Virtual Field trips in tertiary science

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Contents

Summary

Field trips are one of the most critical pieces of learning for students in sciences like geology, biology, and geography. Virtual field trips (VFT) are being increasingly considered as sophisticated and effective forms of teaching, especially with the rise of new technologies and the growing demand for more inclusive classroom environments. This research developed a virtual field trip for Tertiary students in an introductory-level geology course (GEOL 113: Environmental Geohazards) at the University of Canterbury. This initiative was in partnership with LEARNZ – a highly esteemed virtual fieldtrip team run by CORE Education that creates successful VFTs for Primary and Secondary students in New Zealand. Key components of the Tertiary VFT include a student acting as the virtual field trip teacher interviewing experts and leading the field trip, web-based background material, online assessment, and photos. In two successive academic years, students participated in the VFT during lectures and as pre class assignments prior to a one-day earthquake hazards workshop. In 2016, the virtual field trip used the LEARNZ web platform and occurred synchronously with the class; in 2017 the virtual fieldtrip reused the video, images and word documents from the previous year with the addition of a Google Earth component and with no reliance on the LEARNZ web platform. The goals of the trip were designed to prepare students for the earthquake hazards workshop, in which students analysed earthquake impacts over varying timescales and then applied that knowledge to develop strategies for the recovery of three crucial industries (dairy, mining, or tourism) on the West Coast of New Zealand's South Island.

In both years, number of clicks data showed that students interacted with online material far more during this week of the course than any other. Following the synchronous version in 2016, the students who were surveyed reported (1) they enjoyed the trip, (2) they found background material useful for preparation for the trip and the workshop, and (3) the additional work was at the appropriate level. Despite predominantly positive responses from the students, we experienced some negative feedback from participating staff mainly associated with stress and technical difficulties in running the synchronous VFT. With the asynchronous trip in 2017, staff reported a highly positive overall experience, with a perceived enhanced interaction with class during lecture time, and an increased and enhanced engagement with course material outside of class. The student survey again showed that the majority of students surveyed enjoyed the virtual fieldtrip, and that it was useful preparation for the workshop. Additionally, they reported an improved link between earth processes and society, which was a key overarching aim for the course.

We propose that the synchronous version poses more excitement and immersion in the field environment, whereas the reuse of the asynchronous version increases the utility (and hence value for money) of the trip, and minimises technical difficulties and lecturer stress. Additionally, re-using the material in the asynchronous version offered opportunities to improve and supplement the past content, such as the incorporation of following an annotated trip path in Google Earth. As recommendations for others interested in developing virtual fieldtrips, we report that the design of a virtual fieldtrip should include (1) Goal-aligned content and assessment for both practice and marks, (2) a student and instructor experience that is authentic and flexible to both the people and the place. We suggest that these aims can be achieved whatever the budget or timeframe and make our material freely available at https://serc.carleton.edu/index.html

Introduction

Motivation for virtual fieldtrips

Field trips are widely considered essential in the geosciences, appreciated for the unique opportunity they offer to ground classroom learning into the 'real world' of the discipline (e.g., Lonergan and Andresen, 1988; Gold et al., 1991; Petcovic et al., 2014). Field work helps students develop geoscientific knowledge and skills, as well as transferrable skills like team work, time management, and problem-solving (e.g., Lonergan and Andersen, 1988; Boyle et al., 2007; Pyle, 2009; Petcovic et al., 2014). It engages students and develops their identities as geoscientists through learning the values and processes of the discipline (e.g., Kastens et al., 2009; Pyle, 2009; Mogk and Goodwin, 2012; Petcovic et al., 2014).

However, field education is becoming increasingly more complicated to implement given concerns about time, logistics, finance, and health and safety pressures (e.g., Gold et al., 1991; Boyle et al., 2007; Boyle et al., 2009; Feig, 2010; Petcovic et al., 2014). The field environment may also be physically challenging or produce feelings of anxiety in students (Boyle et al., 2007; Stokes and Boyle, 2009). Any one or combination of these factors may result in an educational experience that is not accessible to all students (e.g., Kent et al., 1997; Hall et al., 2004). Virtual fieldtrips (VFTs) hence become an option when real fieldtrips are not available to individuals, or as a way to add value to a resource intensive real fieldtrip.

Virtual Field Trips and a Partnership with LEARNZ

Technology, such as Google Earth, is increasingly used by geoscience professionals. This has led to an increased use of technology in geoscience education, particularly in the field (e.g., Whitmeyer et al., 2009; Feig, 2010; Mogk and Goodwin, 2012). VFTs offer a way to interact with this technology to complement or provide an effective alternative to traditional field trips. Hence, VFTs offer an alternative where difficulties in finance, health and safety, and accessibility arise (e.g., Hurst, 1998; Stainfield et al., 2000; Atchison and Feig, 2011). VFTs range from web pages and animations through interactive and immersive experiences (Atchison and Feig, 2011), and have been used in geoscience education for a variety of topics, skills and educational levels (e.g., Hurst, 1998; Stainfield et al., 2000). However, virtual learning is not without drawbacks. Problems can include a lack of development of classroom community (as opposed to an in-person field trip) and slow or non-specific instructor feedback to students (Song and Hill, 2007).

