Teaching Cartography at Scale in a Massive Open Online Course

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Agenda

• Background & Motivation
• Designing a MOOC on Mapping
• Response and Engagement
• Outcomes and Observations
• Lessons Learned
Background & Motivation
Online Geospatial Education @ Penn State

- Certificate and Degree programs for experienced and aspiring geospatial professionals in:
  - Geographic Information Systems
  - Geospatial Intelligence
  - Geodesign

- Serving over 5500 students since 1999 with 30+ classes

- Open Educational Resources: open.ems.psu.edu

- www.pennstategis.com
Distance Education

• Universities can grow by focusing on wider and more inclusive student populations
  – Working graduates seeking advancement
  – Adults who have only completed some college
  – Lifelong learners

• Online programs can serve these audiences

• New methods of online instruction are emerging
MOOCs?

- **MOOC** = Massive Open Online Course

- Content & assessments that scale to 1000s of students

- **Coursera**, **edX**, and **Udacity** are major platforms

- Free for anyone to take, not for credit*

*some are trying this, like HKUST on Coursera*
MOOCs ≠ All Online Classes

Dim Sum ≠ All Food
Taxis ≠ All Transportation
HKU ≠ All Universities
Cathay Pacific ≠ All Airlines
‘Traditional’ Online Classes

• Small class sizes (~15 for a graduate seminar, ~50 for an introductory GIS class)

• Very high instructor & peer-to-peer engagement

• All content + assessment types are possible (scalability/automation are not essential)

• Student motivation to earn a passing grade is very high (paid tuition, for credit)
Designing a MOOC on Mapping
Motivation

- **Encourage** new audiences to engage with Geography

- **Enhance** visibility of our online geospatial education programs, provide path to entry

- **Explore** this new method of online instruction

- **Evaluate** new research possibilities from MOOC data
Maps and the Geospatial Revolution

• 5-week, 1-credit equivalent experience

• Announced February 12, 2013 & Launched July 17, 2013

• Goals:
  ▪ Rethink what a map is and what it can do
  ▪ Create your first map to tell a story
  ▪ Evaluate and critique the qualities of a map
  ▪ Explain what is revolutionary about all things geospatial
  ▪ Recognize that Geography is ordinary

• Overall Objective: create the Gateway Experience for Mapping
Pennsylvania State University

Founded in 1855 as Pennsylvania’s only land-grant university, The Pennsylvania State University combines academic rigor with a vibrant campus life. A nationally recognized Research-1 institution, Penn State teaches students to be leaders with a global perspective. Supporting not only the citizens of our Commonwealth, Penn State engages in collaborative activities with industrial, educational, and agricultural partners in the United States and abroad to generate, disseminate, integrate, and apply knowledge that is valuable to society.

Creative, Innovation, and Change
Sep 1st 2013

Energy, the Environment, and Our Future
Sep 16th 2013

Epidemics - the Dynamics of Infectious Diseases
Oct 15th 2013

Introduction to Art: Concepts & Techniques
May 28th 2013

Maps and the Geospatial Revolution
Jul 17th 2013
Course Content

• Text and graphics developed to teach core competencies for each lesson

• Short lecture videos (2x each week)

• Lab assignments using ArcGIS Online

• Assessments:
  – Weekly Quizzes
  – Discussion activity
  – Peer Review Final Map
  – Final Exam
Lesson 1: The Geospatial Revolution

- Lecture 1
  - The Geospatial Revolution
  - How We Navigate
  - Making Decisions
  - Sharing Stories
- Lecture 2
  - The Changing Nature of Place
  - What is Geography?
  - Maps to Tell Stories, Maps to Provide Context
  - The Earth is Round and Maps are Flat
- Video Assignment: Geospatial Revolution, Episode 1 (Full Episode)
- Lab Assignment: Ecoregion and Population Mapping (Population Dynamics and Scale)
- Discussion Assignment: Privacy and the Geospatial Revolution
- Quiz #1

