ABSTRACT

The use of mobile technologies to facilitate field trip experiences inclusive of both face-to-face and remote students has been explored as part of a course in Digital Learning Technologies at the Eastern Institute of Technology. This paper reports on the field based activity where 3G/4G data services were used by both the students and lecturers to include the remote cohort in the experience and to collect evidence while in the field. The research uses two cycles of an experiential learning model combined with a case study methodology to answer the research question, “What are the challenges of using a mobile technology supported gxLearning environment in the field?” The findings from this research show that while mobile devices do offer remote students a means of participation and engagement, the experience is dependent of careful planning and the variables of network connectivity and device quality. While the use of mobile data networks exacerbated overall performance students did find that being able to communicate with their peers gave them a sense of unity over a shared real time experience.

Keywords: Field trip, web conferencing, gxLearning, mobile, experiential learning, digital technologies, Adobe Connect

1. INTRODUCTION

Over the past two years, the use of mobile devices to implement and support field trips for both face-to-face and remote students in a Digital Learning Technologies (DLT) course, has been explored at the Eastern Institute of Technology (EIT). As part of a wider study in using web technologies to enable geographically extended learning gXLearning (Verhaart & Hagen-Hall, 2012), the use of mobile technologies to extend learning into the field has offered all students, regardless of the method of attendance, an authentic learning experience in the context of their studies.

In 2015 students in the DLT class were taken on a field trip as part of their learning into mobile technologies and related pedagogies. Focusing on the integration of multiple technologies to support participation and engagement for both face-to-face and remote students, the 2015 field trip highlighted several issues and provided an opportunity to reflect on the lessons learned in preparation for the 2016 iteration of the course. Notably, the issues were the low level of audio and video quality provided to the remote students, the need for good quality hardware and supporting infrastructure, e.g. strong Wi-Fi or 3G connectivity, data streaming costs and choice of devices used (Day & Verhaart, 2015).

Using a case study approach, this research revisits the field trip as a short-term experiential learning opportunity in the context of the Digital Learning Technologies course. In extending and adapting the 2015 approach to further test the capabilities of current mobile technologies, while endeavouring to be inclusive of remote students, this paper reveals the current technological limitations when using mobile technologies to enable field-based learning.

This paper will firstly give a brief review of the literature outlining the educational benefits of field trips and the various ways field trips are being extended to include virtual participation. This is followed by a description of an experiential learning model that explains the preparation, sequence of events and cycle of learning for both the lecturers and students before, during and after the field trip. The field trip itself is described and the feedback from both students and lecturers is analysed giving recommendations for those wishing to use mobile technologies to support field based learning in the future.

2. LITERATURE REVIEW

2.1 gxLearning

“gxLearning” is a term coined by Verhaart and Hagen-Hall (2012) and refers to a method of teaching to “a geographically distributed class, consisting of students in a face-to-face mode plus students in a remote location” (p. 111). gxLearning is also known as synchronomodal classes (Bell, Sawaya & Cain, 2014) and the Hyflex Course Design (Beatty, 2007). GxLearning is supported by web conferencing technologies such as Adobe Connect. Adobe Connect provides the technology infrastructure that enables synchronous video, audio, chat and other interactive capabilities. These capabilities help support remote student interaction and communication with the class lecturer and the in class student cohort. The gxlearning environment is able to be supported using web conferencing enabled mobile technologies and as such has the potential to allow engagement of students in a variety of activities, including field trips, regardless of location.

2.2 Field trips as experiential learning

Kolb (1984) described experiential learning as a process of learning that can be represented as a cycle of four stages; Concrete Experience (learner is experiencing), Reflective Observation (the learner is reflecting on the experience), Abstract Conceptualization (the learner is drawing wider conclusions and generalizing) and Active Experimentation (the learner is applying their new knowledge in a different context). Experiential learning provides the opportunity to learn skills that can be used applied in a real world context. Scare (1997) has since described field trips as short term experiential learning opportunities, where “students are motivated to learn when they concretely experience social phenomena though the everyday settings of field trips; such
experiences are impossible in the classroom” (p. 220). Linking these experiences with classroom based learning exposes students to real world learning in the context of their studies (Wright, 2000). Real problems are experienced and the opportunity for reflection encourages deeper thinking and problem solving. Modern teaching methods however, may mean that students are not present in the class. Students may be online learners, attending a blended learning class that mixes online and face-to-face learning or attend remotely using web based communication technologies. This provides additional complexity when offering field trip based experiential learning opportunities.

