Bringing geodesign to the world in a massive, open, online engagement

'Geodesign: change your world'

KELLEANN FOSTER

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Abstract

A MOOC titled "Geodesign: Change your world" demonstrated a unique approach to scaling up awareness about geodesign to a global audience. Massive Open Online Courses (MOOCs) are gaining visibility as a wide-reaching educational trend to provide exposure on topics, theories and techniques in any field. The first MOOC on the subject of geodesign was offered in Autumn 2014. Over 17,000 people registered from 167 countries. The results yielded a unique worldwide conversation about geodesign. This paper discusses how this MOOC engaged a global audience of thousands, including the challenges and opportunities experienced with the development and delivery of the MOOC. The outcomes illustrate how participants gained appreciation for the role geodesign can play in land planning and design issues in their location. The Geodesign MOOC course's dynamic structure breaks from the typical format of MOOCs. Examined here are the innovative course design and delivery mechanisms deployed in this MOOC. Drawing on recent research about online learning, pedagogical and technological issues important to consider in MOOC development are reviewed.

KEYWORDS

Geodesign; MOOC; Distance Education; GIS; Collaboration

1. INTRODUCTION

There have been nine international conferences (Geodesign summits) focused on geodesign in the past five years and each year a growing number of publications mention geodesign, but yet, overall, geodesign is still considered a fairly new term and an emerging field (Wilson, 2014). The author is an educator responsible for advancing understanding about this new field; one which our university has invested in by establishing new online graduate programs in geodesign. Due to these circumstances, the possibilities of what a MOOC could provide were intriguing. MOOC is short for Massive Open Online Courses. MOOCs are classified as "virtual, distributed classrooms" (Kizilcec, Piech, & Schneider, 2013, p. 170). They are offered primarily as asynchronous courses and centralize all course resources in the cloud (de Waard et al., 2011). MOOCs are gaining visibility as a wide-reaching casual educational trend to provide exposure to topics, theories and techniques on any subject. A MOOC is usually an individual course (versus a series), very large (typically in the thousands), free for anyone, anywhere – that is, the "open" part, offered via the internet, and it is (typically) not awarded college credit. There is no "entrance" requirement other than access to an online connection and standard internet browser software.

MOOCs began in 2008 and started gaining traction in 2011. They were on a grow curve but appear to have levelled out in 2013 (Miller, 2014). There are three primary MOOC providers: Coursera (www. coursera. org), EdX (www. edx. org), and Udacity (www. udacity. com) (Robinson, 2013). Universities subscribe to a provider, which means they are buying access to a database of millions of potential students. Coursera, for example, has nearly seven million users, worldwide (Perna et al., 2014; Robinson et al., 2015).

MOOC courses can vary in length from four to twelve weeks. Research shows that participation in MOOCs slows after the second week and really begins to trail off after four weeks (Straumsheim, 2014; Perna et al., 2014). The subject of this paper is a Geodesign MOOC titled: 'Geodesign: Change your world'. It is five weeks in length and was offered for the first time August-September 2014.

As with any new subject or terminology, the early players to the dialogue can have a strong influence on its future. The potential global reach that a MOOC provides served as a strong incentive to the MOOC development team to become a larger player in the discourse that is continuing to define and shape geodesign. Something similar can also be said with respect to new education mechanisms. Though MOOCs are relatively new, pedagogical and technical issues have been raised regarding MOOC participation and effectiveness (Yousef, Chatti, Schroeder, & Wosnitza, 2014). The structure and approach to this Geodesign MOOC sought to address these.

2. GEODESIGN MOOC BACKGROUND

The Geodesign MOOC's sponsoring institution, Penn State University, is not new to online course offerings. The University's World Campus has over fifteen years of success in offering courses and degrees solely online (www.worldcampus.psu.edu/about-us). Along with the services of a World Campus instructional designer with online expertise, within the MOOC development team's home college there is also a resource for creating online courses: the eLearning Institute. Additionally, the new online graduate programs in geodesign are in partnership with the University's Geography Department. Their long track record of success with an online Master of Geographic Information Systems (MGIS) degree, and the development of a Maps MOOC one-year earlier, enabled them to contribute valuable mentorship to the Geodesign MOOC team. This combination of expertise and resources served as impetus to proceed with preparing a Geodesign MOOC.

Penn State University signed on as a Coursera partner in February 2013. The University has a limited number of MOOC course slots; for that reason, and to monitor the quality of the proposals, there is a competitive two-stage review process to determine who can offer a MOOC. The Geodesign MOOC development team became aware of this opportunity when Geography started preparing a Maps MOOC in 2013. The Geodesign MOOC is part of the second round of MOOC courses authorized from Penn State University (Figure 1). Some MOOC courses are purely thought-leadership; some are closely tied to current online degree programs. The Geodesign MOOC is a combination of both of those reasons for doing the course.

