Incorporating MOOCs and other Online Resources into On-Campus Courses

Douglas H. Fisher
Director of the Vanderbilt Institute for Digital Learning
Vanderbilt University
Nashville, TN

Developed from various invited presentations, including

ITHAKA S+R Sustainable Scholarship Symposium (http://vimeo.com/53361649) (10/16/12)
COURSERA Webinar (http://www.youtube.com/watch?v=v4MKx-SEKr4) (1/17/13)
ABET 2013 *Panel titled The Future is Now* (4/12/13)
AAUP 2013 Panel on *Open Access Textbooks and MOOCs (6/21/*13)
COURSERA in TN (http://news.vanderbilt.edu/2013/06/coursera-videos/) (6/24/13)

Outline

- My experience with using MOOCs for supporting blended (online and face-to-face) learning
- My experience creating online content, designed for my on-campus students, but also used by students of MOOCs and others
- Customization using on-line material available to the community of instructors and students
- “A MOOC is NOT a textbook”, and other concerns about the online education movement
- “Undergraduate education in the national spotlight”, and other exciting consequences of the online movement
- Questions of design, practice, and research

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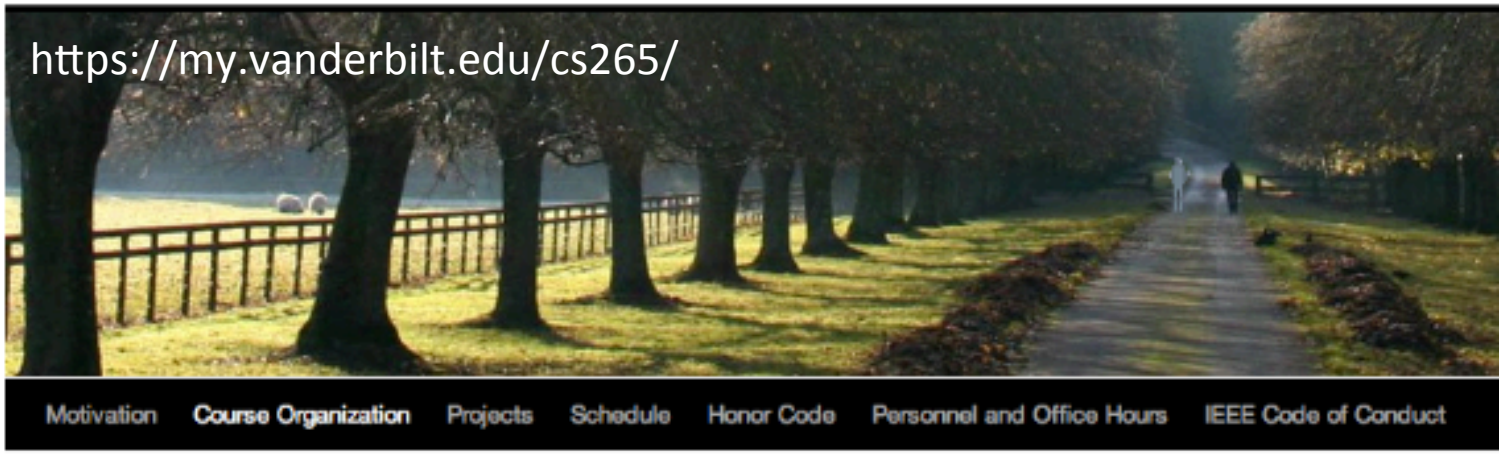
Introduction to Database Management Systems

An example in Database class



WEEK 2

Flipping the class: "Passive" info reception out of class; active learning in class

To Do (additionally) before Jan 14/15 Quiz: read (a) Sections 2.3 and 2.4, from textbook; **watch** videos at https://class.coursera.org/db/lecture/index "Querying relational databases" (6 min), and "Relational Algebra" (18 min + 20 min)

Video lectures from a Stanford MOOC

QUIZ 1 (Jan 14/15): Quiz 1 (You have 15 min from time of download to complete this quiz

PLENARY Class meeting (Jan 15): Discussion on Introduction, Relational Model from readings and video to date; watch http://www.youtube.com/watch?v=jbkSRLYSojo and answer post (to Oak Discussions) the questions given here Hans Rosling Database Exercises (week of Jan 13); illustrate study group dynamics; announce project teams and meeting times

