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Examining Student and Educator use of Digital Technology in an Online World

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EDUCATIONAL USE OF DIGITAL TECHNOLOGY

Examining Student and Educator use of Digital Technology in an Online World

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Abstract

Over the past thirty years, institutions of higher learning across the world have increasingly embraced digital technology for teaching and learning. Many institutions have begun to offer mobile, hybrid, and online courses and programs for enhanced relevance and accessibility. Universities and colleges employ digital technology through learning management systems for maintaining and processing educational information/records, offering blended/hybrid learning using asynchronous online student/instructor interaction and collaboration, and web conferencing software for synchronous and asynchronous virtual classroom functionality. Thus, it is critical for us to gain a better understanding the nature of these technological changes and the factors affecting the online realities of 21st Century teaching and learning. The study reported here involved students and instructors at the University of Ontario Institute of Technology (UOIT) in Oshawa, Canada using the *General Technology Competency and Use (GTCU) Survey*, in which they assessed the purpose and frequency for which they used a variety of digital technologies, and the confidence they had in using various digital technologies. Preliminary results indicated high scores in both confidence and frequency of use for computers/laptops and smartphones, and low scores for frequency of use and confidence with newer technologies, such as “wearables” and the “Internet of Things”.

Keywords: online, virtual, learning, technology, competency, confidence, frequency, social, informational, epistemological

Examining Student and Educator use of Digital Technology in an Online World

Introduction

New directions in higher education demand significant shifts in pedagogy and the effective use of technology for learning. Today, in the 21st Century, the broader goals of post-secondary education—often characterized in terms of a liberal arts orientation—are being shaped by powerful social and economic forces which are increasingly determining the knowledge, skill, and attitude outcomes necessary for learner success, as well as for employee success in the work environment. These outcomes have, more recently, been articulated by a variety of international, national, and regional bodies, including the World Economic Forum (2015), the Conference Board of Canada (2016), and the Ontario Ministry of Training, Colleges, and Universities (2015). Important learning outcomes now include the development of complex problem-solving skills, critical thinking skills, creativity, coordinating with others (including collaboration and negotiation), innovation, and emotional intelligence. In order to create learning environments that enhance these qualities, a learner-centred approach to developing confidence and competence in technical skills is required.

Pedagogical methods aimed at facilitating the development of these qualities are shifting toward learner-centred approaches wherein individuals can identify their skills and select open educational resources that can help them enhance their digital skills. The tool designed for the study reported here, the General Technology Competency and Use (GTCU) survey tool, enables learners and educators to create a personal profile that indicates how they use a broad variety of technology, measuring their confidence and frequency of use. It is clear that “learners are responding to the new technical and social opportunities with little help from the formal education system” and there is “evidence of deep networking and knowledge building in

learners' informal practices" (Littlejohn, Beetham, & McGill, 2012, p. 551). As a result, allowing learners to build a personal profile of technical skills, and identifying for themselves which areas they need to develop further, is a valuable skill set that aligns with qualities identified by industry as important outcomes of higher education.

This research demonstrates that the GTCU can be an effective tool to enable and empower individuals and teams to build on successes, identify areas for improvement, and most importantly, build capacity for self-determined, ongoing learning. In a digital culture, individuals most frequently consult the Internet for information, using You-tube and other social media to connect and learn, or by "Googling it" to find what they need to know. This mode of gaining knowledge focuses on the individual defining what they want to learn and choosing the methods for learning it. By developing a personal profile of how individuals use technology, the GTCU tool can provide a platform through which individuals may effectively identify their skill levels, and then choose learning goals that will help them become more effective in their uses of technology.

Frameworks

In order to present a comprehensive overview of the types of skills required by digital technology users, a GTCU Framework (Desjardins, Lacasse, Bélair, 2001; Desjardins, 2005) (Figure 1) was employed in the development of the GTCU Survey tool. This framework references the Institute of Electrical and Electronics Engineers (IEEE) definition of computer hardware as the "physical equipment used to process, store, or transmit computer programs or data" (IEEE, 2009). Accordingly, in addition to the practical skills (Technical Order of Competency) required to effectively and efficiently interact with a computer or mobile device,

three other orders are described within the GTCU Framework: the Social Order of Competency, the Informational Order of Competency, and the Epistemological Order of Competency.