2.3 The Virtual field trip

Virtual Field Trips (VFT) as an alternative to an actual field trip are enabled by the development of multimedia technologies. Initially limited to students passively watching pre-recorded video of field activities, developments in communication technology firstly enabled teleconferencing “field trips” between schools as early as 1985 (Tuthill & Klemm, 2002) and more recently online virtual worlds have offered simulations of a real experience (Schott, Murray, Melean & Raivoka, 2011). In New Zealand (NZ), LEARNZ offers educators and students access to a variation of the VFT, where the authenticity of the online experiences reflect international and local content and cultural context and links to the NZ curriculum (LEARNZ, 2016). These VFT’s provide a range of media, live chat and interactive content as part of that experience.

The Remote Access Field Trip (RAFT) project started in early 2002 used video-conferencing and instant messaging services to create an environment where some students attended a field trip and others remained in class. Technology was used to facilitate their interaction with each other (Joel, Arnott, Ingvarsson, Rentoul & Schofield, 2004). Although some time has passed since this project, the findings still remain true; the infrastructure used to support both the field in-class students needs to be pervasive and all encompassing. These finding are supported by Day and Verhaart (2015) who found that the integration of mobile devices and web conferencing technologies using a ‘gxLearning environment’ (Verhaart & Hagen-Hall, 2012) could provide students the means to actively participate in a field trip. However, the quality of the experience was dependant on the quality of the technologies used and the strength and reliability of the internet connection.

3. RESEARCH MODEL

The research model shown in Figure 1, draws together two iterations of Kolbs (1984) experiential learning cycle. The first cycle is the learning process undertaken by the session organiser(s) (in the case study presented, included the lecturer and the learning advisor) in the role of field trip planner and the second is that of the students during the field trip. These are linked as the learning from one feeds into the other in a continuous cycle.

The first cycle is undertaken by the session organisers and consists of a site visit in preparation for the field trip. As Scarcie (1997) states, “good field trips are made possible by instructors’ attention to detail” (p. 3) and this gave an opportunity to test the technology, reflect on possible field scenarios and to redefine any technology decisions before the students engaged in the field. This is the time for planning, organising dates, arranging guest speakers and ensuring the students know a trip into the field is imminent and what is required of them.

The second cycle occurs when the students participate in the field trip, reflect on their experience, discuss and conceptualize what they have learned and apply their learning to a new scenario. As the students reflect and apply their learning, the session organiser(s) has access to this information and can use it for future planning. An explanation of how this was applied in this research is presented as part of the case study.

![Figure 1. Two cycles of experiential learning used in this case study](image-url)
4. CASE STUDY BACKGROUND

4.1 Digital Learning Technologies

Digital Learning Technologies (DLT) is a level 7 Bachelor of Computing Systems paper at EIT. This course aims to give students practical experience in the use of digital technologies for education and training purposes (Digital Learning Technologies, 2016). The DLT class uses the Adobe Connect web conferencing technology as the gxLearning enabled environment to allow both face-to-face and remote students synchronous participation in class. As part of this course, students explore the use of mobile technologies for learning in an educational or training setting.

To meet these learning outcomes, the DLT students were taken on a field trip to a nearby sustainable house project. While the project itself was of interest when considering the impact of technology on the environment and future sustainability, it was the mobile technologies used during the field trip to facilitate student participation that was the primary learning focus.

4.2 Learning cycle one: Field trip planning and organising

Initially the plan was to give the DLT students a unique experience away from the classroom and to test the limitations of mobile devices by extending the field trip to an area outside normal Wi-Fi coverage. This would enable students to experience how mobile devices could be used in field based learning and to test the limitations of using Adobe Connect in a gxLearning environment while in the field.