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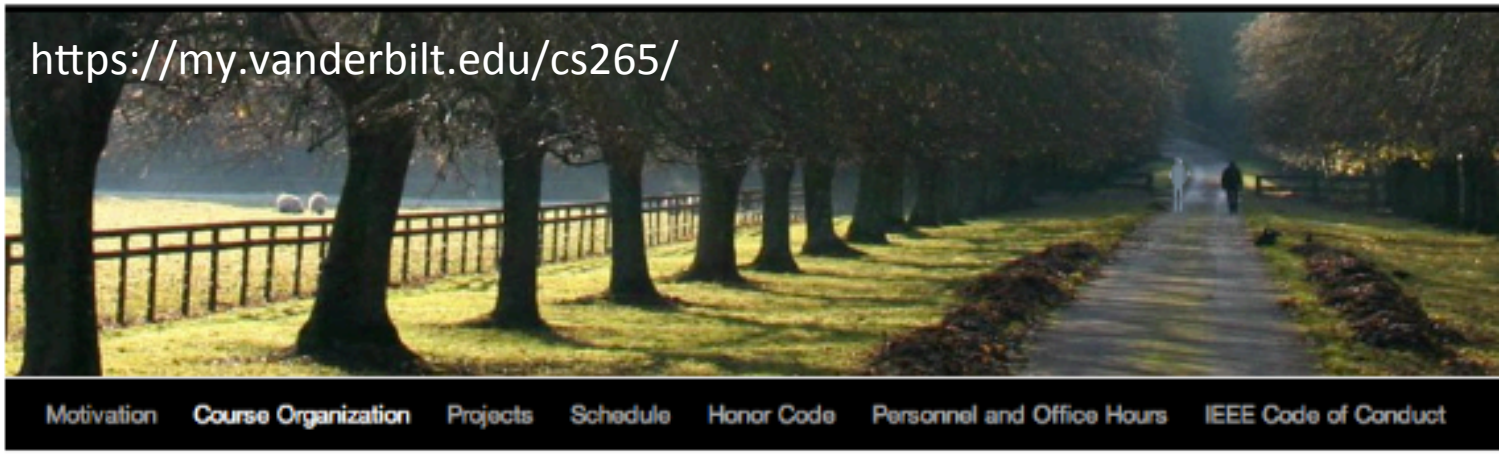
Example in-class session

Introduction to Database Management Systems



In Class Exercises

In Database class, 'flipping' enabled small-group problem solving and/or treatment of larger scale database designs that illustrated the concepts.

1. Watch the Hans Rosling video on visualizing data at http://www.youtube.com/watch?v=jbkSRLYSojo (a 4 minute video)

2. Dr. Rosling concludes that the analysis involved plotting "120,000 numbers." Explain where the 120,000 count came from.

3. List the attributes that you believe must be stored in a database that supports this analysis (and perhaps similar analyses)

4. Give candidate (tentative) relational schema (at least two) for a database that would support this and similar analyses

5. Give three queries in relational algebra over the schema that you give in part 4, which you think would be useful for the video's analysis or a similar analysis

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Brief history with (other professors') MOOCs

Since Spring 2012: Have used online lectures by others for

- **Database** (Spring 2012, Spring 2013 *with caveat* *)
- **Machine Learning** (Spring 2012, Fall 2012 was full *wrapper* **)
- **Artificial Intelligence** (Fall 2012)

Summary of all use

With following instructor and course ratings on 5 point scale ; 3 is "average"

- **Database (S12) Instructor Average: 4.27 (0.74) Course Average: 3.63 (0.64)**
  pre-MOOC use: 4.00 (0.95) from Spring 2011 3.41 (1.11)
- **Machine Learning (S12) Instructor Average: 4.33 (0.66) Course Average: 4.22 (0.41)**
  pre-MOOC use: 3.83 (0.89) from Spring 2006 3.66 (1.11)
- **Machine Learning (F12) Instructor Average: 4.16 (0.68) Course Average: 4.16 (0.68)**
- **AI (F12) Instructor Average: 4.25 (0.66) Course Average: 4.00 (0.70)**
  pre-MOOC use: 4.25 (1.03) from Fall 2011 4.05 (0.72)

Summary Observation: Instructor rating and course rating *means went up* or held steady; *standard deviations went down;* but *beware confounds!*

* **Videos optional in 2013 (because of concerns with Terms of Service)**

** **Stanford course on COURSERA required (lectures, programs, quizzes) for Vanderbilt course – obtained written approval, consistent with Terms of Service**