Content Areas and Competencies

- Discuss the roles of several geometric approximations of the earth’s shape, such as geoids, ellipsoids, and spheres
- Describe characteristics and appropriate uses of common geospatial coordinate systems, such as geographic (latitude and longitude), UTM and State Plane Coordinates
- Describe characteristics and appropriate uses of common map projections, such as Transverse Mercator, Lambert Conformal Conic, Albers Conic Equal Area, Azimuthal Equidistant, and Polar Stereographic
- Identify legal, ethical, and business considerations that affect an organization’s decision to share geospatial data
- Identify allied fields that rely on geospatial technology and that employ geospatial professionals
- Ethical issues, including privacy, geographic profiling, and inequities due to the digital divide
- Spatial Thinking: Identify, explain, and find meaning in spatial patterns and relationships, such as site conditions, how places are similar and different, the influence of a land feature on its neighbors, the nature of transitions between places, how places are linked at local, regional, and/or global scales
- Regional Geography: Know and apply knowledge of the physical and human geography of a specific country or world region
Response and Engagement
Maps are Massive

First Session in July 2013

- 48,448 registered
- 36,384 active
- 170,489 lecture streams
- 58,824 quizzes submitted
- 13,030 discussion threads
- 95,945 posts & comments

First Session + Second Session in 2014

- 73,906 registered
- 52,390 active
- 242,454 lecture streams
- 85,007 quizzes submitted
- 16,619 discussion threads
- 117,167 posts & comments

• 8707 active students in final week of class (23.9%)
• 3064 passed the course (8.4%)

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1 Hour
24 hours
Global Reach

- 200 countries represented
- 69% male / 30% female

Top 10 countries:
- USA 30.4%
- India 5.7%
- Spain 4.8%
- Canada 3.6%
- UK 3.5%
- Brazil 3.1%
- Germany 2.8%
- Greece 2.3%
- Australia 2.2%
- Russia 2.1%

“Thank you” in 68 languages
Who Takes MOOCs?

- **Education**
  - Bachelor degree (33%)
  - Master’s degree (39%)
  - Currently attending (19%)

- **51% native English speaking**

- **Professional Background**
  - Comp. Sci (33%)
  - Education (14%)
  - Arch & Engineering (10%)
  - Business (8%)

- **Employed full-time (55%)**
210 posts in this thread, many of which highlighted additional examples of choropleth maps that should have been normalized.
A third of the food we grow is either lost or wasted. Insects are a significant cause of this crop loss. This project focused on a major fruit pest in the United States: the plum curculio beetle (*Conotrachelus nenuphar*). This beetle is found everywhere east of the Rockies and loves to eat and lay eggs in apples, peaches, plums, cherries, and other fruits.

In 2009 I visited about 14 sites in the midwestern U.S. in hopes of collecting specimens for genetic analysis. This map contains information about the dozen places where I did end up collecting plum curculio specimens. I collected 263 specimens in the end. It’s a snapshot into what it’s like to do fieldwork for evolutionary analysis in the United States.

*Explore the locations*
A Tale of Love in Acadie, home of the happy
North America through the eyes of Evangeline

1. Grand-Pré
2. The Search Begins
3. Evangeline Goes to Find Gabriel
   Evangeline embarks on a boat trip south with a crew of Acadians, hoping to find Gabriel among the Acadians they heard have settled in the area that will become Louisiana.
4. In Hot Pursuit
5. Sister of Mercy

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John Beales @johnbeales  Mar 6
Got an inquiry from @natgeo because of a map I made while in
@A_C_Robinson's 1st #mapmooc

Expand
Vulnerable Populations
At-Risk to Mount Rainier Lahars

When Disasters Strike, Who is Vulnerable?
Individuals in need of additional response assistance before, during, and after a disaster. These include people with disabilities, people who live in institutionalized settings, the elderly, children, people from diverse cultures, have limited English proficiency or are non-English speaking, and people who lack adequate transportation.

