Curated Courses in Mathematics

Petra Bonfert-Taylor, Sarah E. Eichhorn, David Farmer and Jim Fowler

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Abstract: Curated Courses in Mathematics is a project to create, gather, curate, tag, review, organize and make available high quality online open educational mathematics resources. The project aims to coordinate work being done at multiple institutions on similar courses, enabling faculty to share resources they create or curate from other sources. By creating a system for curating and tagging resources our hope is that faculty can more easily find high quality materials to utilize in their classes and more broadly disseminate good resources they create.

We will describe the project itself, describe resources we have created for faculty about how to design and produce online mathematics content, describe our tagging system for content submitted to our site as well as present our future goals for the project.
Introduction to the CuratedCourses Project
Curated Courses in Mathematics (Curated Courses)

Project to:

- Create and
- Curate (gather, tag, organize, review, make available)

high quality online open educational mathematics resources.

Motivation?
Active Learning

- Rather than passively listening to information being transmitted: students learn through activities and/or discussions.

- Large body of scientific evidence asserts:
  - Retention improves significantly if learning is active.
  - Active learning leads to significantly lower failure rates in STEM classes.
Sample Activities

- Small group discussion
- Peer instruction
- Clickers
- Problem-based learning
- Group tests
- Concept mapping
- ...

Curated Courses
Difficulty

- Creating educational mathematics resources is time-consuming.
  - Videos
  - Online quizzes
  - In-class activities
  - Simulations
  - ...
- Additional time has to be spent to decide on
  - best tools
  - best practices
- Sharing such resources is currently not the norm.
- Many great resources are "stuck" in LMS's or other password-protected sites.
Solution: CuratedCourses in Mathematics!

● Current focus: Linear Algebra

● Types of resources we curate:
  ○ Video
  ○ Worksheets
  ○ Quizzes
  ○ Lesson plans
  ○ Clicker questions
  ○ Etc.

● Website: [https://curatedcourses.org/](https://curatedcourses.org/)
CuratedCourses is here to help.

What is CuratedCourses?
Finding online education resources may not be difficult, but finding great resources known to be high-quality is a challenge.

CuratedCourses is here to help.

Collaborative
Everyone can contribute to the CuratedCourses catalog of great resources.

Aligned
The catalog of CuratedCourses is aligned to both standards and popular textbooks, making it easy to integrate high-quality resources into your classroom.

Reviewed
The posted content is carefully curated by experts. Search the repository to find content you can use today.

Learn More

Using matrices to solve linear systems
Equivalence of systems of linear equations, row operations, corresponding matrices representing the linear systems

When does a linear system have a unique solution?
A 3x3 system having a unique solution is solved by putting the augmented matrix in reduced row echelon form. A picture of three intersecting planes provides geometric intuition.

Linear systems have zero, one, or infinitely many solutions.

Definition of consistent linear system: A linear system is consistent if it has at least one solution.

Definition of matrix in reduced row echelon form:
A matrix is in reduced row echelon form if it is in row echelon form and each leading coefficient is 1 and is the only nonzero entry in its column.

Definition of row operations on a matrix:
Row operations are elementary operations that can be performed on the rows of a matrix without changing the solution set of the system of equations to which the matrix corresponds.

Row equivalent matrices represent equivalent linear systems:
Two matrices are row equivalent if one can be transformed into the other by a sequence of elementary row operations.

Learn More
Demonstration

Supplementary material in the margin

(demonstrate how a resource shows up in the margin of a textbook automatically)
Resources for Creating and Using Content
Activity: What challenges do you see in creating online mathematics content?
Resources: How to Design and Produce Content (for students to view outside class)

Guidelines and details for:

- Audio/video recording
- Screencasting
- Green screening
- Lightboard videos
- Accessibility (coming soon!)

