15

Digital Investigations

Using Virtual Fieldwork in the Classroom

Byron Haast and Phillip O'Brien

There is a well-known phrase, often attributed to the Chinese philosopher Xunzi: "I hear and I forget. I see and I remember. I do and I understand." Having students *see* and *do* provides for significantly more meaningful learning experiences and has long been a staple of the geography classroom. That said, getting out and seeing the world is subject to many variables at a school and personal level, and it has been further complicated by the COVID-19 pandemic. This therefore necessitates new pathways for fieldwork, giving rise to the use of research, virtual reality, and satellite technology and imaging in the learning arena. This provides exciting opportunities to find ways of integrating often preexisting student skill sets in digital literacy, developed through their own exploration of satellite programs like Google Earth and games like *Minecraft*. Furthermore, the use of the digital medium has been shown to improve engagement, interest, focus, and permanent learning.[1] From *Carmen Sandiego* to *GeoGuessr*, the use of digital geography and gaming to enhance and support the learning of our world is not a new phenomenon per se—Kirriemuir and McFarlane suggested that the use of simulations and virtual immersive worlds are increasingly being used to supplement traditional teaching—but the use of a digital medium for geographic fieldwork is a growing and exciting area.[2]

Lockdowns, quarantines, and social distancing have created a need for teachers to explore new ways to bring the world into their classrooms; this resource essay aims to shine a light on the myriad possibilities that exist, as well as an in-depth look at how one can "take" students to visit Fukushima, Japan. One of the joys of virtual fieldwork is the ability to visit locations that cannot physically be accessed (such as Fukushima or Chernobyl) or that would otherwise be unsafe (conflict zones); no paperwork, permission, visas, or vaccinations required.

Getting Started

Geographic fieldwork is generally mandated by most curricula, such as the International Baccalaureate, British, American, Canadian, and Australian Curriculum. Virtual fieldwork has an invaluable role to play in meeting these requirements. Better still, it can broaden horizons in terms of where and when students investigate, with broad applicability well beyond the geography classroom. Perhaps students of ancient history would like to visit renowned archaeological locations and museums in the Near East or the Mediterranean? Art classes could walk the halls of some of the world's most well-known galleries, or students of literature and languages can dive firsthand into streets and sites to illuminate their learning. In a crowded curriculum—in addition to demographic change and institutional pressures—the use of a digital "virtual" medium provides real opportunity for increasing fieldwork opportunities.[3] In terms of planning, one need only consider the core knowledge or concept to be covered and from there, simply visualize a suitable location to "see" it in action. For example, if one were looking at coastal landforms, a virtual visit to Australia's Great Ocean Road may be in order; if the topic was deforestation, one could "take" the students to Borneo or the Brazilian Amazon. With a concept in mind, there are a broad range of straightforward options for conducting the virtual visit, but perhaps the best and broadest is Google Earth (www.google.com/earth). Satellite imagery, once primarily the domain of the military and meteorology, is now an increasingly integral part of our lives; tapping into skills with which students have some degree of familiarity both accelerates and excites the learning process.[4]

With no equipment required other than a computer and a connection to the Internet, one can readily begin to develop familiarity with digital visits. Within Google Earth, one can use Google Street View to zoom down to street level, a wonderful tool for exploring human geography in particular. An excellent starting point for the beginner is Google Earth Outreach (https://www.google.com/earth/outreach/learn/), which provides a series of short, guided visual modules for professional development and skill acquisition. As one develops familiarity, there are a range of other options available to begin to customize content, including:

- Google Tour Creator: https://arvr.google.com/tourcreator/
- Google My Maps: www.google.com.au/maps
- Google Maps Treks: https://www.google.com.au/maps/about/treks

Here one can begin to establish clear tours for students to follow. For schools with access to Augmented Reality or Virtual Reality equipment and software, the possibilities grow even further:

- Google Expeditions: https://edu.google.com/products/vr-ar/expeditions/
- VR Glaciers: https://vrglaciers.wp.worc.ac.uk/wordpress/

Many of the aforementioned sites have ready-made sample tours and examples that can inspire and guide teachers as they develop their own ideas and expand them into their units. When supporting fieldwork with further opportunities for digital investigation by accessing rich quantified data sources such as the United Nations, World Bank, NASA, and national or state census records, teachers can prepare rich learning units for their students.