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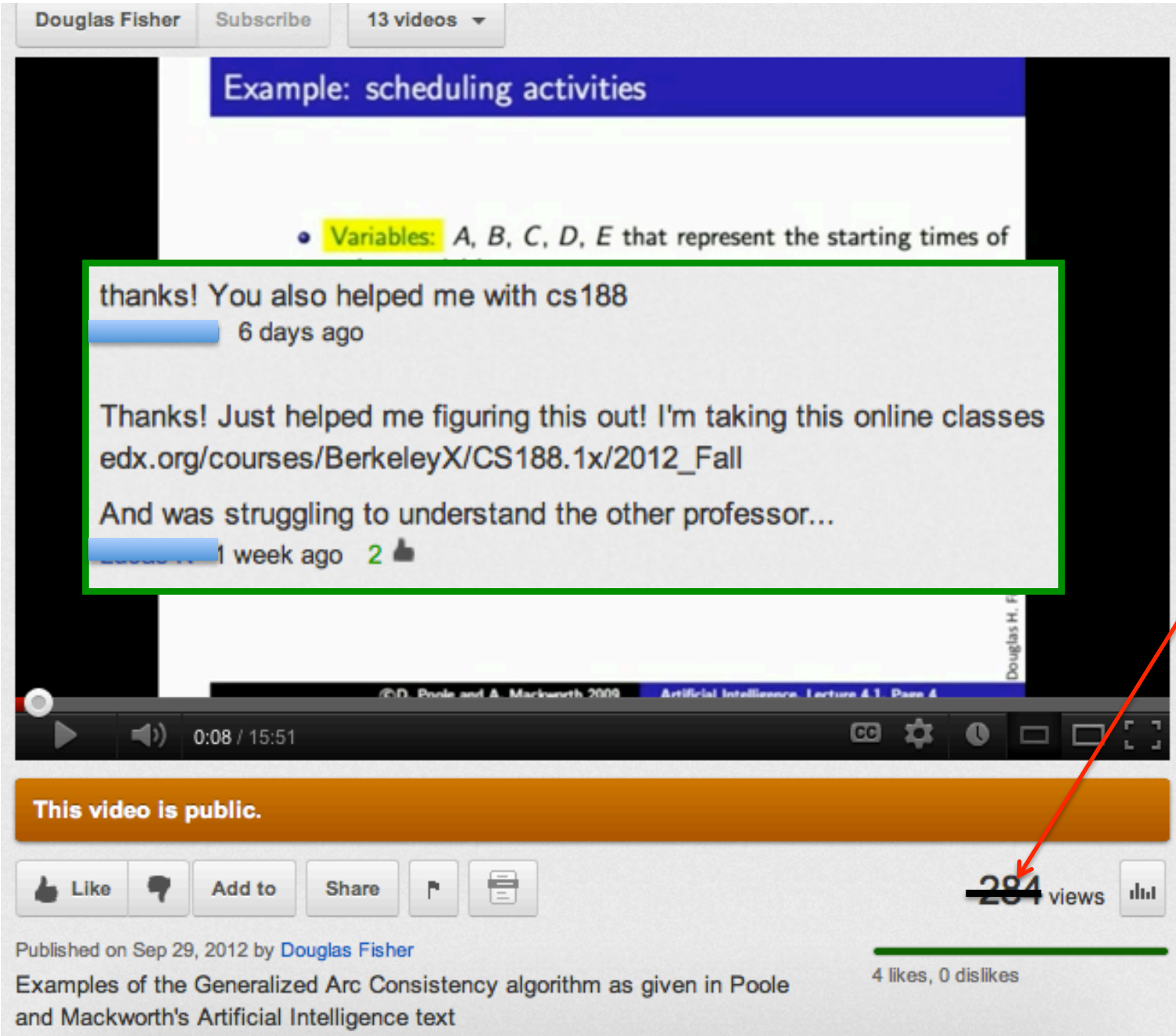
Video call out(s) from an AI MOOC in Fall 2012 of MY video



Number of Views, top-8 videos

5,261 biggest 'hit'
4,127
3,858
1,445
1,307
1,182
982
964 my first 'hit'

20,600 views total since Fall 2012 (5,151 in last 30 days)

106 thumbs up, 3 thumbs down; 62 subscribers

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My video lectures have used slides, licensed for derivations, from course textbook site

artint.info/slides/slides.html

lost Visited Getting Started

ARTIFICIAL INTELLIGENCE

FOUNDATIONS OF COMPUTATIONAL AGENTS

Home | Complete Book | Resources | Slides

Next step (I hope): use nb to enable online annotation. Reinvigorate textbooks by making them environments/contexts for discourse

Slides

This page contains slides from David Poole and Alan Mackworth, *Artificial Intelligence: foundations of computational agents*, Cambridge University Press, 2010. All lecture materials are copyright © Poole and Mackworth, 2010 and are licensed under a Creative Commons Attribution-Noncommercial-Share Alike 2.5 Canada License.

These slides are in PDF format and can be read using the free acrobat reader or with recent versions of Ghostscript. You can get a zip file of the latest distribution of all of the slides that includes the sources. They were written using the LaTeX beamer class. To regenerate them you will also need the figures, and our beamer style file.

