Annotated Bibliography Series: Virtual Field Trips

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Summary

- Attempts to create virtual field trips (VFTs) date back several decades, but have recently seen an increase in form and quality due to the increasing availability of technological means to create and consume VFT.
- Virtual Reality technology is coming at a time when conducting traditional field trips is becoming more and more difficult due to funding constraints and larger classes.
- VFTs are generally recommended as a supplement rather than a substitution of traditional field trips.
- A “sense of being there” is an important part of the VFT experience – representation fidelity and learner interaction being central technical components in generating presence, co-presence, and identity.
- Students generally report that teamwork is an important facet of VFTs and should be included.
- Interactive content is a very important criteria for student learning – encourage active and higher level learning rather than just passively receiving information.
- VFTs can create flexibility in learning and show potential for including students with physical, financial, or other barriers to accessing traditional field trips.

Annotated Bibliography

Arrowsmith, C., A. Counihan, and D. McGreevy (2005) Development of a multi-scaled virtual field trip for the teaching and learning of geospatial science. *International Journal of Education & Development using Information & Communication Technology,* 1, 42–56.

Cited by 28

This article was written by Australian researchers, who developed a virtual field trip for the Grampians National Park in the state of Victoria. It was specifically designed for second-year geospatial students who would undertake fieldwork in that area and the virtual field trip was designed to prepare them. Arrowsmith et al. found that the virtual field trip (VFT) was very helpful because students could go at their own pace. There are also some aspects of the VFT that cannot be experienced in the real world: for example, students can have a view from above and of the entire park and then they can zoom in on the parts that interest them the most. Also, the program has a Heads-Up-Display menu, from which students can choose specific viewpoints and site-specific models within the park. While students were looking at the latter models, question bubbles would pop up, which increases the interactivity of the program.

Overall, students enjoyed this VFT. In a questionnaire that came afterward, most students said it was very useful, but that it should not replace real fieldwork. Half of the students commented that they had trouble navigating, something to account for when designing VFTs. Also, it is very difficult to simulate touch and smell in a VFT, but soundscapes are possible. Finally, the authors noted that teamwork is an important facet of fieldwork, thus collaboration should be a part of VFTs. In this case, there were discussion boards and students could collectively write a report. This VFT can be found at the following URL: http://user.gs.rmit.edu.au/caa/VFT/start.htm

Bose, P. S. (2014) Technofetishism and online education: globalizing geography through virtual worlds. *Journal of Geography in Higher Education*, 38, 28-39.

Cited by 2

This article is more of a reflective or critical review of the current state of online courses with an example provided by the author. Bose begins with a review of the benefits (cheaper, more accessible, more flexible for students) and drawbacks (vehicle of neoliberalism to train workers while compromising quality of learning) of online learning. He then uses the example of an international collaboration which he took part in, to examine an instance of online course creation. This collaboration resulted in an online

module for late year high school or introductory undergraduate students on migration from Kerala. The module contains web page content substituting for lectures, YouTube video links and two projects (a map drawing project of migration routes and a letter writing exercise eliciting the students to take on the role of an immigrant).

Bose goes on to critically evaluate the module, questioning whether more technologically savvy instructors might not be able to introduce the material in a more interactive way than lectures. He notes from his own experience that student engagement in the course increases when students are aware that their instructor is present (i.e. logged on and actively responding at the same time as the students). Bose goes on to note a personal example where a web-based course resulted in more engaged participation from students than the same course in traditional, land-based form (in contrast to most other situations where students in a web based course feel less connected to one another and to their instructor). However he adds the caveat that the web-based course in this example had fewer students in it. The major question then becomes, can the successes of a small, online course be scaled up to a MOOC (Massive Open Online Course). It is clear that the technological literacy of the writer and his associates is not on par with the skillset of our group and many of the challenges that he raised are irrelevant to our research. Other, more general critiques on the nature of online learning remain valid but perhaps are not especially original.

Boyle, A., S. Maguire, A. Martin, C. Milsom, R. Nash, S. Rawlinson, A. Turner, S. Wurthmann, and S. Conchie (2007) Fieldwork is Good: The Student Perception and the Affective Domain. *Journal of Geography in Higher Education,* 31, 299–317.

Cited by 142

This article is written by UK based researchers. They write that fieldwork, which would include short field trips, is threatened in the UK due to decreased funding. In addition, faculty are under pressure to do more research as opposed to taking students into the field. Fieldwork also fell off in 2000 and 2001 during the foot and mouth disease crisis. That being said, the students in this study reported fieldwork as beneficial. From February to October 2002, 365 students in geography, earth and environmental sciences filled in questionnaires both before and after conducting fieldwork. There was a lot of anxiety before the fieldwork commenced, but afterward, most students reported that they enjoyed it, it was worthwhile, and that they learned a lot. Mature students and students who lived at home found fieldwork more challenging than other students and women also reported feelings of not wanting to go beforehand.

Although the emphasis in this article was on fieldwork rather than shorter field trips, it does show that going into the field can provoke anxiety, but that the experience is worthwhile. This article was strong in that quotes from the students were included and the sample was fairly large, which makes it statistically significant. However, the article repeatedly referred to statistical language that could be unknown to some readers. Given that this article focused on enjoyment, statistics seem to matter less than the qualitative responses. There are however, good lessons from this article. In terms of conducting virtual field trips, this article teaches us that being prepared for a trip is good, as it will lead to less anxiety. Even if that trip may not involve leaving the classroom, this is something to keep in mind.

Cornelius, S., D. Medyckyj-Scott, D. Forrest, A. Williams & W. Mackaness (2008) The virtual placement: an alternative to the traditional work placement in the geographical sciences? *Journal of Geography in Higher Education*, 32, 287-302.

Cited by 9

Cornelius et al. have designed a virtual work placement that can act as an alternative to traditional work placements in the geographical sciences. The motivations for creating a virtual work placement have substantial overlap with the reasons to run a virtual field trip, such as avoiding issues with transportation for students and making sure there is equitable access to a valuable learning experience (some students may have difficulties finding a traditional work placement etc.). As the work placement was based on experiencing a job related to GIS software it was reasonably smooth to carry out all of the tasks in virtual reality. Tasks were assigned by email from a company "consultant" (course staff member), and included such projects as completing a report on the visual impacts of wind turbines.