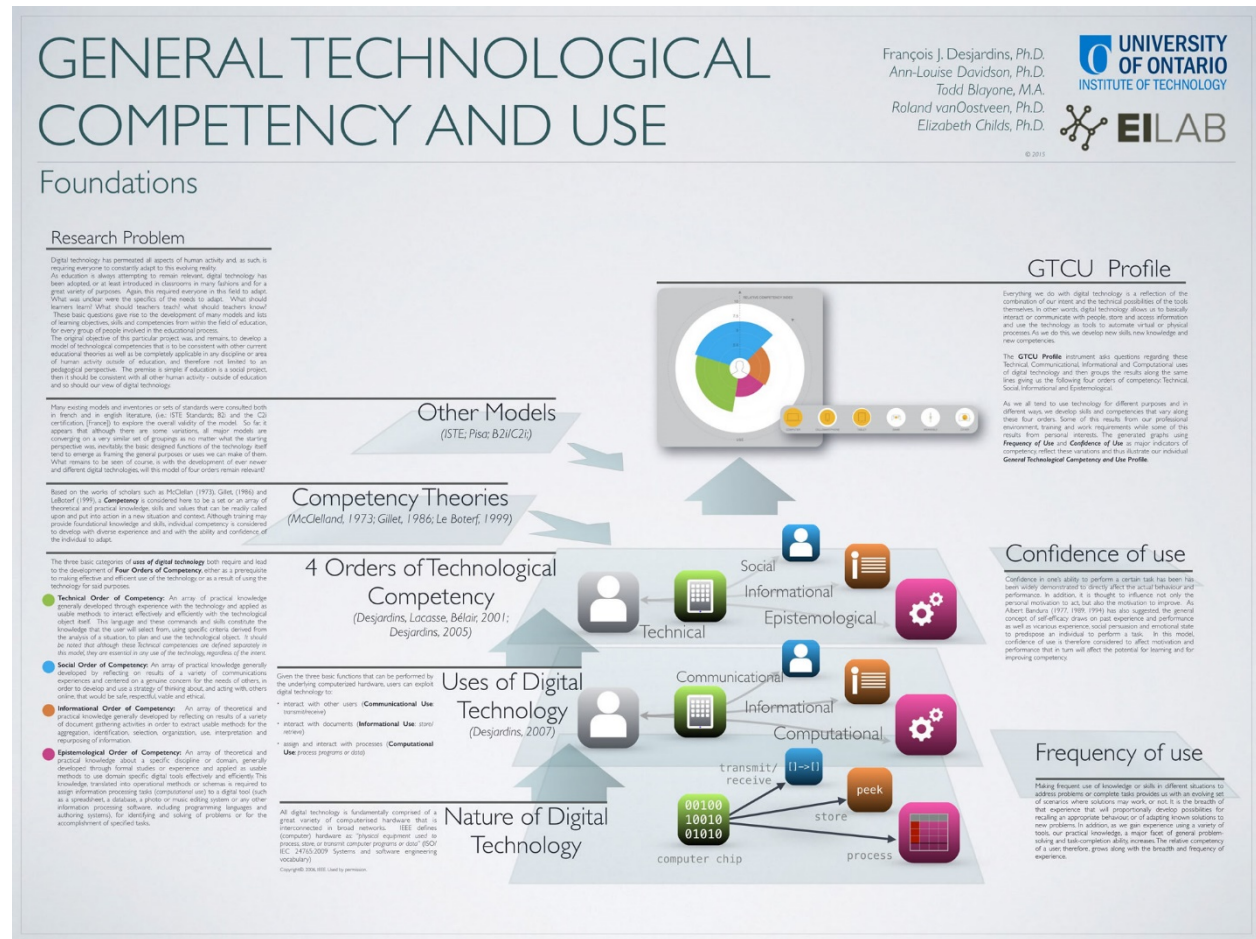


Figure 1. The General Technological Competency and Use (GTCU) Framework

It should be noted that while the Technical Order (T) is represented separately within the framework, technical skills and competencies must be developed and used in all of the other orders. The Social Order of Competency (S), building on the “transmit” function of the IEEE definition, refers to skills required to effectively communicate (digitally) with others. Interacting effectively with others requires users to be concerned with the needs of others and working in ways that are safe, respectful, and ethical. The Informational Order (I) builds on the IEEE