Authors

David Poole
Alan Mackworth

Douglas H. Fisher

nb is an annotation taking tool developed by the Haystack Group at CSAIL. Students and Faculty can use nb to annotate arbitrary PDF files online, in a collaborative fashion. nb.mit.edu/about/

Students and faculty can crowd-source textbook creation (here, an example of a lab text by "the community")

Artificial Intelligence for Computational Sustainability: A Lab Companion

Please see how you can contribute: Guide for Contributors

0. Preface for educators and learners
1. Introduction to Computational Sustainability

AI Chapters

2. State Space Search
3. Constraint-Based Reasoning and Optimization
4. Knowledge Representation
5. Reasoning Under Uncertainty
6. Machine Learning for Prediction
7. Deterministic Planning and Problem Solving
8. Planning Under Uncertainty
9. Machine Learning for Planning and Problem Solving
10. Multi-Age

Sustainability Chapters

11. Agriculture
12. Behavior and Consumerism
13. Biodiversity and Conservation
14. Climate and Ocean modeling and observation
15. Design, Life-Cycle, and Materials
16. Energy, including Smart Grids
17. Fresh Water Ecosystems and Resources
18. Transportation and Urban Design

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http://en.wikibooks.org/wiki/Artificial_Intelligence_for_Computational_Sustainability:_A_Lab_Companion

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The next Machine Learning course I teach will be drawn from multiple sources, including some of my own

Creative, Serious and Playful Science of Android Apps (UIUC)

Creative programing For digital media & Mobile Apps (U of London)

Software Defined Networks (U Maryland)

Functional Programming Principles in Scala (Ecole Polytechnique)

Image and Video (Duke)

Malicious Software underground story (U of London)

Heterogeneous Parallel Programming (Stanford)

Computational Photography (GaTech)

Web Intelligence and Big Data (IIT, Dehli)

Interactive

community

(Rice)

Computer Vision (UC Berkeley)

Computer Vision (Stanford/Michigan)

Crytography (Stanford)

Machine Learning (Stanford)

Machine Learning (U Washington)

Gamification (U Penn)

Applied Crytography (Udacity)

AI Planning (Edinburgh)

customization

Computing for Data Analysis (Johns Hopkins)

VLSI CAD: Logic to Layout (UIUC)

C (Melbourne)

NLP (Stanford)

Networked Life (U Penn)

Coding the Matrix: Linear Algebra CS applications (Brown)

Social Network Analysis (Michigan)

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Community resource repositories: One example

teaching tree

http://www.teachingtree.co/

Online Knowledge: Rapid and Unconstrained

Artificial Intelligence and Machine Learning

Definition of Machine Learning	Definition of Artificial Intelligence	Types of Learning	Application of AI
Supervised Learning	Unsupervised Learning	Reinforcement Learning	Learning Feasibility
Agents	Reflex Agents	Goal Based Agents	Cocktail Party Problem
Search Problems	Perception-Action Cycle	State Spaces	Linear Regression
Search Trees	Parameters of a Learning Algorithm	State Graph Vs. Search Tree	Search Algorithms
Completeness of Search	Blind Search	Gradient Descent	Deterministic Environments

Show More

Supporting customization and online textbooks, and steps towards online educational social networks

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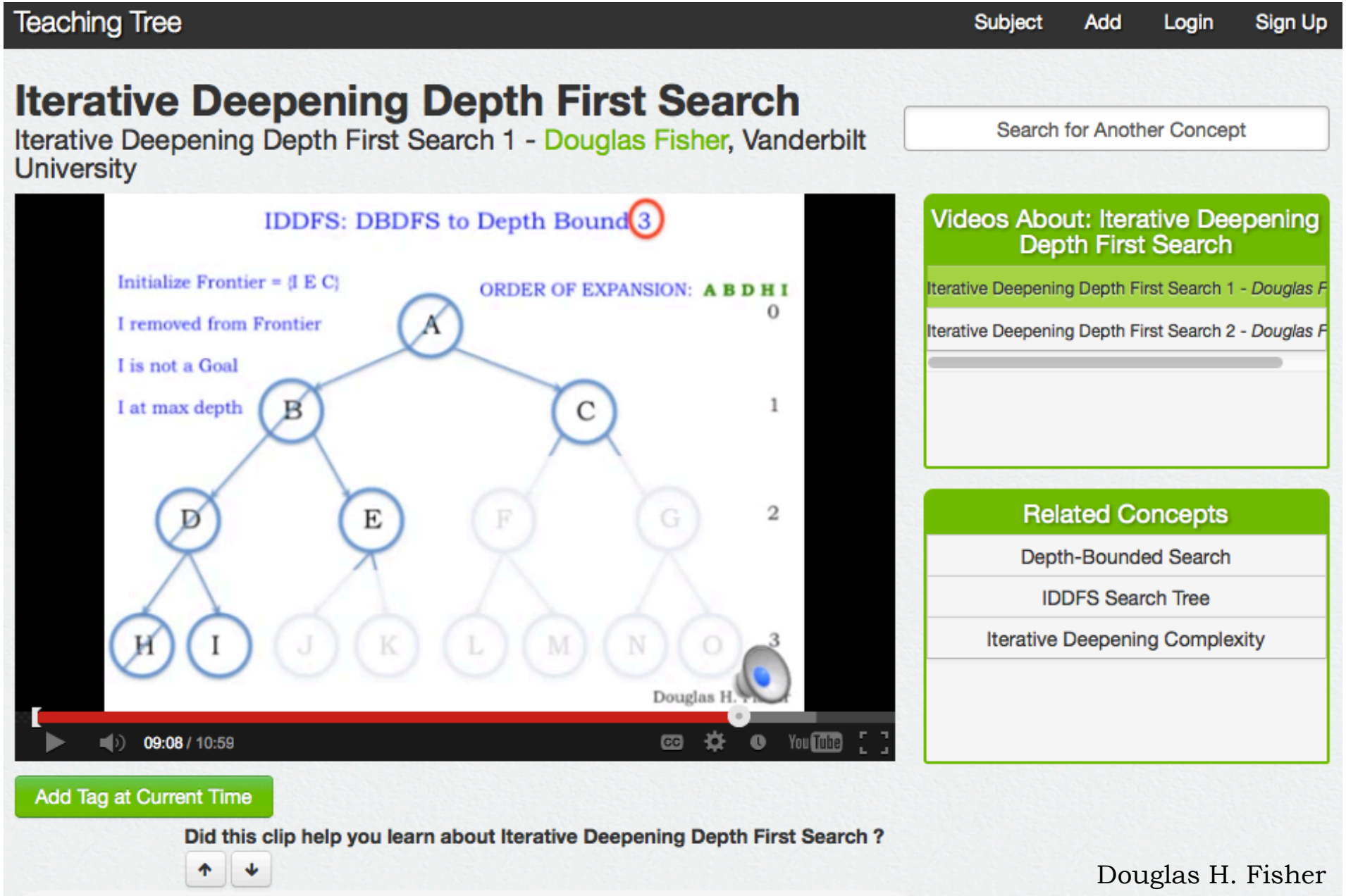
An example video page from Teaching Tree



