ABSTRACT
Mobile technology is becoming prevalent in today’s society. Yet despite the widespread use of Internet-accessible mobile devices, very little research has been undertaken to examine the value that mobile technology may have (Cheung & Hew, 2009), especially within the milieu of higher education. With ever-expanding technological capabilities and rapidly increasing student use of sophisticated mobile devices, such as smartphones and tablets (Chaffey, 2017; Chang, Lai, & Hwang, 2018; Guri-Rosenblit, 2009; Peng et al, 2009), it is imperative that educators consider the impact that these devices may have—particularly when it comes to the affordances such devices provide for mobile learning in the digital classroom (Demmans Epp, Watanabe, & Swann, 2017). This paper reports on the demographic and descriptive findings from a three-year study on online graduate-level students’ perceptions and experiences with mobile devices that provides some insight into the relationship between graduate level learners, their online learning contexts, and their use of mobile devices for learning. The results indicate that: (1) the use of mobile devices for learning is common among these students, and (2) these devices and how they are being used are rapidly evolving to provide nearly seamless continuity of formal learning for the increasingly mobile learner.

Author Keywords
Affordances, higher education, mobile devices, mobile learning, multi-platform, online learning, seamless integration

INTRODUCTION
Although mobile communication devices are widespread in western society, “the fact is that today most of the large distance teaching universities do not offer distance education through e-learning devices” (Guri-Rosenblit, 2009, p. 106). Some academic research has explored the use of mobile devices for learning, yet “there [has been] little attention paid to the impact of the latest technological developments on distance education” (Kurubacak, 2007, p. 216), and even less research has been conducted in relation to the impact of mobile technology on online learning.

In order to consider how mobile communication technology is already being used and how its use could further assist online learners in a mobile community of inquiry, the mixed methods study discussed herein consulted online users who are already using mobile devices—individuals enrolled in graduate programs at one online distance education institution in Canada. This paper reports upon the descriptive data gathered during the project. In doing so, the paper answers the following questions from the research study: (1) What mobile devices do students use when they learn online? (2) What is the frequency of mobile device use when learning online? and (3) What activities do students engage in when using mobile devices for online learning? The report begins with a review of literature on this topic.

LITERATURE REVIEW
Very few studies—particularly in Canada—have explored the use of Internet-accessible mobile devices as learning tools. A recent systematic review of literature found just 44 studies directly concerned with the use of such devices in an educational setting (Cheung & Hew, 2009). Among these studies, only two concentrated specifically on the use of mobile devices in the Canadian education system. One (Allan, Carbonaro, & Buck, 2006) was focused on a middle school classroom setting, while the other (McCracken, Withers & Fee, 2007) sampled first year university students.

Clearly, very little is known about the use of mobile devices in Canadian classrooms. A handful of studies have focused on student attitudes and opinions towards mobile technology (e.g., Al-Fahad, 2009; Daher, 2009; Dearnley et al, 2009; Koole, 2009; Grant et al, 2015; Motiwalla, 2007, Pawluk, Palalas, & Wark, 2018; Philip, 2017). Findings from these studies suggest that mobile learning can enhance the learning experience. With clear benefits such as affordability and portability (Attewell, 2005; Chee, Yahaya, Ibrahim, & Noor Hassan, 2018; Gartner, 2017), mobile communication technology promises to assist online learners beyond the classroom. However, clarifying how, if at all, widespread use of mobile devices affects distance education remains to be done. Therefore, one of the aims of this study was to shed some light on online graduate learners’ perceptions of and experiences with mobile devices for learning.

A brief review of the research method and data collection procedures employed for the study follows next.

DATA COLLECTION
This three-year mixed methods research project involved numerous online graduate programs at a Canadian distance education university over five academic terms. The results reported herein include demographic and descriptive data collected from two self-administered online questionnaires completed by volunteer student participants. The initial questionnaire was completed by two groups: those who identified themselves as using mobile devices while completing
online courses, and those who did not. Mobile device users who completed the first questionnaire were then invited to complete a follow-up questionnaire. The average response rate over all semesters for the initial questionnaire was 28 percent (N=695). Of the 539 who indicated that they used mobile devices, 389 (or 72%) completed the second questionnaire. SPSS data analysis software was employed to produce frequency and descriptive data used for reporting the following findings of this research project.

Over half (54%) of respondents were between the ages of 35 and 49, with over 21 percent being between the ages of 44 and 49. Sixty-two percent were female; 38 percent were male. Two out of five were from an urban center with a population over 500,000. Nearly one out of five lived in medium urban (population of 100,000 to 499,999), small urban (population of 10,000 to 99,999), or rural areas (that is, within two hours of commuting distance from large, medium, or small urban centers). Less than three percent lived in remote locations (more than two hours of commuting distance from large, medium, or small urban centers). Finally, almost half (47%) had finished seven or more online courses prior to completing the questionnaire.

