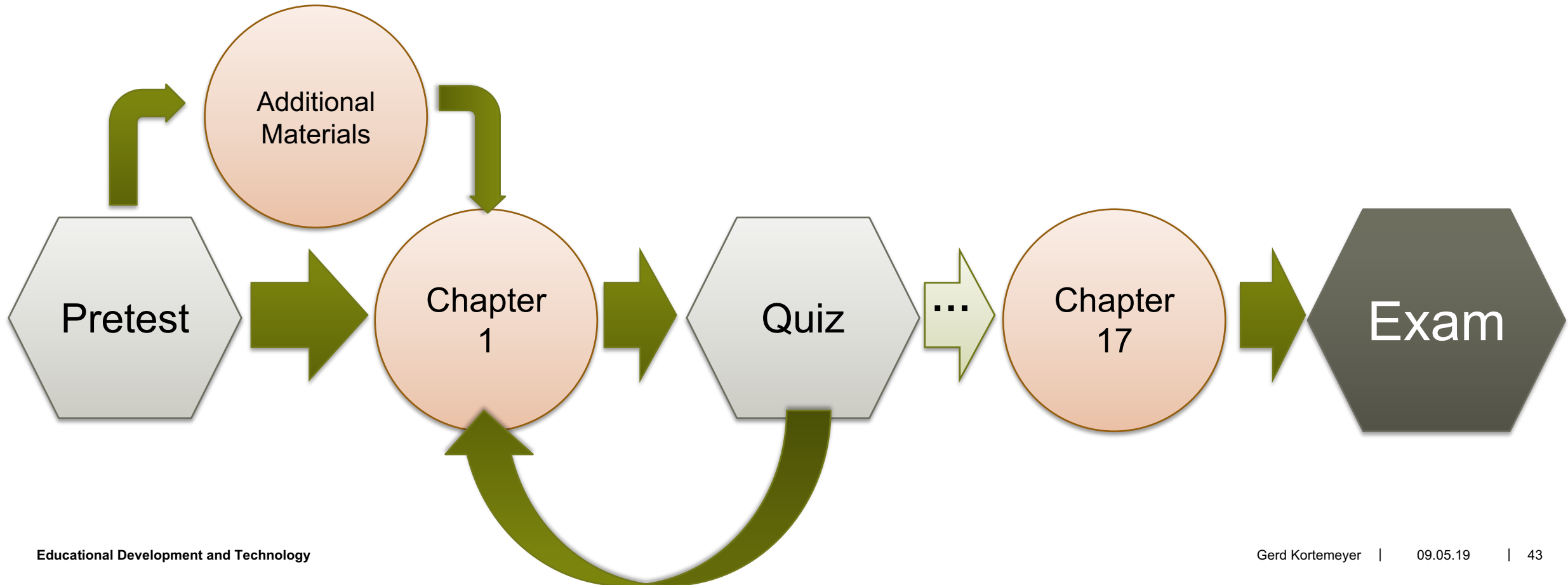
Adaptivity

Traditional, linear course sequence:



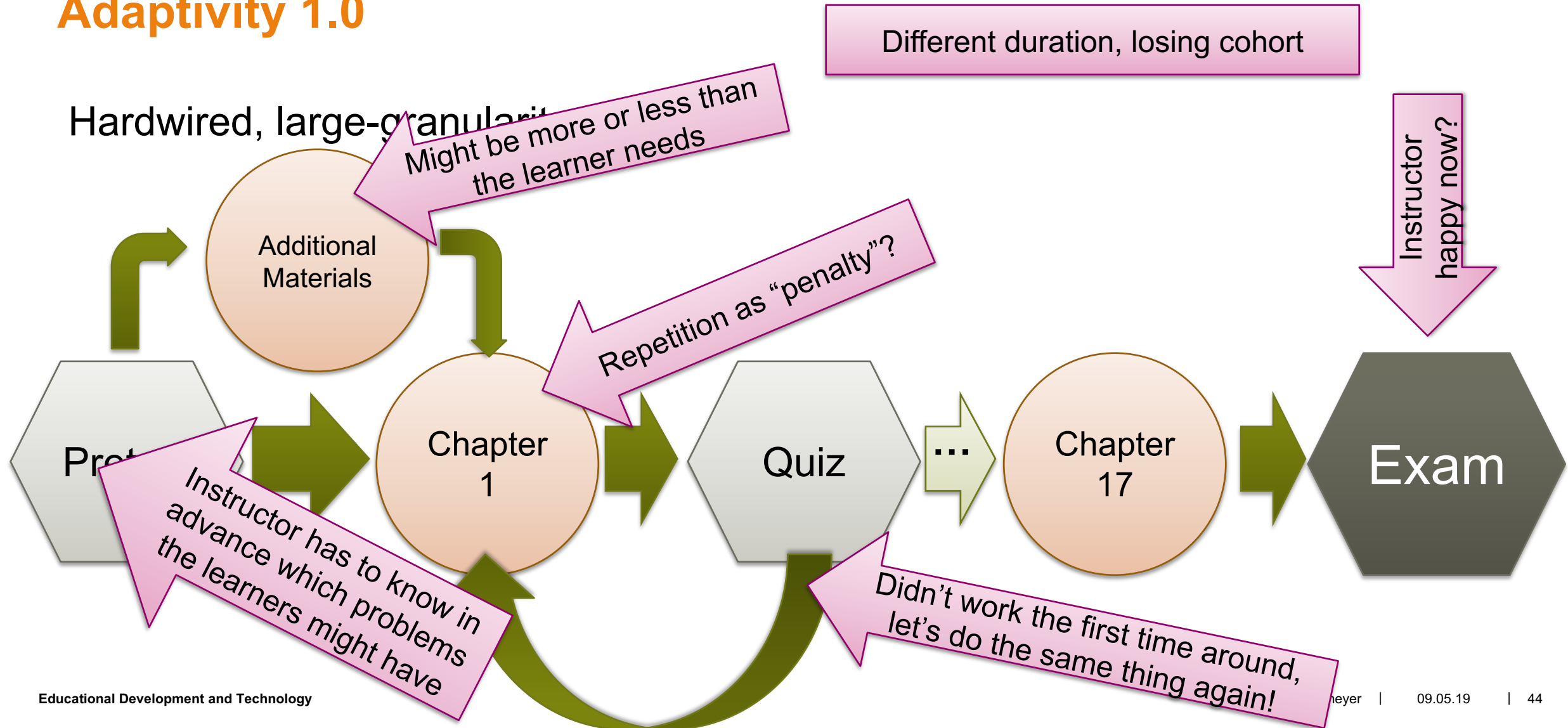
Adaptivity 1.0

Hardwired, large-granularity sequences



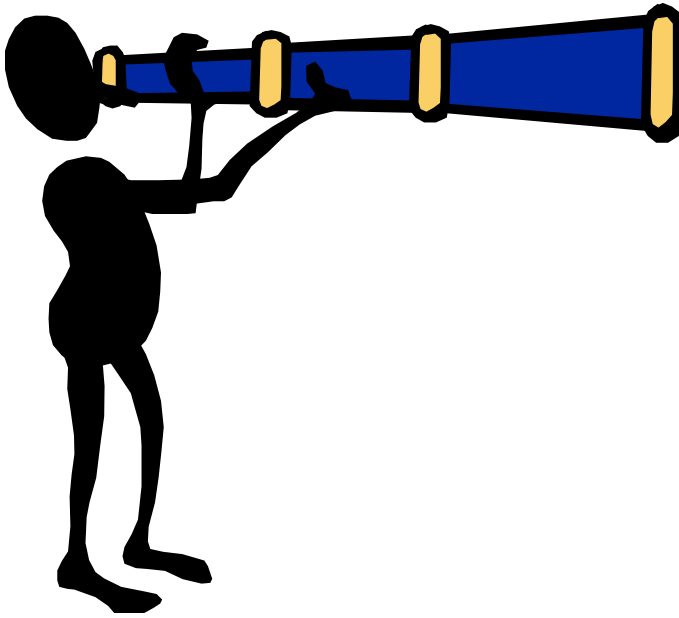
Adaptivity 1.0

Hardwired, large-granularity



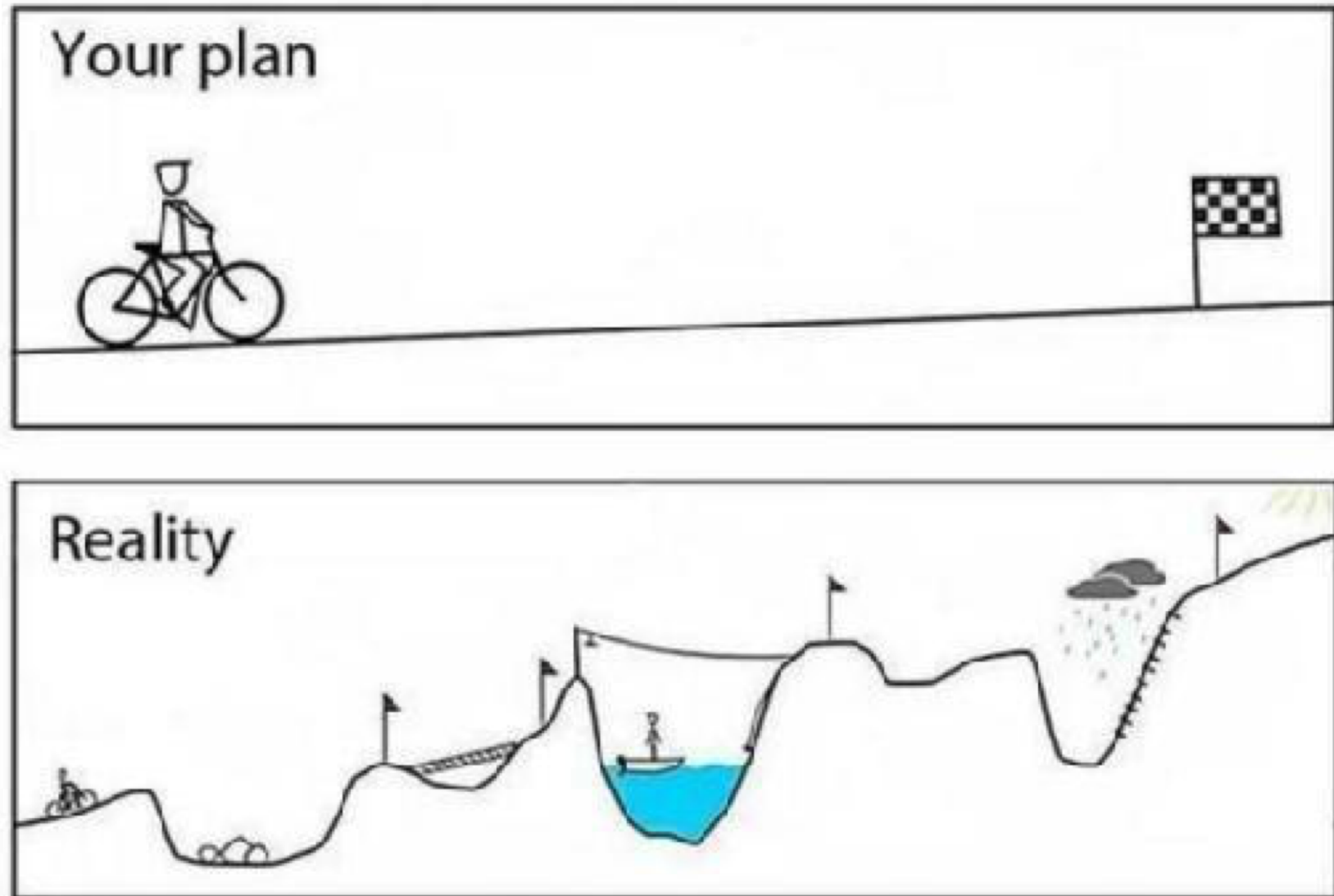
Adaptivity 2.0

Viewing learning differently: having the goal in mind instead of linear process

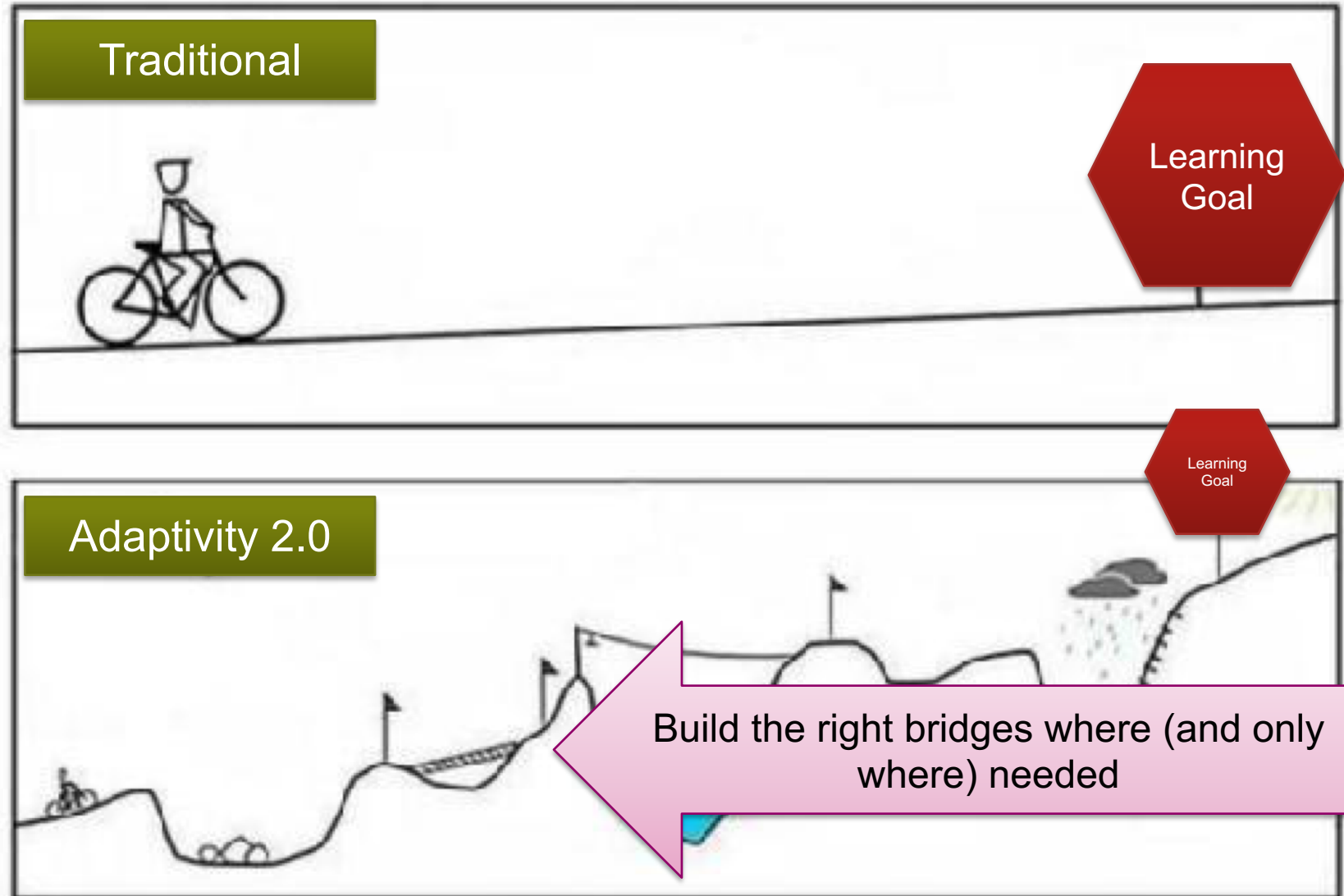


Learning
Goal

Adaptivity 2.0



Adaptivity 2.0



Adaptivity 2.0

Get recommendations for learners from usage data

Energy Density of Sunlight

EXAMPLE

Question:

Sunlight enters the Earth's atmosphere with an average electric field strength of about 700 N/C. What is the energy density and the magnetic field strength of it, and what is the intensity?

Answer:

- We can simply plug the E-field strength into our equation for the energy density:

$$u = \epsilon_0 E^2 = (8.85 \cdot 10^{-12} \text{ C}^2/(\text{N} \cdot \text{m}^2)) (700 \text{ N/C})^2 = 4.34 \cdot 10^{-6} \text{ J/m}^3$$

- The B-field strength at this point is simply given by:

$$B = \frac{E}{c} = \frac{700 \text{ N/C}}{3.0 \cdot 10^8 \text{ m/s}} = 2.33 \cdot 10^{-6} \text{ T}$$

- The intensity is:

$$S = c u = c \epsilon_0 E^2 = (3.0 \cdot 10^8 \text{ m/s}) (8.85 \cdot 10^{-12} \text{ C}^2/(\text{N} \cdot \text{m}^2)) (700 \text{ N/C})^2 = 1300 \text{ W/m}^2$$

- Is this a big number? Yes, it is actually big enough to solve all of our energy problems we might have in the foreseeable future! The power radiated by the Sun on every square mile is almost 2.6 MW, the power output of a small nuclear power plant.

Intensity

The strength of the electric field of sunlight incident on the surface of some asteroid in the solar system is $E = 360 \text{ N/C}$. What is the intensity of the sunlight at its surface in W/m^2 ?