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Online Computer Science curricula can be customized
from courses that are free and online (this slide, some "Basic" courses)

Introduction to Logic
(Stanford)

Combinatorics
(Princeton)

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Learn to Program: Fundamentals (Toronto)

Introduction to Computer Science 1 (Harvard) and 2 (MIT)

CS 101 Introduction to Computer Science (Udacity)

Computer Science 101 (Stanford)

"equivalent" alternatives

Learn to Program: Crafting Quality Code (Toronto)

CS 212 Design of Computer Programs (Udacity)

"equivalent" alternatives

The Hardware/Software Interface (U Washington)

CS 215 Algorithms: Crunching Social Networks (Udacity)

Algorithms Part 1 (Princeton)

"equivalent" alternatives

Algorithms: Design and Analysis, Part 1 (Stanford)

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October 2012

An Online Computer Science Curriculum (Core)

Algorithms Part 2 (Princeton)

Algorithms: Design and Analysis, Part 2 (Stanford)

"equivalent" alternatives

Automata (Stanford)

Programming Languages (U Washington)

Compilers (Stanford)

Pattern-Oriented Software Architectures (Vanderbilt)

Design of Computer Programs (Udacity)

Software as a Service (UC Berkeley)

Introduction to Databases (Stanford)

Computer Architecture (Princeton)

Computer Networks (U Washington)

CS188.1x Artificial Intelligence (UC Berkeley)

CS373 Artificial Intelligence (Udacity)

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An Online Computer Science Curriculum (Technical Electives)

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Crytography (Stanford)

Computer Vision (UC Berkeley)

Computer Vision (Stanford/Michigan)

Machine Learning (Stanford)

Machine Learning (U Washington)

Gamification (U Penn)

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AI Planning (Edinburgh)

Discrete Optimization (Melbourne)

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Networked Life (U Penn)

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An Online Computer Science Curriculum
Tech/Soc

Writing in the Sciences
(Stanford)

Internet History, Technology, and Security
(Michigan)

Sci, Tech, Soc in China
(Hong Kong)

Securing
Digital
Democracy
(Michigan)

How to Build a Startup
(Udacity)

Computational
Investing
(GaTech)

Online Games:
Literature,
New Media, and Narrative
(Vanderbilt)

Information Security
and Risk Management
in Context
(U Washington)

Specialized and Tutorial

MySQL Databases
For Beginners
(Udemy)

Differential
Equations
(Khan Academy)

Sciences, Humanities, Arts

few thus far, but enough
To fill out a “major”

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What had concerned me

- What would I do in class if not lecture? (happily, I ended up enjoying "***flipping***" the class, using active learning methods)
- What would students, faculty, and Vanderbilt think of my "***outsourcing***" lectures?