FINDINGS

All demographic and most descriptive data was generated from mobile device users and non-users who completed the first questionnaire. A more in-depth exploration on what devices were being used and how they were being employed by users was subsequently undertaken in the second questionnaire.

The first descriptive data explored herein details the communication and interaction tools and processes offered and used in the current course that each respondent was recruited from. Basic information about mobile devices gathered from mobile device users and non-users is presented next. This is followed by a more in-depth examination of mobile devices and how they are used by the mobile device users in this study.

The most prevalent forms of media used in respondents’ current courses were email (89%) and hard copy texts (88%). This was followed by digital text-based files (78%) and online chat or instant messaging applications (55%). One quarter of the courses incorporated the use of digital audio, audiovisual, CDROMs, and/or DVDs. Six percent of respondents’ classes used other forms of media, ranging from blogs and social media to video- and teleconferencing. A final one percent used audio cassette tapes.

When asked what kind of Learning Management System (LMS) options were offered as part of their current course, respondents most often identified the course homepage (over 93%), assignment drop-box and related course management tools (92%), and asynchronous text postings (89%). Nearly half of the courses offered a student “About me” page via the LMS system. Less frequent offerings were a student blog (26%), synchronous virtual classrooms (22%), and wikis (20%).

Almost three out of four classes engaged in whole class activities (73%); 44% involved the use of small group activities.

Over 99% of the courses included the submission of individual assignments, while nearly half (48%) also incorporated group assignments. These results indicated a near balance between small group activities and group assignments.

Having provided a basic profile of who the study respondents are and what kind of online learning environments they are learning in, attention now turns the participants’ initial responses to questions about mobile devices.

Introducing the Topic of Mobile Devices with Users and Non-users

Over three quarters (N=389; 78%) of respondents indicated that they currently used one or more mobile devices. When those who responded “yes” to this question were asked if they were using a mobile device in any manner to help complete their course, seven out of ten (71%) said that they were. Ninety-nine percent of this latter group indicated that they were using mobile devices voluntarily in the course; one percent stated that this was a course requirement.

Mobile device users who were not using their devices for their current course were asked why this was so. The most common response related to shortcomings of the device itself; the device was too small to input (63%) or view information (60%). Secondly, it was incompatible with other hardware, such as printers (17%). Software issues were also noted. Respondents reported a shortage of required applications (apps; 28%), as well as incompatibility issues with the course LMS (19%). Cost was a factor as well. One out of five respondents who were not using their devices in their current course cited Internet connection fees as a reason, while a few (5%) reported the fear the loss or theft of the device as another concern. A further seven percent indicated that their device was used exclusively for work. A final five percent listed a variety of other reasons, from living in countries such as Saudi Arabia and China, to a preference for using their home computer and the desire to keep all coursework on one device, for example.

Expanding the Discussion with Mobile Device Users

All respondents who indicated that they used one or more mobile devices, whether or not they were using them in their current course, were invited to complete a second online questionnaire. Part of this questionnaire asked respondents to provide more information about their general use of mobile devices. This was followed by questions that focused more specifically on student use of these devices.
**General use of mobile devices.**

Three out of ten (29%) respondents said that they had been using mobile devices for five to ten years. One out of five (19%) had been using the devices for more than ten years and a further one out of five (18%) had been using these devices for three to five years. One in ten had been using mobile devices for one to two years (12%) or two to three years (13%). Less than one in ten (9%) had been using mobile devices for under a year.

Most respondents currently used two mobile devices (35%). There was a nearly even split between those who used one (23%) or three (24%) devices. A further 18 percent currently used four or more.

Respondents were also asked to select all types of mobile devices that they were currently using for everyday tasks. The most commonly used device was a cell phone or smartphone (90%). Nearly seven out of ten (68%) respondents also reported using tablets. Fewer respondents reported using portable media players (27%), personal navigation devices (PNDs/GPS; 23%), or handheld computers/Mobile Internet Devices (MIDs; 21%). One in ten was currently using an Ultra Mobile PC (9%). Only a handful reported using an e-book reader (5%), personal digital assistant (PDA; 3%), or pager (2%). Although respondents were also asked to list any other mobile devices that they might be using at the current time, no other devices were reported.

**Student use of mobile devices.**

Next, respondents were asked to select the type of mobile device that they used most often for learning. Their most frequent preferences were a tablet (44%) or cell phone/smartphone (36%). Handheld computers/MIDs (8%), portable media players (5%), Ultra Mobile PCs (4%), and e-book readers (2%) were infrequently selected as the most used types of devices. A further two percent of respondents said that there was no device that they used most often as a student. No respondent listed any other mobile device as being used most often.

The most common brands of mobile devices cited for student use were the Apple iPad (38%) and iPhone (27%). The RIM Playbook (8%) and Blackberry (4%) were about as popular as Nokia (8%) and Android (6%) devices. The brands least often selected as being used most often for student purposes were: Samsung (2%), HP Touchpad (1%), Kindle (1%), Kobo (1%), LG (1%), Motorola (1%), Nook e-Reader (1%), and the Toshiba tablet (1%).