LEARNZ (www.learnz.org.nz), a division of CORE Education (a global education company), has been developing and implementing VFTs for the primary and secondary (compulsory) education sector in New Zealand since 1995. Their VFT model aims to combat the potential problems with VFTs mentioned above by offering synchronous (live), immersive, and interactive curricula. A cornerstone of the LEARNZ model is alignment with Universal Design for Learning (UDL) principles (e.g., Dolan, 2000; Hitchcock et al., 2002; Edyburn, 2005). UDL results in curricula that are effective for all learners, with no modifications necessary. It is recommended that: 1) material be represented in a variety of ways to promote knowledge acquisition, 2) learners have multiple opportunities to express or demonstrate their knowledge, and 3) many methods are used to engage and motivate learners (Edyburn, 2005). Key features of the VFT included: background material, online assessment (quizzes), having a student as the VFT teacher (guide), videos, photos, daily diaries, and an audio/video conference with experts.

Methodology

Research Setting

GEOL113: Environmental Geohazards is an introductory paper at the University of Canterbury (UC) which teaches the science behind hazard, exposure, vulnerability and impact assessment, linking physical geohazards to societal impacts and considering mitigation measures. Due to the variety in content covered, the course is split into modules taught by instructors with differing areas of expertise (Table 1). GEOL113 is not a required paper for geological sciences majors, but is a popular option. It is also a common elective for non-geological sciences students (particularly engineering majors). We targeted this paper for VFT implementation because it already had a strong history of educational transformation (Kennedy et al., 2013), a teaching team with interests in geoscience education, and content that aligned well with achievement standards relating to hazards and therefore the ability for LEARNZ to create parallel Primary and Secondary School VFTs. LEARNZ had already received funding from the Earthquake Commission (EQC) to create a geohazards VFT for school students and so aligned the project with GEOL 113. Enrolments in GEOL113 are typically about 100 students, making traditional field trips both financially and logistically cumbersome. Therefore, we expected that the introduction of the VFT would create a novel opportunity for learners to experience field landscapes that they would otherwise be unable to see.

Table 1: GEOL113 Topics Covered

Course Week	Lecture Topics	Practical Components	Assessment
1	Geohazards and Society		
2	Origins of Earthquakes		
3	Measuring Earthquakes		
4	Earthquake Hazards	Virtual Field Trip – Week Long	Quizzes (Formative)
5	Geohazards Case Studies	Workshop – One Day	Report (30%)
6	Volcanic Hazards 1		
7	Volcanic Hazards 2	Field Trip – One Day	Report (30%)
8	Managing Volcanic Disasters		
9	Coastal Hazards		
10	Landslide Hazards		
11	Flood Hazards		
12	Current Geohazard Issues		Final Exam (40%)

The first iteration of the Geohazards VFT was implemented during 8th-12th August 2016, over the course of three regular lecture sessions with the approximately 110 students enrolled in GEOL113 (Figure 2). It was run in parallel with LEARNZ's Primary/Secondary Geohazards VFT, with approximately 3300 school students participating. Both the Primary/Secondary and Tertiary VFTs were synchronous, meaning that the students participated in the VFT as the experts were in the field visiting individual sites and filming and editing videos. The Primary/Secondary VFT followed the typical LEARNZ structure of having a teacher as a guide and sending school mascots (stuffed toys) to be taken into the field. The Tertiary VFT instead had an undergraduate student as a guide who was in the field with the experts, asking them questions in the videos and posting daily diaries of their activities and observations.

As there was already a substantial assessment (full day workshop and associated report – Table 1) in GEOL113 focused on evaluating the impacts of and response to a potential Alpine Fault earthquake on West Coast communities and industries, the decision was made to structure the VFT around earthquake hazards and impacts with special attention to the township of Franz Josef and the West Coast. The VFT could then serve as a lead in to the workshop, by introducing and connecting the students to the natural landscape and its specific hazards. It was envisaged that this context would aid in bridging the science and processes of the earthquake hazards lectures to the societal impacts of the workshop.

Curriculum Development and Implementation

Synchronous Version (2016)

After selecting earthquake hazards and Franz Josef as the focus for the VFT, development of curricular materials evolved through an iterative process grounded in educational theory and relevant literature (Figure 1). Initial ideas were drafted based upon the LEARNZ model and their pre-existing geohazards materials, which were linked to NCEA

Achievement Standards. Goals were aligned with course level GEOL 113 goals and the goals of the workshop assessment. Importantly, we consulted with the GEOL113 teaching team to ascertain their vision for the VFT and collaboratively developed learning goals specific to the GEOL113 VFT (Table 2). The resulting GEOL113 VFT learning goals were constructively aligned with the GEOL113 curriculum components and used to plan the filming schedule (Table 3). Consultation with the teaching team was ongoing through this process until a final VFT design for the 2016 semester was realised.