The authors reported both strengths and weaknesses of the virtual work placement, which again, were similar to those that might be experienced in a virtual field trip. For instance, the virtual work placement could not perfectly simulate the culture of a real organization or the development of face to face communication skills. The strengths and weaknesses found in Table 4 perhaps offer the most concise summary of the results of this project. It should be noted that the project did not evaluate student outcomes, and certainly did not compare student outcomes to a control group (such as a group who did not participate in any work placement, or a group participating in a traditional placement). Instead students filled out questionnaires and offered feedback on the course experience (see for instance, Table 2). While their work would be difficult to generalize or replicate, it does offer insight on how one could create an effective virtual work placement, and is a strong example of the use of virtual reality offering an alternative to traditional forms of education.

Crampton, J. W. (1999) Integrating the Web and the geography curriculum: The Bosnian virtual fieldtrip. *Journal of Geography,* 98, 155–168.

Cited by 16

This paper discusses the Bosnian Virtual Fieldtrip (BVF), developed by the author. The BVF was developed during that country's conflict in order for students to understand the realities of the war and to dispel stereotypes. In the first section of the BVF, users receive an introduction to Bosnia, its size, history, physical landscape, and climate. The second section explains about key people and places and the last section details the Dayton Peace Accords. All told, the BVF includes 50 pages with maps, pictures, sounds, and movies and it is possible skip between the sections. There are also questions for each section and students are rewarded for deeper answers, though Crampton does not mention about any specific rewards or who would evaluate the students' answers. On the site, there are also activities such as deciding which parts of the country to allocate to which ethnic group.

This is an interesting VFT, however the article has a few pitfalls. Crampton mentions that usage patterns on the site can be gathered, but mentions that that was not done; this would have enriched the article greatly. The beginning of the article has a section on the uses of hypertext and although the BVF makes use of that, the section itself did not seem to have an objective. It is also noteworthy that the discussion board on the site did promote debate about the conflict, but that there were many abusive messages, which resulted in the board being closed for ten months. For VFTs on sensitive topics, this is something to be concerned about. One positive aspect of the article is that 90 percent of BVF users were not at the host university, thus students at other universities were accessing the BVF as well as members of the public; this shows its influence.

Dalgarno, B. & M. J. Lee (2010) What are the learning affordances of 3- D virtual environments? *British Journal of Educational Technology*, 41, 10-32.

Cited by 638

Dalgarno & Lee start with the premise that educators, though excited to begin using 3D technologies such as those seen in video games, have yet to take the time to evaluate these technologies. Additionally, they suggest that 3D technologies should not be compared against no technologies, but against their 2D counterparts to truly ascertain if they justify the extra expense. In favour of 3D technologies, the authors note that these technologies

allow for object manipulation, navigation and view control, whereas other technologies offer only disembodied ways of learning. This level of embodiment is also important for the social aspects of constructing an online avatar. While these are reasonable assertions, no evidence of increased learning associated with them is provided in the rigorous sense of a comparison between 2D and 3D technologies. However, the central learning affordances of 3D VEs are reasoned out and put forward by the authors.

1) 3D VLEs can increase spatial knowledge of an environment. Examples range from the spatial experience of marine animals in their ecosystem to understanding of the components and movements of a quantum atom
2) 3D VLEs can facilitate learning experiences that would be impractical in the real word. Examples include the training of astronauts and nuclear power plant users or environments that are not real, such as abstract geometry. This is particularly useful for some of our groups' work, such as disaster management, where real-world experiences are too dangerous for students.
3) 3D VLEs can lead to increased engagement and motivation on learning tasks. This may be especially true for VLEs with a game or narrative approach, and are suspected to result in increased attention to the task and less attention to one's surroundings, which is a state of mind known as flow.
4) 3D VLEs can increase knowledge transfer to real world settings because the learning environment is a better approximation of reality
5) 3D VLEs can lead to richer collaborative learning than 2D simulations. For instance, in a 3D VLE, learners can carry out a task together, rather than simultaneously or only with communication.

When undertaking a 3D VLE it might be advantageous to identify which of the learning affordances we are targeting, and similarly advantageous to point these out (with reference to this paper) when we report our findings.

The authors establish a research agenda, specifically asking that future studies move away from a show and tell approach to empirical evaluations of the effectiveness of 3D VLEs as educational tools.

I would simply add as a final note on this article that as a review it useful for being comprehensive in its citations. Those looking to expand understanding of certain areas of the literature would do well to start here.

Fowler, C. (2015) Virtual reality and learning: Where is the pedagogy? *British Journal of Educational Technology*, 46, 412-422.

Cited by 25

This paper builds on the Dalgarno and Lee framework for 3D VLE learnings. Fowler notes

that some of the learning affordances of 3D VLEs will not be useful for all learning experiences (e.g. increased spatial understanding etc.) and that instructors may encounter tradeoffs. For instance, increased photorealism results in increased costs but does not add learning value past a certain point. Dalgarno and Lee's framework lacks a way of addressing such a tendency. Rather than using a framework that results in five different technological affordances (Dalgarno and Lee) it would be more useful to include pedagogical requirements that inform the learning experience design. Fowler's framework allows for the design of 3D VLEs to begin with pedagogical "affordances" rather than technological considerations.

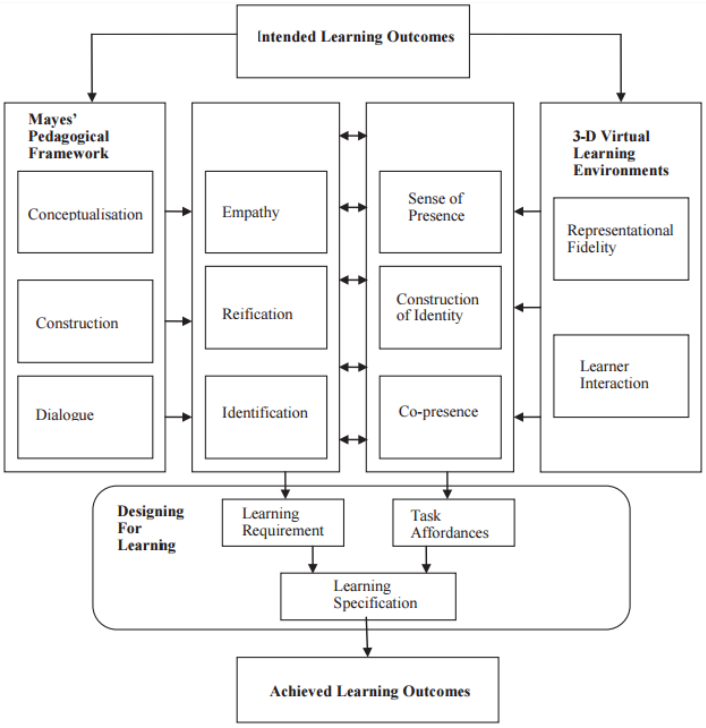

Figure 2: An enhanced model of learning in 3-D VLEs

The benefits of this framework are therefore a focus on learning so that the correct teaching strategy and technological practice can be matched together. Learning outcomes are made explicit so that VLE's are not used for their own sake.