- UN Data: https://data.un.org/
- World Bank Open Data: https://data.worldbank.org/
- NASA Open Data: https://nasa.github.io/data-nasa-gov-frontpage/
- CIA World Factbook: https://www.cia.gov/library/publications/the-world-factbook/

In addition to the excitement of global learning opportunities, one can also use virtual fieldwork in a local context. The Victorian Certificate of Education—the senior high school award for the Australian state of Victoria—mandates fieldwork as a core element of the geography curriculum three times across the two-year course in the differing contexts of hazards and disasters, tourism, and land use change and management. In the case of investigating the potential for sea level rise to create issues on a local scale as part of the hazards and disasters unit, students at McKinnon Secondary College investigate the preparedness of the local bayside suburbs to deal with this hazard and to explore existing flood mitigation strategies in place. With a blanket ban on excursions in place as a result of the COVID-19 pandemic, students have used the tour feature on Google Earth and Google Street View to explore the area remotely, capturing images of key features and noting the geographic characteristics of the region. Supplementing this with data available online via the local government authorities and comparing it to national averages via the Australian census, students were able to build a profile and gain sufficient data to discuss the topic at length. For the teacher, this involved preparing the tour beforehand and flagging key sites of note; however, student feedback emphasized the ease with which they were not only able to collect data, but also to revisit and expand their knowledge using skills they had, in many cases, developed independently.

Using Virtual Fieldwork to Drive a Unit of Learning: Fukushima, Japan

A unit of learning centered on disaster provides an excellent point of study for students to consider the origins and impacts of hazards. In the Australian state of Victoria, the study of hazards forms a core component of the senior geography curriculum. In other curriculum contexts, there is broad applicability to consider hazards and disasters within a range of different units of study at different levels. Virtual fieldwork in these locations also allows students to gain a sense of scale and empathy for the people involved in these phenomena and empowers students to consider how disasters can be managed and mitigated in the future. Furthermore, Hupy demonstrated that students working with geospatial data sources reported far greater clarity with the content than beforehand, overcoming previous uncertainty with the material. Indeed, the presentation of conceptual content in actual settings proved of great support for student understanding.[5] Ultimately, virtual fieldwork allows students to access places that would otherwise be off-limits, like the exclusion zone surrounding Fukushima Daiichi Nuclear Power Plant in Okuma, Japan, which suffered a catastrophic meltdown in the aftermath of the 2011 Tohoku earthquake and tsunami. This investigation fits within both the International Baccalaureate "Geophysical Hazard" component and Key Stage 3 of the National Curriculum in England: "Human and Physical Geography."

Before considering the impact of this event on places and people, students will need to consider the wider context of the Daiichi power plant's position within its surrounding coastal landscape and its location in one of the most geologically active regions on earth. The island of Honshu, located at the edge of the Pacific Ring of Fire, exists as the meeting place for the Eurasian, Pacific, and Philippine tectonic plates. This is an important point where students will need to consider tectonic plates on a global scale and a great opportunity to add some academic and scientific rigor before delving into a regional- and local-scale investigation of the 2011 earthquake and tsunami. Here, students can dissect top-quality publications, like the report from the UK Geological Society (The Geological Society of London—Tohoku Earthquake, Japan, 2020) on the Tohoku Earthquake from the "Plate Tectonic Stories" section of their website, which explains the plate movements at the heart of the event.[6] This could be digested after a wider introduction to global plate movements.

On a local scale, students could then focus on the coastal landscape of northern Honshu, which bore the brunt of the resulting tsunami. This is where

Figure 1: IAEA experts depart Unit 4 of TEPCO's Fukushima Daiichi Nuclear Power Station on 17 April 2013 as part of a mission to review Japan's plans to decommission the facility. Photo Credit: Greg Webb / IAEA.
Source: Wikimedia Commons.

students begin to consider the impacts of geomorphological hazards in the context of the destruction that occurred in the Tohoku region, including the meltdown of Fukushima Daiichi. Fukushima Beach is an interesting case study of a coastal landscape interconnected with human uses of this landscape. Coastal landforms can be taught to students; they can consider a Google Maps scavenger hunt using coordinates for various coastal landscapes in the area before considering the potential effects of longshore drift on nuclear power plants located in coastal environments like Dungeness Nuclear Power Plant in the UK. Digesting the causes of this event and considering how erosion interacts with human uses of coastal landscapes, students can now begin to investigate the destruction wrought by the event itself.