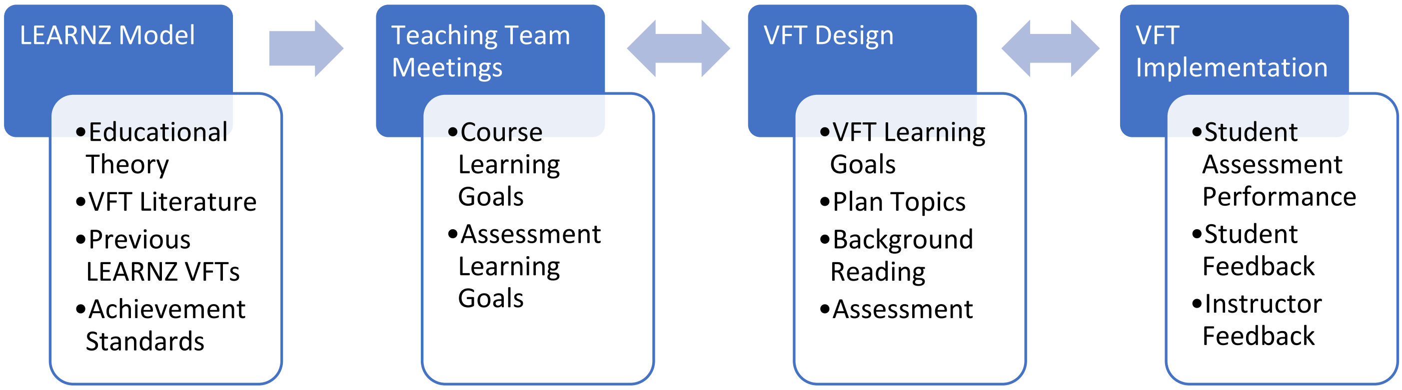

Figure 1: Overview of VFT Development Process

Table 2: Geohazards VFT Topics and Learning Goals

Topics	**Learning Goals**
Geohazards	Identify major geohazards and cascading multihazards in New Zealand, with special attention to the West Coast and Franz Josef.
Seismicity of the Alpine Fault	Use the paleo-seismic record to interpret how often the Alpine Fault ruptures and from this, estimate the likelihood of a future earthquake.
Earthquakes in New Zealand	Estimate the length of the Alpine fault and deduce the likely magnitude of the earthquake and its shaking intensity at Franz Josef.
Earthquake Impacts on the Natural Environment	Identify features in the landscape that result from earthquake shaking and can contribute to river aggradation and flooding.
Earthquake Impacts on the Built Environment	What will be the likely impacts of an Alpine fault earthquake and its consequential hazards on assets and lifelines (e.g. communications, transport, energy supply, water supply, services) on the West Coast? How long will these impacts last?
Hazard Management and Mitigation	What resources will be needed to respond to the earthquake and its impacts? What can be done in advance to reduce these impacts?

Table 3: Draft Filming Plans and alignment with VFT Content

<table>
<tr><th>Lecture Time</th><th>Filming Times</th><th>Locations</th><th>Content Topics</th><th>Additional Materials</th></tr>
<tr><td>Tuesday 9th (class at 2pm)</td><td>Sunday 7th – Monday 8th</td><td>Various stops on drive to West Coast via Arthur’s Pass</td><td>Geohazards, Seismicity of the Alpine Fault</td><td>Tectonics of NZ figure, map of Alpine Fault, example of multihazard (relating to past rupture), average interval of Alpine Fault rupture figure, map of past rupture events</td></tr>
<tr><td colspan="5">Key messages: Distinction between geohazards and multihazards. Earthquake effects not limited to the shaking we feel, they are often followed by landslides, flooding, etc. How to use the seismic record of the Alpine Fault to interpret recurrence interval and probability of occurrence.</td></tr>
<tr><td>Wednesday 10th (class at 5pm)</td><td>Monday 8th – Tuesday 9th</td><td>Previous rupture site (Gaunt Creek), landslide deposit (Poerua Valley)</td><td>Earthquakes in NZ, Earthquake Impacts on the Natural Environment</td><td>Examples of geomorphic consequences, length and magnitude figure, photos of recent flooding, photos of landslide deposits</td></tr>
<tr><td colspan="5">Key messages: Magnitude of shaking along and surrounding the Alpine Fault (especially in the case of a future rupture). Evidence of past flooding and cascading hazards.</td></tr>
<tr><td>Friday 12th (class at 4pm)</td><td>Wednesday 10th – Thursday 11th</td><td>Franz Josef overlook and township</td><td>Earthquake Impacts on the Built Environment, Hazard Management and Mitigation</td><td>Infrastructure maps (highways, train lines, power lines, etc.), photos of national/international aid, UC Geological Sciences Department’s emergency materials</td></tr>
<tr><td colspan="5">Key messages: Infrastructure (Arthur’s Pass, highways, power lines, etc.). Critical industries (dairy farming, mining, tourism) as a lead in to the workshop. Focus on people.</td></tr>
</table>