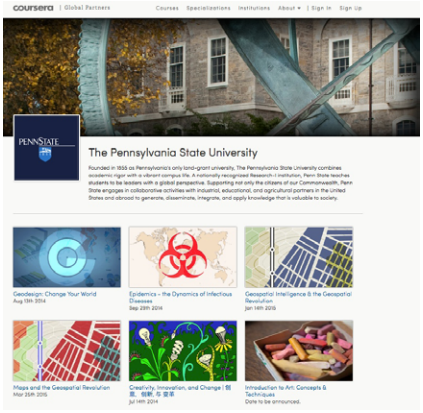


Figure 1. MOOC provider Coursera's list of Penn State University Courses.

2.1 Motivation to pursue a MOOC

There appear to be no generalizable motives for why a MOOC is produced. "Motivations vary from philanthropy/altruism to marketing/branding to fu-

ture profit-making" (Bali, 2014, p. 44). The Geodesign MOOC development team's motivation for creating their MOOC touches on these and is centered on three chief purposes. The first is that the term geodesign is still new enough to have a variety of conceptions about it (Artz, 2010; Flaxman, 2010; McElvaney, 2013; Miller, 2012; Steinitz, 2012). The development of the Geodesign MOOC was based on the team's strong desire to help shape dialogue regarding this emerging form of land design and planning practice. In particular, the authors of the MOOC are in a school of landscape architecture and seek to reinforce recognition that geodesign is a collaborative process, with design as one of its core components (Foster, 2015). The Geodesign MOOC development team believes a MOOC affords a unique opportunity to clarify and advance their perspective on what geodesign is (or should be) and what it is not, and to help steer the dialogue in a specific direction. The primary motivation for doing this MOOC is to provide thought-leadership about geodesign.

The second motivation for undertaking a MOOC is to expose new audiences to geodesign. There is a strong interest in exploring the role that technology can play to broaden access to this content (Lang, 2014). As a Coursera partner, there is potential for this MOOC to have a very broad reach. Heavy promotion through a variety of channels was also paramount to reaching a diversity of students. Due to MOOCs being low-stakes and free, they provide an excellent way to expand awareness about geodesign to many who would likely have never heard about it otherwise.

The third motivation for doing this MOOC is to enhance visibility about educational opportunities in geodesign, which includes the sponsoring university's new online geodesign graduate programs. Many online courses for credit target working professionals who seek career advancement without relocating. A MOOC expands that audience to include individuals pursuing continued personal growth. Research shows that MOOCs attract life-long learners (de Waard et al., 2011; Koller, 2012). Because there are no entrance requirements, MOOC students can be at any stage of a career and from any background (Kizilcec et al., 2013). Some who take a MOOC may be interested in exploring the course's key concepts further.

2.2 Course Goals

MOOCs continue to evolve and each course is based on its own underlying priorities (de Waard et al., 2011). As discussed above, a key motivation for undertaking this MOOC is to provide thought-leadership about geodesign. To support that desire, four key goals were identified to guide creation of the Geodesign MOOC.

The initial focus is the importance of offering this at a very introductory level; the team did not want to lose students in jargon and minute details. We correctly surmised that most students were not aware of geodesign prior

to the course. The first goal is to create a geodesign "gateway" experience. Covering basic concepts about a subject is a common approach for MOOCs (Miller, 2014).

The second goal is to raise the level of excitement about the possibilities for positive change in a place. This goal is of personal significance for the course faculty author. It is based on the desire to instil hope in the students. One of geodesign's tenets is its potential to empower people (McElvaney & Foster, 2014). The course author wants to assist students in understanding how they can participate in advancing desired change in their community.

The Penn State University geodesign graduate program's advisory board of national experts highlighted the third goal. They insisted the course must inspire students through real-world examples of geodesign from across the globe. With an anticipated global audience, avoiding being too USA-centric can enable students to find relevance. A diverse set of case study examples were curated and are discussed below.

The last goal, related to the others, is the course faculty author's desire to have this MOOC encourage a global conversation about issues surrounding change in a place (Figure 2). In particular, the potential to approach how land design and planning challenges can be handled differently – specifically how the geodesign process can facilitate desired change.

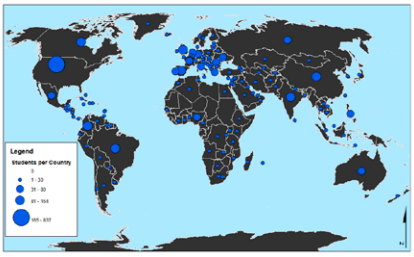


Figure 2. Map of Geodesign MOOC course enrolment numbers by location.