- Preparation: Impacts: https://www.theatlantic.com/photo/2012/02/japan-earthquake-before-and-after/100251/
- Conducting fieldwork—the *Guardian* walk-through: https://www.theguardian.com/environment/ng-interactive/2018/mar/12/fukushima-360-walk-through-a-ghost-town-in-the-nuclear-disaster-zone-video

More than nine years after the event, a number of great quality visual media exists to facilitate virtual fieldwork activity that adequately investigates the

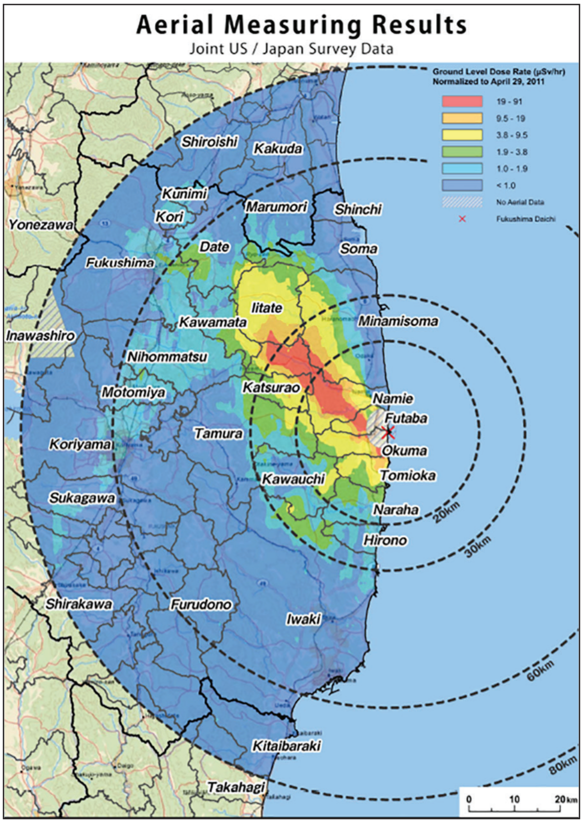

Figure 2: A map of the instant radioactivity of the Fukushima reactor area, as measured from the air. Source: Wikimedia Commons.

aftermath of both the tsunami and the meltdown. *The Atlantic*'s "5 Years Since the 2011 Great East Japan Earthquake" allows for an in-depth list of the short-term impacts through captivating photos, which can be discussed and written about at length. The primary fieldwork tool involves the *Guardian*'s "Fukushima 360: Walk Through a Ghost Town in the Nuclear Disaster Zone." This tool allows users to return to the evacuation zone with a former resident. Users can rotate the camera, view current radiation readings, and consider how places change as a result of disasters. For teachers of other disciplines like science, this resource is a great tool for teaching about nuclear radiation, sieverts, or microsieverts, or for a wider study about the human body responding to its external environment.

At this point, students may be beginning to grow weary of hazards and the toll they take on people, places, and environments. This is a pertinent opportunity

Figure 3: Satellite picture of the Himalaya Mountain ranges and the Tibetan Plateau. Source: Wikimedia Commons.

to begin investigating the Japanese government's response to the disaster by empowering students to apply their investigative skills. Having investigated the causes and impacts of the disaster, spatial technology can now take center stage as students apply their understanding. Spatial technology is an important point of difference for geography as a discipline as students learn to interpret the data generated by these tools and use the tools themselves. Students should be given a solid understanding of the various costs and benefits of using spatial technology in aiding responses to problems and understanding phenomena before undertaking this task.

Google My Maps is a custom mapmaking tool that allows users to add polygons, pins, descriptions, and media to a location of their choice around the world. For the purpose of this unit, My Maps can be used to create an overview of the disaster. A pin can be placed on the epicenter of the earthquake, off the coast of Japan, and a description can be added outlining how events unfolded on the day of the earthquake and tsunami. Pins and polygons can then be added to the coastline, indicating immediate impacts and the eventual exclusion zone surrounding Fukushima Daiichi Nuclear Power Plant. For assessment purposes, students will have already built a sound understanding of these events through their classroom work, so the assessment allows students to recap what they have learned and to really start to refine their writing as they will be revisiting phenomena they have already written about. Students can be assessed on their ability to describe, explain, and analyze causes as they relate to tectonic plate movements. They can also be assessed on their ability to analyze the government's response and evaluate this response by referring to agreed criteria such as whether or not citizens have been allowed to return to the area or whether or not the exclusion zone is still in effect. Another avenue could involve students mapping the route they took while using the *Guardian*'s "Fukushima 360" fieldwork tool referred to earlier in this piece.