	Mon 8 Aug	Tues 9 Aug	Wed 10 Aug	Thurs 11 Aug	Fri 12 Aug	Sat/Sun 13/14 Aug
Prep.	Read Nathaly's trip diary. Read background pages learning goals 1 and 2. Post one Question (1%). Complete Quiz 1 (1%)		Read Nathaly's trip diary. Watch videos for learning goals 1 & 2. Read background pages complete quiz 2 (1%) Best questions sent to experts	Read Nathaly's trip diary. Watch videos for learning goals 3 & 4 Read background pages complete quiz 3 (1%)	Read Nathaly's trip diary. Watch videos for learning goals 5 & 6. Read background pages complete quiz 4 (1%)	Workshop handout
		Clark Fenton Tuesday 2 – 2:50 pm in C3 Clark give feedback on good questions Answer questions interactive classroom related to learning goals 1 & 2. Talk up first sites for fieldtrip Link to workshop. Set up video watching	Tom Wilson 5-5:50 pm in E8. Play live conference based on questions. Live questions to experts. Tom interactive classroom relating questions to workshop. Talking up next sites on fieldtrip and new goals.		Tim Davies 4 – 4:50 pm in A3 Class discussion with experts in person. Interactive classroom on learning goals 3 – 6 all relating to workshop.	Workshop
Evening		1st 5 videos posted (learning goals 1 & 2)	2nd 5 videos posted (learning goals 3 & 4)	3rd 5 videos posted (learning goals 5 & 6)		

Figure 2: VFT Implementation - 2016

Challenges with Implementation

The first implementation of the Geohazards VFT experienced some difficulties, particularly with respect to the tight timeline of the synchronous VFT and technological challenges associated with that. UC uses Learn (local implementation of the Moodle Learning Management System) to host online course materials; however, LEARNZ has their own online domain in place to do this. Therefore, students had to be directed from the GEOL113 course page on UC Learn to the LEARNZ website, where they had to create another login and password. There was some confusion and frustration with having to do this, compounded by technical difficulties with the creation of student logins. This frustration was then passed on to the teaching team who had to liaise with LEARNZ to solve the problem swiftly in line with the tight schedule. Students were also frustrated when videos and associated quizzes were not released at the time indicated on the course schedule (Figure 2). Filming and editing videos in real time meant that delays were at times unavoidable. Finally, the last lecture session where an A/V conference was held in the classroom with the experts in the town of Hari Hari experienced a delay in connecting the audio.

Asynchronous Version (2017)

In 2017, the VFT materials were reused in an asynchronous, or non-live, manner to compare the effectiveness of the two different versions. Although LEARNZ make their VFT materials accessible after the field trip has been run, we were not sure how widely these were used and whether they had the potential to be as effective as the original synchronous version of the VFT. The asynchronous Geohazards VFT was implemented during the week of 7th-11th August 2017 (Figure 3), and like 2016, during three regular lecture sessions of GEOL113 with an enrolment of approximately 110 students. This version retained the background readings and videos developed in 2016, but changed: (1) the live A/V conference for a Google Earth component and tutorial, and (2) the student guide to an instructor guide. The use of Google Earth was intended to retain the connection to place (Figure 4). Students were taught to use Google Earth in class and were provided annotated field stops (kmz files) for each day of the trip that corresponded to those on the filmed VFT. The instructor taking ownership of the VFT served to ensure that students felt they were a part of the field trip process. The success of the asynchronous VFT was contingent on the instructor being interested in and committed to its implementation. In this case, a new instructor had taken over this component of the course and took ownership of how to effectively adapt the synchronous aspects into aspects that would serve a similar purpose in the asynchronous version.

Mon 7 Aug	Tues 8 Aug	Wed 9 Aug	Sat 19 Aug
IN-CLASS Overview of field trip, online resources, and Google Earth in class. Go through first three videos of field trip. Discuss long-term earthquake impacts.	**IN-CLASS** Discuss videos Day 1: 4,5,6 and go over any issues with online system. Go over quiz responses. In-class exercise on Alpine Fault paleoseismicity.	**IN-CLASS** Discuss videos Day 2: 1-4. Go over quiz responses. Discuss resilience and review session	Workshop handout
VIRTUAL FIELD TRIP: DO BEFORE CLASS TOMORROW Read background pages and watch videos 4,5,6,7. Quiz 1 open. UC Overview of the Alpine Fault. UC Rupture history of the Alpine Fault. UC Shaking intensity and the MMI scale UC Debris flow and quake multihazards	**VIRTUAL FIELD TRIP: DO BEFORE CLASS TOMORROW** Read background pages and watch videos from Day 2. Quiz 2 open UC Debris flow and quake multihazards UC Landslides in New Zealand UC Impacts of landslides UC Dambreak floods through time	**VIRTUAL FIELD TRIP: DO BEFORE FRIDAY 11th AUGUST** Read background pages and watch videos from Day 3. Quiz 3 open UC Overview of Franz Josef from the Glacier Lookout UC Franz Josef Hazard Exposure UC Worst-case Earthquake Impacts to Franz Josef Field trip summary	

Figure 3: VFT Implementation - 2017

Figure 4: Google Earth screenshot looking southwest at the Poerua Valley. This stop was used to show multi-hazard impacts on the natural environment.