One critique of this framework is that it is relatively complex for practitioners (who are supposedly the target audience of the framework) to use. Practitioners can look at Bloom's Taxonomy, be told that they should aim to hit multiple levels in the hierarchy and derive their own teaching strategies based on this. Here, keywords like reification and empathy take on a meaning that is exclusive to this context so that a teaching practitioner would be hard pressed to understand and make use of the framework without first reading the whole paper, Dalgarno and Lee's paper, and perhaps familiarizing themselves with Mayes and Fowler's previous framework (1999). For someone without a background in SOTL who wants to use 3D VLEs in their post-secondary classroom, this framework will be unwieldy.

Friess, D. A., G. J. Oliver, M. S. Quak & A. Y. Lau (2016) Incorporating "virtual" and "real world" field trips into introductory geography modules. *Journal of Geography in Higher Education*, 40, 546-564.

Cited by 1

Friess et al. compare three field exercises at the National University of Singapore repeated over two years; a staff-led trip, a self-guided field experience with electronic supplements and a virtual field trip video. The staff-led trip followed a traditional, guided structure in a nature reserve. The self-guided field experience had students download a two hour audio PowerPoint file which offered a site-specific risk assessment of the biophysical features of NUS Kent Ridge Campus and required students to take photos as proof of participation. The two virtual field trip videos were five and seven minutes in length and described the mangroves and green spaces of Singapore.

Friess et al. find that the staff-led trip resulted in the highest levels of enjoyment, knowledge and deep thinking awareness. This was measured through a self-reflective questionnaire filled in by 47/76 students who participated in the field trips. The survey was composed of tick, Likert and qualitative questions. One especially useful feature of this article was an inclusion of the time taken to produce the various resources, a detail missing in other papers that could prove useful to other practitioners. While the authors claim that the questionnaire shows the greater effectiveness overall of the traditional field-trip, one could argue that it is unfair to compare a four-hour outdoor experience with a two hours self-guided tour or the experience of watching two videos which are each less than ten minutes. The greater levels of interaction offered by the virtual field trips which we are producing are likely to produce results closer to an actual field trip than those achieved in this paper.

Gilley, B., C. Atchison, A. Feig, and A. Stokes. (2015) Impact of inclusive field trips. *Nature Geoscience,* 8, 579–580.

Cited by 0

This brief article discusses issues around disability and field trips in the geosciences field. According to the authors, every academic field is strengthened by diversity. In the geosciences, there is also the fact that there may be a work shortage in the coming decade as many people retire, thus it is important to ensure that people have the desire to enter the field. In order to build diversity in the geosciences, considering people with physical and cognitive disabilities is vital, especially with regard to field trips and fieldwork. On a trip, a disabled person may feel left out because everyone else is far ahead of them; field trips should allow students to get to know each other, so abled people understand what it is like to have a disability.

The authors of this article conducted a field trip with both able-bodied and disabled students. Each able-bodied person was paired with a disabled partner and did icebreakers to get to know one another. The authors also discussed expectations with everyone and chose an accessible location to take people to. During the trip, tactile maps and audio field guides were used to better equip the disabled students. On that day, one participant commented: "It was an even playing field for everybody. That day there were no disabilities. Everybody was on the same page, and we were all equal" (Gilley et al 2015, 580). This particular article did not have any details about what the students did on the field trip however; that would have been useful information. Also, it is unclear which course the students were taking and how the field trip fit into the curriculum.

Herrick, C. 2010. Lost in the field: ensuring student learning in the "threatened" geography fieldtrip. *Area,* 42, 108–116.

Cited by 33

In this article, Herrick argues that field trips are vital to the field of geography. They allow students to observe, collect, and analyze data, exercise decision-making, and learn teamwork skills. Herrick, a British based geographer, refers to the UK Quality Assurance Agency for Higher Education, which states that fieldtrips are integral part of the field because of their emphasis on experiential learning. Recently, universities have to deal both with dwindling resources and concern over risks to students. In addition, university students increasingly have been abroad, creating a desire for long haul field trips; students also pay for these field trips and demand value for their money. Herrick cites her experience of taking students to Berkeley and San Francisco, where students both collected their own data for research projects and were taken to specific projects. The students were able to apply research methods learned in the classroom and, Herrick argues, experienced deeply seated thought processes, which enhanced learning.

Herrick argues that "in the rush to impose risk minimization strategies, standardize the student fieldwork experience, provide value for money and entice students away from competitor courses with exotic locations, the far more fundamental pedagogical reasons for leaving the classroom behind are all too often forgotten" (Herrick 2010, 114). This is a strong argument because it is clear in the article that most instructors and universities are less concerned with the pedagogical value of field trips than with ensuring value for money. Recently, tuition fees in the UK have become prohibitive for many students, meaning that the middle and upper classes are more likely to go to university and, having been abroad before, expect that their instructors will take them to exotic locales. Thus, the meaningful field trip is in danger and this situation may not change in the near future.

Hirsch, P. & K. Lloyd (2005) Real and virtual experiential learning on the Mekong: Field schools, e-sims and cultural challenge. *Journal of Geography in Higher Education*, 29, 321-337.