Submit Answer Tries 0/99

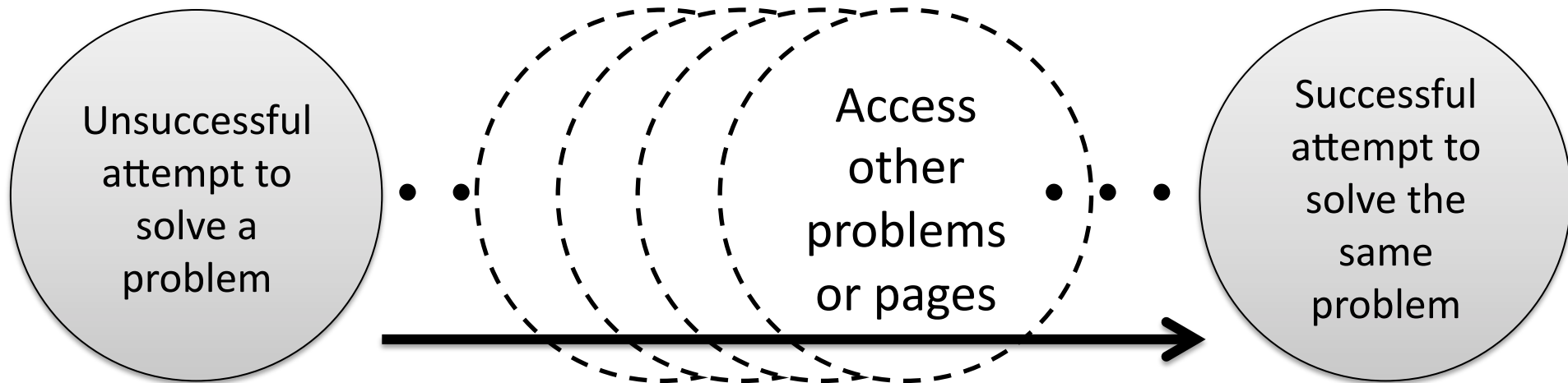
Recommended

...