As part of a PhD study into sustainability, a staff member at EIT is building a log cabin close to campus. In conversation with the staff member, it was decided that this venue provided just enough scope to test the limitations of the technology, give the students a trip that was within walking distance, meet a number of course objectives and contribute to his PhD study. As part of the scoping exercise, the DLT lecturer and an education advisor in Learning Technologies visited the site to test the technology and decide on strategies for managing the gxLearning environment.

4.2.1 Experiencing: Site visit and technology testing

The site visit by the DLT lecturer and Learning Technologist stage one of the “tutor” learning cycle. During the visit, the technology needed to enable a gxLearning environment was tested. As Wi-Fi was not available on site, mobile devices were used to trial the strength of the 3G/4G internet connection. The strength of signal varied as the area was bush clad and some distance from the nearest cell tower and there were issues using one device for simultaneous audio and video streaming. Using the mobile phones as data hotspots for Wi-Fi only devices such as a laptop and tablet was also trialled, but this was less successful and the connection was intermittent and showed a high degree of data latency.

4.2.2 Reflection and Conceptualization: Technology decisions and refinement

Trials revealed that using one device to stream the video and the other to manage the audio and text chat within the Adobe Connect environment offered a better experience. It also meant that the PhD candidate could use the audio streaming phone when speaking, ensuring that his talk was audible to the remotely attending students. The video capturing mobile device could then be used to capture multiple scenes by not being tethered to the speaker. After testing in and around the log cabin surrounds, it was felt that there was enough data capability and speed to offer remote students a chance to participate and date and time arrangements were finalized for the students visit. Data usage was also measured to ascertain requirements for the estimated one hour field trip duration. As the field trip linked to an assessed blogging activity, the questions and requirements for the activity were developed once the site visit was completed.

4.3 Learning cycle two: Student field trip

4.3.1 Preparation

In preparation for the student cycle of learning, the students were first introduced to the idea of a field trip for the purpose of testing mobile devices as tools for learning and in the context of their own experiences. The PhD candidate was also interested in having the DLT students participate in his research, so in the class prior to the trip, the students were asked to respond to a survey on sustainability and were advised of the requirements for the field trip, including bringing their mobile devices and coming with sensible footwear.

4.3.2 The experience

On the day of the field trip, the PhD candidate was to introduce the log cabin project in class before venturing to the site. However, due to a miscommunication about the start time, the PhD candidate arrived towards the end of the field trip. Luckily, due to the preparation visit that had occurred, the class lecturer and learning technologist felt that they had enough information to guide the field trip on their own. The remote students attended class using the gxLearning environment and were able to join at this point using Adobe Connect and then ‘virtually’ take the walk to the log cabin.

The technology was described (shown in Figure 2) and students were encouraged to use their devices to take photos and videos for later inclusion in their blogs. After the briefing students were taken to the site of the log cabin (Figure 3).

Figure 2. Preparing the class and testing the technology prior to walking to the log cabin project (Lloyd, 2016)

The activity within Adobe Connect was also set to be recorded so those who were unable to attend in either mode, could watch the field trip later. Once at the log cabin site, the class lecturer introduced the log cabin project. The students spent some time investigating the project, asking questions, taking photos and videos and using their mobiles to test the Adobe Connect environment. As the field trip wrapped up, the PhD candidate arrived and followed the students back to the classroom to give a presentation and debrief.

4.3.3 Reflection, Discussion and application

The students completed their blog posts, reflecting on the use of mobile technologies in the field for the purpose of including remote students and capturing evidence as part of their learning. The students were asked to give recommendations for a better/improved experience and to think about how mobile may be applied in a learning context.
As a final project in this course, the students are required to build a learning object to meet a specific purpose. It was hoped that the field trip experience may provide students with practical knowledge that they may be able apply within the context of their own learning object.