When asked what they generally used the device for, respondents stated that the device was used for school (88%), pleasure (85%), work (73%), socialization (65%), and other (9%) activities. Other activities ranged from scheduling, checking the news and weather, conducting research, and banking, to “keeping track of the family,” taking photos, and monitoring fitness.

Most respondents had been using the device selected most often for student use for one to two years (43%). A further fourteen percent stated that they had been using this device for four to six months, seven to eleven months, or three to five years. Eleven percent had been using the device for three months or less, and a final four percent had been using this device for more than five years.

The final question asked respondents how frequently they used the device that they most often used as a student. Nine out of ten respondents used this device daily (90%). Seven percent said that they used it two to three times a week. Three percent indicated that they used it once a week and a final one percent said that they used it less than once a month.

**DISCUSSION**

The use of mobile devices is prevalent among the respondents in this study. Nearly four out of five respondents use mobile devices. Seven out of ten use these devices for school. Although students involved in this research study are not required to use mobile devices while they complete online courses, many of them use mobile devices as they learn online. In the future, students will expect that all courses should be mobile friendly to allow access from anywhere and anytime. This has many implications for delivery of education. Courses must be designed for delivery on desktops, laptops, and mobile devices. Also, educational organizations must have the infrastructure to implement mobile learning successfully.

As indicated by the study findings, the most common reason why those who have mobile devices, but do not use them for school is related to the size of the device. However, as the pervasiveness of smartphones has grown (Gartner, 2017; Statista, 2017), so have their screen size, battery life, and memory. In short, “[t]he smartphone is no longer just a phone, but a hybrid of devices – and increasing, the most common way to interact with the world” (Taylor, 2014) Incompatibility with other hardware and software has, in many ways, also become less of an issue in recent years. While Apple products and apps still tend to remain rather exclusive, many Android and Microsoft products are increasingly cross-platform and can interface with a growing number of plug-and-play devices. The Samsung micro USB cable pigtail, for example, enables any Samsung device that has a micro port to connect with any other USB-port device that has an android or Microsoft operating system (OS). This trend supports multiprogram usage between wired and mobile devices (Chaffey, 2017) and thus allows learners greater ability to study on the go. There has been a similar growth in mobile app development, with Google Play currently offering over 2.2 million apps and Apple App Store having close to 2 million (Saifi, 2017).

A comparative analysis of general versus student use of mobile devices for learning indicates that the two most frequently chosen devices for general and student use are the mobile phone and tablet, as indicated in Figure 1. The slight preference for using a tablet for school use may be due to the larger screen and keyboard sizes common to most tablet devices, as well as the availability of apps that enable students to view, create, and edit documents, using programs like Word and Excel.
CONCLUSION
This study is perhaps the first of its kind to present findings from a lengthy research project with a large group of Canadian online graduate level learners on what and how mobile devices are used by such learners for general and school-related purposes. As such, this project presents some important insights and valuable recommendations to assist the academic community in enhancing future mobile learning opportunities.

In the first two years of this study, the Moodle LMS used by the University was not mobile device accessible. This LMS was upgraded in the third year of the study; the initial upgrade enabled varying degrees of mobile device accessibility, depending on the device OS and screen size/resolution. Near the end of the third year, a subsequent Moodle LMS upgrade enabled the LMS to be accessible via most mobile devices being used by students at that time. Given the results of this study, it is concluded that educational organizations that are planning to implement mobile learning should have a mobile-friendly LMS to allow students to access learning materials with mobile devices. Also, courses should be designed for delivery on many devices since students have different and multiple devices, as indicated in this study.

As reported, over half (54%) of the respondents in this study were between the ages of 35 and 49, with over 21 percent being between the ages of 44 and 49. The subjects who participated in this study were enrolled in graduate courses; hence, their age range was higher than undergraduate students’ age ranges typically are (Aslanian & Clinefelter, 2013). Some reported difficulty in using smaller mobile devices; this could help to explain the more frequent use of tablets for learning purposes. Such findings suggest that students should be given the choice of device to use and that the courses should be designed for access by devices of any size. As emerging wearable and virtual technologies integrate with existing technologies, mobile devices will become more user-friendly for different age groups. For instance, the use of 3D-glasses will enhance the viewing of textual and multimedia materials when learning.

This is the online and always-on era where current and upcoming generations are connected and are comfortable using mobile devices. Education should take advantage of this by delivering courses for access on mobile devices. Online students are increasingly able to learn almost anywhere and at any time using information and communication technologies (Yu, Ally, & Tsinakos, 2018). Such technologies enable students to be mobile and learn as they move around. Research is needed on how to design learning materials for students on the go and to promote high level learning using interactive strategies (Suárez, Specht, Prinsen, Kalz, & Ternier, 2018). Also, this study indicates that students use mobile devices at work, at home, and in different contexts. Therefore, research should also be conducted on how students can use mobile devices in various learning contexts.

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