My responses to my concerns

- Create my own content, so that I just don't take, but I "give back"
- Cast a MOOC as a "multimedia textbook" for purposes of acceptance

What concerns me (and/or others)

- MOOCs of today are NOT "multimedia textbooks" – they support "just-enough" learning
- Lack of incentives (e.g., reputation, financial) to create open-source content
- Intellectual property – copyright, licensing, patents (a concern of many)
- Academic integrity (but I think that disruption so far has been positive)

A MOOC is NOT a Textbook

- (I now know that) MOOCs of today are NOT "multimedia textbooks", though they have been cast that way to promote acceptance

- A MOOC supports "just-enough" learning (some would justifiably say "just-in-time" learning)

- In contrast, a good textbook

  … is inclusive of knowledge and exceeds the knowledge that any one course/ instructor would cover;

  … synthesizes knowledge from multiple sources, aspiring to create a big picture with common terminology and complementary components; and

  … supports course customization by each of the many faculty who will adopt the textbook.

- A MOOC is intended as a course, not a textbook, though it can be part of the community resources from which multimedia textbooks arise

- Open-source, multimedia textbooks will be emerge as community members skilled at synthesis "step up to the plate" to synthesize across the online resources

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What gets me excited about unfolding online activity

- Higher education, particularly ***undergraduate education, is in the national spotlight,*** among faculty, students, parents, and alums
- I feel in ***community*** with other educators (for first time in 25 years teaching); students see community embraced by their instructors – ***a scholarly community***
- ***Content creation***, by me *and by students,*
- ***Open source*** for content and infrastructure (e.g., edX, Open Learning Initiative)
- Professors and alums in learning community, ***modeling lifelong learning***
- ***Students can sample new areas cheaply*** (even with 10s of $1000s in tuition!!!)
- ***Local and global learning communities, and interaction between them***
- ***Across-institution MOOCs*** (yet more community) ***e.g., Sustainability***
- ***Learning about learning*** (e.g., Workshop on Multidisciplinary Research for Online Education – see link on final slide)
- Even greater ***customization*** across courses and curricula (the response to "just enough" material – a true "multimedia textbook" results from community)

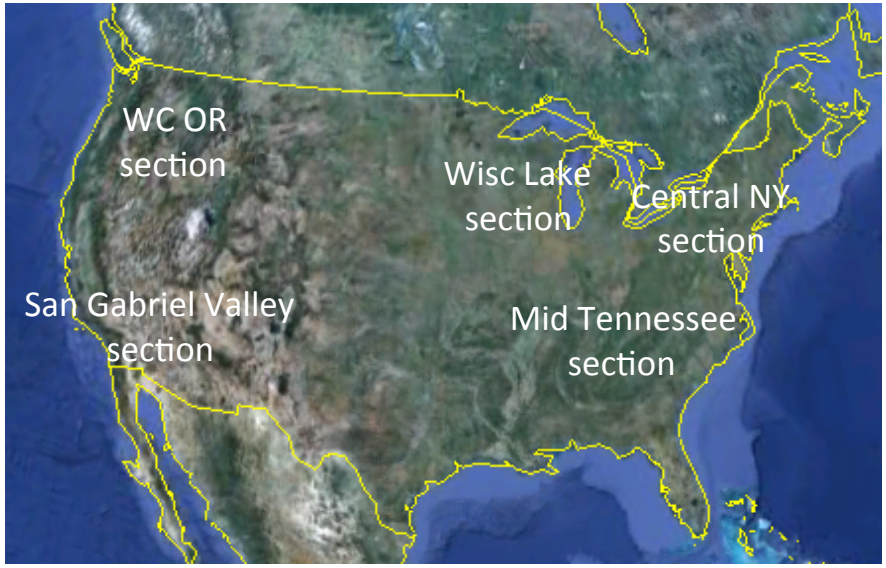
Example of Distributed Shared (Across-institution) Course

Build on our previous course development activities (e.g., the highly interdisciplinary and popular "State of the Planet" course at Cornell) by developing a distributed shared course across many institutions

Exploit existing infrastructure to develop and host courses

Virtual technology to manage lectures, and formal and informal discussion groups

Instill a commitment to place through local and regional "super sections, with course activities customized to regional challenges



One general theme: what will my region be like in 40 years?