... because
struggle with this

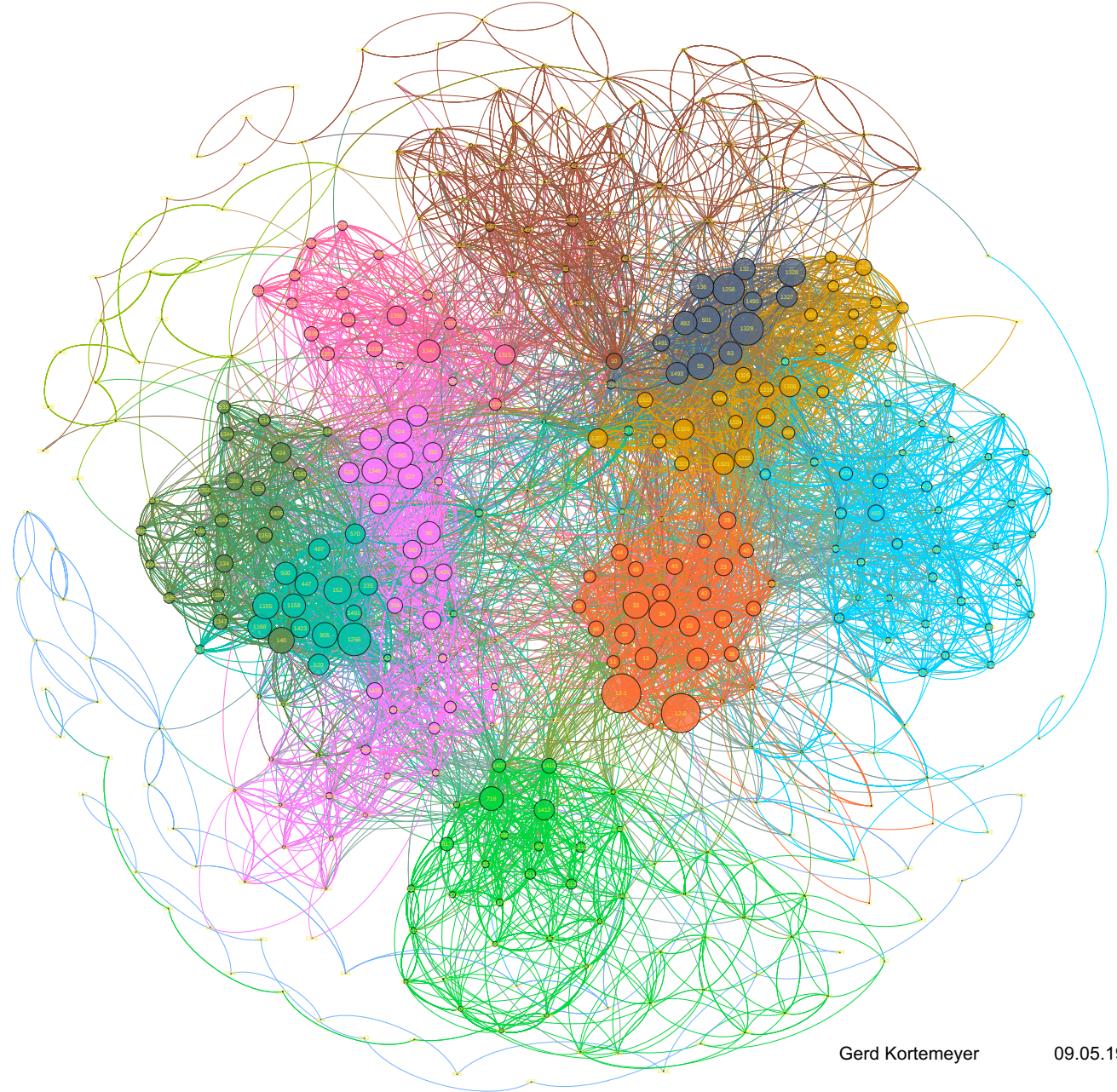
Adaptivity 2.0

Consider these sequences



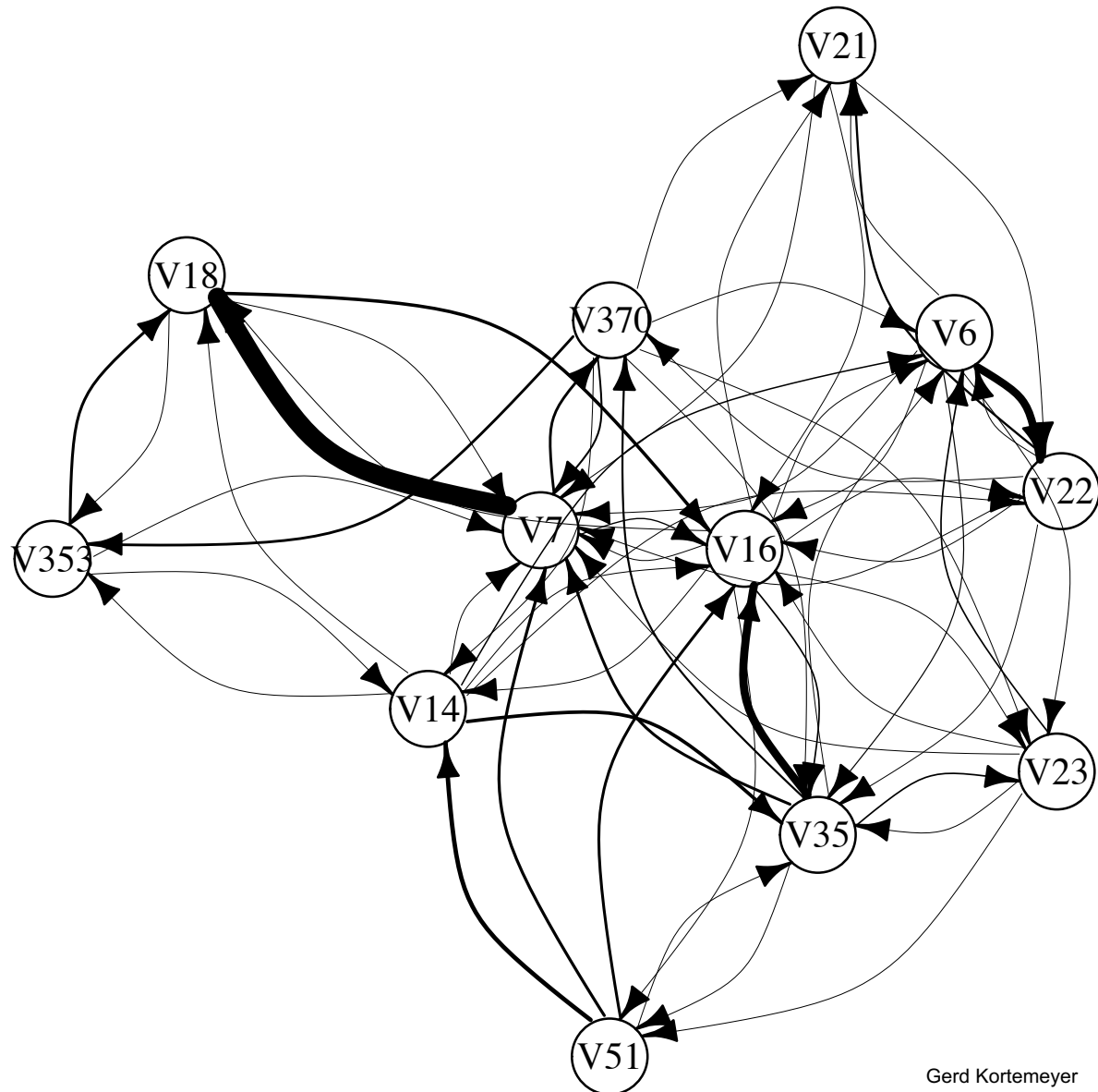
Adaptivity 2.0

- All the ways from failing a certain problem to solving it
- Vertices are resources
- Edges are user paths through materials



