

Barriers to Teaching Introductory Physical Geography Online*

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Abstract

Learning geography online is becoming an option for more students but not without controversy. Issues of faculty resources, logistics, professional recognition, and pedagogical concerns are cited as barriers to teaching online. Offering introductory physical geography online presents special challenges. As a general education course, an introductory physical geography course has a diverse population of students with disparate educational needs and goals that impacts its ability to be delivered online. Online learning is further complicated when lab courses require specialized laboratory equipment and fieldwork. A survey of geography departments in the United States was conducted to determine barriers to the deployment of introductory physical geography lab courses. Lack of faculty interest, faculty resources, and pedagogical concerns were found to be the most important barriers to deploying online physical geography lab courses.

Knowing the challenges faced by geography departments offering online courses provides insight into where valuable support services and resources can best be used to address them. Recent advances in blogging, podcasting, lecture capture, web conferencing, and augmented reality are offered as solutions to the concerns expressed by survey respondents.

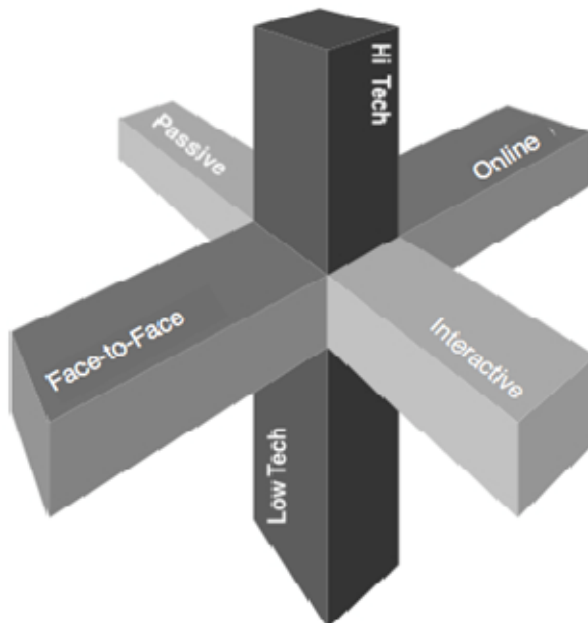
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Introduction

Online education bestows the advantages of flexible learning over time and space, ready access to rich learning materials, promotion of collaborative learning, self-assessment, and application of constructivist and connectivist pedagogies (Menges, 1994; Hill & Solem, 1999; Lemke & Ritter, 2000; Ritter & Butler, 2001; Siemens, 2005). Encouraging the development of online courses has been shown to positively affect faculty pedagogical styles in their conventional lecture courses (Bishop & White, 2007). Over sixty percent of chief academic officers in the United States believe online education is critical to the long-term strategy of the institution resulting in explosive growth in online courses (Allen & Seamen, 2010). Lynch, Bednarz, Boxall, Chalmers, France, and Kesby (2008) suggested that geography educators need to occupy the e-learning space because of “pressure from students and potential employers” (p.144). The urgency of geography as a discipline to embrace online education was recently described by Association of American Geographers President Ken Foote, “... as an imperative, not just an option.” (Glasmeier, 2012)



A body of research has been unfolding over the last decade to address the efficacy of online education in geography (Rodrigue, 2002; Jain & Gettis, 2003; Terry & Poole, 2011). Lynch et. al. (2008) described how geography educators have tapped into e-learning tools and proposed a multidimensional model of geography’s learning spaces upon which an activity can be mapped (Figure 1).

Figure 1. *Geography’s learning spaces (after Lynch et. al., 2008). Used with permission.)*

The three axes, or continua, of the model relate to:

- The environment where learning takes place (face-to-face classroom to totally online)
- Tools required (hi to low tech)
- Degree of engagement (passive to interactive)

The environment for e-learning can be an online addition to a face-to-face course, a partially online hybrid course, or totally online. Online learning can employ low tech means of engaging students with simple web pages to high tech augmented reality applications and virtual environments like Second Life (Dittmer, 2010). Determining the continua of e-learning tools is difficult as technology constantly evolves for what was once high tech soon becomes low tech. The degree of engagement in the e-learning space ranges from passive text-based reading assignments to the use of highly interactive online simulations.

Lynch et. al. (2008) suggests that “If we understand the e-space we describe and configure, and recognize the context of teaching and learning experiences, we can facilitate the use of versatile and pedagogically appropriate e-learning technologies” (p.146). They further suggest the model can identify potential barriers to occupying a particular space in the model. For example, laboratory activities and field study skills needed for geography majors are difficult to undertake online. If the geography course is aimed at general education students as well as majors, these skills may not be relevant to all students and activities that can be done online can be substituted. Virtual field trips may be a suitable replacement, addressing similar but not necessarily equal, learning outcomes. Hence, the role of the course plays in the department and university curriculum may guide its content and the opportunities for alternative delivery modalities.