Cited by 40

Hirsch & Lloyd describe their design of an undergraduate geography course at the University of Sydney featuring a field trip to the Mekong Delta, followed by an e-simulation roleplay of real-life socio-environmental issues in Southeast Asia (e.g. a public hearing of dam construction on the Nam Theun River). Both experiences aim to be grounded in Kolb's experiential learning theory, where knowledge is created through an iterative transformation of experience. The field school paired students with local "buddies" and had them conduct interviews with government officials about environmental and agricultural changes in the local area. The Mekong E-Sim offered an opportunity for these same students to apply their real-world learning, but also allowed students from other universities who did not participate in the field school a chance for virtual learning. Students were assigned persona that represented key actors (business, media, corporations) who sometimes met face to face and otherwise interacted via discussion boards and emails through the Blackboard Learning Management Software.

The E-Sim learning experience was evaluated through a debriefing essay, a paper-based survey and student focus groups. The survey results were aggregated and treated as one data set, which negates the opportunity to treat those students who had completed the real-world field school as different from those students from other universities who had not. Indeed, no nuanced results differentiating these groups were described for any of the three reporting measures. The results were also oversimplified, with only positive responses reported in the survey results. While it may be the case that the students regard the E-sim with overwhelming enthusiasm, the authors leave no room for improvement and no suggestions for how this experience could be made better by other educators. Overall this paper provides a positive template for an educational experience pairing a real-world field trip with a virtual roleplaying exercise, but adds little else.

Hope, M. (2009) The importance of direct experience: A philosophical defence of fieldwork in human geography. *Journal of Geography in Higher Education,* 33**,** 169-182.

In this article, Hope examines the link between affective response and deep learning. He argues that fieldwork facilitates that connection because fieldwork allows students to

experience places and people directly. Deep learning can only happen when students are relaxed, which is not always the case in the classroom. Fieldwork also promotes important skills such as mapping, active learning, and connecting theory with practice. The main issue with fieldwork that Hope addresses is the fact that students will always bring their own cultural background with them when they head into the field. Hope refers to his experience as the instructor of class in Sustainability Community, a second year undergraduate class when students have the opportunity to visit Lewis and Harris, two of the Western Scottish Isles. Students perceived Islanders as backward and isolated and, as quoted directly from a student, "the young people want to get out as soon as they can" (Hope 2009, 174). That being said, students also reported that their ideas of Islanders changed over the course of the trip and students learned how to live with each other, as they were all in the same residence during the trip.

This article is very good at articulating the connection between affective response and deep learning. At the end of the article, Hope discusses how direct experience facilitates an emotional response and that emotional knowledge of the world is much deeper than intellectual knowledge about the world. Hope also points out that many students learn experientially, which is greatly facilitated by a field trip rather than just being in a classroom. The only downside of this article is that there is no sense of what the students actually did while on the trip. There are quotes from the students about their opinions of the Islanders but not about the specific skills they learned while in the field.

Howard, J. L. (2011) Using a virtual national park to teach workplace skills in conservation management. *Journal of Geography in Higher Education*, 35, 11-22.

Cited by 5

Howard describes his design of virtual roleplaying experiences for three different undergraduate programs at an Australian university: Environmental Management, Parks and Recreation and Ecotourism. The roleplaying came about because of a demand from employers for undergraduates with work-related skills, but early attempts to meet this demand through course changes were met with criticism from students because the courses were excessively dull. The three scenarios for the different programs included simulations of managing a national park, a catchment management authority and an ecotourism resort. Each of these was broken up into eleven separate problems, such as writing a proposal for the conservation of a karst system. Students worked on these problems in a computer lab, with twenty other students and a single instructor. The CD-ROM which included these problems also contained podcasts from experts in the field, examples of how other institutions solved similar problems and directions for how to find

useful information online. The goal of these problems was to teach administrative skills including strategic thinking and working as part of an accountability regime.

A student evaluation was carried out by questionnaire which included eleven Likert scale ratings. Interestingly, the first year that the simulation was run (as opposed to the normal lectures) student satisfaction was lower than in the previous year. But after adjustments based on student feedback were performed in the second year, student evaluations described the simulations not only as better than in the year previous, but also as better than in the year when only traditional lectures were run. It should be noted that no evidence is offered to show that this change was statistically significant. Even so, it suggests the benefit of running a program for multiple years and allowing for a feedback mechanism that can lead to improvements.

Johnson, A. B. & J. M. Boyd (2005) Content, community, and collaboration at ESRI Virtual Campus: A GIS company's perspective on creating an online learning resource. *Journal of Geography in Higher Education,* 29**,** 115-121.

Cited by 15

This article describes the creation of a virtual campus by ESRI in 1996. On this online platform students could take GIS courses, access library materials and interact with one another. At the time of writing, the campus had expanded to 230 000 members and featured 70 different courses. Johnson and Boyd describe the challenges faced by the ESRI team and the innovations that allowed their platform to be so successful. These included a highly interactive website at a time when most websites were little more than online brochures. They also allowed for personal profiles that created a more interactive atmosphere amongst the students. Later iterations of the platform made use of livestreaming lectures where the lecturer would interact with the audience in a way that imitates a traditional classroom.
The virtual campus was an early runner of the many educational websites (such as MOOCs) that have since proliferated. Unfortunately, the technology described in this paper is changing so quickly that ten years later it bears little relevance for our work. Lessons that could be learned from this paper are mostly generalizable principles such as the benefits of increased interactivity for student learning.

Johnson, N. D., N. P. Lang & K. T. Zophy (2011) Overcoming assessment problems in Google Earth-based assignments. *Journal of Geoscience Education,* 59, 99-105.

Cited by 11

This article examines how to formulate assignments after students have done an activity using Google Earth (GE). For some virtual field trips, GE could be utilized, thus it is important to understand how to assess what students have done. The authors first outline Bloom's taxonomy, which outlines six levels of thinking: Knowledge, Comprehension, Application, Analysis, Synthesis, and Evaluation. Application, analysis, and synthesis are often the hardest, but are important for students to learn actively. The authors then discuss how to give students instructions for their assignment. The teacher should include the audience (usually the students), the required behaviour, condition (what tools they will use), and degree. Here is an example: "Students (A) will be able to create a five stop (D) tour of the Grand Canyon (B) using Google Earth (C)" (Johnson et al 2011, 101). When this is done correctly, the students understand why they are learning the particular material and how the assessment will look.