5. RESEARCH

5.1 Purpose
The purpose of this research was to investigate the application of mobile technologies and a gxLearning environment to support a field trip for both face-to-face and remote students. In applying both a theoretical approach derived from Kolbs (1984) experiential learning cycle and a case study approach in investigating contemporary phenomena (Yin, 2003), this research answers the question “What are the challenges of using a mobile technology supported gxLearning environment in the field?”

5.2 Method and data collection
For the purpose of this study the assessed student blog entries, class based discussion feedback and lecturer observation provide the case study evidence and basis for discussion. Of the 32 students enrolled in the course, four students attended the field trip face-to-face and 4 attended virtually using the gxLearning environment. Students in a postgraduate class in Advanced Digital Learning Technologies were invited to participate also, and three attended virtually (one from Christchurch). The field trip was attended by the class lecturer and an education advisor in learning technologies.

Student experience of the field trip was captured by extracting comments from the student’s blog posts. These comments were coded into themes that were revealed during the analysis; mobile, gxLearning and digital technologies. The comments were further coded according to key properties and attributes. The lecturer and Education Advisor reflections add further explanation and depth and these are interwoven to form a narrative of key events and findings.

5.3 Ethics
This research was approved by EIT’s Research and Ethics Approvals Committee (2012) under the umbrella of approval granted for gxLearning research. All student comments are reported anonymously.

5.4 Limitations
This study is limited by the small sample size and the unique context in which it occurred. The students attending the field trip were primarily third year undergraduate IT students and as such have the digital literacy skills and technological capability to troubleshoot and make recommendations on technology used. The field trip was unique in that the focus of the trip was the technology used, unlike regular field trips where the site visit is of importance, however this was in the context of the DLT course requirements.

6. FINDINGS
The purpose of this research was to investigate the application of mobile technologies and a gxLearning environment to support a field trip for both face-to-face and remote students. The findings reveal several issues that impact on overall student experience and provide considerations for using mobile technologies to support field trips in the future.

6.1 Mobile capability
A focus of the field trip was to trial and consider the use of mobile technologies to support remote student participation using the gxLearning environment. Students took this opportunity to test the mobile capabilities of their own devices while in a field situation outside Wi-Fi coverage. Being IT students, they were interested in network connectivity, “Weak connection of data, 3G and 4G”, speed “the signal went from being 4G at the front of the house to H at the back. It probably didn’t help that there were about 20 of us all trying to use the same signal at once” and quality. “When we went out of WiFi range and changed to 4G the video quality had dropped significantly, to the point where there was a frame of video every few seconds. The sound had kept play[sic], but was not in sync with audio”. Students speculated on the cause of the poor connection. The students also offered some suggestion on how this may be improved, “A wireless repeater or access point in the cabin would be helpful here” and “Obviously we can’t cut down the surrounding trees for better reception; so, a wireless range extender might help for those connecting to Wi-Fi and a signal booster for those using mobile data”.

Figure 3. Environment at the Log Cabin (Parthiban, 2016)

6.2 gxLearning environment
The gxLearning environment was used to enable remote students’ virtual participation in the field. Two devices were used, one to stream the audio and facilitate the student chat and one to stream the video. Several students attending face-to-face also joined in on Adobe Connect and communicated with their remote peers using the chat facility. This gave them the opportunity to experience the gxLearning environment from a remote student perspective (Figure 4), and as such were able to offer a unique perspective of both environments.

Figure 4. Adobe Connect interface. Screen capture from iPhone 5S. (Lloyd, 2016)

These students noticed the lag between real time audio and the gxLearning environment audio, “we found that the audio which was being streamed to those watching via Adobe Connect was extremely laggy, being about 20 seconds behind real time” and “When using the H signal, the lag between spoken voice and the time it took to actually come out of our
phone streaming quality was also commented on by students, “The quality of the video was grainy meaning it was difficult as the images were not clear”, as was the difference in quality between devices, “when recording and streaming through the iPad, the video quality was very low and grainy, whereas streaming through a smartphone seemed to produce a better quality video, but better quality may have also resulted in a larger amount of data having to be sent and therefore more lag”. One student however, thought Adobe Connect worked well, “I also logged into Adobe Connect, which came through really well”. Another commented on the chat facility, “The chat function is one of the more successful features of this set up, and worked really well despite the sometimes patchy signal”. It also made the students feel more inclusive of each other, “Having them being able to communicate back to us in real time made it feel much more like those at home were experiencing the field trip with us.”