Results and Discussion

To evaluate the impact of the synchronous and asynchronous versions of the VFT on learners in GEOL113, we collected data relating to two major research questions:

(1) What were students' experiences in the VFT?
(2) How did student engagement in the post-VFT workshop compare to previous years?

Data collected included usage data from the Learning Management System, student questionnaires, and instructor interviews (synchronous – all workshop instructors, asynchronous – instructor guide only).

Engagement with Learn

During the weeks of both the synchronous and asynchronous VFTs, there was a dramatic increase in the number of student accesses on Learn (Figure 5). This was much higher than typical usage, even for the asynchronous version when no grades were assigned to the completion of quizzes or to posting of forum questions. The instructor did however emphasise that the participation in the VFT was mandatory preparation for the earthquake hazards workshop the following week. We must note here that while students were accessing materials, this does not mean that they were learning. To evaluate learning, we look to the student experience data and instructor feedback.

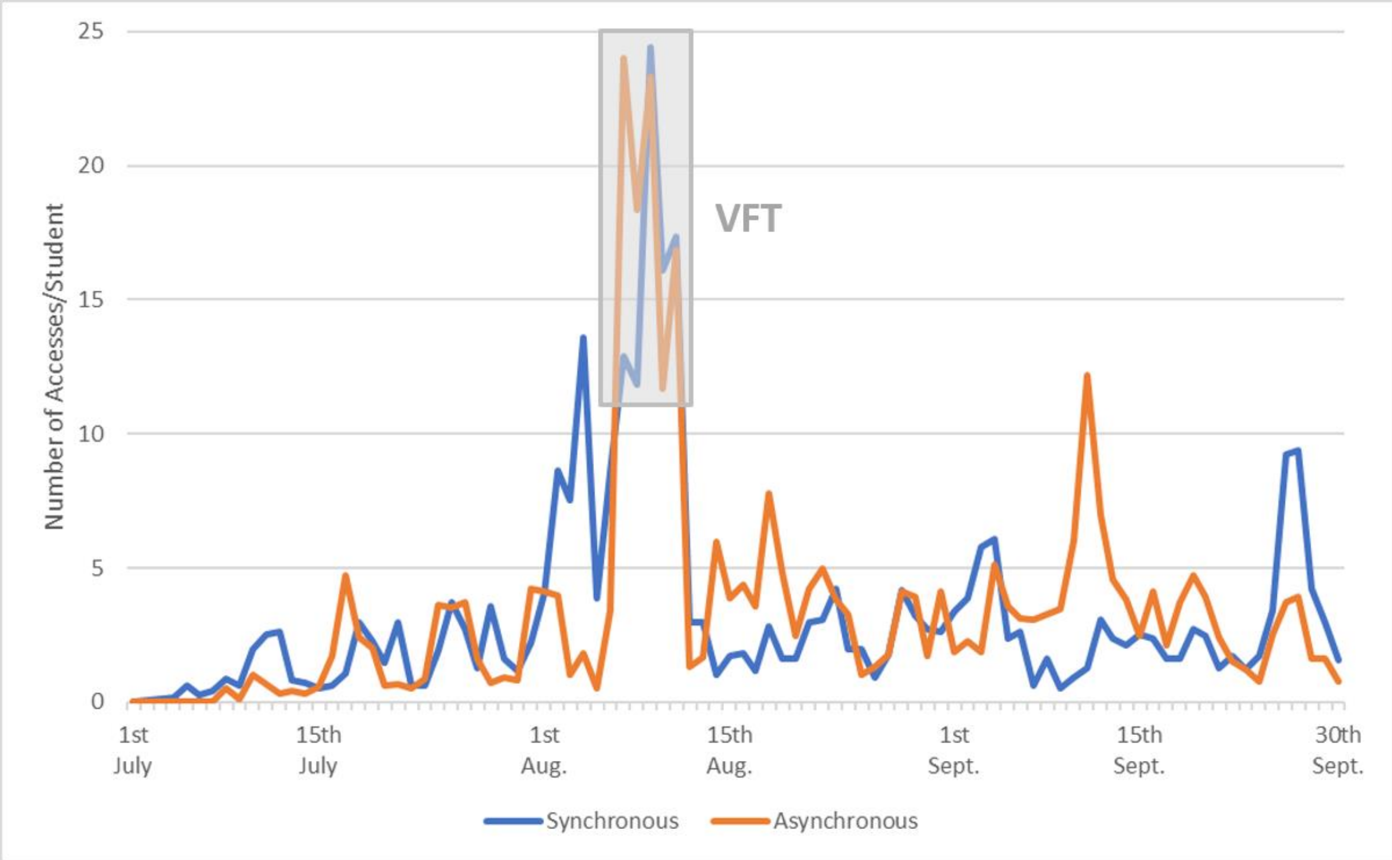

Figure 5: Overview of Student Accesses on Learn

Student Questionnaires

Student feedback was obtained via an online questionnaire after both the synchronous and asynchronous VFTs. Unfortunately, we were limited by a low response rate in both years (n=17, synchronous and n=11, asynchronous; approximately 12% of students enrolled in GEOL113). However, we have used qualitative survey responses to gain a better understanding of the quantitative data.