3. COMPONENTS TO ENHANCE MOOC SUCCESS

Increasingly both the conversation and research about what constitutes success in a MOOC is shifting. Sharp criticism has been levelled that the percentage of student completion rates are too low (de Waard et al., 2011; Miller, 2014; Stenger, 2014; Yousef et al., 2014). This perspective is slowly being replaced by other means of assessing MOOC success. There is growing understanding that different types of student learners seek different educational experiences and ways of gaining new knowledge – and not all desire an official statement of accomplishment awarded to those who satisfactorily complete all MOOC course requirements (De Waard et al., 2011; Kizilcec et al., 2013; Straumsheim, 2014). There are a variety of findings aimed at understanding

what approaches may yield more effective online teaching. For this paper, those also well suited for MOOC instruction are curated and discussed. They are provided to address attaining successful MOOC outcomes, defined here as student-identified satisfaction via post-course self-reflection feedback and surveys. These findings are primarily pedagogical issues, with some related to technological issues, which MOOC course designers should be mindful of when creating a MOOC.

The research points to seven pedagogical and platform issues with noted impact on MOOC quality and student success:

- More than lectures as content
- Student motivation & engagement
- Assessment
- Organization & structure
- Differential learning styles & Accessibility
- Application of new knowledge
- Online Platform Issues

Naturally, several of these are interrelated; however reviewing each reinforces the potential opportunities for overcoming concerns about the MOOC educational experience.

3.1 More than lectures as content

The original method of instructional delivery for a MOOC was the recorded video lecture. Many MOOCs still follow this format; however, relying on video of a standard 'talking head' lecture as the primary method of instruction is now recognized as one of the least effective ways to deliver educational content online (Koller, 2012; Robinson et al., 2015; Straumsheim, 2014). Videos most certainly can and should be used, but it is best if they comprise only part of the course content and are properly designed. When determining content for a video, course authors should adhere the 'segmenting principle', which is a key multimedia instructional tenet (Miller, 2014, p. 155). It is particularly beneficial to students who are new to the subject matter to deliver that information by dividing it into shorter segments, preferably about ten minutes in length (Miller, 2014; Norvig, 2012). Providing content in a variety of formats and organized as modules is a best practice, including incorporating active learning (Lang, 2014; Straumsheim, 2014). For this MOOC, in addition to the video lectures, content is offered that highlights geodesign through mapped and hyper-linked case study examples, targeted readings, and interactive activities, such as exploring alternative design scenarios.

3.2 Student motivation & engagement

Free courses are particularly susceptible to student distraction and disengagement. There are plenty of interesting things on the internet – what will keep students motivated to return each week? Additionally, large online courses can seem particularly impersonal, so recognizing the social needs of students is an important consideration. For MOOCs, the course instructional design is paramount to manage for active student engagement (Miller, 2014). Students respond best to repeated opportunities to review and practice the key concepts (Lang, 2014). Proper design of assignments and activities, seeded-prompts in discussion forums and fostering voting on peers' discussion forum posts can contribute to engagement (Robinson et al., 2015). This MOOC begins with an introductory interactive map as a social connector to help engage students and make it feel less impersonal (Head, 2013; Robinson et al., 2015). The map immediately immerses students in spatial issues central to geodesign by having each student self-locate and contribute something about themselves related to their interest in geodesign.

3.3 Assessment

One study clearly showed that "learning analytics and assessment" were key features in MOOC effectiveness (Yousef et al., 2014, p. 48). Providing regular feedback to students on their progress helps them understand and "improve their learning outcome" (Yousef et al., 2014, p. 46). This is often accomplished with short, weekly quizzes. With the massive student numbers in a MOOC, it can be difficult to provide detailed, personal assessments. A unique way to address this has emerged in form of peer-grading of assignments (Luo, Robinson, & Park, 2014). Related to student engagement above is the value in having students become fully engaged in course content through evaluating their peers' work. Along with that desired engagement, the peer assessed assignments also represent a valuable learning strategy because students discover and grow from that experience (Koller, 2012; Luo et al., 2014). This MOOC deployed peer assessment of the final activity, which relates specifically to geodesign – each student submitted their outline of a geodesign challenge. As discussed previously, there is increasing recognition that many MOOC learners do not need or seek assessment of their learning progress (de Waard et al., 2011; 2014; Kizilcec et al., 2013; Straumsheim, 2014).

3.4 Organization & structure

Most recognized instructional design approaches stress the importance of a well-organized course to help students frame their learning (Miller, 2014; Yousef et al., 2014). Additionally, the content of lectures and their organization are also found to be an important factor in MOOC success (Yousef et al., 2014). There is also considerable value in using a graphically visual calendar

to help students get an overall grasp of the course structure (Kizilcec et al., 2013; COIL, n.d.). The course's objectives and schedule must be clearly defined for students from the very beginning of the MOOC (Yousef et al., 2014), and reinforced again each week. It is important to remember that a MOOC should not be treated the same as a traditional classroom course (Bali, 2014; Straumsheim, 2014). The aforementioned principle of "segmenting" (Miller, 2014, p. 155) can also apply to how the course is organized; chiefly: in modules. Modules can, for example, introduce a topic in different formats or the same topic divided into different parts (Straumsheim, 2014). Modules can reinforce each other, but each is also discrete; this means that if a student does not view every module, the goal of introductory exposure to the topic may still be satisfied. This MOOC is organized in modules to provide consistent structure each week with diversity of content delivery as discussed above; modules are discussed below in section 4 (Outcomes).