It also gave an opportunity for students to think about the benefits of gxLearning in the field as opposed to watching a video of an event, “Instead of streaming we could of just videoed it and posted it online later. However, this would mean people at home could not interact with us at all (compared to complaining about the video quality)”. The field trip was recorded, and other students took the opportunity to watch it later. “upon watching the recording of the video stream back, I found that the video was extremely low quality and laggy, and that the sound quality was almost inaudible – which would have made it very difficult for those watching remotely to follow what was going on”.

### 6.3 Technology observations
Students used the field trip opportunity to make some observations about the limitations of current mobile technologies “Even before we left the computer lab, the iPad that streamed it, had downsized the video”, “The use of mobile and digital learning technologies during field trip might be not so effective and efficient as they rely much on the Internet”, and “Video quality was also variable depending on whose device was doing the recording”. One student related the limitation experienced on their ability to learn “The most evident issues noticed during the field trip from a personal point of view was how dated technology can affect learning, as my mobile phone isn't 4G compatible meant I was unable to stream the video and audio at the required speed, meaning learning would have been hindered”. One student enjoyed the challenge of using the technology, “Alltogether it was a great experience to put all our DLT technologies to the extreme push”.

### 6.4 Reflections

#### 6.4.1 Lecturer reflections
Organising this particular field trip had many risks as it involved many variables outside of our control. From a people perspective there were two additional staff members, the education advisor and guest presenter. To ensure the guest presenter understood clearly what we were intending for the class, and for us to understand what he wanted from us, we held a pre-field trip visit. The walking track to the log cabin was not particularly easy so instructing students to have suitable footwear was important. A laptop, and mobile phones were taken and it was found that both the Wi-Fi and tethering the laptop to a 3G/4G phone were not feasible options. Testing the technology first was an important step in determining whether the field-trip could be undertaken. It was discovered that splitting the voice, text chat to one phone (3G) and video on another (4G) proved to be possible throughout the building site. To ensure that everyone was reminded, an email was sent to the guest presenter the night before however, as he did not show for either the briefing prior, nor the actual field trip, with hindsight this was something that should have been sent earlier.

On the day of the field-trip the weather at 5:30am was not looking good, and a quick check on a weather app showed a 74% likelihood of rain with showers expected early in the morning. This certainly was of concern as the field trip required a tricky walking path, had a significant outside component, and was difficult to reschedule as the trip was the last day before the Easter holidays.

![Figure 5. Weather forecast for the day](Image 376x554 to 481x666)

Technology issues are discussed in other parts of the paper, however, moving technology around also created a handling risk as devices are not in their normal locations, indeed at one point the iPad was inadvertently dropped on the floor (luckily no damage)!

Using two separate mobile devices to broadcast the field trip proved to be a bonus, as the presenter was able to broadcast the audio and keep a watching eye on the text chat questions submitted by the remote students, while the video feed had the ability to view not only the students and site, but the presenter as well.

What worked well, although not planned, was the de-brief by the guest lecturer back in the computer lab directly after the field-trip, as we met him just as the students had left the log cabin so asked if he would de-brief back in the computer lab. In the lab Adobe connect had a stable connection and in an organized room this allowed every student to hear and pose questions. In an outside field trip it is difficult to get all students to hear what is being said, and more so if they are online.

It was also interesting to note that one of the students viewed the field trip from Christchurch, showing that distance from the site is not a barrier.