The majority of students enjoyed their VFT experience whether it was synchronous or asynchronous, though the synchronous field trip appeared to be more polarising (Figure 6). Student opinions on the synchronous elements of the VFT were mixed, exemplified by the two quotes below:

"The lecture where we talked to the experts over skype was interesting." – Synchronous Participant

"There was absolutely [no] reason for them being there when everything could have been done on a photo on powerpoint. The question and answer session would have been better off answered by Franz Josef locals and people involved in civil defence (with them being in the lecture hall rather than by skype.) And why was it being filmed on the day? Why not do it a week in advance and put it all up on learn at the same time?" – Synchronous Participant

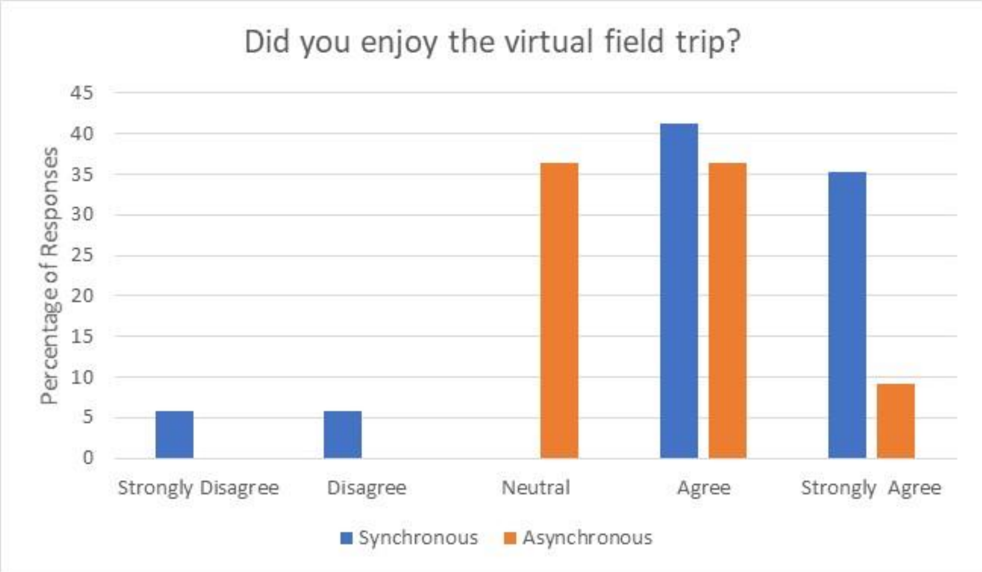

Figure 6: Enjoyment of the VFT

From the above criticism and similar comments, we hypothesise that frustration with the synchronous elements stemmed from technical difficulties experienced in its implementation, as well as delays experienced in posting videos and associated quizzes. Positive comments generally tended to overlook these difficulties and appreciate the novel and engaging nature of the VFT, for example:

"Was interesting getting to learn about a place through seeing it. Something different than your average lecture." – Synchronous Participant

Students from both years described the clarity of learning goals and identified useful connections between the VFT and workshop objectives. These comments support the constructive alignment between learning goals and curriculum components that was a key part of our development process (Figure 1). For example:

"The learning objective was clear and I understood each learning stage." – Synchronous Participant

"I enjoyed the whole virtual field [trip], as it prepared me well for the workshop." – Synchronous Participant

"It was good field prep before our actual fieldtrip and gave us a look into what fieldtrip[s] at higher levels will be like." – Asynchronous Participant

A crucial next step from the constructive alignment of the VFT content was the alignment of this content and associated learning goals with assessment. The only assessments directly associated with the VFT were online quizzes (worth participation grades in the synchronous VFT but not graded in the asynchronous VFT). The workshop that built on the VFT context had a final report which was summative, but not directly related to the VFT. Students that participated in the synchronous VFT saw value in the online quizzes when they were awarded incentives for completion, but some of the students on the asynchronous VFT were frustrated that these were no longer worth marks. For example:

"The nightly quizzes was [sic] good to reinforce what was talked about in the videos." – Synchronous Participant

"It didn't seem that relevant because it wasn't worth any grade percentage." – Asynchronous Participant

Although the workshop report was not directly related to the VFT content, students perceived the connections with place that created a context for the workshop, as well as the way that Earth processes link to societal impacts (Figure 7). They also felt that this aided in their writing of the report. For example:

"Seeing them via maps and photos/ videos allowed for us to see the correlation for ourselves." – Asynchronous Participant

"Started to think about the geohazards and relevance. Made it easier and less stressful when coming to write the report." – Asynchronous Participant