3.5 Differential learning styles & accessibility

The sheer quantity of students and the fact that MOOCs have no entrance filters means that there will be a wide variety of student abilities, learning styles, facility with language, and accessibility issues. The MOOC instructor should be cognizant of accessibility, particularly for students from locations with bandwidth or other online access limitations (Kizilcec et al., 2013). People process information in different ways, referred to a "VAK: Visual Auditory Kinesthetic" (Miller, 2014, p. 150). In other words, some people prefer a graphic modality; some process better via spoken word; and others prefer making activities. In point of fact however, it is how these modalities are combined that is most important (Miller, 2014). Providing instruction in a variety of modalities enables a wider range of students to learn more effectively. For example, "narration works best when it uses conversational … language", and it is not verbatim of text on the screen (Miller, 2014, p. 154). The aforementioned discussions about video lectures should also be considered related to differential learning styles and accessibility. It is a best practice to include, along with the video, the written text of what is spoken in the video and any included graphics (Robinson et al., 2015; Yousef et al., 2014). Furthermore, the recorded lecture itself should not be just the professor talking, but rather seek to engage visual learners, which is the majority, by incorporating illustrations or graphics that directly support the concept being discussed. And the video and accompanying text can go further by deploying the "signaling principle", which advocates highlighting key points so they stand out (Miller, 2014, p. 155). The goal here is to enable each learner to proceed at his or her own pace (Koller, 2012). The fact that a MOOC is asynchronous and videos can be slowed down as well as watched multiple times, or read instead of watched, can be an advantage in achieving this. With geodesign rooted in spatial issues

and place-based design principles, the MOOC faculty author could easily address this component through the generous use of graphical examples specific to these issues and principles.

3.6 Application of new knowledge

A strong concern voiced about MOOCs is that they typically provide little or no opportunity for students to apply their new knowledge (Stenger, 2014). Deeper reflection about the subject is desired (Bali, 2014). This can be a challenge due to the scale of the class size, the uneven skill level of the students and the typically introductory nature of MOOCs. There are two instructional techniques that can be used to address this need: thoughtfully detailed discussion forums, and assignments that go beyond basic auto-graded responses. As discussed above in the section on Student motivation & engagement and in the section on Assessment, there are exciting ways to foster dialogue within the discussion forums that can ask students to think more deeply, and requiring an assignment prepared by the student that is peer reviewed will necessitate that students apply what they have learned.

3.7 Online platform issues

The MOOC providers have a robust platform that scales to accommodate thousands, but that may also mean it is less forgiving in how a course is structured (Head, 2013). As mentioned, MOOCs evolved from a video-biased format. Both of these issues may require some creativity to overcome these limitations in order to address issues outlined above. An important distinction in massive online instruction, which can be a huge factor in determining content, is that MOOC's do not fall under the United States' 'fair use' educational standards (Smith & McDonald, 2013). If the provider is a for-profit company, such as Coursera, then MOOCs must receive permission for any content except for direct links. The Geodesign MOOC course faculty author contacted one publisher for permission to use an paper and the response was to have each student pay individually $2.00 per copy. This counteracts the notion of a free MOOC and places students unable to pay at a disadvantage. Some publishers may be more understanding (Smith & McDonald, 2013). It is probably best, however, that course authors rely primarily on instructor-generated content or use third-party public domain or open access materials, such as Creative Commons licensed content. Two organizations did grant permission to access and showcase online content specific to geodesign issues, which enabled the course author to provide key information about geodesign that would not have been possible otherwise.

4. OUTCOMES

4.1 Geodesign MOOC Course Design and Structure

This course was developed by working through a desired set of learning objectives and matching those to logical course content, including outlining seminal introductory-level geodesign topics (Table 1).

GEODESIGN MOOC	TOPIC/SHORT OUTLINE	LEARNING OBJECTIVES
Week 1	Shared Languages (Key underpinnings of geodesign) •Spatial Thinking •Creative Change •Location, location, location	1) Identify how geodesign embodies "things" that are within vour personal, everyday experience 2) Be able to identify and expl ain the potential for change in a problem. 3) Begin to explore what geodesign is through interactive mapping (Case Studies) and readings.
Week 2	The Three 01s of Geodesign (Geodesign is a design process) •Design •Decision •Data	1) identify the key components and their operations (or functions) that are central to the geodesign process. 2) Recognize how these three key components are interrelated. 3) Continue to e xplore what geod esign is through interactive mapping and readings.
Week 3	The Three C's of Geodesign (Geodesign components in action) •Complexity •Computation •Collaboration	1) Recognize the complexities inherent in the geodesign process 2) Be able to explain the value of computation and collaboration to geodesign. 3) Translate week two's components into an understanding of how those are put into action to accomplish geodesign.
Week 4	The Influence of Context (Culture of shaping force) •People of the Place •Factors and Scale	1) Recognize that there are myriad factors that influence how a development may impact upon a place. 2) Be able to describe the value of local knowledge. 3) Gain understanding about the interrel ationships of the physi cal and human aspects that contribut e to how geodesign s trategies are c.omposed.
Week 5	Process and Framework (The value of using a proven process) Six models as the method to address fundamental questions	1) Build awareness that there is an iterativ e process needed to work through a geodesign challenge. 2) Distinguish between all the components of the geodesign process and how each one's role contributes to the process. 3) Be able to describe the scope and team members who should participate in a self-sel ected geodesign study.