In terms of supporting students with learning needs, using My Maps as an assessment tool provides a number of benefits. First, it is easily turned into a nondigital equivalent if required. For example, a teacher could easily provide a printout with assigned squares in which the student could write. This allows graphic organizers to take the place of digital tools, which could allow for "virtual" fieldwork to be carried out in cases where there is no available internet connection. Alternatively, the teacher can provide sentence starters in a teacher-created map, which can then be shared with the student. Finally, the assessment requires a summary of the content covered throughout the unit so the student is scaffolded throughout the process, and this can be made explicit to the learner perhaps through a portfolio in which they save their work, ready to compile it for the assessment.

Virtual fieldwork has a viable place in the classroom, particularly in geography. In addition to the acquisition and development of new skills, students also enjoy opportunities to be effective digital citizens and more confident online learners. In terms of engagement, studies indicate that the use of virtual mediums certainly supports increased participation and excitement. Getchell et al. reported that "a wave of excitement and activity rolled over . . . as the other groups, spurred on by the outcome, began to try to complete the stage with renewed interest."[7] "Hooking" students is key to developing deeper engagement; virtual fieldwork certainly has a key role to play and provides exciting possibilities to continue and expand programs regardless of the current public health climate.

Further Sites to Explore

There are myriad possibilities for virtual fieldwork and opportunities for taking students "out" of the classroom. Some curated highlights include:

- CyArk: https://cyark.org/
- Ib Digital Geography: http://ibgeography.digital/

- Geography.org: https://www.geography.org.uk/Virtual-fieldwork
- Mt. Everest 3D: http://www.everest3d.de/
- Joseph Kerski: https://www.josephkerski.com/
- ArcGIS Storymaps: https://storymaps.arcgis.com/
- Esri Storymaps: https://storymaps-classic.arcgis.com/en/
- Digital Geography: https://digital-geography.com/
- Swiss Topography: https://www.swisstopo.admin.ch/
- Palestine Open Maps: https://palopenmaps.org/
- All Global Cities: https://globalcities-koptiuch.jimdofree.com/
- Chernobyl Walkthrough: https://www.cbc.ca/news2/interactives/360-chernobyl/chernobyl-full.html
- Virtual Museums and Monuments: https://www.historyextra.com/magazine/virtual-remote-museum-exhibition-tours-how-explore-history-from-home/
- Archaeological Institute of America—Virtual Field Trips: https://www.archaeological.org/programs/educators/media/virtual-field-trips/

Notes

[1] Mustafa Girgin, "Use of Games in Education: Geoguessr in Geography Course," *International Technology and Education Journal* 1, no. 1 (2017), https://files.eric.ed.gov/fulltext/ED581261.pdf (accessed May 31, 2020).

[2] John Kirriemuir and Angela McFarlane, "Use of Computer and Video Games in the Classroom." *Proceedings of the Level Up Digital Games Research Conference*, Universiteit Utrecht, Netherlands, 2003.

[3] Robert Rundstrom and Martin Kenzer, *The Decline of Fieldwork in Human Geography*, *The Professional Geographer* 41, no. 3 (1989), 294–303.

[4] Aaron Rothman, Mishka Henner, Danile Leivick, Clement Valla, "Beyond Google Earth," *Places Journal*, May 2015. Maps also provide unique opportunities to discuss issues of cultural power dynamics and inherent bias as manifest in place names, points of interest, orientation, and projection (Mercator or Peters, for example).

[5] Joseph P. Hupy, "Teaching Geographic Concepts Through Fieldwork and Competition," *Journal of Geography* 110, no. 3, 2011, https://www.tandfonline.com/doi/abs/10.1080/00221341.2011.532229 (accessed May 29, 2020).

[6] Geolsoc.org.uk, The Geological Society of London—Tohoku Earthquake, Japan. Available at: https://www.geolsoc.org.uk/Policy-and-Media/Outreach/Plate-Tectonic-Stories/Outer-Isles-Pseudotachylytes/Tohoku-Earthquake (accessed May 28, 2020).

[7] Kristoffer Getchell, Alan Miller, Ross Nicoll, Rebecca Sweetman, Colin Allison, "Games Methodologies and Immersive Environments for Virtual Fieldwork," *IEEE Transactions on Learning Technologies* 3, no. 4, 2020, https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=5557838 (accessed June 1, 2020).