Though many benefits exist, some educators find teaching and learning at a distance less than desirable. Educators fear the loss of teacher-student contact, informal student-to-student learning, and the institutional culture promoted by attending a conventional onsite, face-to-face course (Neem, 2011). Probationary faculty is wary of the amount of work to retool and revise their courses and its value towards retention and tenure decisions. Resistance to teaching online may be related to the role a distance educator plays in the online classroom. An online course facilitates moving from teaching-centered learning to student-centered learning. Student-centered learning, especially online, is a disruptive force to conventional teaching practices. Student centered distance education forces educators to re-evaluate their position in the educational process, transitioning from the dispenser of

course content to facilitator. The educator does very little if any lecturing as a facilitator, and places more responsibility for learning on the students. The teacher as facilitator guides students through the content of the course, steering them to learning resources, encouraging discussion, and fostering collaboration between students.

An introductory physical geography course is common to most geography programs. The introductory course often serves multiple requirements in the department and university curriculum. An introductory physical geography course serves 1) as a general education science course for graduation, 2) a foundational course for a major, or 3) both requirements. For many institutions, the introductory course plays all three of these roles. A general education introductory physical geography course can be a high enrollment course presenting logistical issues in delivering the content. General education courses can have a substantial population of non-majors enrolled. Such diversity of students presents a challenge for addressing their varying needs and learning styles.

An introductory physical geography course can be more effectively deployed online to general education students, as they do not need use the same tools, or gain the same skills as a geography major. The needs of those taking the course for general education credit are not necessarily the same as a geography major. Thus it is incumbent upon instructors to create learning outcomes addressing the needs of the students the course is intended for (Cloutis, 2010). For example, fieldwork is an essential part of every geographer's training, especially a physical geographer, but not necessarily for the general education student. Knowing how to measure stream discharge is a skill all physical geographers should have, but it's irrelevant to most general education students. Knowing how to search and use discharge and flood stage information from online sources may be a more relevant skill for both general education student and new geography major. Thus, the role the course plays in the university curriculum will drive its content and how it is delivered.

For some geography educators, online learning cannot convey the essence of being a geographer. Gober (1998) cautioned that conducting online courses, even portions of a course, threatens 'the essence of what it means to be a geographer', particularly the 'connection with real, live places'. DiBiase (2000) countered that geography educators have a moral obligation to offer distance education especially to the non-traditional student. DiBiase correctly identified the challenge for geography educators, that being whether to accept a 'Faustian bargain' to sacrifice the connections to real places to reach students desiring an education uninhibited by time and distance. Over the last decade, many geography educators have accepted

this bargain, yet challenges remain.

Given the urgency expressed by leaders of professional organizations, administrators, and students themselves for offering online courses, this paper is an initial investigation into how well the discipline has responded to these calls. The purpose of this research is to examine the penetration of online introductory physical geography lab courses in the geography curriculum and issues that have hindered their implementation.

Method

A random sample of geography departments in the United States was used to determine the extent to which introductory physical geography lab courses have occupied the totally online e-learning space in the United States. The sample was drawn from the Association of American Geographers (AAG) Guide to Geography Programs 2010 - 2011. A short email survey was sent to 90 geography departments in the United States asking:

1. Do you currently offer a totally online undergraduate introductory physical geography lab course?
2. If you do not, why not? Check all that apply.
 - a. Lack of faculty interest
 - b. Lack of faculty expertise in online education
 - c. Lack of faculty resources to devote to online education
 - d. Lack of information technology support for online education
 - e. Pedagogical reasons, do not feel it is an appropriate format for introductory physical geography lab course.
 - f. Logistics of offering a physical geography lab course online - too hard to implement online.
 - g. Other (please explain)
3. If you have other insights or comments to share about offering online physical geography courses please do so.

No questions were asked about the level of technology used in their courses and so this dimension of Lynch et. al.'s model is not addressed. Forty-eight percent of departments contacted returned the survey.

Findings

Results of the survey showed that geography departments have yet to offer online introductory physical geography courses in a major way. Only thirty-seven percent of those responding currently offer online physical geography lab courses. Of the remaining sixty-three percent that do not, the reasons in rank order are given in Table 1.