“storage” function, and describes the skills required to gather information from a wide variety of sources, and to create new knowledge and materials that may be posted back onto the Internet. Skills associated with the Informational Order include searching, sorting, aggregating, filtering, creating, and connecting content. The final order, the Epistemological Order (E), also known as the Procedural or the Computational Order, includes skills required to use a computer or computer-based system as a cognitive tool (Jonassen, 1996), where the user assigns information processing tasks (computational use) to a digital tool (such as a spreadsheet, a database, a photo, a music editing system, or any other information processing software, including programming languages and authoring systems), for identifying and solving of problems, or for the accomplishment of other specified tasks.

In this study, an online version of the GTCU Survey was used to probe students’ and instructors’ frequency of use, and confidence in using digital technologies for university and extra-university purposes. Survey design was based on the GTCU Framework, and included, for example, items in which participants indicated the purpose(s) (e.g., email, downloading music) for which they used various classes of digital devices, including computers, smartphones, tablets, gaming consoles, etc., by selecting from five possible frequencies measures: (1) Never, (2) A few times a year, (3) A few times a month, (4) A few times a week (5) Daily, and five confidence measures: 1. Do not know how to use, 2. Not confident, 3. Confident, 4. Quite confident, and 5. Very confident. The GTCU survey tool uses a combination of these measures as major indicators of competency. In all, the survey included 3 items regarding general technical uses, 7 items regarding digital technology used for communication and collaboration purposes, 6 items focusing on the use of technology for accessing information, and 7 items examining use of technology for processing information.

In general, we may assume that everything we do with digital technology is reflected in a combination of our intentions and the technical possibilities of the tools themselves. As stated earlier, digital technology allows us to interact or communicate with people, store and access information, and use the technology as tools to automate virtual or physical processes. As users perform such tasks, new skills, knowledge, and competencies are developed. The GTCU Survey tool produces a series of graphs which, when taken together, provides a profile snapshot of the ways in which digital technologies are used, and the competencies that have been developed. As such, GTCU profiles may help users identify strengths and gaps in their use of technology that may be addressed through further education and/or experience as they endeavour to match their skills to the requirements of particular career paths or aspirations. In addition, composite profiles, produced by analyzing data collected from a defined group, may be used to develop workshops or other professional learning opportunities that will be of value to a corporation or learning organization.

Methods

Procedure

The GTCU survey tool used in the study reported here evolved over the course of the past ten years, and has been validated across a wide variety of populations. This study examines the extent to which students and educators in the University of Ontario Institute of Technology (UOIT)—a mid-sized university in Ontario, Canada—employed a broad range of digital technologies in terms of the types of technologies used; the purposes for which they were used; the confidence users had in using the technologies; and the frequency with which they used them. The resulting data allowed the study's researchers to produce detailed profiles of the uses of technology by learners and educators across the university, and also to explore if there may

have been generational differences in student and instructor use of digital technology (Bennett, Maton, & Kervin, 2008; Jones, Ramanau, Cross, & Healing, 2010).

Data Gathering

An invitation by e-mail was sent to all participants, with two reminders spaced at 1 week intervals. This project focused specifically on instructors and undergraduate students across faculties at the University of Ontario Institute of Technology. All genders were represented. Undergraduate students were typically in their 20s, while graduate student ages ranged from 20 to 50 years, and instructors from 30 to over 50 years.

Findings

As mentioned elsewhere in this paper, the GTCU survey was completed in February 2016 by a variety of UOIT undergraduate and graduate students and instructors. Table 1 lists key demographic data for this sample. The data in Table 1 indicate that a majority of students and instructors were studying or teaching within science and/or technology fields. The majority of instructors were at least twice as old as the students, indicating the existence of a sizeable generational gap between them.