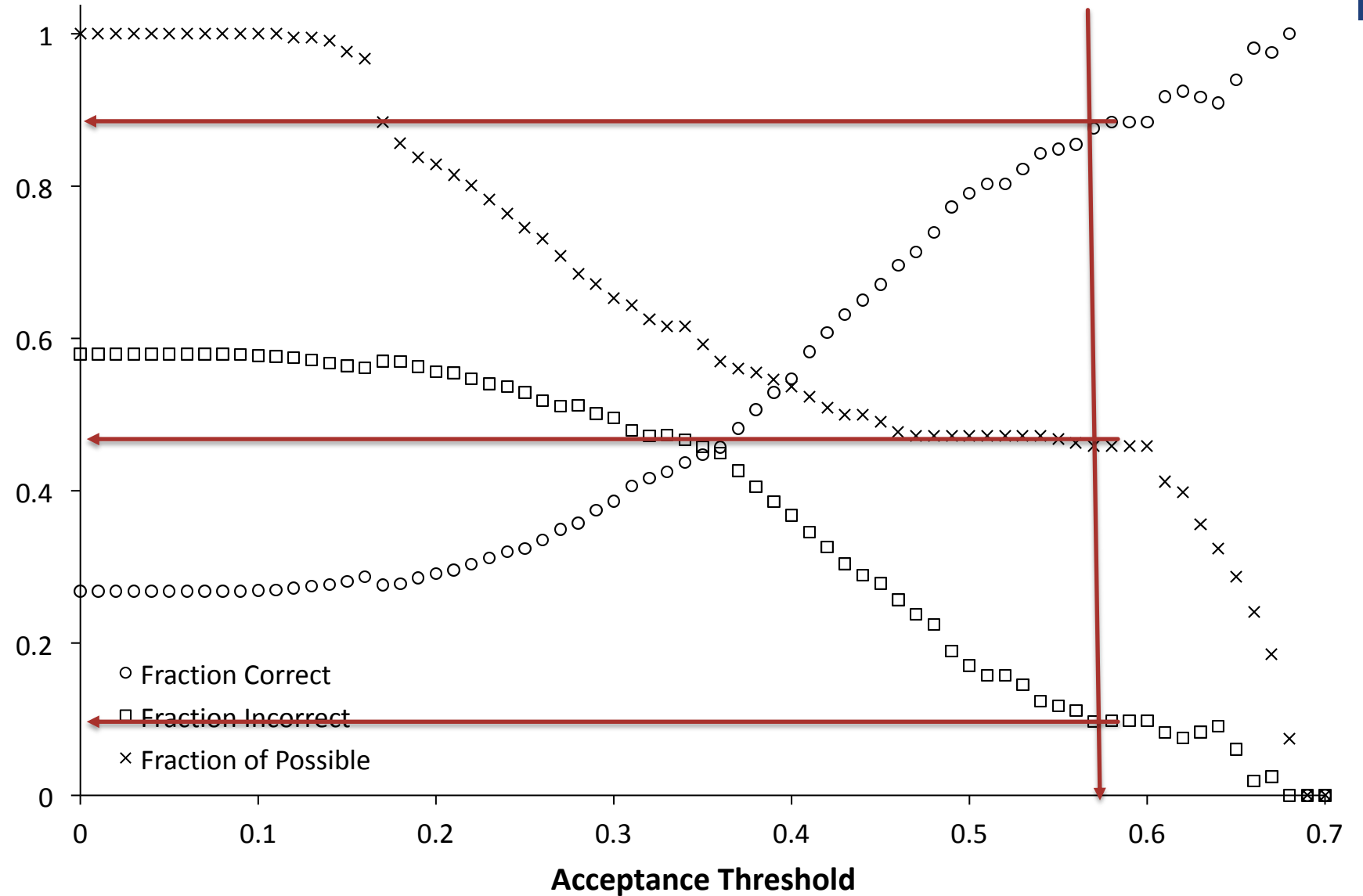
Adaptivity 2.0

- Vertices are resources
- “What leads to solving Problem 7?”



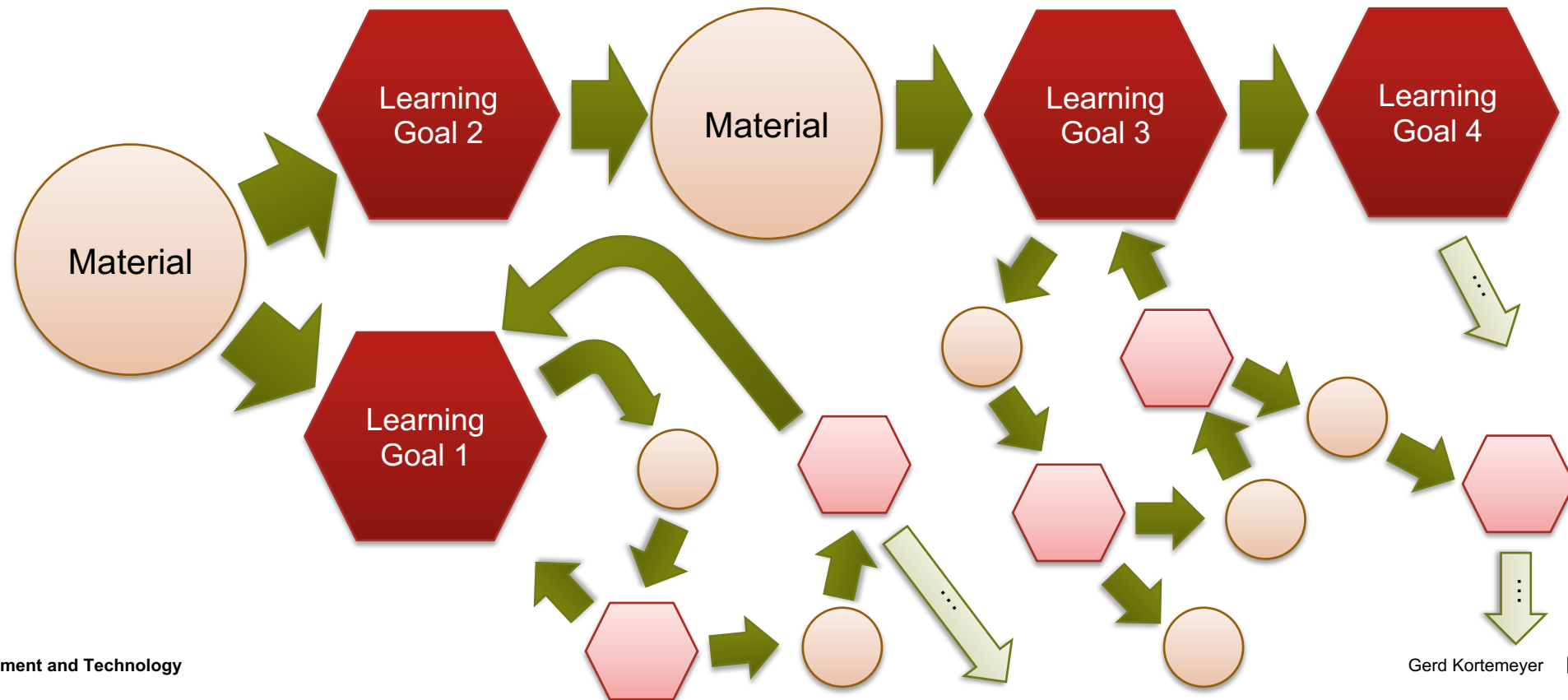
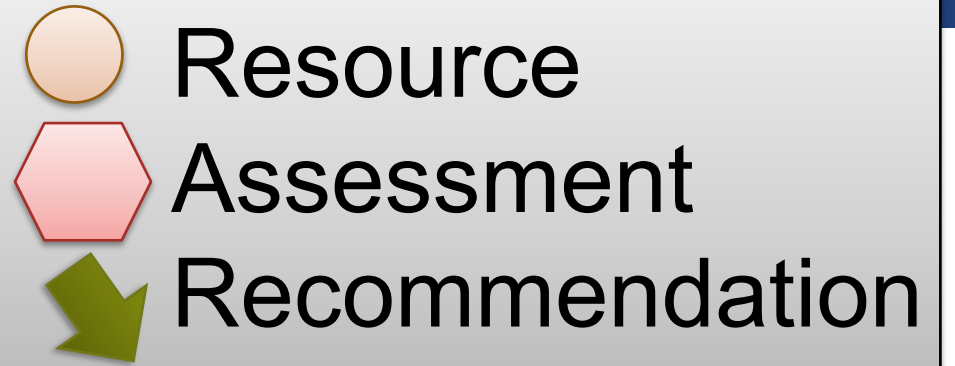
Adaptivity 2.0