Interestingly, lack of faculty interest topped the list of reasons for not offering online physical geography courses. Open-ended comments provided by the chairs offer some insight into faculty concerns, e.g., issues related to professional growth and tenure, and compensation. Why they were not interested was not ascertained from individual faculty as the survey was sent to department chairs. Not surprising was the lack of faculty resources to devote to online instruction. Recent budgetary constraints in most states have put pressure on already limited faculty time and resources. In spite of the vociferous condemnation of online geography courses by some geography educators, only 38% of those not delivering online physical geography courses are doing so for pedagogical reasons.

Table 1. <i>Reasons for Not Offering an Online Physical Geography Lab Course</i>	
Reason	Percentage Responding
Lack of faculty interest.	54%
Lack of faculty resources.	46%
Pedagogical	38%
Logistical	35%
Lack of faculty expertise in teaching online.	12%
Lack of university information technology support.	13%

Discussion

Comments made by respondents offer insight into the reasons given for not offering an online physical geography course in Table 1 and provide a basis for solutions to address their concerns. The respondent comments fell into two broad categories 1) faculty and institutional resources and interest, and 2) pedagogical concerns. Though faculty resources and interest topped the list of reasons for not offering online physical geography courses, few of those responding in that manner followed up with comments directed at these issues. Those who responded with comments indicated a lack of need for developing online course due to current high enrollment in conventional face-to-face courses. The majority of respondent comments addressed three areas of pedagogical concern, 1) how to address classroom concerns like delivering “lecture” content to potentially large enrollment classes, 2) logistics of handling lab activities, and 3) how to accomplish field study.

Lack of interest and faculty resources were the two of the most reported reasons for not teaching an online physical geography lab course. The lack of interest may result from faculty experience and perception of the value of distance education. Faculty often perceive online courses as time consuming to build and deliver. Meyer and Xu (2009) found that as teaching load increases, the likelihood to using web technologies increases as instructors try to find alternative ways to present course content. Unless teaching online is recognized in their professional development, they are less likely to engage in it (Foote, 1999; Zhao & Cziko, 2001; Lucas & Wright, 2009).

A survey respondent stated that their institution was a residential campus and thus did not have any online courses. Online courses are not exclusive to non-residential learners, a growing number of online course are available to residential students. Online courses bestow to residential students the same scheduling flexibility as nonresidential students. Some university systems are turning to online education as a means of reducing the cost to residential campuses while increasing enrollment (Keller & Perry, 2011; Young, 2011). One survey respondent that did not check any of the suggested reasons for not offering online course noted that they did not need to “go in this direction to get enrollments”.

For some, the very practical challenges of teaching online are an important deterrent to doing so. The challenge for moving a physical geography course online was expressed by one survey respondent who stated:

“The demand for seats is tremendous making it difficult to offer even the lecture online. Most faculty admit the online requires much smaller class enrollment, unless it is turned into a correspondence type course.”

This comment reflects a common approach to building online courses. For many, the development of an online course has meant trying to replicate their traditional face-to-face lecture-based course online. Free of the constraint of time and space, new ways to deliver course content that promotes active learning and critical thought are possible with online distance education. In spite of the limitations of the lecture method for encouraging critical thought (Blighe, 2000), it has been a preferred method of instruction in geography (Gold et. al., 1993) because of its economy of scale. A conventional face-to-face lecture is a practical way delivering course content to large numbers of students by bringing them together at a set time and place. Efficiencies of scale for information delivery are obtained in the lecture hall, but such passive approaches do little to engage the student (Mazur, 2009). Conventional face-to-face lectures are a “one off” method of content delivery to students who must rely on quality notes to study outside of class. Lecture capture technology enables on-demand review of the class proceedings and entry into delivering courses at a distance. Lecture capture software can broadcast lectures live to students at a distance while also recording them for later review. Those students attending a conventional face-to-face lecture find access to recorded lectures for later review helpful and can improve performance on course assessments (Turner & Farmer, 2008). The proliferation of low-cost video equipment and production software has resulted in a community of educators willing to share their lectures. Apple’s iTunesU provides many such examples from educators around the world to watch for free on their desktops, laptops, and mobile devices.

Some survey respondents indicated that the amount of effort to deliver an online course was a deterrent to offering online courses. Class size and scalability are concerns raised by potential instructors of online courses. One survey respondent stated that their online courses were restricted to thirty students. They felt that it was not practical to replace large, face-to-face sections taught by tenure-track faculty with them. DiBiase (2004) found that the effort associated with teaching an online GIS course scaled to larger enrollments as the instructors gained experience with asynchronous teaching and learning. The results of DiBiase’s analysis may not be applicable to all geography courses, yet indicates that with experience efficiencies of scale can be realized.