Table 1. Key Demographic Data

Status	n	Gender	Age	Educational Attainment (completed or in progress)	Specialization
Student	36	Female - 50% Male - 50%	19 - 25 years – 100%	Bachelor's Degree – 64% College Diploma – 25% Master's Degree – 11%	Technology – 33% Sciences – 21% Humanities – 21% Business – 17% Education – 8%
Instructor	15	Female – 60% Male – 40%	30-49 years - 54% 50-69 years – 46%	Doctoral Degree – 67% Master's Degree – 20% Bachelor's Degree – 13%	Sciences – 53% Humanities – 40% Technology – 7%

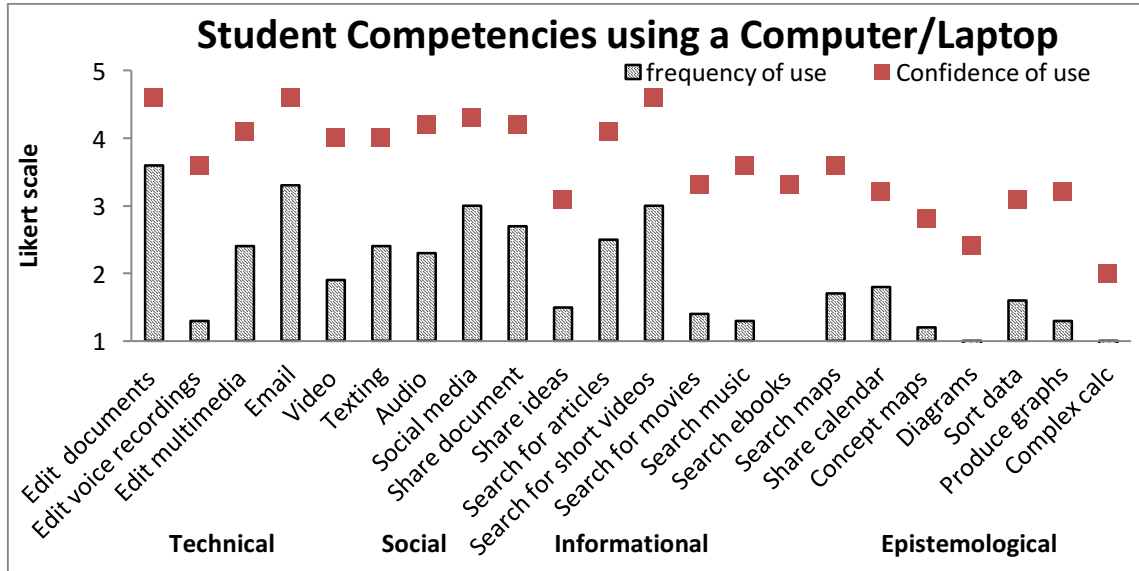


Figure 1. Student Competencies using a Computer/Laptop

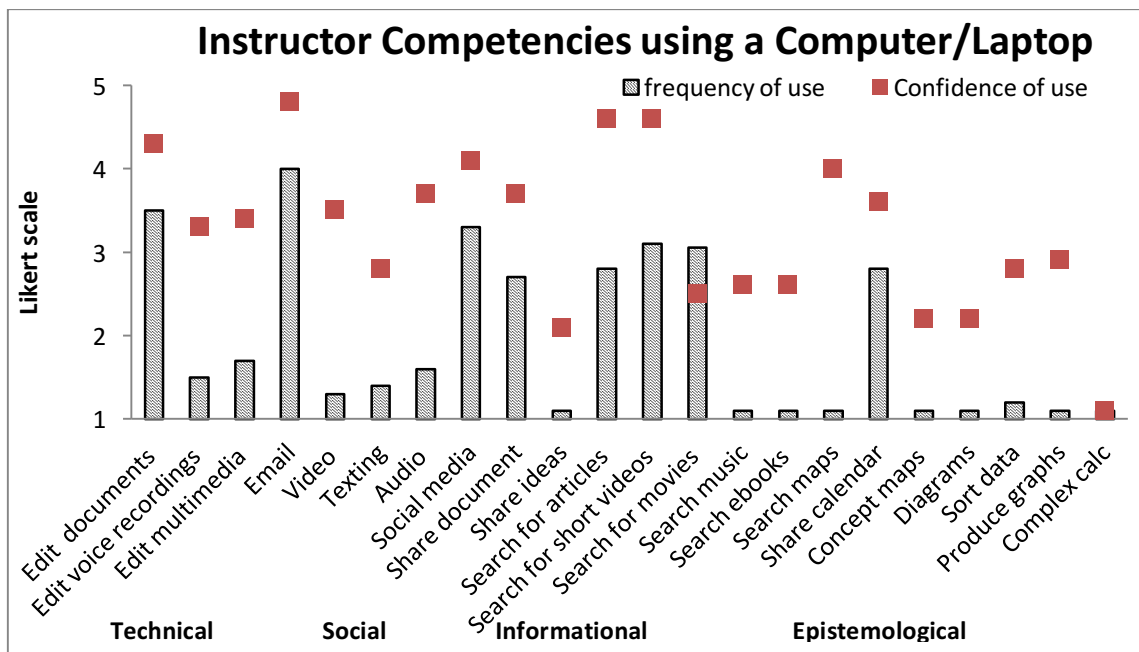


Figure 2. Instructor Competencies using a Computer/Laptop

In terms of GTCU competencies, the data in Figures 1 and 2 indicate that, overall, participating students and instructors employed a computer or laptop with relatively high frequency and confidence, with variations in confidence levels generally aligning with changes in frequency of use levels. Furthermore, it appears that instructors tend to employ their computers and/or laptops for informational purposes more frequently than students (e.g., searching for articles, videos, and movies), with both student and instructor frequency of use and confidence in using these devices for epistemological purposes being relatively low.