What is a Lahar?
Lahar is an Indonesian term that describes a hot or cold mixture of water and rock fragments flowing down the slopes of a volcano and/or river valley. When moving, a lahar looks like a mass of wet concrete that carries rock debris ranging in size from silt to boulders more than 10 m in diameter. Lahars vary in size and speed. Small lahars less than a few meters wide and several centimeters deep may flow at a few meters per second. Large lahars hundreds of meters wide and tens of meters deep can flow several tens of meters per second—much too fast for people to avoid.

Lahars almost always occur on or near stratovolcanoes (such as Mount Rainier) because this type of volcano tends to erupt explosively and their flanks have steep slopes. Lahars are either snow covered, topped with a crater lake, constructed of weakly consolidated rock, or debris that is easily eroded, or thermally weakened by hot hydrothermal fluids. (Source: U.S. Geological Survey; http://scienceservice.org/vulcan взаимодействия)
Rainbows Kill People, So Stop Using Them On Maps

Do I have your attention? Good. Resist the urge to use continuous rainbow color schemes to assign data values to your map. They're formally referred to as spectral color schemes, as they typically use most of the colors in the visible spectrum. They're also a type of qualitative color scheme. You see them all the time on maps that have a default choice of qualitative colors. They're often used when assigning values to data values, such as heights, temperature, rainfall, and so on.

Here's why they're awful — 99% of the time when you use them, they have been applied to data that is divergent in nature, not qualitative. For example, they're used a lot to show different levels of rainfall on maps. Ask yourself this question: how much more does purple represent than orange? See what I mean? One way to interpret data categories on a map that uses a rainbow of colors to represent something (more or less rain) — it's not intuitive. A spectral scheme also emphasizes variation where there might not be anything significant. It may also hide the variation you're actually supposed to be revealing with your map. They don't work well for color blind users, either. Many others aside from me have elaborated on these aspects.

They're popular in part because they result in very bold-looking, colorful maps. More exciting ≠ better. If you are using a rain map, for example, you should be using something that goes from a light to dark range with the same hue.

Why rainbow colors aren’t the best option for data visualizations

Data visualizations are beautiful, exciting ways to tell stories. But you have to choose carefully in designing and chart, and one of the biggest mistakes is using rainbow colors.

Rainbow color schemes — also called spectral color schemes — are frequent choices for visualizing data, both because they look bold and exciting and because they're the default for many visualization software tools. But they usually do more harm than good. Detecting the colors at all is a problem for more readers than you might guess, and the rest of the audience will find it easier to understand the visualization if it's presented with a different palette.

Rainbow color schemes are “almost always the wrong choice,” Anthony C. Robinson, geography professor at Pennsylvania State University, wrote in an online class on Coursera, which taught students how to use spatial technologies to map data.

Here are some reasons why rainbow colors are the “wrong choice”.

Colorblindness and ordering colors

People who are colorblind have difficulties detecting colors, particularly red and green. (Try this color vision test to see if you're one of them.) Colorblindness affects up to 10 percent of men. That means if you're serving visuals to an audience of hundreds of thousands, you're missing out on a large slice of your audience.

Even though most people aren’t colorblind, rainbow color schemes can be confusing because there’s no clear “greater than” or “less than” logic to ordering the colors. Warn computer science researchers David Brilland and Russell M.
Outcomes & Observations
Assessments

The graph illustrates the number of students attempting each assessment and their mean scores across various assessments: Quiz 1, Quiz 2, Quiz 3, Quiz 4, Final Exam, and Peer Review.

- Quiz 1: 13.0% attempt, mean score: 13.0%
- Quiz 2: 16.4% attempt, mean score: 15.0%
- Quiz 3: 15.3% attempt, mean score: 15.3%
- Quiz 4: 20.3% attempt, mean score: 15.0%
- Final Exam: 24.0% attempt, mean score: 16.4%
- Peer Review: 24.0% attempt, mean score: 16.4%

The trend shows a decrease in the number of students attempting assessments from Quiz 1 to Peer Review, with a corresponding increase in mean scores.
4400+ have passed the course
50+ years of resident teaching
This course encouraged me to think about Geography in a new way.