The authors then give an example of how to use Bloom's taxonomy to create an assignment with GE in a geology class. For Knowledge, students learn how to locate subduction zones. They can mark the zones on GE and email them to the teacher. For Comprehension, students learn how to recognize differences between subduction zones and the mid-ocean ridge. GE now can show 3D images of oceans, so this task should be straightforward. For Application, students describe subduction zone characteristics of other places and how to find them, which shows that students have understood and can apply what they have already learned. For Analysis, students find and analyze volcano features and compare them to other places; they can also describe what causes the volcanoes to appear in different places. In terms of Synthesis, students make a hypothesis concerning why volcanoes occur near subduction zones and show the information using GE. Finally, students can evaluate their hypothesis using GE for accuracy. They can compare their work with other students and determine whether the hypothesis is supported. One very positive thing about this type of assignment is that students are doing most of the work themselves with the teacher being the facilitator, thus the learning is very active.

Kent, Martin, David D. Gilbertson, and Chris O. Hunt (1997) Fieldwork in Geography Teaching: A Critical Review of the Literature and Approaches. *Journal of Geography in Higher Education,* 21, 313–32.

Cited by 360

This is a review of best practice in geography fieldwork. Kent et al. begin by tracing the development of fieldwork from its origins in a "look and see" observation model, to a problem-based approach and now the modern era where the issue of large class sizes and cutbacks have prompted the exploration of alternatives such as virtual field trips. As with virtual field trips, Kent laments the lack of empirical evaluation of traditional field trips, noting that the cost incurred justifies a better evaluation than simple participant feedback. However, those evaluations that have been conducted suggest that students prefer problem-based fieldwork, that fieldwork motivates students and that fieldwork is generally seen as good preparation for work.

The section of future directions for fieldwork is the most relevant to our work. They note for instance the gender differences in fieldwork, where women are more likely to perceive a requirement for physical fitness than men and also more likely to judge themselves as not physically fit. This raises issues of equality which can be avoided to some degree by using VFT. Issues of cost create similar problems in equity. As costs of fieldwork has risen, more of the price has been passed on to students, creating disparities where wealthier students are able to take courses that feature expensive and exotic fieldwork and others are not. VFTs once again offer some solutions to these problems.

Kolivras, K N, C R Luebbering, and L M Resler (2012) Evaluating Differences in Landscape Interpretation between Webcam and Field-Based Experiences. *Journal of Geography in Higher Education*, 36, 277–91

Cited by 11

Kolivras et al. conduct an experimental study to determine the efficacy of a webcam experience compared to real world field trips. 9 students went on a field trip to Charlotte, while 8 other students went on a field trip to the Great Smoky Mountains National Park (all students were registered in geography classes at Virginia Tech). At this field site they went to a certain viewing location and filled out a landscape interpretation questionnaire. The results of this survey were compared to responses by 22 and 13 students who visited those same respective sites via webcam. The authors report on statistically significant differences between these two groups.

The study showed that students who visited the sites via webcam were less likely to pick up on certain details than students in the field trip group, especially details that required contemplation (such as evidence of culture or interdependence). What was perhaps most different between the two groups was their response to the activity; 100% of field trip

respondents believed that the field trip increased understanding while only 32% of the webcam group felt similarly. There was strong agreement that webcams alone were insufficient tools for geography learning.

Aside from the issue of small sample size in this study, a generalizable flaw in many of these studies is the comparison of apples and oranges. The differences in this study are not just webcam vs reality, but differences of time spent on the activity, interactions with peers and interactions with an instructor. Any research comparing these experiences needs to be cognizant of such differences (and while the authors of this study mention these biases they do not attempt to control for them). While it may be difficult for researchers to control for time spent on a task, they could at least make efforts to ensure that virtual experiences are shared, collaborative experiences as this is known to increase learning and allows for a more fair comparison between a VFT and a traditional one.

Lemke, K A, and M E Ritter (2000) Virtual Geographies and the Use of the Internet for Learning and Teaching Geography in Higher Education. *Journal of Geography in Higher Education*, 24, 87–91.

Cited by 30

In this symposium paper, Lemke and Ritter explain results gathered by several groups showing effective methods to teach geography using the internet. Many of the results (as they are almost twenty years old) have lost considerable relevance. Perhaps this can most easily be seen through the authors understanding of the world as a binary: online or offline. They report, for instance, that students felt that "electronic mail enhanced student–instructor communication". Today emails are indispensable forms of communication for all courses and students communicate through personal computers that they store in their pockets. Asking the question of whether email is effective for administrative communication is no longer relevant because it is such a permanent fixture of our culture (academic and otherwise).

I will, however, say that two comments remain useful today. One researcher found that students in a lab group that made use of real-time, online meteorological data responded positively to this form of learning compared to students in another lab who used more traditional learning. Certainly such real-time online data is easy enough for instructors to incorporate in geography classes at UBC. Another researcher made an argument that online distance learning results in a loss of disciplinary identity and face to face contact merely for the sake of convenience. A study actually attempting to measure outcomes of

online distance learning (where the outcomes were more relational than educational) would be especially novel.

McGuinness, M., and D. Simm (2005) Going Global? Long-Haul Fieldwork in Undergraduate Geography. *Journal of Geography in Higher Education,* 29, 241–253.

Cited by 59

This article looks at the growth of long-haul fieldwork, specifically in the UK. First, McGuinness and Simm address the advantages and drawbacks of fieldwork generally: building technical and research design skills are some of the advantages while drawbacks include assumptions about cultural sameness or Otherness and the lack of emphasis by faculty on personal development, which is one of the main reasons why students desire to do fieldwork. The authors also refer to Pawson and Teather, who state that the main purposes of fieldwork, as articulated by students, are discovery and hands-on learning. In recent years, the decreasing cost of air travel has meant that 1 in 8 travellers in the UK aged 16-24 go to Africa, Asia, South America, and Australia, thus students are becoming more familiar with further flung locations; this creates a demand for long haul fieldwork. McGuinness and Simm designed their class to include an eight-day trip to Boston, on which 10-15 students go every year. The authors emphasize the process of the fieldwork rather than the content, so the aims of the fieldwork are to develop research, teamwork, and project management skills, acquire experience in a research environment, and develop confidence in a foreign place. Students were given freedom to research what they desired and afterward, they wrote a paper for both a symposium and for potential publication in a journal. On the trip, students wrote a research diary, which allowed for deep reflection on the process.