Table 1. The learning objectives for each week of the MOOC.

A five-week structure was established and designed for approximately three to five hours of student engagement per week. The course design designates each week as one lesson that centres on a major theme or key topic. The learning objectives and topics were prioritized from a list the faculty course author assembled based on research during preparation of new graduate course proposals, a review of issues from recent conferences (Geodesign

Summits), and as stated previously, the particular perspective this geodesign MOOC intended to cultivate. The design and structure of two recent successful MOOCs at Penn State University were also analysed (www.coursera.org/course/maps, www.coursera.org/course/art).

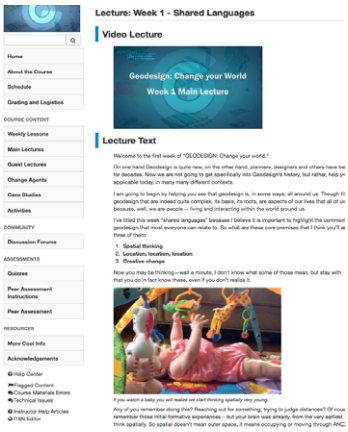
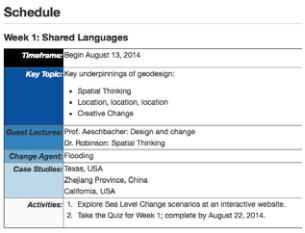


Figure 3. Example MOOC page shows main lecture displayed as text and graphics.

To address aforementioned issues deemed to enhance MOOC success; the Geodesign MOOC course is designed as modules to offer consistent structure for each week. The MOOC course design team also took the approach that the main lecture video is not the core content; instructional content provided in the other modules is equally valuable. Furthermore, to provide an alternative way to access and view the Key Topic material covered in the video, the lecture content is directly embedded on the Coursera page as text and graphics (Figure 3). Additionally, a companion theme is introduced each week in the form of a "Change Agent". Geodesign is defined as creative change for a place (McElvaney & Foster, 2014). A Change Agent theme is identified to provoke student thinking about who or what instigates change in a place. The structure then for each week includes five modules: A Key Topic, Guest Lectures, Change Agent, Case Study Examples, and Activities. Each module reinforces or complements either the weekly Key Topic or the Change Agent. For example, each guest lecture goes into more detail about a concept revealed in the main lecture's overview of the Key Topic. The Case Study Examples, on the other hand, reinforce each week's Change Agent theme. The weekly structure is announced to the MOOC students as a visually graphic outline, shown in Figure 4. The MOOCs Discussion Forum, which provides a significant means for student engagement, was arranged to include sub-forum discussion areas related to each of the course modules.


Schedule

Week 1: Shared Languages

Timeframe:	Begin August 13, 2014
Key Topic:	Key underpinnings of geodesign: • Spatial Thinking • Location, location, location • Creative Change
Guest Lectures:	Prof. Aeschbacher: Design and change Dr. Robinson: Spatial Thinking
Change Agent:	Flooding
Case Studies:	Texas, USA Zhejiang Province, China California, USA
Activities:	1. Explore Sea Level Change scenarios at an interactive website. 2. Take the Quiz for Week 1; complete by August 22, 2014.

Figure 4. Example schedule showing five modules included in each weekly lesson.

4.2 Geodesign MOOC Subject Matter

Content was selected to respond to the course goals: to create an introductory-level experience, to inspire attitudes about the opportunities geodesign can provide, and to provide a balanced view of what geodesign is, all while being mindful of the platform and "fair use" limitations discussed above. The primary influences on the details of what to include were the Key Topic and Change Agent for each week. These are shown in Table 2. The following provides an overview of the subject matter covered within each of the modules each week.

GEODESIGN MOOC	KEY TOPIC	CHANGE AGENT THEME
Week 1	Shared Languages •Spatial Thinking •Creative Change •Location, location, location	Flooding
Week 2	The Three 01s of Geodesign •Design •Decision •Data	Infrastructure
Week 3	The Three C's of Geodesign •Complexity •Computation •Collaboration	Conversation
Week 4	The Influence of Context •Factors •Scale •People	Sustainable Development
Week 5	Geodesign Process and Framework	Urbanisation

Table 2. The guests provide additional perspective regarding the week's Key Topic.