This course motivated me to pursue Geography by obtaining a certificate or degree.
Will you do an advanced course?

Dear Dr.

This course it's simply great!

Being a GI(cob)(ssed) I loved the geospatial revolution video series, and, of course, this course. Will you do a more advanced course, and what about a technical course only on map production?

42

Jose Carlos Giron Marin - 9 days ago

An advanced course would be great!!! And more practical....

7

Umberto Dassi - 6 days ago

Absolutely nice idea!

Umbe

0

Patricia Mathews - 6 days ago

I'd also like to continue seeing there is a sequel to this course and a follow up site or forum, where we can some how keep in touch, among those who would like to, knowing that we are all busy. I'd also like the possibility of offering this course again for those who didn't have the opportunity to sign in this summer. I'm recommending it to many!

thanks, Anthony

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Lessons Learned
Workload

• For me: \(\frac{1}{2}\) time for 6 months to prepare the course
• \(\frac{1}{4}\) time for one learning designer
• After course launch, 2-4 hours, 7 days a week for me
• Weekly lessons require greater engagement on launch days
• Second run & beyond have assistance from a TA
Tactics in MOOC Teaching

• Response time matters
  – 1000s will see improved content

• Instructor posts can draw a lot of attention to issues
  – Can be good or bad

• Neutralizing negativity is not easy, but it’s essential
  – Drop the crazy troll people
  – Directly address critique and move it to a separate forum
Interaction is Hard (but excellent)

- ~1000 forum posts in 5 weeks
- 2-4 hours every day of the week, sometimes more
- Three examples of on-the-fly adjustments that worked
  - Week 3 “Ask Me Anything” Activity
  - Weekly Discussion Digests
  - Created a bunch of additional off-topic forums, seeded those myself
- One on-the-fly adjustment that did not work
  - Trying to appease complaining students by extending deadline for Peer Assessment in their final project
What's the deal with the "creepy" guy in your videos?

Subscribe for email updates.

No tags yet. + Add Tag

Anonymous  ·  8 months ago

I have been distracted by the photo of the guy we've nicknamed "the creepy guy" that appears in a video.

In the first week he appeared in the second video behind your head, staring at you. In the second week, in the second video, he "sat" on your shoulder. In the third week, I think he appeared in lower resolution in the background of the second video.

There was a previous thread that took a reasonable guess about his identity:
https://class.coursera.org/maps-001/forum/thread?thread_id=1

My questions are:
Is this James Sloan?
Do you have some kind of bet with him?
What are you betting? (ie, what will you "win")

Thank you for making him less obtrusive in the third week. I hope you're going to use them as useful distractions.

Anonymous  ·  8 months ago

I just watched the 2nd video for the third week. He is there again "hiding" behind the lamp. This is not accidental. This has to be some kind of bet!
The Experience

• Most intense teaching experience I’ve ever had

• Some students expect interaction with you as if they had paid to take the class
  – Thousands of dead grandparents due to my final exam

• You control the content you post, the students control everything else that happens
  – The audience may include your friends, family, and colleagues, including some who would delight in your failure
The Future

• MOOCs are one option for distance education, not going to replace everything else

• Traditional online courses remain a great option for high-engagement, higher-level topics

• Future students will be price sensitive and demand more options than ever

• US DoL projects the need for 300,000 new positions in Geospatial Technology in the next 10 years
Lessons Learned

• Massive global interest in mapping

• MOOC student engagement much higher than I anticipated

• Unique visitors to online program page +400% in 2014

• Online program enrollments at all-time high, +24% in 2014

• MOOCs generate research projects
What’s Next?

• Next offering begins March 15, 2015
  – www.coursera.org/course/maps

• Geodesign and GEOINT MOOCs
  – www.coursera.org/course/geodesign
  – www.coursera.org/course/geoint
Thanks.

Maps and the Geospatial Revolution www.coursera.org/course/maps

Online Geospatial Education www.pennstategis.com

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