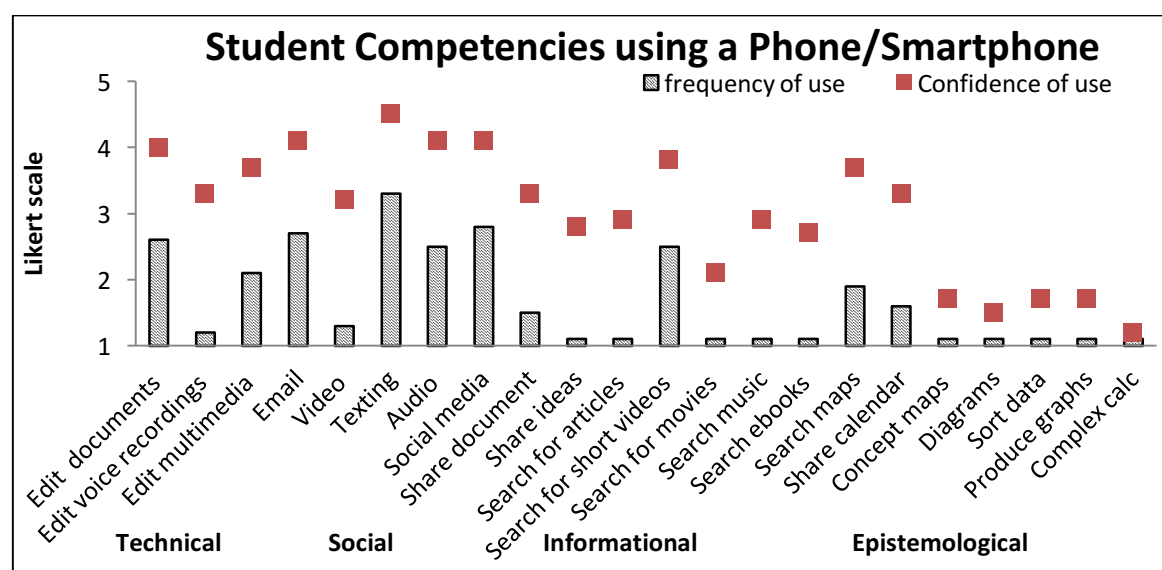


Figure 3. Student Competencies using a Phone/Smartphone

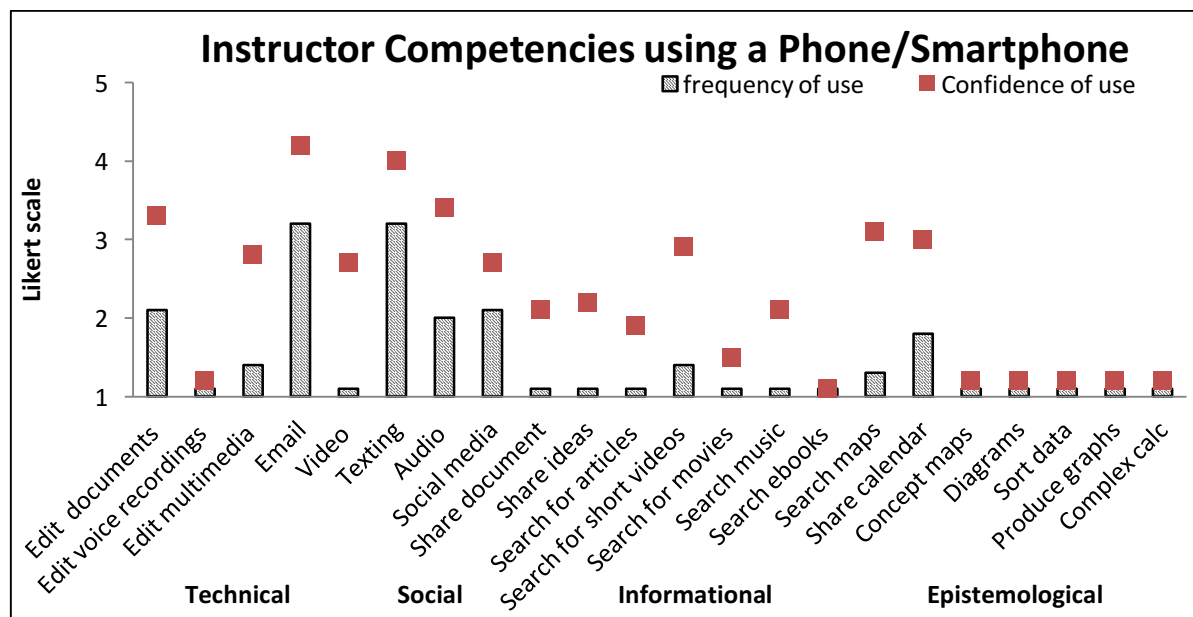


Figure 4. Instructor Competencies using a Phone/Smartphone

Figures 3 and 4 represent student and instructor frequency of use and confidence in using devices such as phones and smartphones. It is evident that students and instructors used these devices with relatively high frequency and confidence for some technical (e.g., editing documents and multimedia) and many social purposes (e.g., email, texting, social media), save using such devices for sharing voice recordings and video. In terms of the Informational order, both students and instructors employed phones/smartphones frequently to search for short videos and maps, and for sharing calendars, while epistemological uses were generally low in frequency and confidence.