To reinforce that the main lecture video is not the sole source of information, guest speakers were selected to provide additional voices, perspective and expertise on the Key Topic each week. The guest lecturer page in the MOOC provides a short biography about each speaker, but unfortunately the video lecture content is not transcribed. Most of the videos are however cap-

tioned, offering students the opportunity to read a transcript during the video. Future offerings of the MOOC hope to rectify this accessibility limitation. The topics covered by the guest lecturers are included in Table 3.

There are of course thousands of reasons change can happen in a place. Change Agents can be forces for positive as well as problematic change. The five Change Agents were selected due to their universal applicability across the global and their representation of how to address both positive and problematic influences in land planning and design contexts. The global design and engineering firm, Arup, has published a series of "cards" called "Drivers of Change" (Arup Foresight, n.d.).

GEODESIGN MOOC	KEY TOPIC	GUEST LECTURER/TOPIC
Week 1	Shared Languages •Spatial Thinking •Creative Change •Location, location, location	Prof. Aeschbacher: Design and change Dr. Robinson: Spatial Thinking
Week 2	The Three 01s of Geodesign •Design •Decision •Data	Prof. Foster: Decision is driver Prof. Aeschbacher: Design: teamwork and iteration
Week 3	The Three C's of Geodesign ••Complexity •Computation •Collaboration	Dr. Flaxman: Tour of geodesign tools Dr. Robinson: Analyzing Data Prof. Aeschbacher: Collaboration
Week 4	The Influence of Context •Factors •Scale •People	Dr. Lisa McElvaney: Human Dynamics Dr. Anthony Robinson: Influence of Scale
Week 5	Geodesign Process and Framework	Or. Olson: Geodesign -Forest Lawn Creek Example Mr. Palavido & Mr. Bhargava: Using GeoDesign Analysis for Sustainable Design and Planning Mr. Beck: Envisioning Utah -Meadowbrook Station Project

Table 3. The guests provide additional perspective regarding the week's Key Topic.

Permission was granted to include a selection of cards chosen for their relevance to weekly Change Agent topics. Figure 5 shows one example card, which is two sided and provides a concise overview on an issue, thus serving as a unique, graphically engaging way to provoke dialogue at an introductory level.

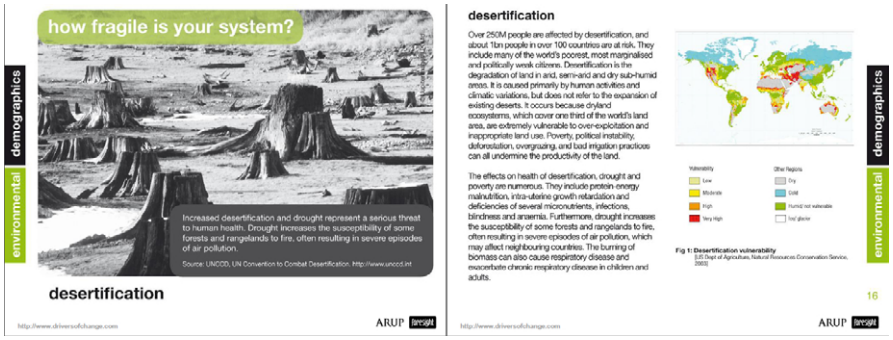


Figure 5: Example Change Agent "card" addresses Week 3 theme: Conservation (Arup Foresight, n.d.).

Showcasing real-world examples of what geodesign is and can be was deemed an essential component of the MOOC. Case study examples were curated to reinforce each week's Change Agent topic (Table 4).

GEODESIGN MOOC	CHANGE AGENT THEME	CASE STUDY EXAMPLES: TOPIC AND LOCATION
Week 1	Flooding	• New National Recreation Area on the Gulf of Mexico: Texas, USA • Growth Pattern of Taizhou City Based on Water Network Landscape: Zhejiang Province, China • Napa River Flood Protection and Waterfront Redevelopment: California, USA
Week 2	Infrastructure	• Exploring options for shale gas pipeline and roadway development: Pennsylvania, USA • Designing for expansion of a national electricity network: Spain • Retrofit five-lane arterial into walkable townscape boulevard: Arkansas, USA
Week 3	Conversation	• Model for heritage conservation of a significant cultural landscape: Shandong Province, China • Halting River Delta decline to protect livelihoods and natural resources: Louisiana, USA • Uncovering buried stream creates ecological, recreational and economic opportunities: Seoul, South Korea
Week 4	Sustainable Development	• Working to reduce carbon emissions in small towns: British Columbia, Canada • Land-based strategies rooted in natural terrain that affordably promote development: Rwanda, Africa • Transform brownfield into living filter to create habitat and enhance public health: Zhejiang Province, China
Week 5	Urbanisation	• Partnerships foster cooperation to design transit-oriented centers: Utah, USA • Port transformed into sustainable communities that respect unique heritage: Hamburg, Germany • Flooding challenges to historic town require both offensive and defensive strategies: Colorado, USA

Table 4. Case Study Examples chosen to illustrate the weekly Change Agent Theme.