Recording Audio

- Use a good quality microphone.
  - CuratedCourses workshop used CAD Audio LSF
- Use a soft/low pop screen
  - CuratedCourses workshop used CAD LSF
- Get a good pair of headphones to be able to listen
  - CuratedCourses workshop used Samsonites
- Try to stay away from background noises.
  - This may include but is not limited to:
    - Air conditioners/fan/etc., knocking on
      desk, hairing
    - Shared office space
  - If you do have background noise, a bit
    of white noise
- Drink lots of water.
  - Make sure you've selected the microphone...
- Record a small test recording for your normal recording time.
  - Record a small test recording for your normal recording time.
- If you make a mistake, stop talking for a bit, back up to the beginning
  - Note: the break you take from talking will help you to be able to cut out your mistake.
  - If you are finding the recording sounds echoy, pillows, blankets, and other soft materials around you.
  - Audacity is a good free tool for editing audio.

Making Videos

Some tutorials on making video techniques for making high-quality educational videos.
Resources: Making Videos with Paper and Pen

Jim Fowler
The Ohio State University
Resources: Making Screencasts I
Resources: Making Screencasts II

Joy Zhou
Lafayette College
Resources: Making Lightboard Videos
Resources: Green Screening
Resources: How to Utilize Open Educational Resources (OERs) to Support Evidence-Based Instructional Practices

JMM 2018 Minicourse:

“Flipping your Mathematics Course using Open Educational Resources”

*Minicourse presentation slides and handouts to be available on Curated Courses website
The CuratedCourses Tagging System
Future Goals
CuratedCourses beyond linear algebra (and mathematics)

There are already repositories outside of mathematics, such as MERLOT and Currwiki and Unizin’s Course Development Suite.

Often these systems only digest coarse-grained content, i.e., content tagged as “linear algebra” instead of say the more specific “Linear systems have zero, one, or infinitely many solutions.”

For math courses besides linear algebra, a challenge is the design of the tags.

For instance, is there a useful collections of “calculus tags” available? That calculus courses are mostly built from examples is a barrier to creating “concept tags” (but consider the approach of SIMIODE).

Resources which aren’t presented as “source” is another challenge, and a challenge we’re already experiencing with video.
“As We May Think Teach”
A vision of the future of online education resources

The most personalized part of the internet is... online shopping (!)

There are structures in the e-commerce ecosystem that can be transported to online education, but haven’t yet been brought over.

“Advertising” is key to discovering new content.
Advertisers have already realized the goals of “adaptive learning.”
For CuratedCourses, “advertising” means related content we add to the margin. We provide JavaScript that can be used on any page to highlight related resources.

“Analytics” is key to iterating on design.
Google Analytics tracks conversions for sales. Imagine a similar product for education which would track learners across multiple platforms and record learning events for later analysis.
Academic Credit

How can we incentivize the creation of high-quality materials?
If CuratedCourses were a “journal”
    then curation might be akin to refereeing,
    and “published resources” may receive academic credit.

A similar shift is arguably happening in research: projects like
    Harvard’s Dataverse and
    the R Journal
are examples where data and code receive citations (cf. Elsevier’s list).

Data repositories face many of the same challenges as education object repositories:
- Managing metadata
- Archiving content in formats that useful in the long-term
- Making content accessible to researchers/learners
- Handling multiple versions of content
- Revealing the license and ownership clearly
CuratedCourse’s goal is to be glue, not a garden.

Business works on the internet because of “technologies” like EDI (Electronic data interchange) for presenting invoices, orders, shipping notices, etc.

Edtech mostly doesn’t have good enough glue between different technologies, with perhaps LTI being the closest analogue to EDI, (and frankly LTI doesn’t work that well.)

Does your edtech tool expose a web-accessible API?

The vision for CuratedCourses is to relate resources between different (walled) gardens, which permits the sharing of content (advertising) and understanding what content is effective (analytics).

Manage metadata with parsimonious extensions to open formats like OpenGraph, Dublin Core.
Store content in source formats (just as the arXiv prefers TeX over PDF).
Make content accessible by providing content-addressible blob storage.
Handle multiple versions of content by training instructional staff and students to use version control.
Questions?