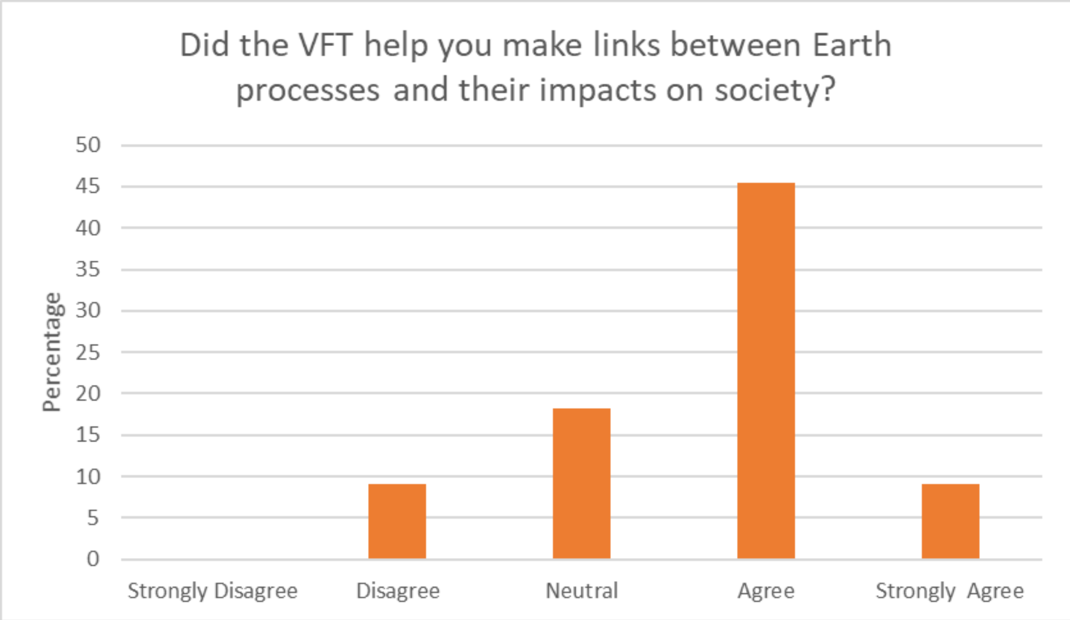

Figure 7: Connections between Earth Processes, Place and People

Instructor Interviews

For the synchronous VFT, short (approximately 10 minute) interviews were conducted with all instructors (n=2) and teaching assistants (n=6) involved in the teaching of the Alpine Fault workshop. These focused on reflecting on student engagement in the workshop in comparison to previous years (if applicable) and any potential connections they saw to the VFT. The course coordinator/lead instructor was impressed with student attendance and engagement during the workshop, which he noted was higher than previous years. However, he did not feel that students brought any better skills or knowledge into the workshop than previous years, and the other instructor agreed with this. None of the teaching assistants had taught in the workshop in the year prior to the synchronous VFT, but all noted the high level of discussion and creativity that the students brought to it. All but one of the teaching assistants had some awareness of the VFT content (either by watching some of the videos online or by being students on a field trip to Franz Josef that was used for reconnaissance). One of the teaching assistants was an expert interviewed during the VFT videos, so he had an exceptionally high awareness of the VFT content. Three of the six teaching assistants stated that knowing the students had the context of the Franz Josef saved them time in explaining the natural and built environments, as well as connecting the students with the reality of the situation. This allowed more time to discuss the complexities of the social aspects and emergency management of a potential Alpine Fault rupture.

A debrief session was held with the new earthquake hazards module instructor regarding the asynchronous VFT. Although this instructor did not see the previous year's synchronous VFT in action, he took ownership of the asynchronous VFT and developed and implemented the Google Earth material (as previously mentioned). He perceived more flexibility in lecture time and thought the VFT made his job less stressful. The instructor felt that students were more engaged during lecture times and with online material outside of lecture time. The latter is consistent with Learn data presented above (Figure 5). The instructor also noted that the student class representative was entirely positive about the VFT experience, even when they had not been shy in the past about providing negative feedback. This may have been because of the class rep and classmates' buy-in to the VFT: they arranged watching 'parties' for video assignments. This is consistent with findings from the student questionnaires (Figure 6).

Critical Elements for Successful VFTs

The above results and our curriculum development process have allowed us to identify four critical elements for successful VFTs: (1) constructively aligned content, (2) assessment opportunities, (3) student experience, and (4) connection to place and people (Figure 8). Care must be taken to ensure that learning goals are well developed and that these are matched to curriculum content and assessment. Assessment opportunities should include some for practice and some for marks. Students must feel connected to the VFT experience and this was achieved in two different ways. In the synchronous field trip, the presence of a student guide who interviewed the experts in the videos and posted daily diaries of the field trip activities helped the students to feel like there was someone like them who was part of the experience. Although this student guide was still present in the videos in the asynchronous version, the diaries would no longer be real time and thus were not included. Instead, the instructor took ownership of the field trip and became their guide. Finally, VFT pedagogy must act to develop a sense of place in students. In the synchronous field trip, this was achieved with the audio/video conference with the experts, conveying a direct physical connection with people who were in the landscape. As this was not an option in the asynchronous field trip, Google Earth was used to help the students build their own sense of place by exploring the landscape.