Fifteen case studies were chosen, over half of which are outside the USA and representing seven countries. It was a distinct challenge to find the desired level of detail available for access solely online. These illustrative case studies were interactively mapped via Esri's Story Maps (http://storymaps.arcgis.com), and each case study example includes web links for further explanations (Figure 6). To facilitate accessibility each case study example was also provided as a PDF. Permission was granted for these, the most prominent of which is the American Society of Landscape Architects's extensive website for award winning projects (ASLA, n.d.).

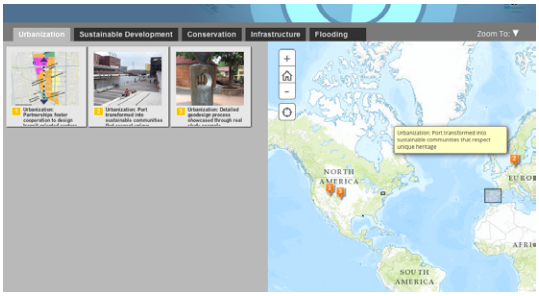


Figure 6. Case Study Examples illustrated via a dynamic interactive map. Each tab represents a Change Agent Theme.

The activities each week included readings and an interactive activity that relates to either the Change Agent or Key Topic. These were designed to address the aforementioned issues of student engagement and knowledge application. The students' final activity is a peer-assessed assignment; they were asked to outline a geodesign challenge upon what they've learned. This final assignment reinforces the goal of having the course be relevant to the students and to help them understand positive change possibilities for their area of interest. The assignment requires the student to discuss seven items, six of which tie directly to the MOOC's weekly topics: what type of change (select from the Change Agent-types); describe why creative change is needed to address the challenge; what scale is most appropriate; who should be the collaborators; what factors will impact the situation; and what types of data are needed. The seventh item is a website address that provides background about the geodesign challenge. Students submitted a short PDF addressing those seven items and also 'pinned' their challenge location to a class map. Figure 7 shows the mapped final assignments, with each colour representing a different type of Change Agent.

Figure 7. Students' final assignment outlined a Geodesign Challenge. The location of each challenge is mapped with the "pin" colour selected to signify the challenge's Change Agent category.

4.3 Student engagement

The Coursera platform has several analytic tools to measure the reach and level of engagement in the course. The Geodesign MOOC enrolled nearly 17,600 students, representing 167 countries. This is in line with a typical MOOC enrolment size of 20,000 (Jordan, n.d.). Of those registered, 38% are considered to be from emerging economies. The course attracted at least one visit from 10,368 or 59%, and 7,890 or 45% watched at least one lecture. For the first time offering this MOOC, the team is happy to see the goal of beginning to build wider awareness of geodesign met with some success. Taking the nearly 8,000 as the 'maximum' engagement via videos, the analytics reveal that 20% of that number were still active in the last week by viewing the main lecture video. Because of the platform limitations and Coursera's emphasis on video content, we unfortunately cannot easily get statics on visits to, for example, the Case Study Examples pages.

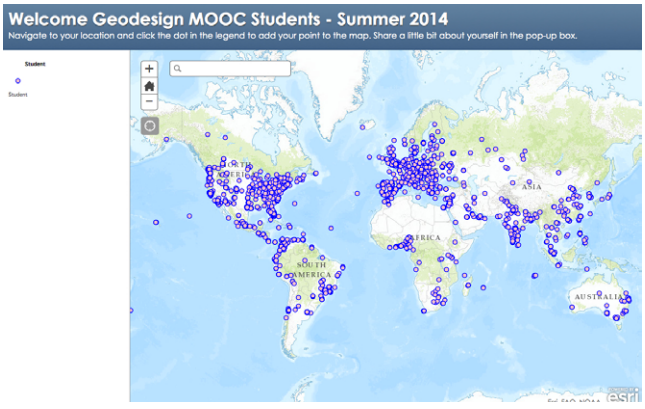


Figure 8. Students' final assignment outlined a Geodesign Challenge. The location of each challenge is mapped with the "pin" colour selected to signify the challenge's Change Agent category.

Familiarity with the Penn State University Maps MOOC enabled the Geodesign MOOC team to deploy a best practice for early student engagement, a class map (Figure 8), which was available beginning the week from before the MOOC opened (Robinson et al., 2015). Students self-locate and share a little bit about themselves, thereby enabling all students to experience a common connection with their peers.

As discussed above, the primary place for student engagement in MOOCs is the discussion forums. Due to the large volume of posts, these can be difficult to monitor closely. Awarding participation points for merely submitting a post to a forum was deemed too superficial, as our MOOC team has no easy way to monitor content. To stimulate student participation, points were awarded if a discussion post receives 'up votes' from fellow MOOC participants. This empowers each student to weigh in on the relevancy or significance of a post, as well as encouraging students to compose thoughtful posts. One student received 32 up-votes over the course of the five weeks, and nearly 150 students received at least one up-vote on a forum post. There were a total of 2,228 forum posts, but well over 23,600 forum-post views. The difference between views and number of posts seems to validate the previous discussion that some MOOC students are primarily there to look at content and browse course resources, which de Waard et al. (2011) called the "lurking participant".