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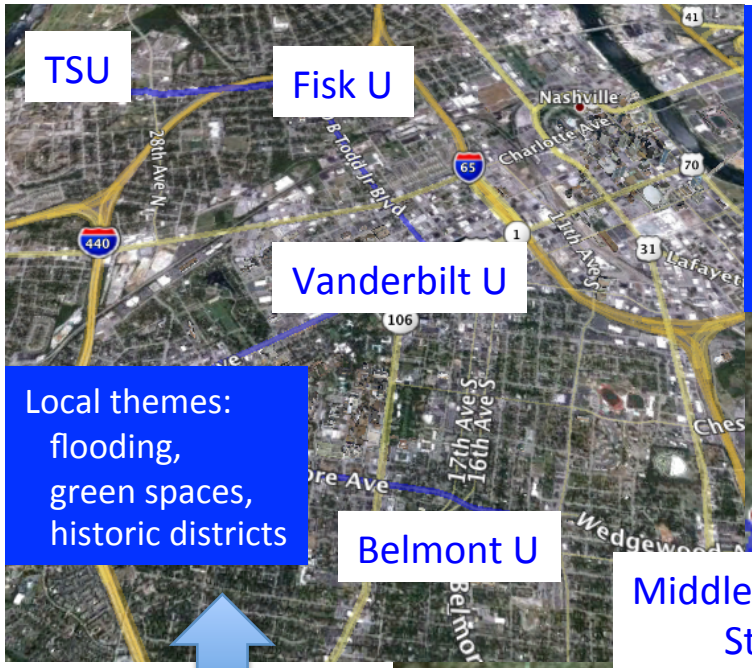
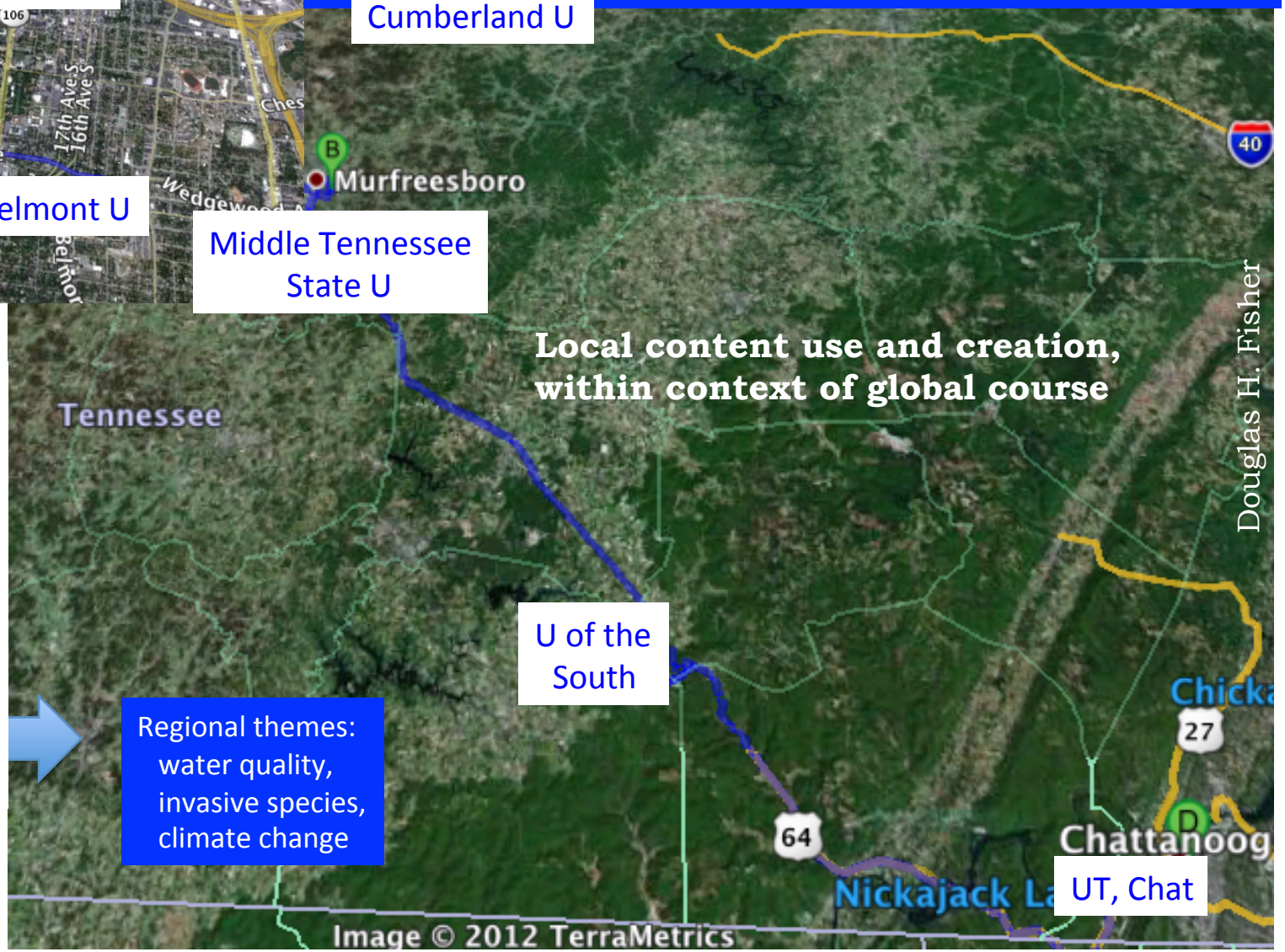
Possible participants in the Middle Tennessee super section of the State of the Planet MOOC (e.g., organized around watershed)



Local themes:
flooding,
green spaces,
historic districts

Possible non-academic partners:

Non-Profits, Governments, Corporate advisors on local and regional issues



Local content use and creation, within context of global course

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Regional themes:
water quality,
invasive species,
climate change

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Design Strategies for MOOCs

- Design MOOCs with local learning communities in mind, so that the designs of MOOCs and of local learning "architectures" co-evolve,
  - rather than simply relying on opportunistic, as-is use; to a great extent this is a lesson from the larger, pre-MOOC experience with online and blended learning

- Design MOOCs explicitly for course customization, with material intended to be reused, **remixed**, and revised (this seems a very novel suggestion).
  - Even those aspects of MOOCs that are consistent with remixing (e.g., short videos), are done for other reasons (e.g., student attention span), rather than with customization in mind *per se*

- Design MOOCs with research opportunities in mind, in areas such as educational data mining and human-computer interactions (though we are seeing more of this),
  - Rather than simply opportunistic, after-the-fact hypothesis generation

Other Questions of Practice and Research

Online education for lifelong learning (requiring longitudinal studies)

- Can institutions leverage "MOOCs" to engage alums in lifelong learning, perhaps with special affordances for alums, giving students more ***bang for their buck*** over a lifetime?

- Do MOOC students remain better engaged in MOOC courses by the institutions from which they graduated (i.e., is there an "***alum effect***")?

- Will ***faculty and alum learners*** increase engagement by on-campus students in courses, raising their appreciation of lifelong learning, informal learning, etc

Generally, ***increasing bang for the buck*** can involve

- ***reducing the buck***, which is way above my pay-grade and currently very controversial

- ***increasing the bang*** (e.g., MOOCs for lifelong and life-wide learning, involving campus students in global discourse), and often at my discretion (e.g., MOOCS to satisfy course prerequisites)

Questions of Practice and Research

Content comparisons (for in-person, online, blended)

- Will lectures that are prepared for the world tend to be better than lectures prepared and reviewed for onsite? (for example)
  Big picture lectures? Big big picture (inspirational) lectures?
  Nuts and bolts lectures? others...
  NOT mutually exclusive ... will they tend to become so???

- Will content creation by students for online and ***authentic audiences****
  raise their game
  - in technical and explanatory writing (e.g., for Wikimedia)?
  - communicating implications of technology?
  - in annotation and providing help (e.g., ***NB***, global discussion)?
  - video creation and lesson planning ?
  - communication generally ?

* Light, R. (2001). *Making the most of college: students speak their minds,* Cambridge, MA: Harvard University Press

** Karger, D and Hayseed Group, MIT: http://oeit.mit.edu/gallery/projects/nb-pdf-annotation-tool

Big questions for assessment

Will computing technologies and educational expertise combined to promote *personalized learning at scale*, allow (ABET) assessments, both "pre-visit" and "visit", to be done "**automatically**", while still

- **thoroughly**
- **consistently**
- **efficiently**

in say, 10-20 years?

Technology will beg data collection and (perhaps) a deep infusion of assessment! (e.g., see Vanderbilt's Knowledge Map: http://knowledgemap.mc.vanderbilt.edu/research/content/knowledgemap-km-web-application)

How will such pedagogically-informed, high-tech systems succeed in different areas, for evaluating

- of technical skills and concepts?
- of systems-level reasoning?
- of writing quality?
- of motivation to engage lifelong learning?
- of collaboration skills and inclination?

List of Courses that used MOOC material

https://my.vanderbilt.edu/cs260/ Undergraduate AI … used lecture material from Web, including my own

https://my.vanderbilt.edu/cs360fall2012/ Graduate AI … no MOOC material per se, but students required to produce a video lecture on undergraduate AI content of a Tutorial nature

https://my.vanderbilt.edu/cs390fall2012/ Graduate Machine Learning course, true wrapper, requiring satisfaction of COURSERA/Stanford MOOC course and additional reading and project

https://my.vanderbilt.edu/cs265/ Undergraduate Database, using COURSERA/Stanford Lectures (required in S12, now optional, waiting to see how user agreements settle out)

Other Links

YouTube channel of my online content:
https://www.youtube.com/channel/UCWOFdpEfNuQP3O_JUiwhT8A?feature=mhee

A narrative summary of my experience "Warming up to MOOCs" http://chronicle.com/blogs/profhacker/warming-up-to-moocs/44022

Workshop on Multidisciplinary Research for Online Education: http://www.cra.org/ccc/visioning/visioning-activities/online-education/286-multidisciplinary-research-for-online-education-workshop

Bruff, D., Fisher, D., McEwen, K., & Smith, B. (in press) "Wrapping a MOOC: student perceptions of an experiment in blended learning." Journal of Online Learning and Teaching. https://my.vanderbilt.edu/douglasfisher/files/2013/06/JOLTPaperFinal6-9-2013.pdf

Learning on Campus and in the Cloud blog: http://cloudandcampus.blogspot.com/