This article illustrates how valuable fieldwork can be from the perspective of developing students' critical thinking and research skills. McGuinness and Simm cite difficulties associated with long-haul fieldwork: jetlag, having to book airfare in advance, knowing what can and cannot be brought on the plane, making the trip accessible for students with disabilities as well as students of different races, classes, or sexual orientation. McGuinness and Simm mention a few ways to address these issues such as having team building activities in the beginning to allow for students to adjust to the time before they conduct their research. The issues of disability and class are more complicated and were not addressed in this article; if they had been addressed, the article would have been stronger. Otherwise, this is a very thoughtful article about the potential of fieldwork.

McMorrow, J. (2005) Using a Web-Based Resource to Prepare Students for Fieldwork: Evaluating the Dark Peak Virtual Tour. *Journal of Geography in Higher Education,* 29, 223–40.

Cited by 30

Citing various literature, McMorrow establishes the need for extensive preparation prior to a field exercise. Reasons for this include saving time while in the field so as to maximize learning once there and allowing for a shorter time in the field (often necessitated by expenses). McMorrow notes that some educators argue for the potential to replace course field work with virtual tours (VTs), but designed their virtual tour website as a supplementary exercise to precede the actual tour. Students were required to complete the virtual tour prior to the field exercise and this was enforced by assessing answers to questions on the tour. All students completed and passed the assessment. The VT consisted of a series of annotated photographs, horizontal and aerial, as well as block diagrams and self-testing questions. The VT was piloted on tutors and refined based on feedback.

The VT was assessed by a survey given to the students. Students responded favourably to the VT, with the majority of students either disagreeing or strongly disagreeing that they would have preferred lectures of directed readings. Opinions however did slightly favour videos as a preparation method over VTs. A similar survey was then given to students after completing the field exercise. Students rated the actual field work as a better learning experience than the virtual tour, but acknowledged that the VT prepared them for the field exercise. McMorrow makes some recommendations that may be translate to our work, such as always having a recognizable ground level photo paired with any aerial or satellite photos and allowing students plenty of time in advance to access a VT if it is meant as a preparatory activity for a real-world field exercise. McMorrow is explicit in maintaining that a VT is not a substitute for real fieldwork and vice-versa.

Mendler, J., D. Simon & P. Broome (2002) Virtual development and virtual geographies: using the Internet to teach interactive distance courses in the global South. *Journal of Geography in Higher Education,* 26**,** 313-325.

Cited by 26

Mendler et al. describe an attempt to use online distance education in the Global South for a masters level program, with the goal of attaining equivalent educational outcomes to

traditional schooling practices. A major struggle of the project was internet connectivity on the part of participants. Idealistic aims such as delivering simulcast lectures degenerated into delivering simultaneous audio programming and then when even that failed, mailing CD ROMs to students. Additionally, some tools were only compatible on newer browsers which students did not possess (which could only be solved by the researchers providing students with better hardware or ensuring that all technology was old and therefore universally accessible).

The authors admit that it was impossible to offer commensurate education to distance as to residential learners. This is for a number of reasons including the difficulty of learning English while not immersed in the culture as well as differences between the student experience (students in residence devoted all of their time to studying while distance learners maintained part time jobs while enrolled).

Initially the authors had hoped that online learning would allow cheap alternatives for students in developing nations. However, they found that it was necessary to have at least some time spent "in residence" which is costly and that the distance learners in their group needed extra support from supervisors which was only financially feasible due to the generosity of the supervisors/instructors. Compromises on many of these matters were necessary in order to make the program feasible and eventually the authors realized that entrance costs into the program would have to be raised.

I suspect that if we attempted to offer resources to students in the developing world, many of the same issues would apply. For instance, a 360 video would require more computing resources than a traditional video and this may make it difficult for students or participants in an area lacking the requisite hardware or bandwidth to participate.

Mundkur, Anuradha, and Cara Ellickson (2012) "Bringing the Real World in: Reflection on Building a Virtual Learning Environment." *Journal of Geography in Higher Education*, 36, 369–84.

Cited by 7

Mundkur & Ellickson describe the use of a Virtual Learning Environment (VLE) created for a certificate program in gender mainstreaming and policy analysis. The authors state that the creation of the VLE was motivated by the internationalization of education, a desire for participatory, constructivist-based learning and an increased push to prepare students for work. The VLE consisted of role-playing in two fictitious organization modelled on the International Development Organization and UN Women. Projects within this role play

were designed to emulate real-world work situations such as writing a grant for a gender analysis project or developing factsheets for gender mainstreaming. The internal workings of these organizations were simulated using emails, discussion boards and a virtual meeting software.

The VLE was evaluated through student discussion boards, emails, journal entries and an evaluative survey. Much of their data was therefore qualitative and consisted of reported quotations from students. Students were quoted as saying, for instance, that they enjoyed the virtual meeting software and found that it allowed for the inclusion of a diverse group of students. I believe, however, that it is difficult to make generalizations from their experience as only 31 students in total participated over the course of two semesters, and only 25 responded to the questionnaire. Overall the authors report mostly positive feedback and claim that negative feedback largely came from students without access to broadband internet connections. This once again reinforces the importance of a smooth technological process to the success of virtual learning experiences. To remedy this, the authors suggest that online courses need to be conducted with the help of technical support workers in order to keep instructor's workload at a manageable level and to ensure student satisfaction with the course.

Philips, A., A. Walz, A. Bergner, T. Graeff, M. Heistermann, S. Kienzler, O. Korup, T. Lipp, W. Schwanghart & G. Zeilinger (2015) Immersive 3D geovisualization in higher education. *Journal of Geography in Higher Education*, 39, 437-449.

Cited by 1

Philips et al. make use of a 3D geovisualization tool to enhance a graduate level learning module on flood risk assessment. The learning module was part of a course that aimed to use technology to quantify flood risk for areas of the Weisseritz catchment (which has previously flooded and caused damage in the city of Dresden). The 3D environment (referred to as the CAVE) was created by wearing 3D glasses in a room where images were cast on three walls by projectors, creating images on the walls, but also images that floated in front of the viewer. The environment could be further manipulated through a tracking system and a joystick employed by the user, and was compatible with various software including ESRI ArcScene. During their simulated educational experience, the CAVE was used for exploration of the study region as well as presenting and discussing the results of the study group.