#### 6.4.2 Education advisor reflections
The pre-fieldtrip site visit was imperative to test the technology and become familiar with the environment. Several combinations of technology were trialled to see which combination worked the best for enabling the gxLearning environment before settling on using two smartphones, one to capture the video and one to provide the audio and text chat stream. It was also interesting to measure the amount of mobile data used for this as this could have significantly impacted on how the devices are used in the field. As it happens, the data consumption was surprisingly low with Adobe Connect using just under 60MB of data to stream video in the half hour of site visit (Figure 5), and 41MB for the audio/text chat stream.
It was encouraging to see the students embracing the use of mobile technology, even to the extent of having the face-to-face students log in to Adobe Connect (when there was no requirement to do so), communicating with their peers and offering valuable input into how this was going by offering comparisons and suggestions.

7. DISCUSSION
The Digital Learning technologies field trip gave opportunity for students to experience how mobile could be used to be inclusive of remote students in a gxLearning environment and to explore the issues of using these technologies for learning.

Planning and implementing of the field trip followed two iterations of the Kolb (1984) experiential learning cycle. This was to ensure the class lecturer and accompanying learning technologist had followed the recommendations of Scarcie (1997) in ensuring the field trip was well thought out, planned and organized before the actual event. Although there were some issues with the late arrival of the PhD candidate as the field trip guide, the pre planning ensured that even though the students were unaware of the technology limitations, this had been experienced and mitigated as much as possible. During the field trip, the students quickly became aware of the limitations of using mobile data to enable the gxLearning environment. Although the gxLearning environment has been well received and found useful by remote students (Verhaart & Hagen-Hall, 2012; Day & Verhaart, 2015), the implications of using this learning mode in the field needs to be considered.

The findings reflect the range of hardware quality within the various mobile devices. Some have better audio and video streaming capabilities, some have better 3G/4G data connection. Experimentation with several devices before the event using a range of devices is recommended. Students also reflected on the impact the locality and environment had, indicating that the large trees may have hindered the mobile connection speed and reliability. They also observed that as more people began using the gxLearning environment, the more the quality dropped. This suggests that the number of devices in the field be limited to the minimum number needed to cover the media requirements. Despite the reports of poor audio and video, the face-to-face and remote students appreciated being able to chat with each other while in the field, suggesting that interaction was an important aspect, giving remote students a feeling of being there, rather than passively viewing the trip.

8. CONCLUSION AND RECOMMENDATIONS
Mobile devices were used to take the gxLearning environment into the field and beyond the reach of Wi-Fi services. Remote students used Adobe Connect to virtually attend the field trip and those who attended face-to-face, used their devices to not only capture evidence of the trip for their blogs, but to experience some of what it is like for a remote student. The student blog posts reflect on the experience and offer some valuable insights into using mobile in the field by answering the research question, “What are the challenges of using a mobile technology supported gxLearning environment in the field?”

This research reveals that the issues experienced during the 2015 field trip using Wi-Fi to connect to the gxLearning environment, still apply and is exacerbated by the use of a 3G/4G mobile data service. However, by repeating and extending the study, some recommendations can now be made for future use of mobile in the field:

- Ensure a thorough preparation and site visit occurs. This involves checking the technologies and making sound decisions based on data availability, signal strength and available devices. Test the devices using a range of usage scenarios.
- Use the highest quality mobile devices available.
- Share the data load by using one device to stream the audio and text chat and one to stream the video, but keep connections to the minimum needed to manage the gxLearning environment used.
- Encourage student peer to peer participation and engagement preferably using the chat feature to minimise data load.

Despite the continuing issues of poor sound and video quality, the use of the gxLearning environment in the field offers remote students a chance to participate in an experience they would otherwise passively view. It also offered a chance for both cohorts of students to communicate and engage in the shared experience. Recognising that technology is evolving and data speeds are increasing, the use of mobile to support remote student learning will continue to be an integral part of the DLT field trip experience.

9. FUTURE WORK
As this case study has shown, the quality of the student experience has depended largely on the quality of the devices used for audio and video streaming. As new technologies become available, further testing and refinement of both the devices used and the configuration of devices is planned. As gxLearning has proven to be an effective way to include remote students in a face-to-face classes, it is intended to produce a model of learning that reflects the pedagogies and technologies used. This will be available to educators who wish to consider a gxLearning model in their own class.

10. REFERENCES


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