The final peer-assessed assignment served as the other primary avenue for student engagement. Using 7,890 as maximum participation (watched at least one video), the analytics show that 482 or 6% participated in the final assignment. Of those, 451 (5.7%) satisfactorily completed all the MOOC course requirements to earn a statement of accomplishment. These numbers fall within the overall completion rates experienced by other MOOCs (Jordan, n.d.).

The Geodesign MOOC was designed for three to five hours of engagement per week. A post-course survey administered by the Geodesign MOOC team reveals that most of the students hit that target: 35% selected one to three hours, and 48% chose three to six hours per week.

4.4 Student Feedback

There were two post-MOOC surveys aimed at better understanding student reaction to the course: both Coursera and the Geodesign MOOC team requested student feedback. One caveat: there is no way of knowing to what extent participation in these surveys overlap, however there is enough distinction in questions to use both. Though these received relatively low participation rates (Coursera, 1.8%; MOOC team, 2.7%), the feedback is none-the-less helpful.

Related to the above discussion about hours of engagement per week, 74% of the students felt the course pace was "just right", while 21% felt is was "somewhat fast". There are several questions regarding the course design. A solid majority rated the quality of the course materials as "excellent" (48%) and "Good" (47%). The question "how relevant do you think the exercises (e.g. quizzes, assignments) are to the rest of the course?" also yielded positive feedback: 50% at "very relevant", 26% at extremely relevant". The responses to the next question point to needs in student engagement improvement: "how valuable are the discussion forums ... in helping you learn?" 39% said "moderately valuable", while the same percentage (22%) said "very valuable"/"slightly valuable", and 7% said "not at all".

The Geodesign MOOC team is particularly pleased to see the student's self-assessed learning metric that provides insight into our goal of improving understanding about geodesign, with over 50% stating "quite a lot". Additionally, 28 students provided a personalized written response to Coursera's open-ended "Learner Stories", which ask students to share course experiences directly to the MOOC instructor. These were wonderful comments to read and came from an astonishing amount of eighteen different countries, ranging from Brazil and Venezuela, to India and Thailand, to Saudi Arabia and the UAE, to Morocco and Democratic Republic of Congo, to five European countries and the United Kingdom, and the USA. These students reported seeing both specific and broad applicability of the geodesign concepts.

5. CONCLUSION

This contribution has described the background, course design and content details associated with offering the first MOOC on the subject of geodesign. The author has also provided an overview of pedagogical and technical considerations found to be associated with producing a successful MOOC. Based on this work several challenges and opportunities emerge.

The faculty course author struggled with how best to balance representation of a process as complex as geodesign without oversimplifying it. The results show that nearly a quarter of the participants felt the pace was a bit too fast. This dilemma of how to best address different learning abilities and levels of prior knowledge is shared with resident instruction, but is likely more pronounced in MOOCs because there are no course entrance standards. Techniques need to be researched and developed for how to engage this wide-range of users without overwhelming some.

Another challenge is how to resolve the conflict between research showing students desire to apply newly learned knowledge and the low percentage of students who participated in the assignment that does this best. There appears to be a need to seek other, less intensive ways that enable students to apply knowledge while still being meaningful.

Student engagement issues related to the discussion forums appear to point out an opportunity to enhance student interaction. Helpful alternative forum engagement strategies, such as those discussed in Robinson et al. (2015), can be investigated. A future modification could include the course instructor selecting and "elevating" insightful or helpful forum posts to bring these to the attention of all MOOC students, and posing further questions or discussion prompts related to these.

The faculty course author's self-reflection reveals an admittedly surprising sense of connection to these students and an overall feeling of success in achieving the course goals. Although there are thousands, those students that chose to share and engage expressed a depth of interest in geodesign not anticipated. And even those that did not share, the fact that thousands watch a video reveals a unique reach well-beyond typical teaching experiences. It was also enlightening to see the diversity of truly inspiring geodesign challenges identified by the students. The students clearly have issues and concerns in their locales for which they see geodesign as a possible way forward. The ability to reach so many individuals across the globe is both humbling and exhilarating. This all reinforces the magnitude of responsibility to prepare a first-rate experience for the students.

The MOOC format is shown to have great potential for informal and lifelong learning. MOOCs also have the amazing capacity to reach individuals from around the globe. Making use of this unique format for introductory exposure to topics should continue to prove valuable as the desire to reach more audiences and the need to increase exposure to geodesign grows. The survey data and student feedback support utilizing a MOOC to build awareness and disseminate information about geodesign. Due to geodesign's complexity, there are certainly possibilities for taking any of the weekly topics and, for example, expounding on those to create five or more MOOCs, each delving into more detail about those components of geodesign. There is clearly interest, worldwide, and due to the interdisciplinary nature of geodesign, as well as the diversity of scales and issues geodesign can address, it is the author's opinion that there is abundant opportunity for more to get involved in expanding the dialogue about geodesign.

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