Evaluations of this experience were conducted by having students make qualitative descriptions which were stuck onto a pin board. Student responses were therefore anonymous, but coded based on whether they were positive or negative. Most of the

responses were positive, and unsurprisingly the one group where there were significantly fewer technological issues responded more positively than the group where glitches were frequent. Based on evidence (comments) from the students, the researchers claim that their 3D environment increased spatial comprehension. The authors acknowledge technical limitations, such as computational rendering limitations which led to low-resolution images, or the sensitivity of the trackers to small movements which could cause large visualization jumps that annoyed participants. Even so, numerous students reported feelings of increased motivation associated with the use of cutting edge technologies. The downside of this technology compared to the visualizations employed by our team is that it requires an entire room with three bare walls in order to function. Even so it shares similarities with our project in terms of student motivation, and increasingly interactive 3D environments.

Ramasundaram, V., S. Grunwald, A. Mangeot, N. B. Comerford, and C. M. Bliss (2005) Development of an environmental virtual field laboratory. *Computers & Education,* 45, 21–34.

Cited by 107

This journal article discusses how to prepare an environmental virtual field laboratory. The authors wanted to ensure that there could be global access, use of different learning mechanisms, and interactivity. The site, which had Cypress swamps and slash pine, was near Gainesville, Florida. Over six years, the researchers took datasets regarding water tables and wells. The students then experienced a simulation of a clear-cut and its effect on water tables. Students were able to view the soil profile using 3D models, terrain, and land use alongside animations, focus questions, and hyperlinks they could follow. In addition, adaptive simulations would show an event such as an earthquake and then the students could observe changes to the ecosystem.

This is a very interesting model that could be followed. The authors used VRML, virtual reality model language, which transfers the 2D and 3D images onto the Internet, replicating the environmental systems shown on the field lab. They point out that this could be used for distance education and GIS courses, which would enhance student learning. Students would need to be provided training in GIS, if they have not received that sort of training before, in order to fully understand what they are experiencing; this would further augment their skills. Given that this study is specifically about the environment, it is very useful for this project.

Rich, David C., Geoffrey Robinson, and Robert S. Bednarz (2000) Collaboration and the Successful Use of Information and Communications Technologies in Teaching and Learning Geography in Higher Education. *Journal of Geography in Higher Education* 24, 2, 263–70.

Cited by 39

Rich et al. posit that collaboration is key to successfully taking advantage of new Information Communication Technologies (ICTs). Many of the forms of collaboration suggested by the authors are at this point well entrenched practices in higher education, such as the use of ICTs to foster cooperation between students (emails are par for the course for student communication) or the use of ICTs for students who are on exchange to update their peers back home in an informative way (blogs would be a common example of this today). On the topic of lecturing, Rich et al. see possibilities for reduced work-load and cross-departmental collaboration by using simulcasts to offer two lectures at the same time to different classes.
Some of the author's critiques do remain salient today. They claim for instance that ICTs and the teaching collaboration that is spurred by them can be resisted by individualistic teaching practitioners. On the other end of the spectrum, Rich et al. see increasing oversight from overly managerial governments as stifling innovation. For them, collaboration offers a positive alternative. Unfortunately, most of this article is very rooted in the problems generated by ICTs in the 2000s and is no longer applicable to our goals today.

Scarce, R. (1997) Field trips as short term experiential education. *Teaching Sociology,* 25, 219–226.

Cited by 77

This paper is a good guide regarding how to conduct field trips. Scarce argues that field trips are important "because they are experiences, lived social events that become ways of knowing" (Scarce 1997, 219). The classroom can never simulate the real world, so stepping out into the field becomes vital. On field trips, students can see theory put into practice and learn how to conduct research. In order for a field trip to be successful, Scarce outlines the following: First, visit multiple sites to decide which would be suitable for a field trip. Make sure there are goals for the field trip; having an assignment to go along with it is useful for the students to learn something concrete. Allow the students to learn things independently, rather than just shepherding them around a site.

Scarce points out the many benefits of field trips. For example, field trips allow students and instructors to become closer, especially if the field trip is longer than just a few hours; students can then appreciate how instructors approach education. There are challenges as well, however. With regard to larger classes, it may be difficult to take all students out on one trip. Scarce suggests taking different groups of students to different sites or repeating the same trip throughout the term so that everyone may attend. The former could be beneficial if students are interested in different issues while the latter would be more uniform. The main disadvantage of this article is that it focuses on the field of sociology, however the guidelines for conducting field trips would be similar across disciplines.

Solem, Michael N. (2000) The Virtual Geography Department: Assessing an Agent of Change in Geography Education. *Journal of Geography in Higher Education,* 24, 353–64.

Cited by 21

This paper evaluates the Virtual Geography Department (VGD) at the University of Austin via interviews with 29 participants. The VGD is not for students but for training faculty in online curriculum development and web pedagogy and, though focused on online education, was held in traditional workshops. The authors seek to analyze the success of the VGD using Innovation Diffusion Theory, where the VGD is viewed as an agent of change and its success is dependent on its ability to encourage adoption of innovative, online techniques. The majority of respondents described the VGD as having contributed to their pedagogical development in a positive way.

The evaluation of this workshop could serve as a useful model for our connections grant as there are many parallels between this pioneering work on encouraging web/computer adoption in classroom teaching and our attempts at sharing best practice in 3D environments in a workshop. For instance, some participants in the interviews describe returning to their places of work after the workshop and sharing resources with their peers and successfully encouraging them to adopt new practices. In terms of knowledge mobilization, this is evidence of the success of a program that is very similar to the one we intend (some of the projects created by participants in the VGD even include virtual field trips). The strategy that the authors cite as being the most effective facet of the VGD was an emphasis on teamwork and cooperation which led to the formation of new partnerships and catalyzed the knowledge mobilization process.

Stainfield, John, Peter Fisher, Bob Ford, and Michael Solem (2000) Journal of Geography in Higher Education International Virtual Field Trips: A New Direction? *Journal of Geography in Higher Education,* 24, 255–62.