A common criticism of online courses is the lack of face-to-face social interaction one has with peers and the instructor. As one survey participant responded:

“We also want them to interact with each other and us, to learn from the informal give and take that happens when working with others.”

Those enrolled in on-campus courses can easily consult on course issues after class or during the instructor's office hours. For the online student and instructor, web conferencing software can replace these visits. Web conferencing software allows two-way audio, video and text communication between instructor and student. Applications like Blackboard Collaborate have an interactive whiteboard for the instructor to illustrate concepts while the students watch. Sessions can be recorded for distribution and review.

Though not specifically asked in the survey, the perceived high upfront cost was singled out as a deterrent to developing online courses. Ever tightening budgets for education require departments to scrutinize where best to allocate resources. Even if departments have faculty resources to devote to distance education, and support from their home university, pedagogical and logistical concerns remain.

Though much of the criticism leveled at teaching geography online is pedagogical in nature, a little over a third of those who do not offer and online physical geography course identified this as reason. Pedagogical reasons for not teaching online given by the survey respondents were related to the differences between teaching and learning in a face-to-face versus online environment. Some respondents indicated they simply prefer face-to-face contact with their students.

Much informal learning occurs during laboratory sessions. Whether participating in groups or individually, access to classmates provides an environment for students to help each other learn. Interacting with fellow students, especially in a lab, may develop interpersonal skills, yet its influence on learning has been called into question. Vavala, Namuth-Covert, Haines, Lee, King, and Speth (2010) examined three introductory science courses each with a face-to-face and online section. They found that online students had less sense of community than their face-to-face counterparts, yet there was no significant difference in their performance on course examinations.

A quote from a survey respondent illustrates the concern that some geography educators have regarding teaching the laboratory component of a physical geography course online:

“We like the lab part of our course to be about the process of science (developing hypotheses, designing experiments, gathering and analyzing data, and observing other factors that may confound the outcome they expect, and want the students to have plenty of hands on experiences. ...”

No matter if the department offered an online physical geography course or not, they expressed concern over the logistics of handling graphic intensive course

assignments and access to equipment. Working at a distance makes assignment submission and return a challenge unless assignments are in digital form. Some survey respondents who offer an online course require students to scan their completed assignments from a commercial manual or submit the assignment as a word processing document. Alternatively, assignments from a manual can be scanned as pdf forms and distributed to the students to complete. Annotation and drawing tools available in most pdf readers are capable of marking up maps. New touch interfaces on mobile devices like an iPad are making it easier to construct maps and graphs using a finger or stylus rather than a mouse.

Conventional hands-on lab activities often require special equipment and are not necessarily accessible to students in an online course. This does not preclude the development of experiments, and the gathering and analyzing data. For example, the USGS real-time water data site (<http://waterdata.usgs.gov/nwis/rt>) can be used to examine hydrological processes or the Earthquake Hazards Program (<http://earthquake.usgs.gov/>) for analyzing earthquake occurrence. The Digital Library of Earth System Education (<http://www.dlese.org/library/index.jsp>) has numerous online exercises that engage students in the scientific method for understanding the physical geography of Earth.

Field study is a hallmark of geography, and students should have opportunities to engage in it. Fieldwork enables students to directly experience what they are studying in the classroom and learn in a collaborative way. For some educators, online courses cannot adequately convey the direct experience of the physical environment. Survey respondents like Gober (1998) felt that the lack of a field experience “prohibits the hands on techniques that we as geographers use everyday.” As one survey respondent said:

“... Frankly, we want to get the students away from their computers and into the natural world.”

Though most of the coursework is done online, real-world activities are not precluded from an online course. A collaborative field experience is not possible when learners are physically separated and thus the communal benefits of field study are missing. Personalized activities can substitute for a shared field experience. Self-directed field trips to geographically significant places can serve as a substitute. Self-guided field trips let students take control of the experience by requiring them to investigate and report on the trip. They are engaged in the logistics and execution and are generally not “along for the ride” as can be the case for group field trips.

Augmented reality is a fascinating way of interacting with real-world environments that have been enhanced with computer-generated sensory input. Advances in geolocation on mobile devices have made it possible to create location-based augmented reality applications employable by students on self-directed field trips. Using the device's GPS capability and compass, information can be overlaid on what is seen through the device's camera. Features are identified by the application as the user scans the landscape before them. Overlays of text can be linked to more in-depth information at the tap of a finger (Figure 2). Shelton and Hedley (2002) used a marker-based augmented reality model to visualize earth-sun relations and found significant improvement in student understanding.