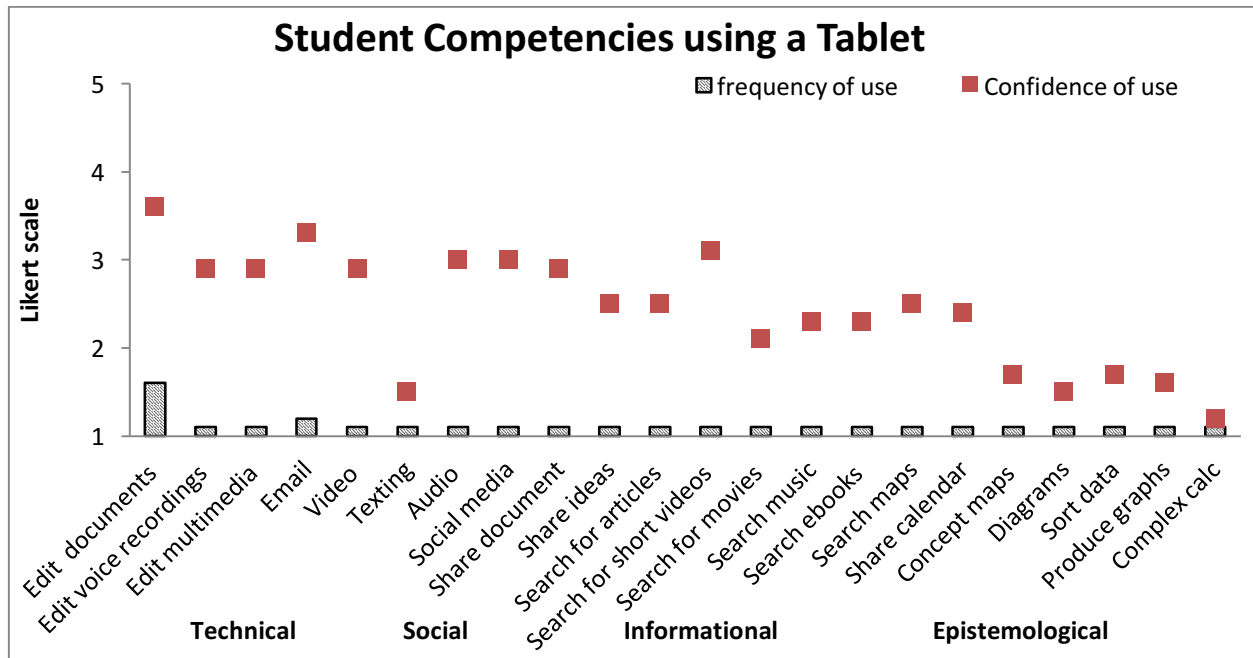


Figure 5. Student Competencies using a Tablet

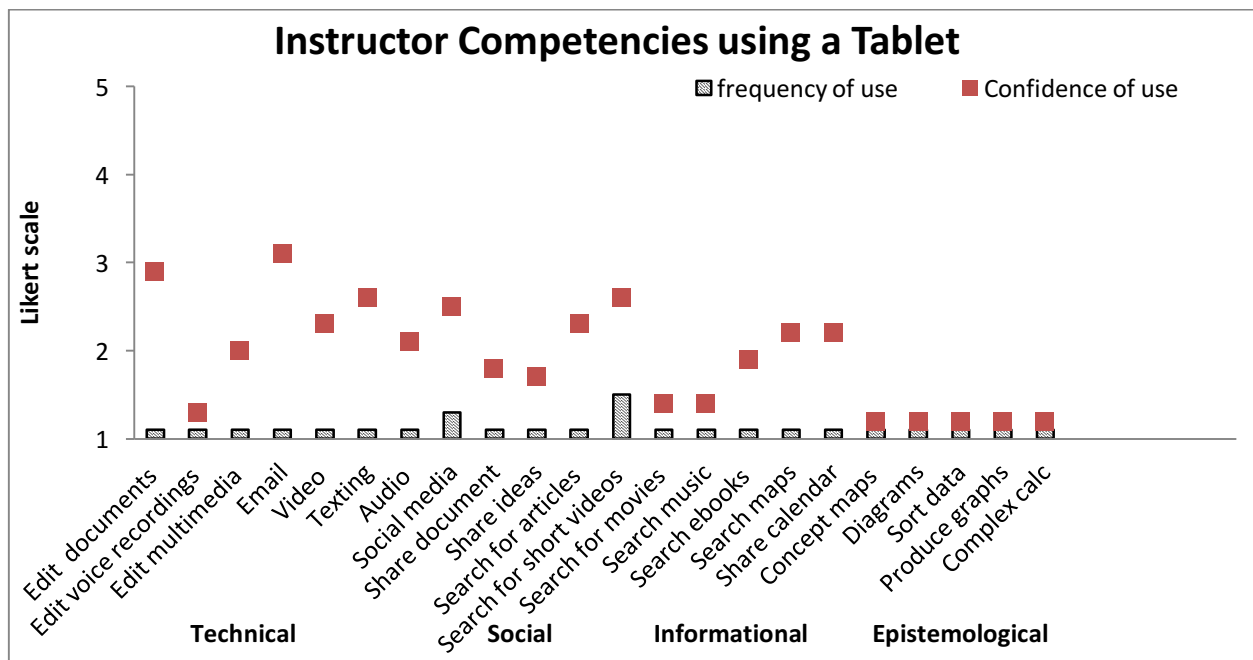


Figure 6: Instructor Competencies using a Tablet

Results indicated in Figures 5 and 6 are interesting in that they tend to show that students and instructors use tablets with overall less frequency than computers/laptops and phones/smartphones, although confidence in using these devices tended to be relatively high for most orders, except in the case of epistemological uses, where confidence (and frequency) levels tended to be relatively low for virtually all purposes.