Cited by: 116

Stainfield et al. describe the current state of international virtual field trips, including motivations for running them, as well as advantages and disadvantages. Because the paper is 17 years old, many of the limitations it describes have either been overcome already or may be left behind in the near future.

This paper begins by citing the difficulties associated with traditional field trips including: inaccessible to disabled students, may have gender biases, may be too expensive for all students, presents language barriers, can result in damage to the environment at the field site, and criticisms of paternalism in the case of wealthy westerners visiting developing nations. VFTs offer an alternative that avoids many of these issues. Stainfield sees VFTs as less of an immersive experience than can presently be offered (more of a CD ROM experience than a 360 video), and therefore explains why VFTs are superior to handbooks (a criticism that is unlikely to be leveled at this point in time). The paper offers links to VFT resources, most of which are no longer operational. He also suggests that a way to increase student interaction in Virtual Field Trips is by having students display their work as a web page. While this is no doubt an effective way to engage students, it would no longer be relevant to a discussion on virtual field trips, and thereby shows just how much the field has changed and improved in 17 years. Some of the best practices described seem like forerunners to current techniques, such as panoramic images (as opposed to 360 videos) or Urban Modeller, a tool for 3D mapping. Overall this paper establishes a historical baseline for where VFTs started and may be useful for this project to demonstrate how far practice has come in the last two decades.

Stoddard, J. (2009) Toward a Virtual Field Trip Model for the Social Studies. *Contemporary Issues in Technology and Teacher Education (CITE Journal),* 9, 412–438.

Cited by 17

This journal article discusses the Colonial Williamsburg (CW) electronic fieldtrip (EFT), which is used in many schools in the US. Stoddard expounds on his idea of a good and authentic field trip, which should include the following elements: a connection to the curriculum, collaboration between teachers and site staff to improve students' learning,

preparation in class before the field trip, clear objectives for the trip, use of media or artifacts, and finally, debriefing to allow students to think more deeply. In order to ascertain whether the CW EFT had all of these elements, Stoddard conducted interviews with staff, sent surveys to participating schools, and observed classes conducting the EFT. Most of the students were in third, fourth, or fifth grade. The basic idea of the EFT is to show students a live video of what CW looked like - these focus on different topics such as archeological evidence, women's roles, and slavery. After watching the EFT, students can phone in with questions. In recent years, students and teachers can also access the website to play games and learn more about issues arising from CW such as the treatment of native people, education, and the battle of Yorktown. There was also an online discussion board, allowing students to ask and answer more questions from CW staff.

One of the strengths of this article is that it points out both the advantages and disadvantages of the EFT model as exemplified with CW. First, the live broadcast was only shown at two set times during the day, thus teachers would have to arrange class time to allow for the broadcast. Also, the main object of the EFT was to provide content; the staff mentioned that they wanted to provoke and promote debate among the students, but the main obstacle for that is what the teacher can do. It appears that there was little engagement between the teachers using the EFT and the staff producing it. This would need to be increased in order for the students to think deeply. This would also allow for students to be debriefed after they watch the video, another missing feature of the CW EFT.

Stumpf, R. J., J. Douglass, and R. I. Dorn (2008) Learning Desert Geomorphology Virtually versus in the Field. *Journal of Geography in Higher Education,* 32, 387–399.

Cited by 18

This article describes an introductory physical geography course where students had the opportunity to do a virtual or real field trip to Tempe Butte, an urban mountain in Tempe, Arizona. One reason to develop the VFT was for the disabled students in the class, who would have been able to attend a real field trip. There were 210 students in the class, with each lab having 35 students. Six of the labs were divided into different field trip styles: one only experienced the VFT, one only in the field, and one who experienced both. Before the trips, students completed a pre-test with several multiple choice questions ascertaining their background and experience with technology. Six weeks after the pre-test, students completed a post-test where they answered questions about Tempe Butte and its geomorphology.

The results of this study are informative; the post-test results showed almost no difference between students who did only the VFT or went into the field. One-third of the VFT students would have preferred the real field trip, but one-half liked the convenience of

staying in the lab. However, 40 percent of the students who went on the real field trip said they would have preferred the VFT. On the post-test, most students successfully answered six of the ten questions. It is noteworthy that "twelve of the 13 students who did both the virtual lab and went into field felt better able to appreciate a natural landform, and 10 of the 13 said that they now think differently about landforms…However, of the 24 virtual-only mature responders, only nine felt better able to appreciate a natural landform and eight now say they think differently when they look at landforms" (Stumpf et al 2008, 396). The authors concluded that a VFT is suitable for learning simple information, but that appreciation and understanding of landscapes is better conveyed in a real field trip.

Treves, R., P. Viterbo, and M. Haklay (2015) Footprints in the sky: using student track logs from a "bird's eye view" virtual field trip to enhance learning. *Journal of Geography in Higher Education,* 39, 97–110.

This article discusses an experiment with students going through a bird's eye view virtual field trip (BEVVFT). Treves et al. point out that for many studies, students report afterward what they did and how they felt about it. This experiment however actually tracked the students' movements to see how they used the BEVVFT and whether they were able to complete the tasks given to them. The main purpose of the BEVVFT was to aid students in identifying paleo-banks, which are "topographical features a few metres high and from tens of metres to several kilometres in length, which are remnants of the topography of dried-up lakes" (Treves et al 2015, 100). The students volunteered for this experiment and were given an honorarium, thus it was not part of a course. They were divided into three groups: no exercise, non-guided, and guided; data was only collected on the latter two groups. The students in the guided group were given extra advice using polygon guides. One of those guides was the target paleo-bank. The non-guided group did not receive such guidance. First, students went on Google Earth and were given a tour. This first step included layers that could be turned on or off. Secondly, students were given a second tour specifically on geomorphology and features of a paleo-bank. Then, the students needed to identify features of the paleo-bank and during that time, their latitude, longitude, and altitude was logged by the researchers. Finally, students were given a test on what they had learned.

The results of this study are instructive: The students in the non-guided group, ironically, searched a lot less than the guided group. This suggests that receiving guidance gives students both greater control and freedom; the non-guided group may not have known what exactly to look for and thus, felt constrained. The researchers also observed that most of the students did not become disoriented and stayed on task. Only a few students searched in areas they did not need to. Thus, VFTs can be designed in a way that keeps students within the area that requires the most examination.