Figure 8: Critical elements for Successful VFTs

Impact of the VFT

The Geohazards VFT involved approximately 220 Tertiary students (synchronous and asynchronous) and 3300 Primary/Secondary School students (synchronous). 1 student research project was completed in conjunction with Frontiers Abroad (Reyna et al., 2016a; http://frontiersabroad.com/research/geology-research-projects/) and this work was also presented to an international audience at the Geological Society of America Annual Meeting (https://gsa.confex.com/gsa/2016AM/webprogram/Paper284184.html). Several presentations at the National level at Education and Geosciences conferences have also occurred.

Ongoing use of the asynchronous VFT in GEOL113 is planned, with the reinstatement of a small grade percentage being attributed to quiz completion. The VFT materials and a how to guide will be publicly available through the Ako project website and the Science Education Research Centre.

Future Work

The Geohazards VFT will continue to be refined by the earthquake hazards instructor, with input from the research team. Brainstorming is already underway for ideas on how to enhance the sense of community in the asynchronous version, including having student added tags in the videos or having instructor-organised study sessions where students watch as a group.

Lessons learned from this research project are already being applied to the development of an Iceland VFT for GEOL336, Magmatic Systems and Volcanology, and for the 2018 Unlocking Curious Minds project "Magma drillers save planet Earth" around drilling into a virtual magma chamber.

Conclusions

In summary, this project found that the LEARNZ model for virtual field trips is appropriate and engaging for first year university students, even in the face of some technical difficulties. Highlights of the project include:

- Students' interaction with online course materials for GEOL 113 increased substantially during the week of the fieldtrip. Students reported; (1) enjoyment and a feeling of being better prepared for the workshop on earthquake hazards on the West Coast of New Zealand; (2) a better connection between Earth processes and society. Additionally, students with anxiety with respect to real fieldtrips appreciated the virtual format.
- UC researchers Sam Hampton and Alistair Davies were watched by 3,000 school pupils, and were publicised in an article in The Press. Nathaly Reyna, a Frontiers Abroad undergraduate, was trained in geoscience education research and was awarded an extended scholarship to continue the work. Research assistant Dr Alison Jolley has been given a full time position as a teaching and learning fellow at University of British Columbia. Both Nathaly and Alison have presented this work internationally in US and Canada.
- The project resulted in an ongoing collaboration developed between UC, CORE education, and College of Education. At least 30 participants attended recent workshops emphasizing virtual fieldtrips, including practicing teachers, student teachers, geology staff and students, staff from College of Education and Core Education. These new collaborations have resulted in funding secured for a second international virtual fieldtrip from MBIE and EQC to Iceland and a successful curious minds grant to build interactive hologram roleplay in this virtual fieldtrip.

By identifying and substituting critical VFT elements, we were able to successfully recycle the content as an asynchronous field trip. These critical elements were: constructively aligned content, assessment opportunities, student experience, and connection to place and people (Figure 8). The asynchronous model worked especially well because the instructor was committed to its implementation. The success of the asynchronous model offers rich opportunities to adapt VFT material in the future, which will improve cost effectiveness and help alleviate scheduling challenges. Ultimately, the critical pedagogical elements of VFTs may be achieved on a small budget and are useful in other pedagogical scenarios beyond the virtual realm.

Implications for practice

How to make a Virtual fieldtrip on a shoestring budget.

Virtual fieldtrips take many shapes and sizes. e.g.

1) Photos and text on a web site
2) Edited video and interviews
3) Google earth tours
4) 3D interactive environments

What is the purpose/learning outcomes of your trip, how much time do you have, and what skills are available?

Potential Outcomes: How will these focus your choice of fieldtrip and assessment type.

(A) To apply classroom concepts to a local real scenario
(B) To practice observational skills and systematic data collection in a complex setting
(C) To learn specific software skills e.g. Google Earth, web page design
(D) To give opportunities to foster teamwork and project based skills
(E) To prepare for a real fieldtrip

Time: Don't bite off more than you can chew

(A) Have you thoroughly checked what is already available online? e.g. https://www.learnz.co.nz/
(B) Will you have the opportunity to visit the place for real before the virtual trip?
(C) Is the trip going to occur during class time?
(D) When are the assessments going to occur?
(E) Is the virtual field trip designer also the teacher.

Skills:

(A) Do you, your students, your teacher help, your institutional experts have cameras/ mobile devices suitable for video and photos recording and editing?
(B) How well do you know the place/ people/ experts ?
(C) How well do you know the software used to make, edit or run the virtual fieldtrip?

Our lessons Learned

(1) Keep technology simple as possible. Make sure you, your students and your team are confident with the technology.
(2) The people and place were important for our learning goals, so video and interview format allowed a good connection to both the people and place.
(3) In our scenario the advantages of having a teacher fully integrated into design and implementation of trip was as important as running the trip live.
(4) Some students don't fully engage if they don't see the link to the rest of course and assessment.
(5) Mutually beneficial relationship with an experienced team (LearNZ) smoothed a lot of potential problems.
(6) It worked to pool financial and staff resources- one real trip to fund several virtual trips, with a series of small grants that can go a long way.
(7) When finances to work with an external company like LearNZ run out, institutional expertise can help with video editing.

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