Discussion and Conclusions

In the past three decades, there has been a constant influx of technology in the educational arena, and this has had particular impact in institutions of higher learning. Most institutions have adopted digital technology but to varying degrees, from simply using the World Wide Web as a means of distributing materials to students, to institutions with maturing Bring Your Own Device (BYOD) and virtualization programs. Although there is a substantial amount of literature on the institutional adoption and implementation of these technologies, few studies have examined use of these technologies by students, and by their instructors, who ultimately drive the integration of technology in the actual teaching/learning process. The GTCU Survey tool used in the current study addressed current use of digital technology by students and faculty at UOIT in terms of (a) the types of technology used; (b) their frequency of use; (c) the confidence participants had in using the technologies; and (d) the purposes (personal or professional) for using them. The resulting data were used to generate rich, current profiles of the uses of technology by learners and instructors in a university with a strong technology focus.

Trends in the data indicated consistently higher scores in both confidence and frequency of use for computers/laptops. These devices continued to be the preferred technology that instructors and students used for academic work. Use of mobile phones appeared frequent for communication, but was limited in terms of academic uses, possibly due to the smaller size of

screens and issues with sound that could occur if students attended virtual classes via phone. Tablet use was second highest in frequency of use by instructors and students, perhaps because the usability for creating documents with tablets is limited. Survey results indicated that both students and instructors deferred to laptops for academic work in creating documents, and for other educational tasks. For all intents and purposes, tablets and smartphones are viewed as consumption devices as opposed to devices for creating documents or other tasks.

Although not illustrated graphically in this paper, an interesting outcome of the study was that both learners and faculty had almost no confidence or frequency of use for “wearable technologies” or the “Internet of Things.” We suggest that this may be due to several factors, including the current scarcity and low durability of such devices. As developments in these emerging technologies improve and these become more available, affordable, usable, and durable, we predict an increase in both frequency and confidence of use among students and instructors. This result is reminiscent of the low frequency and confidence of use that UOIT students and instructors ascribed to smartphones in a similar study conducted in the 2012-2013 academic year (Partosoedarso, DiGiuseppe, vanOostveen, & Desjardins, 2013), a time when smartphone technology had not yet reached its current high levels of popularity and use, and when the term “smartphone” was not yet in common usage. In terms of gaming, the use of gaming devices was significantly different between students (more frequent and confident) and instructors (less frequent and confident). We suggest, however, that this result may not be due to generational differences (as some have suggested), but to perceptions regarding the pedagogical value games in educational settings. The GTCU survey did not specify whether “gaming” was to be understood as academic/educational gaming or personal/entertainment gaming, causing instructors to reported less use of games than students because they may have thought the survey

was asking them about their use of games for university work. This suggests an interesting gap in how instructors view the purpose and role of games and game play in education. Further investigation into instructors' perceptions of the role of gaming and game play in post-secondary education is suggested. To facilitate the development of 21st Century learning outcomes such as collaboration, problem-solving, creativity, and innovation, the role for serious games and play-based inquiry, in particular, warrants further exploration. In particular, we see a link between the competencies surveyed by the tool, learning, and new student-centred pedagogical approaches. By developing co-designed learning environments, we increase the capacity building potential of the GTCU for individuals and collaborative groups.

In summary, the GTCU survey system is proving to be a useful tool for helping to assess students' and instructors' purpose for using current digital technologies; the frequency with which they use these technologies; and the relative confidence they have in using them. There will be more detailed analysis occurring in the Educational Informational Informatics Lab (EI Lab) at UOIT, particularly when these results are compared to the results from other institutions, countries, and cultures. As demonstrated in this study, the data gathered by the GTCU survey may be analyzed on an individual basis to assess personal frequency and confidence levels, and on a group basis to assess aggregate group results. Further, survey results, whether individual or aggregate, may be analyzed in relation to the GTCU Framework's four orders of competency (T, S, I, and E), and to construct rich user profiles illustrating relative levels of individual and/or group digital technology competencies. The results of these analyses may then be used by individuals and/or groups to assess current and future strengths and limitations, and use these results to better focus the plans they make for enhancing their proficiencies in the use of digital technologies.

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