- Recommender system
- Can get
 - 50% of viable recommendations
 - 90% of which are correct



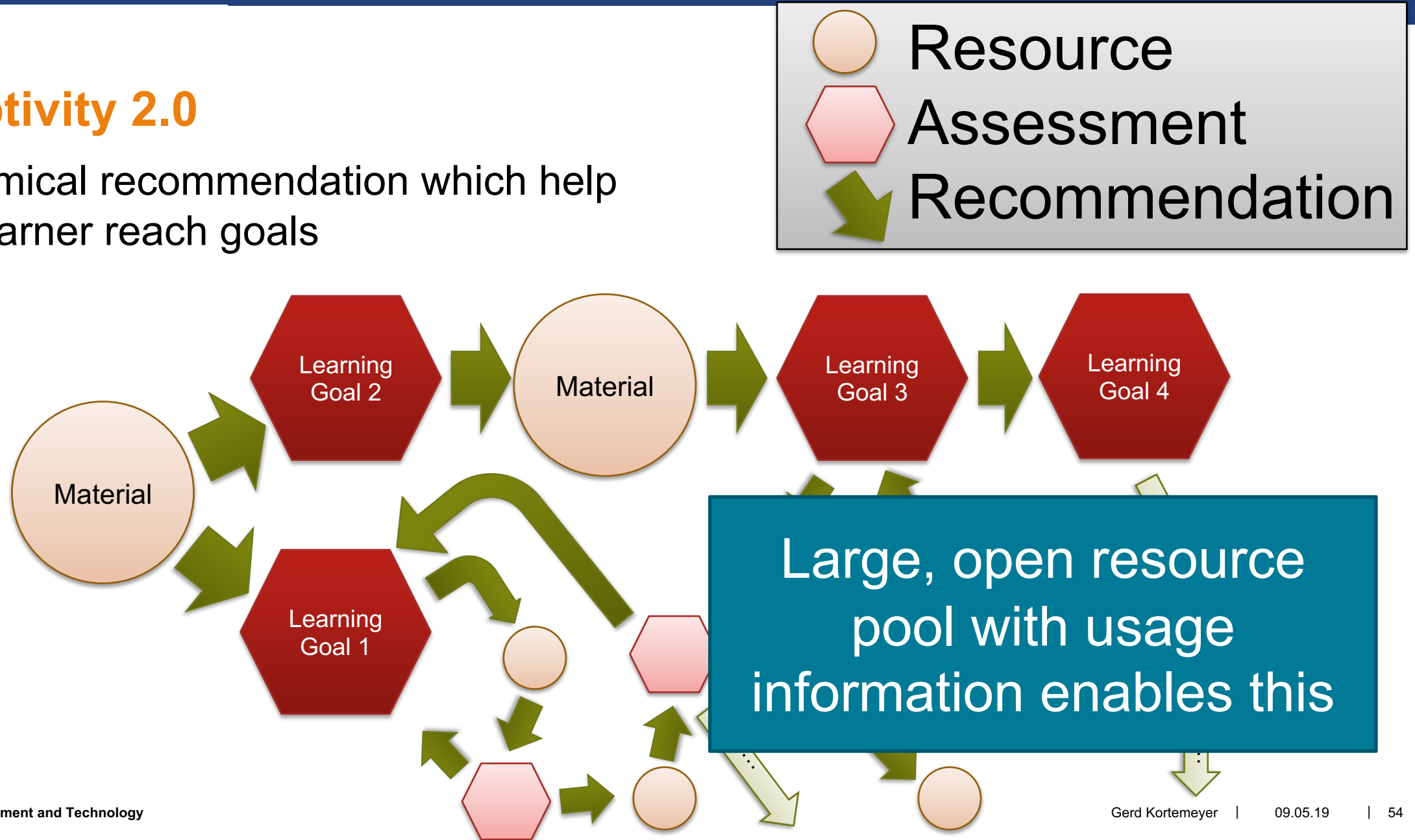
Adaptivity 2.0

Dynamical recommendation which help the learner reach goals

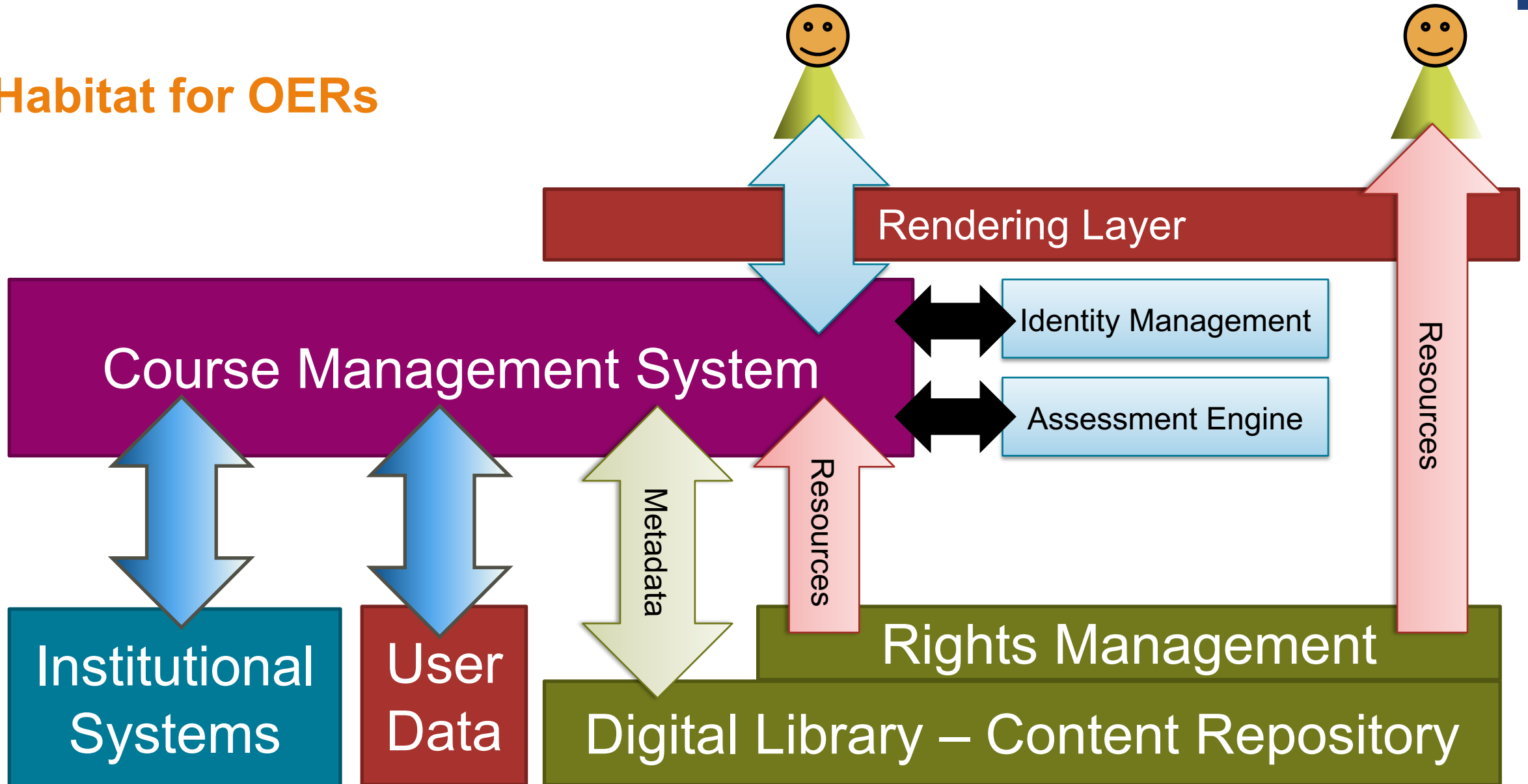


Adaptivity 2.0

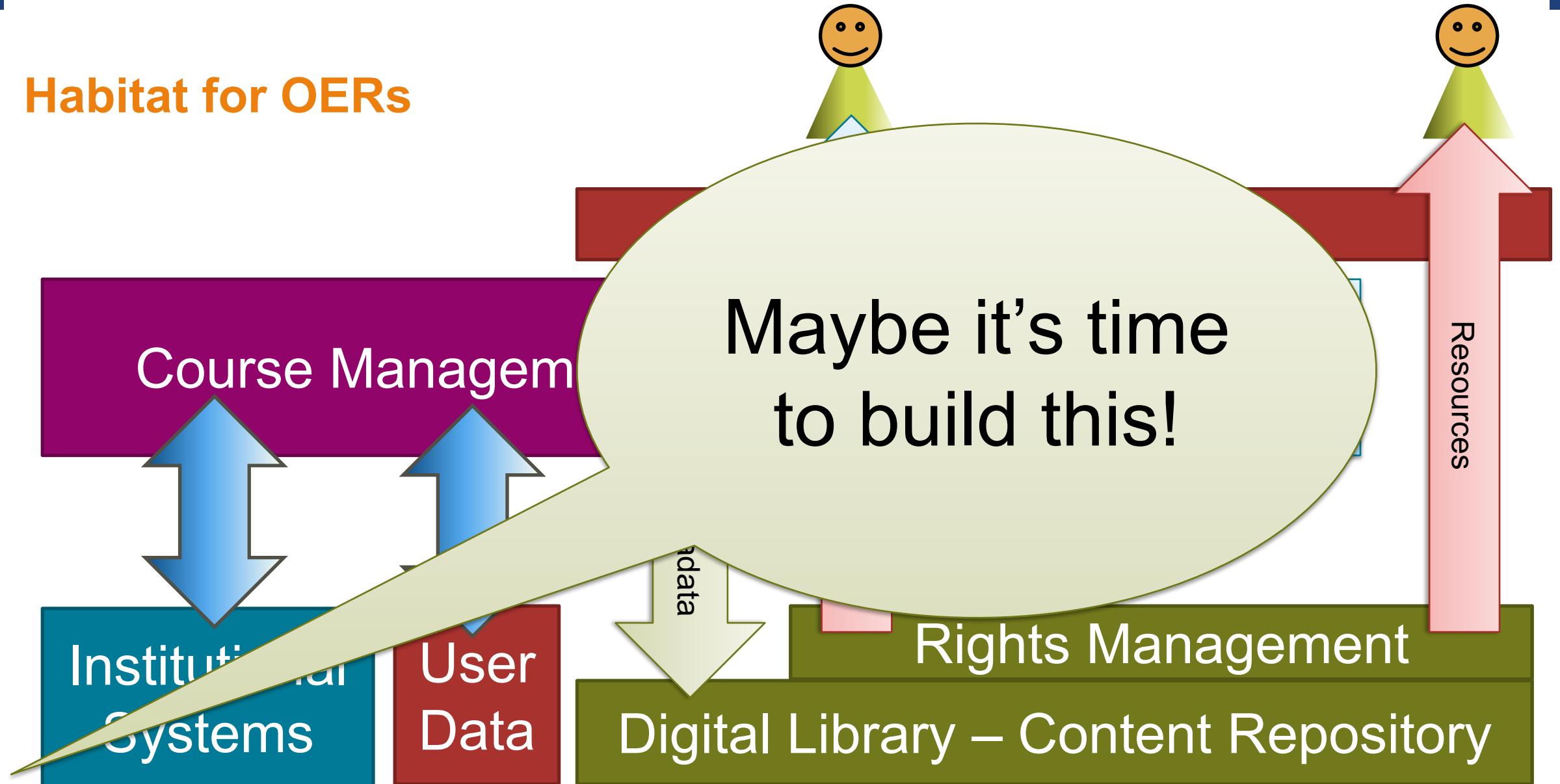
Dynamical recommendation which help the learner reach goals



Habitat for OERs



Habitat for OERs



Thank You

- Gerd Kortemeyer, Ph.D.
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Educational Development and Technology
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