Figure 2. “Peaks” augmented reality application. Image Courtesy Augmented Outdoors (<http://peaks.augmented-outdoors.com/>)

Access to equipment for field study is an issue for online instruction. Today, smartphones and computer tablets permit the student to record field notes, enter data, and visually document using still images or video. Applications for new mobile devices equipped with compass and gyroscopes simulate expensive instruments for students to conduct field work. Applications that perform the functions of compasses and theodolites for example are available either free or for minimal download cost (Figure 3).



Figure 3. *Theodolite application for iPhone*

In the absence of real field experience, virtual ones are increasingly being employed with a high degree of success. It's obvious that (at this point) a virtual field experience cannot completely replace a real field experience. Whether a virtual field experience is suitable may depend on the learning outcomes of the course. A virtual experience may be a suitable replacement for a real experience in a general education course but for specialized courses in the student's major.

Making their appearance in the mid-1990s, virtual fieldtrips and studies have proven effective at enriching introductory courses. Virtual field trips have evolved from a set of static text pages to employing virtual globes that encourage interactive exploration and terrain analysis (Ritter, 1998; Buchanan-Dunlop, 2007; Schultz, et. al, 2008). Clary and Wandersee (2010) found that students using Google Earth for virtual fieldtrips gave them a "real-life picture" of what they were learning. Stumpf, Douglas, and Dorn (2008) showed that a virtual field trip was statistically indistinguishable from real field trips in establishing basic knowledge about desert geomorphology at the introductory level. Oberdofer (2011) used video-taped field trips to engage online students in mapping exercises. Videos of geoscientists visiting

sites along the Hayward Fault were used to collect data in a virtual way to plot on maps for analysis. Honing the observational skills of a young geographer is important for seeing spatial patterns in the natural environment to apply concepts learned in the classroom. Watching web cams became a popular pastime after their appearance on the Web and now can be employed for field observation. A number of web cams continuously monitor geographically significant sites like Mount St. Helens (<http://www.fs.fed.us/gpnf/volcanocams/msh/>) and the Grand Canyon (<http://www.nps.gov/grca/photosmultimedia/webcams.htm>). Web cams like that mounted on Niwot Ridge, Colorado (<http://instaar.colorado.edu/tundracam/>) can be manipulated by the user. Sawyer, Butler, and Curtis (2010) demonstrate how web cams can be used to observed weather changes associated with fronts, changes in the sun's altitude, changes in river levels during floods, water clarity, and timing of vegetation changes. Kolivras, Luebbering, and Resler (2011) found that differences in landscape interpretation between field trip participants were often statistically insignificant. Web cam users have the advantage of spending as much or as little time at a site. Those participating in the onsite field trip valued their experience whereas web cam users had a mixed view.

Conclusion

The results of the survey reported here indicate that geography departments have established a presence in the e-learning space for introductory physical geography lab courses. The survey uncovered three basic issues that inhibit the occupation of the eLearning space for geography education, 1) faculty interest, 2) instructional resources, and 3) pedagogical concerns. Over a decade ago, Hill and Solem (1999) recognized that the adoption of technology-enhanced learning occurs by incremental change. Faculty interest can be nurtured through professional development opportunities that demonstrate how eLearning can enhance their skills and improve learning. Overcoming pedagogical concerns requires thoughtful consideration of the essence of geography education and the role an introductory course plays in the curriculum of a department and university, and the needs of the students enrolled in the course.

The results of the survey also point to future areas of research. The survey was targeted at department chairs or their designees. Their responses may not accurately reflect the opinions of individual faculty. A survey of individual faculty may present a different picture. Responses from those in the classroom can help target areas in need of solutions for delivering physical geography lab courses via distance education. In addition, there was no attempt to locate courses within the e-learning space. Doing so provides insight into the way geography educators are addressing

the needs of distance education students and provide a model for other departments to follow.

Many geography departments are in the midst a period of great change. Budgetary shortfalls, a rapidly evolving technology landscape notably in distance education, and meeting the needs for students to compete in the knowledge economy presents many challenges and opportunities for geography educators. Online distance education has the potential to address these pressures. One way to promote the longterm goal of using technology to “engage students thoughtfully and imaginatively in geography” is to encourage faculty to explore new pedagogies among which is web-based interactive learning (Hill & Solem,1999). Encouraging distance education within the discipline brings geography to an ever-greater audience of learners as it occupies the e-learning space.

Biographical statement

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